

System i DB2 for i SQL Reference

Version 6 Release 1





System i DB2 for i SQL Reference

Version 6 Release 1

Before using this information and the product it supports, read the information in Appendix K, "Notices," on page 1493.				

subsequent releases and modifications until otherwise indicated in new editions. This version does not run on all reduced instruction set computer (RISC) models nor does it run on CISC models.

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About DB2 for i SQL Reference

About SQL reference

This book defines Structured Query Language (SQL) as supported by DB2[®] for IBM[®] i. It contains reference information for the tasks of system administration, database administration, application programming, and operation. This manual includes syntax, usage notes, keywords, and examples for each of the SQL statements used on the system.

Standards compliance

DB2 for i Version 6 Release 1 conforms with IBM and Industry SQL Standards.

- ISO (International Standards Organization) 9075: 2003, Database Language SQL -Core
- ISO (International Standards Organization) 9075-3: 2003, Database Language SQL
 Part 3: Call-Level Interface (SQL/CLI)
- ISO (International Standards Organization) 9075-4: 2003, Database Language SQL
 Part 4: Persistent Stored Modules (SQL/PSM)
- ANSI (American National Standards Institute) X3.135-2003, Database Language SQL - Core
- ANSI (American National Standards Institute) X3.135–3: 2003, Database Language SQL - Part 3: Call-Level Interface (SQL/CLI)
- ANSI (American National Standards Institute) X3.135–4: 2003, Database Language SQL - Part 4: Persistent Stored Modules (SQL/PSM)

For strict adherence to the standards, consider using the standards options. Standards options can be specified through the following interfaces:

Specification

Table 1. Standards Option Interfaces

SOI Interface

SQL Interface	Specification
Embedded SQL	SQLCURRULE(*STD) parameter on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to set the SQLCURRULE values. (For more information about CRTSQLxxx commands, see Embedded SQL Programming.)
Run SQL Statements	SQLCURRULE(*STD) parameter on the Run SQL Statements (RUNSQLSTM) command. (For more information about the RUNSQLSTM command, see SQL Programming.)
Call Level Interface (CLI) on the server	SQL_ATTR_HEX_LITERALS connection attribute (For more information about CLI, see SQL Call Level Interfaces (ODBC).)
JDBC or SQLJ on the server using IBM Developer Kit for Java™	Translate Hex connection property object (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)
ODBC on a client using the System i [®] Access Family ODBC Driver	Hex Parser Option in ODBC Setup (For more information about ODBC, see System i Access.)

Table 1	Ctandarda	Ontion	Interferen	(continued)
Table 1.	Stariuarus	Орион	interraces	(continued)

SQL Interface	Specification
OLE DB on a client using the System i Access Family OLE DB Provider	Hex Parser Option Connection Object Properties (For more information about OLE DB, see System i Access.)
ADO .NET on a client using the System i Access Family ADO .NET Provider	HexParserOption in Connection Object Properties (For more information about ADO .NET, see System i Access.)
JDBC on a client using the IBM Toolbox for Java	Interpret SQL hexadecimal constants as binary data in JDBC Setup (For more information about JDBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)

Assumptions relating to examples of SQL statements

The examples of SQL statements shown in this guide assume the following.

- SQL keywords are highlighted.
- Table names used in the examples are the sample tables provided in the SQL Programming topic collection. Table names that are not provided in that appendix should use schemas that you create. You can create a set of sample tables in your own schema by issuing the following SQL statement:

CALL QSYS.CREATE SQL SAMPLE ('your-schema-name')

- The SQL naming convention is used.
- For COBOL examples, the APOST and APOSTSQL precompiler options are assumed (although they are not the default in COBOL). Character-string constants within SQL and host language statements are delimited by apostrophes (').
- A collating sequence of *HEX is used.

Whenever the examples vary from these assumptions, it is stated.

How to read the syntax diagrams

The following rules apply to the syntax diagrams used in this book.

Read the syntax diagrams from left to right, from top to bottom, following the path of the line.

The ▶ symbol indicates the beginning of the syntax diagram.

The → symbol indicates that the syntax is continued on the next line.

The ►— symbol indicates that the syntax is continued from the previous line.

The → symbol indicates the end of the syntax diagram.

Diagrams of syntactical units start with the |---- symbol and end with the -----

Required items appear on the horizontal line (the main path).

▶►—required item—

• Optional items appear below the main path.

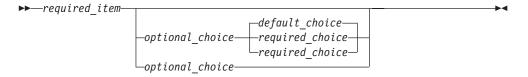
If an item appears above the main path, that item is optional, and has no effect on the execution of the statement and is used only for readability.

• If more than one item can be chosen, they appear vertically, in a stack. If one of the items must be chosen, one item of the stack appears on the main path.

If choosing one of the items is optional, the entire stack appears below the main path.

If one of the items is the default, it will appear above the main path and the remaining choices will be shown below.

If an optional item has a default when it is not specified, the default appears above the main path.



· An arrow returning to the left, above the main line, indicates an item that can be repeated.



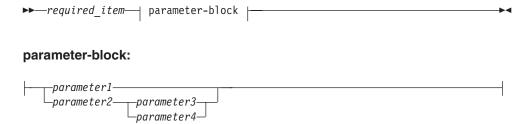
If the repeat arrow contains a comma, you must separate repeated items with a comma.



1

A repeat arrow above a stack indicates that the items in the stack can be

- · Keywords appear in uppercase (for example, FROM). They must be spelled exactly as shown. Variables appear in all lowercase letters (for example, column-name). They represent user-supplied names or values.
- If punctuation marks, parentheses, arithmetic operators, or other such symbols are shown, you must enter them as part of the syntax.
- The syntax diagrams only contain the preferred or standard keywords. If nonstandard synonyms are supported in addition to the standard keywords, they are described in the Notes sections instead of the syntax diagrams. For maximum portability, use the preferred or standard keywords.
- Sometimes a single variable represents a larger fragment of the syntax. For example, in the following diagram, the variable parameter-block represents the whole syntax fragment that is labeled **parameter-block**:



Conventions used in this book

This section specifies some conventions which are used throughout this manual.

Highlighting conventions

Bold	Indicates SQL keywords used in examples and when introducing descriptions involving the keyword.
Italics	Indicates one of the following:Variables that represent items from a syntax diagram.The introduction of a new term.A reference to another source of information.

Conventions for describing mixed data values

When mixed data values are shown in the examples, the following conventions apply:

Convention	Meaning			
S ₀	Represents the EBCDIC shift-out control character (X' 0E')			
s _I	Represents the EBCDIC shift-in control character (X'0F')			
sbcs-string	Represents a string of zero or more single-byte characters			
dbcs-string	Represents a string of zero or more double-byte characters			
•	Represents a DBCS apostrophe (EBCDIC X'427D')			
G	Represents a DBCS G (EBCDIC X'42C7')			

Conventions for describing mixed data values description

Conventions for describing mixed data values. Shift-out character represented by X' 0E', shift-in characters represented by X' 0F', single-byte characters represented by sbcs-string, double-byte characters represented by dbcs-string, DBCS apostrophe represented by EBCDIC X' 427D, and DBCS G represented by EBCDIC X' 42C7.

Conventions for describing Unicode data

When a specific Unicode UTF-16 code point is referenced, it can be expressed as U+n, where n is 4 to 6 hexadecimal digits. Leading zeros are omitted, unless the code point has fewer than 4 hexadecimal digits. For example, the following values are valid representations of a UTF-16 code point:

U+00001 U 0012 U+0123 U+1234 U+12345 U+123456

SQL accessibility

I

IBM is committed to providing interfaces and documentation that are easily accessible to the disabled community.

For general information about IBM's Accessibility support visit the Accessibility Center at http://www.ibm.com/able.

SQL accessibility support falls in two main categories.

- System i Navigator is graphical user interface to the IBM i operating system and DB2 for i. For information about the Accessibility features supported in Windows® graphical user interfaces, see Accessibility in the Windows Help Index.
- Online documentation, online help, and prompted SQL interfaces can be accessed by a Windows Reader program such as the IBM Home Page Reader. For information about the IBM Home Page Reader and other tools, visit the

Accessibility Center

The IBM Home Page Reader can be used to access all descriptive text in this book, all articles in the SQL Information Center, and all SQL messages. Due to the complex nature of SQL syntax diagrams, however, the reader will skip syntax diagrams. Two alternatives are provided for better ease of use:

 Interactive SQL and Query Manager Interactive SQL and Query Manager are traditional file interfaces that provide prompting for SQL statements. These are part of the IBM DB2 Query Manager and SQL Development Kit for i5/OS[®]. For more information about Interactive SQL and Query Manager, see the SQL Programming and Query Manager Use



topics.

SQL Assist

SQL Assist is a graphical user interface that provides a prompted interface to SQL statements. This is part of System i Navigator. For more information, see the System i Navigator online help and the Information Center.

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(www.adobe.com/products/acrobat/readstep.html)



What's new for V6R1

This topic highlights the changes made to this topic collection for V6R1.

The major new features covered in this book include:

- DECFLOAT data type
- BX literals
- FOR BIT DATA and binary compatibility
- Client special registers
- Grouping Sets and Super groups
- · ASCII and CHR scalar functions
- ENCRYPT_AES scalar function
- TIMESTAMP_FORMAT scalar functions and VARCHAR_FORMAT scalar function enhancements
- MONTHS_BETWEEN, ROUND_TIMESTAMP and TRUNC_TIMESTAMP scalar functions
- VALUES in SELECT
- INSERT in FROM
- · Full Outer Join
- Skip Locks

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- Several restrictions related to NLSS, translation, UDTFs, and lateral correlation have been removed
- Ignore unsupported DDL syntax
- SYSTOOLS and SYSIBMADM schemas
- ALTER FUNCTION
- · COMMENT and LABEL enhancements
- NCHAR, NVARCHAR, and NCLOB
- Expressions in indexes
- Hidden columns
- Auto-generated timestamps
- FOR EACH STATEMENT on INSTEAD OF triggers
- · Indicator variable values that indicate no update
- 128-byte cursor and statement names
- More than 120 columns in GROUP BY
- · Remove number of schemas limit
- · Several new statistical views
- RPG variables within procedure scope
- Precompiler support for IFS source
- Add order-by-clause and fetch-first-clause support to a subselect
- Allow the starting-clause and ending-clause to be optional in range-partition-specs

How to see what's new or changed

To help you see where technical changes have been made, this information uses:

- The >> image to mark where new or changed information begins.
- The
 image to mark where new or changed information ends.

To find other information about what's new or changed this release, see the Memo to users.

SQL accessibility

Chapter 1. Concepts

This chapter provides a high-level view of concepts that are important to understand when using Structured Query Language (SQL). The reference material contained in the rest of this manual provides a more detailed view.

Relational database

A *relational database* is a database that can be perceived as a set of tables and can be manipulated in accordance with the relational model of data. The relational database contains a set of objects used to store, access, and manage data. The set of objects includes tables, views, indexes, aliases, distinct types, functions, procedures, sequences, and packages.

There are three types of relational databases a user can access from a System i product.

system relational database

There is one default relational database on any System i product. The system relational database is always local to that System i product. It consists of all the database objects that exist on disk attached to the System i product that are not stored on independent auxiliary storage pools. For more information on independent auxiliary storage pools, see the System Management category of the i5/OS Information Center.

The name of the system relational database is, by default, the same as the System i system name. However, a different name can be assigned through the use of the ADDRDBDIRE (Add RDB Directory Entry) command or System i Navigator.

user relational database

The user may create additional relational databases on a System i product by configuring independent auxiliary storage pools on the system. Each primary independent auxiliary storage pool is a relational database. It consists of all the database objects that exist on the independent auxiliary storage pool disks. Additionally, all database objects in the system relational database of the System i product to which the independent auxiliary storage pool is connected are logically included in a user relational database. Thus, the name of any schema created in a user relational database must not already exist in that user relational database or in the associated system relational database.

Although the objects in the system relational database are logically included in a user relational database, certain dependencies between the objects in the system relational database and the user relational database are not allowed:

- A view must be created into a schema that exists in the same relational database as its referenced tables and views, except that a view created into QTEMP can reference tables and views in the user relational database.
- An index must be created into a schema that exists in the same relational database as its referenced table.
- A trigger or constraint must be created into a schema that exists in the same relational database as its base table.

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- The parent table and dependent table in a referential constraint must both exist in the same relational database.
- Any object in the system relational database can only reference functions, procedures, and types in the same system relational database. However, objects in the user relational database may reference functions, procedures, and types in the system relational database or the same user relational database. However, operations on such an object may fail if the other relational database is not available. For example, if a user relational database is varied off and then varied on to another system.

A user relational database is local to a System i product while the independent auxiliary storage pool is varied on. Independent auxiliary storage pools can be varied off on one System i product and then varied on to another System i product. Hence, a user relational databases may be local to a given System i product at one point in time and remote at a different point in time. For more information on independent auxiliary storage pools, see the System Management category of the i5/OS Information Center.

The name of the user relational database is, by default, the same as the independent auxiliary storage pool name. However, a different name can be assigned through the use of the ADDRDBDIRE (Add RDB Directory Entry) command or System i Navigator.

remote relational database

Relational databases on other System i and non-System i products can be accessed remotely. These relational databases must be registered through the use of the ADDRDBDIRE (Add RDB Directory Entry) command or System i Navigator.

The database manager is the name used generically to identify the System i Licensed Internal Code and the DB2 for i portion of the code that manages the relational database.

Structured Query Language

Structured Query Language (SQL) is a standardized language for defining and manipulating data in a relational database. In accordance with the relational model of data, the database is perceived as a set of tables, relationships are represented by values in tables, and data is retrieved by specifying a result table that can be derived from one or more base tables.

SQL statements are executed by a database manager. One of the functions of the database manager is to transform the specification of a result table into a sequence of internal operations that optimize data retrieval. This transformation occurs when the SQL statement is *prepared*. This transformation is also known as *binding*.

All executable SQL statements must be prepared before they can be executed. The result of preparation is the executable or *operational form* of the statement. The method of preparing an SQL statement and the persistence of its operational form distinguish *static* SQL from *dynamic* SQL.

Static SQL

The source form of a *static* SQL statement is embedded within an application program written in a host language such as COBOL, C, or Java. The statement is

prepared before the program is executed and the operational form of the statement persists beyond the execution of the program.

A source program containing static SQL statements must be processed by an SQL precompiler before it is compiled. The precompiler checks the syntax of the SQL statements, turns them into host language comments, and generates host language statements to call the database manager.

The preparation of an SQL application program includes precompilation, the preparation of its static SQL statements, and compilation of the modified source program.

Dynamic SQL

Programs containing embedded dynamic SQL statements must be precompiled like those containing static SQL, but unlike static SQL, the dynamic SQL statements are constructed and prepared at run time. The source form of the statement is a character or graphic string that is passed to the database manager by the program using the static SQL PREPARE or EXECUTE IMMEDIATE statement. A statement prepared using the PREPARE statement can be referenced in a DECLARE CURSOR, DESCRIBE, or EXECUTE statement. The operational form of the statement persists for the duration of the connection or until the last SQL program leaves the call stack.

SQL statements embedded in a REXX $^{\text{\tiny TM}}$ application are dynamic SQL statements. SQL statements submitted to the interactive SQL facility and to the Call Level Interface (CLI) are also dynamic SQL statements.

Extended Dynamic SQL

An extended dynamic SQL statement is neither fully static nor fully dynamic. The QSQPRCED API provides users with extended dynamic SQL capability. Like dynamic SQL, statements can be prepared, described, and executed using this API. Unlike dynamic SQL, SQL statements prepared into a package by this API persist until the package or statement is explicitly dropped. For more information, see the Database and File APIs information in the Programming category of the i5/OS Information Center.

Interactive SQL

An interactive SQL facility is associated with every database manager. Essentially, every interactive SQL facility is an SQL application program that reads statements from a workstation, prepares and executes them dynamically, and displays the results to the user. Such SQL statements are said to be issued interactively.

The interactive facilities for DB2 for i are invoked by the STRSQL command, the STRQM command, or the Run SQL Script support of System i Navigator. For more information about the interactive facilities for SQL, see the SQL Programming and

Query Manager Use books.

SQL Call Level Interface and Open Database Connectivity

The DB2 Call Level Interface (CLI) is an application programming interface in which functions are provided to application programs to process dynamic SQL statements. DB2 CLI allows users of any of the ILE languages to access SQL

Structured Query Language

functions directly through procedure calls to a service program provided by DB2 for i. CLI programs can also be compiled using an Open Database Connectivity (ODBC) Software Developer's Kit, available from Microsoft[®] or other vendors, enabling access to ODBC data sources. Unlike using embedded SQL, no precompilation is required. Applications developed using this interface may be executed on a variety of databases without being compiled against each of the databases. Through the interface, applications use procedure calls at execution time to connect to databases, to issue SQL statements, and to get returned data and status information.

The DB2 CLI interface provides many features not available in embedded SQL. For example:

- CLI provides function calls which support a consistent way to query and retrieve database system catalog information across the DB2 family of database management systems. This reduces the need to write application server specific catalog queries.
- Stored procedures called from application programs written using CLI can return result sets to those programs.

For a complete description of all the available functions, and their syntax, see SQL Call Level Interfaces (ODBC) book.

Java DataBase Connectivity (JDBC) and embedded SQL for Java (SQLJ) programs

DB2 for i implements two standards-based Java programming APIs: Java Database Connectivity (JDBC) and embedded SQL for Java (SQLJ). Both can be used to create Java applications and applets that access DB2.

JDBC calls are translated to calls to DB2 CLI through Java native methods. You can access DB2 for i databases through two JDBC drivers: IBM Developer Kit for Java driver or IBM Toolbox for Java JDBC driver. For specific information about the IBM Toolbox for Java JDBC driver, see IBM Toolbox for Java.

Static SQL cannot be used by JDBC. SQLJ applications use JDBC as a foundation for such tasks as connecting to databases and handling SQL errors, but can also contain embedded static SQL statements in the SQLJ source files. An SQLJ source file has to be translated with the SQLJ translator before the resulting Java source code can be compiled.

For more information about JDBC and SQLJ applications, refer to the Developer Kit for Java book.

OLE DB and ADO (ActiveX Data Object)

System i Access for Windows includes OLE DB Providers, along with the Programmer's Toolkit to allow DB2 client/server application development quick and easy from the Windows client PC. For more information, refer to the System i Access for Windows OLE DB provider in the i5/OS Information Center.

.NET

System i Access for Windows include a .NET Provider to allow DB2 client/server application development quick and easy from the Windows client PC. For more

information, refer to the System i Access for Windows .NET provider in the i5/OS Information Center.

Schemas

The objects in a relational database are organized into sets called schemas. A schema provides a logical classification of objects in a relational database.

A schema name is used as the qualifier of SQL object names such as tables, views, indees, and triggers. A schema is also called a collection or library.

Each database manager supports a set of schemas that are reserved for use by the database manager. Such schemas are called system schemas. The schema SESSION and all schemas that start with 'SYS' and 'Q' are system schemas.

User objects must not be created in system schemas, other than SESSION. SESSION is always used as the schema name for declared temporary tables. Users should not create schemas that start with 'SYS' or 'Q'.

A schema is also an object in the relational database. It is explicitly created using the CREATE SCHEMA statement.¹

An object that is contained in a schema is assigned to the schema when the object is created. The schema to which it is assigned is determined by the name of the object if specifically qualified with a schema name or by the default schema name if not qualified.

For example, a user creates a schema called C:

CREATE SCHEMA C

The user can then issue the following statement to create a table called X in schema C:

CREATE TABLE C.X (COL1 INT)

Tables

Tables are logical structures maintained by the database manager. Tables are made up of columns and rows. There is no inherent order of the rows within a table. At the intersection of every column and row is a specific data item called a value. A column is a set of values of the same type. A row is a sequence of values such that the *n*th value is a value of the *n*th column of the table.

There are three types of tables:

• A base table is created with the CREATE TABLE statement and is used to hold persistent user data. For more information see "CREATE TABLE" on page 768. A base table has a name and may have a different system name. The system name is the name used by the IBM i operating system. Either name is acceptable wherever a table-name is specified in SQL statements.

A column of a base table has a name and may have a different system column name. The system column name is the name used by the i operating system.

^{1.} A schema can also be created using the CRTLIB CL command, however, the catalog views and journal and journal receiver created by using the CREATE SCHEMA statement will not be created with CRTLIB.

Either name is acceptable wherever *column-name* is specified in SQL statements. For more information see "CREATE TABLE" on page 768.

A *materialized query table* is a base table created with the CREATE TABLE statement and used to contain data that is derived (materialized) from a *select-statement*. A source table is a base table, view, table expression, or user-defined table function. The *select-statement* specifies the query that is used to refresh the data in the materialized query table.

Materialized query tables can be used to improve the performance of SQL queries. If the database manager determines that a portion of a query could be resolved by using the data in a materialized query table, the query may be rewritten by the database manager to use the materialized query table. For more information about creating materialized query tables, see "CREATE TABLE" on page 768.

A partitioned table is a table whose data is contained in one or more local partitions (members). There are two mechanisms that can be specified to determine into which partition a specific row will be inserted. Range partitioning allows a user to specify different ranges of values for each partition. When a row is inserted, the values specified in the row are compared to the specified ranges to determine which partition is appropriate. Hash partitioning allows a user to specify a partitioning key on which a hash algorithm is used to determine which partition is appropriate. The partitioning key is a set of one or more columns in a partitioned table that are used to determine in which partition a row belongs.

A *distributed table* is a table whose data is partitioned across a nodegroup. A *nodegroup* is an object that provides a logical grouping of a set of two or more systems. The *partitioning key* is a set of one or more columns in a distributed table that are used to determine on which system a row belongs. For more information about distributed tables, see the DB2 Multisystem book.

- A *result table* is a set of rows that the database manager selects or generates from a query. For information on queries, see Chapter 4, "Queries," on page 469.
- A declared temporary table is created with a DECLARE GLOBAL TEMPORARY TABLE statement and is used to hold temporary data on behalf of a single application. This table is dropped implicitly when the application disconnects from the database.

Keys

A *key* is one or more expressions that are identified as such in the description of an index, unique constraint, or a referential constraint. The same expression can be part of more than one key.

A *composite key* is an ordered set of expressions of the same base table. The ordering of the expressions is not constrained by their ordering within the base table. The term *value* when used with respect to a composite key denotes a composite value. Thus, a rule such as "the value of the foreign key must be equal to the value of the primary key" means that each component of the value of the foreign key must be equal to the corresponding component of the value of the primary key.

Constraints

A *constraint* is a rule that the database manager enforces.

There are three types of constraints:

 A unique constraint is a rule that forbids duplicate values in one or more columns within a table. Unique and primary keys are the supported unique constraints. For example, a unique constraint can be defined on the supplier identifier in the supplier table to ensure that the same supplier identifier is not given to two suppliers.

- A referential constraint is a logical rule about values in one or more columns in one or more tables. For example, a set of tables shares information about a corporation's suppliers. Occasionally, a supplier's ID changes. You can define a referential constraint stating that the ID of the supplier in a table must match a supplier ID in the supplier information. This constraint prevents insert, update, or delete operations that would otherwise result in missing supplier information.
- A check constraint sets restrictions on data added to a specific table. For example, a check constraint can ensure that the salary level for an employee is at least \$20 000 whenever salary data is added or updated in a table containing personnel information.

Unique constraints

A unique constraint is the rule that the values of a key are valid only if they are unique. A key that is constrained to have unique values is called a *unique key*. A unique constraint is enforced by using a unique index. The unique index is used by the database manager to enforce the uniqueness of the values of the key during the execution of INSERT and UPDATE statements.

There are two types of unique constraints:

- Unique keys can be defined as a primary key using a CREATE TABLE or ALTER TABLE statement. A base table cannot have more than one primary key. A CHECK constraint will be added implicitly to enforce the rule that the NULL value is not allowed in the columns that make up the primary key. A unique index on a primary key is called a *primary index*.
- Unique keys can be defined using the UNIQUE clause of the CREATE TABLE or ALTER TABLE statement. A base table can have more than one set of UNIQUE keys.

A unique key that is referenced by the foreign key of a referential constraint is called the parent key. A parent key is either a primary key or a UNIQUE key. When a base table is defined as a parent in a referential constraint, the default parent key is its primary key.

The unique index that is used to enforce a unique constraint is implicitly created when the unique constraint is defined. Alternatively, it can be defined by using the CREATE UNIQUE INDEX statement.

For more information about defining unique constraints, see "ALTER TABLE" on page 585 or "CREATE TABLE" on page 768.

Referential constraints

Referential integrity is the state of a database in which all values of all foreign keys are valid. A foreign key is a key that is part of the definition of a referential constraint.

A referential constraint is the rule that the values of the foreign key are valid only if:

- They appear as values of a parent key, or
- Some component of the foreign key is null.

The base table containing the parent key is called the *parent table* of the referential constraint, and the base table containing the foreign key is said to be a *dependent* of that table.

Referential constraints are optional and can be defined in CREATE TABLE statements and ALTER TABLE statements. Referential constraints are enforced by the database manager during the execution of INSERT, UPDATE, and DELETE statements. The enforcement is effectively performed at the completion of the statement except for delete and update rules of RESTRICT which are enforced as rows are processed.

Referential constraints with a delete or update rule of RESTRICT are always enforced before any other referential constraints. Other referential constraints are enforced in an order independent manner. That is, the order does not affect the result of the operation. Within an SQL statement:

- A row can be marked for deletion by any number of referential constraints with a delete rule of CASCADE.
- A row can only be updated by one referential constraint with a delete rule of SET NULL or SET DEFAULT.
- A row that was updated by a referential constraint cannot also be marked for deletion by another referential constraint with a delete rule of CASCADE.

The rules of referential integrity involve the following concepts and terminology:

Parent key

A primary key or unique key of a referential constraint.

Parent row

A row that has at least one dependent row.

Parent table

A base table that is a parent in at least one referential constraint. A base table can be defined as a parent in an arbitrary number of referential constraints.

Dependent table

A base table that is a dependent in at least one referential constraint. A base table can be defined as a dependent in an arbitrary number of referential constraints. A dependent table can also be a parent table.

Descendent table

A base table is a descendent of base table T if it is a dependent of T or a descendent of a dependent of T.

Dependent row

A row that has at least one parent row.

Descendent row

A row is a descendent of row p if it is a dependent of p or a descendent of a dependent of p.

Referential cycle

A set of referential constraints such that each table in the set is a descendent of itself.

Self-referencing row

A row that is a parent of itself.

Self-referencing table

A base table that is a parent and a dependent in the same referential constraint. The constraint is called a self-referencing constraint.

The insert rule of a referential constraint is that a nonnull insert value of the foreign key must match some value of the parent key of the parent table. The value of a composite foreign key is null if any component of the value is null.

The update rule of a referential constraint is specified when the referential constraint is defined. The choices are NO ACTION and RESTRICT. The update rule applies when a row of the parent or dependent table is updated. The update rule of a referential constraint is that a nonnull update value of a foreign key must match some value of the parent key of the parent table. The value of a composite foreign key is treated as null if any component of the value is null.

The delete rule of a referential constraint is specified when the referential constraint is defined. The choices are RESTRICT, NO ACTION, CASCADE, SET NULL or SET DEFAULT. SET NULL can be specified only if some column of the foreign key allows null values.

The delete rule of a referential constraint applies when a row of the parent table is deleted. More precisely, the rule applies when a row of the parent table is the object of a delete or propagated delete operation (defined below) and that row has dependents in the dependent table of the referential constraint. Let P denote the parent table, let D denote the dependent table, and let p denote a parent row that is the object of a delete or propagated delete operation. If the delete rule is:

- RESTRICT or NO ACTION, an error is returned and no rows are deleted
- CASCADE, the delete operation is propagated to the dependents of p in D
- SET NULL, each nullable column of the foreign key of each dependent of p in D is set to null
- SET DEFAULT, each column of the foreign key of each dependent of p in D is set to its default value

Each referential constraint in which a table is a parent has its own delete rule, and all applicable delete rules are used to determine the result of a delete operation. Thus, a row cannot be deleted if it has dependents in a referential constraint with a delete rule of RESTRICT or NO ACTION, or if the deletion cascades to any of its descendants that are dependents in a referential constraint with the delete rule of RESTRICT or NO ACTION.

The deletion of a row from parent table P involves other tables and may affect rows of these tables:

- If table D is a dependent of P and the delete rule is RESTRICT or NO ACTION, D is involved in the operation but is not affected by the operation.
- If D is a dependent of P and the delete rule is SET NULL, D is involved in the operation, and rows of D may be updated during the operation.
- If D is a dependent of P and the delete rule is SET DEFAULT, D is involved in the operation, and rows of D may be updated during the operation.
- If D is a dependent of P and the delete rule is CASCADE, D is involved in the operation and rows of D may be deleted during the operation.
 - If rows of D are deleted, the delete operation on P is said to be propagated to D. If D is also a parent table, the actions described in this list apply, in turn, to the dependents of D.

Tables

Any base table that may be involved in a delete operation on P is said to be delete-connected to P. Thus, a base table is delete-connected to base table P if it is a dependent of P or a dependent of a base table to which delete operations from P cascade.

For more information on defining referential constraints, see "ALTER TABLE" on page 585 or "CREATE TABLE" on page 768.

Check constraints

A check constraint is a rule that specifies which values are allowed in every row of a base table. The definition of a check constraint contains a search condition that must not be FALSE for any row of the base table.

Each column referenced in the search condition of a check constraint on a table T must identify a column of T. For more information about search conditions, see "Search conditions" on page 201.

A base table can have more than one check constraint. Each check constraint defined on a base table is enforced by the database manager when either of the following occur:

- A row is inserted into that base table.
- A row of that base table is updated.

A check constraint is enforced by applying its search condition to each row that is inserted or updated in that base table. An error is returned if the result of the search condition is FALSE for any row.

For more information about defining check constraints, see "ALTER TABLE" on page 585 or "CREATE TABLE" on page 768.

Indexes

An *index* is a set of pointers to rows of a base table. Each index is based on the values of data in one or more table columns. An index is an object that is separate from the data in the table. When an index is created, the database manager builds this structure and maintains it automatically.

An index has a name and may have a different system name. The system name is the name used by the IBM i operating system. Either name is acceptable wherever an index-name is specified in SQL statements. For more information, see "CREATE INDEX" on page 723.

The database manager uses two types of indexes:

- Binary radix tree index
 - Binary radix tree indexes provide a specific order to the rows of a table. The database manager uses them to:
 - Improve performance. In most cases, access to data is faster than without an
 - Ensure uniqueness. A table with a unique index cannot have rows with identical keys.
- Encoded vector index

Encoded vector indexes do not provide a specific order to the rows of a table. The database manager only uses these indexes to improve performance.

An encoded vector access path works with the help of encoded vector indexes and provides access to a database file by assigning codes to distinct key values and then representing these values in an array. The elements of the array can be 1, 2, or 4 bytes in length, depending on the number of distinct values that must be represented. Because of their compact size and relative simplicity, encoded vector access paths provide for faster scans that can be more easily processed in parallel.

An *index* is created with the CREATE INDEX statement. For more information about creating indexes, see "CREATE INDEX" on page 723.

For more information about indexes, see Indexing and statistics strategies for DB2 for i5/OS .

Triggers

A *trigger* defines a set of actions that are executed automatically whenever a delete, insert, or update operation occurs on a specified table or view. When such an SQL operation is executed, the trigger is said to be activated.

The set of actions can include almost any operation allowed on the system. A few operations are not allowed, such as:

- Commit or rollback (if the same commitment definition is used for the trigger actions and the triggering event)
- CONNECT, SET CONNECTION, DISCONNECT, and RELEASE statements
- SET SESSION AUTHORIZATION

For a complete list of restrictions, see "CREATE TRIGGER" on page 813 and the Database Programming book.

Triggers can be used along with referential constraints and check constraints to enforce data integrity rules. Triggers are more powerful than constraints because they can also be used to cause updates to other tables, automatically generate or transform values for inserted or updated rows, or invoke functions that perform operations both inside and outside of database manager. For example, instead of preventing an update to a column if the new value exceeds a certain amount, a trigger can substitute a valid value and send a notice to an administrator about the invalid update.

Triggers are a useful mechanism to define and enforce transitional business rules that involve different states of the data (for example, salary cannot be increased by more than 10 percent). Such a limit requires comparing the value of a salary before and after an increase. For rules that do not involve more than one state of the data, consider using referential and check constraints.

Triggers also move the application logic that is required to enforce business rules into the database, which can result in faster application development and easier maintenance because the business rule is no longer repeated in several applications, but one version is centralized to the trigger. With the logic in the database, for example, the previously mentioned limit on increases to the salary column of a table, database manager checks the validity of the changes that any application makes to the salary column. In addition, the application programs do not need to be changed when the logic changes.

For more information about creating triggers, see "CREATE TRIGGER" on page $813.^{2}$

Triggers are optional and are defined using the CREATE TRIGGER statement or the Add Physical File Trigger (ADDPFTRG) CL command. Triggers are dropped using the DROP TRIGGER statement or the Remove Physical File Trigger (RMVPFTRG) CL command. For more information about creating triggers, see the CREATE TRIGGER statement. For more information about triggers in general, see the "CREATE TRIGGER" on page 813 statement or the SQL Programming and the Database Programming books.

There are a number of criteria that are defined when creating a trigger which are used to determine when a trigger should be activated.

- The *subject table* defines the table or view for which the trigger is defined.
- The *trigger event* defines a specific SQL operation that modifies the subject table. The operation could be delete, insert, or update.
- The trigger activation time defines whether the trigger should be activated before or after the trigger event is performed on the subject table.

The statement that causes a trigger to be activated will include a set of affected rows. These are the rows of the subject table that are being deleted, inserted or updated. The trigger granularity defines whether the actions of the trigger will be performed once for the statement or once for each of the rows in the set of affected rows.

The trigger action consists of an optional search condition and a set of SQL statements that are executed whenever the trigger is activated. The SQL statements are only executed if no search condition is specified or the specified search condition evaluates to true.

The triggered action may refer to the values in the set of affected rows. This is supported through the use of transition variables. Transition variables use the names of the columns in the subject table qualified by a specified name that identifies whether the reference is to the old value (prior to the update) or the new value (after the update). The new value can also be changed using the SET transition-variable statement in before update or insert triggers. Another means of referring to the values in the set of affected rows is using *transition tables*. Transition tables also use the names of the columns of the subject table but have a name specified that allows the complete set of affected rows to be treated as a table. Transition tables can only be used in after triggers. Separate transition tables can be defined for old and new values.

Multiple triggers can be specified for a combination of table, event, or activation time. The order in which the triggers are activated is the same as the order in which they were created. Thus, the most recently created trigger will be the last trigger activated.

The activation of a trigger may cause trigger cascading. This is the result of the activation of one trigger that executes SQL statements that cause the activation of other triggers or even the same trigger again. The triggered actions may also cause updates as a result of the original modification, which may result in the activation of additional triggers. With trigger cascading, a significant chain of triggers may be activated causing significant change to the database as a result of a single delete, insert or update statement.

^{2.} The ADDPFTRG CL command also defines a trigger, including triggers that are activated on any read operation.

The actions performed in the trigger are considered to be part of the operation that caused the trigger to be executed. Thus, when the isolation level is anything other than NC (No Commit) and the trigger actions are performed using the same commitment definition as the trigger event:

- The database manager ensures that the operation and the triggers executed as a result of that operation either all complete or are backed out. Operations that occurred prior to the triggering operation are not affected.
- The database manager effectively checks all constraints (except for a constraint with a RESTRICT delete rule) after the operation and the associated triggers have been executed.

A trigger has an attribute that specifies whether it is allowed to delete or update a row that has already been inserted or updated within the SQL statement that caused the trigger to be executed.

- If ALWREPCHG(*YES) is specified when the trigger is defined, then within an SQL statement:
 - The trigger is allowed to update or delete any row that was inserted or already updated by that same SQL statement. This also includes any rows inserted or updated by a trigger or referential constraint caused by the same SQL statement.
- If ALWREPCHG(*NO) is specified when the trigger is defined, then within an SQL statement:
 - A row can be deleted by a trigger only if that row has not been inserted or updated by that same SQL statement. If the isolation level is anything other than NC (No Commit) and the trigger actions are performed using the same commitment definition as the trigger event, this also includes any inserts or updates by a trigger or referential constraint caused by the same SQL statement.
 - A row can be updated by a trigger only if that row has not already been inserted or updated by that same SQL statement. If the isolation level is anything other than NC (No Commit) and the trigger actions are performed using the same commitment definition as the trigger event, this also includes any inserts or updates by a trigger or referential constraint caused by the same SQL statement.

All triggers created by using the CREATE TRIGGER statement implicitly have the ALWREPCHG(*YES) attribute.

Views

A view provides an alternative way of looking at the data in one or more tables.

A view is a named specification of a result table. The specification is a SELECT statement that is effectively executed whenever the view is referenced in an SQL statement. Thus, a view can be thought of as having columns and rows just like a base table. For retrieval, all views can be used just like base tables. Whether a view can be used in an insert, update, or delete operation depends on its definition.

An index cannot be created for a view. However, an index created for a table on which a view is based may improve the performance of operations on the view.

When the column of a view is directly derived from a column of a base table, that column inherits any constraints that apply to the column of the base table. For example, if a view includes a foreign key of its base table, INSERT and UPDATE

Views

operations using that view are subject to the same referential constraints as the base table. Likewise, if the base table of a view is a parent table, DELETE operations using that view are subject to the same rules as DELETE operations on the base table. A view also inherits any triggers that apply to its base table. For example, if the base table of a view has an update trigger, the trigger is fired when an update is performed on the view.

A view has a name and may have a different system name. The system name is the name used by the IBM i operating system. Either name is acceptable wherever a view-name is specified in SQL statements.

A column of a view has a name and may have a different system column name. The system column name is the name used by the i operating system. Either name is acceptable wherever column-name is specified in SQL statements.

A view is created with the CREATE VIEW statement. For more information about creating views, see "CREATE VIEW" on page 835.

User-defined types

A user-defined type is a data type that is defined to the database using a CREATE statement.

A distinct type is a user-defined type that shares its internal representation with a built-in data type (its source type), but is considered to be a separate and incompatible data type for most operations. A distinct type is created with an SQL CREATE TYPE statement. A distinct type can be used to define a column of a table, or a parameter of a routine. For more information, see "CREATE TYPE" on page 827 and "User-defined types" on page 82.

Aliases

An *alias* is an alternate name for a table or view.

An alias can be used to reference a table or view in cases where an existing table or view can be referenced.³ However, the option of referencing a table or view by an alias is not explicitly shown in the syntax diagrams or mentioned in the description of SQL statements. Like tables and views, an alias may be created, dropped, and have a comment or label associated with it. No authority is necessary to use an alias. Access to the tables and views that are referred to by the alias, however, still requires the appropriate authorization for the current statement.

An alias has a name and may have a different system name. The system name is the name used by the IBM i operating system. Either name is acceptable wherever an alias-name is specified in SQL statements.

An alias is created with the CREATE ALIAS statement. For more information about creating aliases, see "CREATE ALIAS" on page 652.

^{3.} You cannot use an alias in all contexts. For example, an alias that refers to an individual member of a database file cannot be used in most SQL schema statements. For more information, see "CREATE ALIAS" on page 652.

Packages and access plans

A package is an object that contains control structures used to execute SQL statements.

Packages are produced during distributed program preparation. The control structures can be thought of as the bound or operational form of SQL statements.⁴ All control structures in a package are derived from the SQL statements embedded in a single source program.

In this book, the term access plan is used in general for packages, procedures, functions, triggers, and programs or service programs that contain control structures used to execute SQL statements. For example, the description of the DROP statement says that dropping an object also invalidates any access plans that reference the object (see "DROP" on page 907). This means that any packages, procedures, functions, triggers, and programs or service programs containing control structures referencing the dropped object are invalidated.

An invalidated access plan will be implicitly rebuilt the next time its associated SQL statement is executed. For example, if an index is dropped that is used in an access plan for a SELECT INTO statement, the next time that SELECT INTO statement is executed, the access plan will be rebuilt.

A package can also be created by the Process Extended Dynamic SQL (QSQPRCED) API. Packages created by the Process Extended Dynamic SQL (QSQPRCED) API can only be used by the Process Extended Dynamic SQL (QSQPRCED) API. They cannot be used at an application server through DRDA® protocols. For more information, see the Database and File APIs information in the **Programming** category of the i5/OS Information Center.

The QSQPRCED API is used by IBM System i Access for Windows to create packages for caching SQL statements executed via ODBC, JDBC, SQLJ, OLD DB, and .NET interfaces.

Routines

A routine is an executable SQL object.

There are two types of routines.

Functions

A function is a routine that can be invoked from within other SQL statements and returns a value or a table. For more information, see "Functions" on page 145.

Functions are classified as either SQL functions or external functions. SQL functions are written using SQL statements, which are also known collectively as SQL procedural language. External functions reference a host language program which may or may not contain SQL statements.

A function is created with the CREATE FUNCTION statement. For more information about creating functions, see "CREATE FUNCTION" on page 655.

^{4.} For non-distributed SQL programs, non-distributed service programs, SQL functions, and SQL procedures, the control structures used to execute SQL statements are stored in the associated space of the object.

Routines

Procedures

A procedure (sometimes called a stored procedure) is a routine that can be called to perform operations that can include both host language statements and SQL statements.

Procedures are classified as either SQL procedures or external procedures. SQL procedures are written using SQL statements, which are also known collectively as SQL procedural language. External procedures reference a host language program which may or may not contain SQL statements.

A procedure is created with the CREATE PROCEDURE statement. For more information about creating procedures, see "CREATE PROCEDURE" on page 730.

Procedures in SQL provide the same benefits as procedures in a host language. That is, a common piece of code need only be written and maintained once and can be called from several programs. Both host languages and SQL can call procedures that exist on the local system. However, SQL can also call a procedure that exists on a remote system. In fact, the major benefit of procedures in SQL is that they can be used to enhance the performance characteristics of distributed applications.

Assume that several SQL statements must be executed at a remote system. There are two ways this can be done. Without procedures, when the first SQL statement is executed, the application requester will send a request to an application server to perform the operation. It then waits for a reply that indicates whether the statement is executed successfully or not and optionally returns results. When the second and each subsequent SQL statement is executed, the application requester will send another request and wait for another reply.

If the same SQL statements are stored in a procedure at an application server, a CALL statement can be executed that references the remote procedure. When the CALL statement is executed, the application requester will send a single request to the current server to call the procedure. It will then wait for a single reply that indicates whether the procedure executed successfully or not and optionally returns results.

The following two figures illustrate the way stored procedures can be used in a distributed application to eliminate some of the remote requests. Figure 1 on page 17 shows a program making many remote requests.

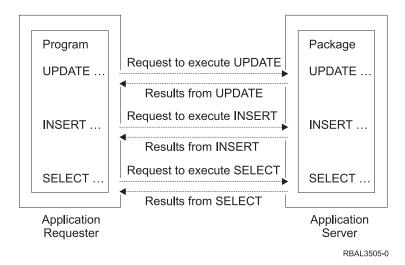


Figure 1. Application Without Remote Procedure

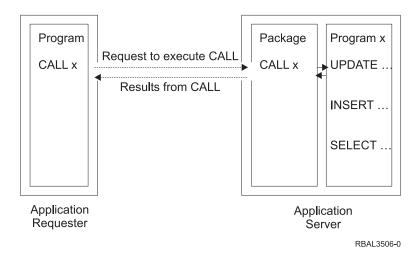


Figure 2. Application With Remote Procedure

Sequences

A sequence is a stored object that simply generates a sequence of numbers in a monotonically ascending (or descending) order. Sequences provide a way to have the database manager automatically generate unique integer and decimal primary keys, and to coordinate keys across multiple rows and tables.

A sequence can be used to exploit parallelization, instead of programmatically generating unique numbers by locking the most recently used value and then incrementing it.

Sequences are ideally suited to the task of generating unique key values. One sequence can be used for many tables, or a separate sequence can be created for each table requiring generated keys. A sequence has the following properties:

- Can have guaranteed, unique values, assuming that the sequence is not reset and does not allow the values to cycle.
- Can have increasing or decreasing values within a defined range.

- Can have an increment value other than 1 between consecutive values (the default is 1).
- Is recoverable.

Values for a given sequence are automatically generated by the database manager. Use of a sequence in the database avoids the performance bottleneck that results when an application implements sequences outside the database. The counter for the sequence is incremented (or decremented) independently from the transaction.

In some cases, gaps can be introduced in a sequence. A gap can occur when a given transaction increments a sequence two times. The transaction may see a gap in the two numbers that are generated because there may be other transactions concurrently incrementing the same sequence. A user may not realize that other users are drawing from the same sequence. Furthermore, it is possible that a given sequence can appear to have generated gaps in the numbers, because a transaction that may have generated a sequence number may have rolled back. Updating a sequence is not part of a transaction's unit of recovery.

A sequence is created with a CREATE SEQUENCE statement. A sequence can be referenced using a sequence-reference. A sequence reference can appear most places that an expression can appear. A sequence reference can specify whether the value to be returned is a newly generated value, or the previously generated value. For more information, see "Sequence reference" on page 179 and "CREATE SEQUENCE" on page 761.

Although there are similarities, a sequence is different than an identity column. A sequence is an object, whereas an identity column is a part of a table. A sequence can be used with multiple tables, but an identity column is part of a single table.

Authorization, privileges and object ownership

Users (identified by an authorization ID) can successfully execute SQL statements only if they have the authority to perform the specified function. To create a table, a user must be authorized to create tables; to alter a table, a user must be authorized to alter the table; and so forth.

There are two forms of authorization:

administrative authority

The person or persons holding administrative authority are charged with the task of controlling the database manager and are responsible for the safety and integrity of the data. Those with administrative authority implicitly have all privileges on all objects and control who will have access to the database manager and the extent of this access.

The security officer and all users with *ALLOBJ authority have administrative authority.

privileges

Privileges are those activities that a user is allowed to perform. Authorized users can create objects, have access to objects they own, and can pass on privileges on their own objects to other users by using the GRANT statement.

Privileges may be granted to specific users or to PUBLIC. PUBLIC specifies that a privilege is granted to a set of users (authorization IDs). The set consists of those users (including future users) that do not have privately granted privileges on the table or view. This affects private grants. For

Authorization, privileges and object ownership

example, if SELECT has been granted to PUBLIC, and UPDATE is then granted to HERNANDZ, this private grant prevents HERNANDZ from having the SELECT privilege.

The REVOKE statement can be used to REVOKE previously granted privileges. A revoke of a privilege from an authorization ID revokes the privilege granted by all authorization IDs. Revoking a privilege from an authorization ID will not revoke that same privilege from any other authorization IDs that were granted the privilege by that authorization ID.

When an object is created, the authorization ID of the statement must have the privilege to create objects in the implicitly or explicitly specified schema. The authorization ID of a statement has the privilege to create objects in the schema if:

- it is the owner of the schema, or
- it has *EXECUTE and *ADD to the schema.

When an object is created, one authorization ID is assigned *ownership* of the object. Ownership gives the user complete control over the object, including the privilege to drop the object. The privileges on the object can be granted by the owner, and can be revoked from the owner. In this case, the owner may temporarily be unable to perform an operation that requires that privilege. Because he is the owner, however, he is always allowed to grant the privilege back to himself.

When an object is created:

- If SQL names were specified, the owner of the object is the user profile with the same name as the schema into which the object is created, if a user profile with that name exists. Otherwise, the *owner* of the object is the user profile or group user profile of the job executing the statement.
- If system names were specified, the owner of the object is the user profile or group user profile of the job executing the statement.

Authority granted to *PUBLIC on SQL objects depends on the naming convention that is used at the time of object creation. If *SYS naming convention is used, *PUBLIC acquires the create authority (CRTAUT) of the library into which the object was created. If *SQL naming convention is used, *PUBLIC acquires *EXCLUDE authority.

In the Authorization sections of this book, it is assumed that the owner of an object has not had any privileges revoked from that object since it was initially created. If the object is a view, it is also assumed that the owner of the view has not had the system authority *READ revoked from any of the tables or views that this view is directly or indirectly dependent on. The owner has system authority *READ for all tables and views referenced in the view definition, and if a view is referenced, all tables and views referenced in its definition, and so forth. For more information about authority and privileges, see Security Reference.

Catalog

The database manager maintains a set of tables containing information about objects in the database. These tables and views are collectively known as the catalog. The catalog tables contain information about objects such as tables, views, indexes, packages, and constraints.

Tables and views in the catalog are similar to any other database tables and views. Any user that has the SELECT privilege on a catalog table or view can read the

Catalog

data in the catalog table or view. A user cannot directly modify a catalog table or view, however. The database manager ensures that the catalog contains accurate descriptions of the objects in the database at all times.

The database manager provides a set of views that provide more consistency with the catalog views of other IBM SQL products and another set of catalog views that provide compatibility with the catalog views of the ANSI and ISO standard (called Information Schema in the standard).

If a schema is created using the CREATE SCHEMA statement, the schema will also contain a set of views that only contain information about objects in the schema.

For more information about catalog tables and views, see Appendix F, "DB2 for i catalog views," on page 1267.

Application processes, concurrency, and recovery

All SQL programs execute as part of an application process. In the IBM i operating system, an application process is called a job. In the case of ODBC, JDBC, OLE DB, .NET, and DRDA, the application process ends when the connection ends even though the job they are using does not end and may be reused.

An application process is made up of one or more activation groups. Each activation group involves the execution of one or more programs. Programs run under a non-default activation group or the default activation group. All programs except those created by ILE compilers run under the default activation group. For example, LANGUAGE JAVA external functions run under the default activation group.

For more information about activation groups, see the book ILE Concepts 🎾 .

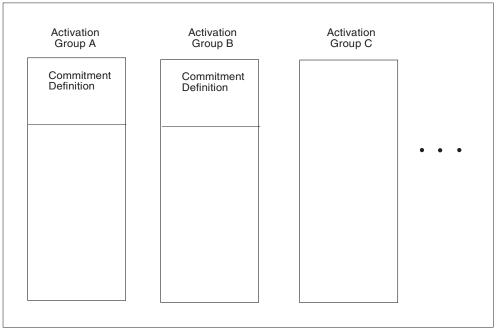


An application process that uses commitment control can run with one or more commitment definitions. A commitment definition provides a means to scope commitment control at an activation group level or at a job level. At any given time, an activation group that uses commitment control is associated with only one of the commitment definitions.

A commitment definition can be explicitly started through the Start Commitment Control (STRCMTCTL) command. If not already started, a commitment definition is implicitly started when the first SQL statement is executed under an isolation level different than COMMIT(*NONE). More than one activation group can share a job commitment definition.

Figure 3 on page 21 shows the relationship of an application process, the activation groups in that application process, and the commitment definitions. Activation groups A and B run with commitment control scoped to the activation group. These activation groups have their own commitment definitions. Activation group C does not run with any commitment control and does not have a commitment definition.

Application Process Without Job-Level Commitment Definition



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Figure 3. Activation Groups without Job Commitment Definition

Figure 4 on page 22 shows an application process, the activation groups in that application process, and the commitment definitions. Some of the activation groups are running with the job commitment definition. Activation groups A and B are running under the job commitment definition. Any commit or rollback operation in activation group A or B affects both because the commitment control is scoped to the same commitment definition. Activation group C in this example has a separate commitment definition. Commit and rollback operations performed in this activation group only affect operations within C.

Application Process With Job-Level Commitment Control

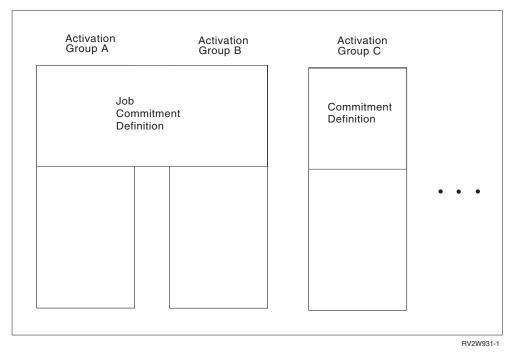


Figure 4. Activation Groups with Job Commitment Definition

For more information about commitment definitions, see the Commitment control topic.

Locking, commit, and rollback

Application processes and activation groups that use different commitment definitions can request access to the same data at the same time. Locking is used to maintain data integrity under such conditions. Locking prevents such things as two application processes updating the same row of data simultaneously.

The database manager acquires locks to keep the uncommitted changes of one activation group undetected by activation groups that use a different commitment definition. Object locks and other resources are allocated to an activation group. Row locks are allocated to a commitment definition.

When an activation group other than the default activation group ends normally, the database manager releases all locks obtained by the activation group. A user can also explicitly request that most locks be released sooner. This operation is called commit. Object locks associated with cursors that remain open after commit are not released.

The recovery functions of the database manager provide a means of backing out of uncommitted changes made in a commitment definition. The database manager may implicitly back out uncommitted changes under the following situations:

 When the application process ends, all changes performed under the commitment definition associated with the default activation group are backed out. When an activation group other than the default activation group ends abnormally, all changes performed under the commitment definition associated with that activation group are backed out.

- When using Distributed Unit of Work and a failure occurs while attempting to commit changes on a remote system, all changes performed under the commitment definition associated with remote connection are backed out.
- When using Distributed Unit of Work and a request to back out is received from a remote system because of a failure at that site, all changes performed under the commitment definition associated with remote connection are backed out.

A user can also explicitly request that their database changes be backed out. This operation is called *rollback*.

Locks acquired by the database manager on behalf of an activation group are held until the unit of work is ended. A lock explicitly acquired by a LOCK TABLE statement can be held past the end of a unit of work if COMMIT HOLD or ROLLBACK HOLD is used to end the unit of work.

A cursor can implicitly lock the row at which the cursor is positioned. This lock prevents:

- Other cursors associated with a different commitment definition from locking the same row.
- A DELETE or UPDATE statement associated with a different commitment definition from locking the same row.

Unit of work

A unit of work (also known as a transaction, logical unit of work, or unit of recovery) is a recoverable sequence of operations. Each commitment definition involves the execution of one or more units of work. At any given time, a commitment definition has a single unit of work.

A unit of work is started either when the commitment definition is started, or when the previous unit of work is ended by a commit or rollback operation. A unit of work is ended by a commit operation, a rollback operation, or the ending of the activation group. A commit or rollback operation affects only the database changes made within the unit of work that the commit or rollback ends. While changes remain uncommitted, other activation groups using different commitment definitions running under isolation levels COMMIT(*CS), COMMIT(*RS), and COMMIT(*RR) cannot perceive the changes. The changes can be backed out until they are committed. Once changes are committed, other activation groups running in different commitment definitions can access them, and the changes can no longer be backed out.

The start and end of a unit of work defines points of consistency within an activation group. For example, a banking transaction might involve the transfer of funds from one account to another. Such a transaction would require that these funds be subtracted from the first account, and added to the second. Following the subtraction step, the data is inconsistent. Only after the funds are added to the second account is consistency established again. When both steps are complete, the commit operation can be used to end the unit of work. After the commit operation, the changes are available to activation groups that use different commitment definitions.

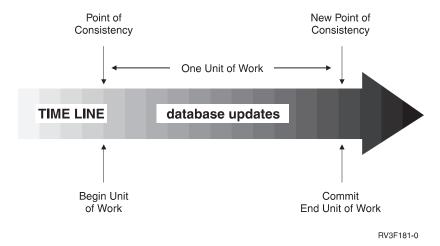


Figure 5. Unit of Work with a Commit Statement

Rolling back work

The database manager can back out all changes made in a unit of work or only selected changes. Only backing out all changes results in a point of consistency.

Rolling back all changes

The SQL ROLLBACK statement without the TO SAVEPOINT clause causes a full rollback operation. If such a rollback operation is successfully executed, database manager backs out uncommitted changes to restore the data consistency that it assumes existed when the unit of work was initiated. That is, the database manager undoes the work, as shown in the diagram below:

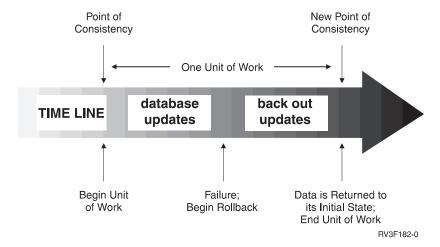


Figure 6. Unit of Work with a Rollback Statement

Rolling back selected changes using savepoints

A *savepoint* represents the state of data at some particular time during a unit of work. An application process can set savepoints within a unit of work, and then as logic dictates, roll back only the changes that were made after a savepoint was set. For example, part of a reservation transaction might involve booking an airline flight and then a hotel room. If a flight gets reserved but a hotel room cannot be

reserved, the application process might want to undo the flight reservation without undoing any database changes made in the transaction prior to making the flight reservation. SQL programs can use the SQL SAVEPOINT statement to set savepoints, the SQL ROLLBACK statement with the TO SAVEPOINT clause to undo changes to a specific savepoint or the last savepoint that was set, and the RELEASE SAVEPOINT statement to delete a savepoint.

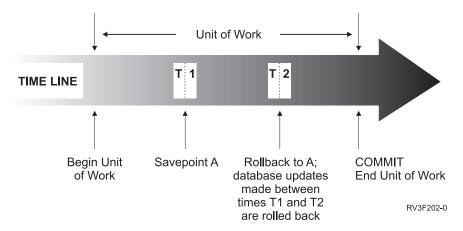


Figure 7. Unit of Work with a Rollback Statement and a Savepoint Statement

Threads

In the IBM i operating system, an application process can also consist of one or more threads. By default, a thread shares the same commitment definitions and locks as the other threads in the job. Thus, each thread can operate on the same unit of work so that when one thread commits or rolls back, it can commit or rollback all changes performed by all threads. This type of processing is useful if multiple threads are cooperating to perform a single task in parallel.

In other cases, it is useful for a thread to perform changes independent from other threads in the job. In this case, the thread would not want to share commitment definitions or lock with the other threads. Furthermore, a job can use SQL server mode in order to take more fine grain control of multiple database connections and transaction information. A typical multi-threaded job may require this control. There are several ways to accomplish this type of processing:

- Make sure the programs running in the thread use a separate activation group (be careful not to use ACTGRP(*NEW)).
- Make sure that the job is running in SQL server mode before issuing the first SQL statement. SQL server mode can be activated for a job by using one of the following mechanisms before data access occurs in the application:
 - Use the ODBC API, SQLSetEnvAttr() and set the SQL_ATTR_SERVER_MODE attribute to SQL_TRUE before doing any data access.
 - Use the Change Job API, QWTCHGJB(), and set the 'Server mode for Structured Query Language' key before doing any data access.
 - Use JAVA to access the database via JDBC. JDBC automatically uses server mode to preserve required semantics of JDBC.

When SQL server mode is established, all SQL statements are passed to an independent server job that will handle the requests. Server mode behavior for SQL behavior includes:

• For embedded SQL, each thread in a job implicitly gets one and only one connection to the database (and thus its own commitable transaction).

 For ODBC/CLI, JDBC, OLE DB, and .NET, each connection represents a stand-alone connection to the database and can be committed and used as a separate entity.

For more information, see SQL Call Level Interface (ODBC).

The following SQL support is not threadsafe:

- · Remote access through DRDA
- ALTER FUNCTION
- ALTER PROCEDURE
- ALTER SEQUENCE
- ALTER TABLE
- COMMENT
- CREATE ALIAS
- CREATE FUNCTION
- CREATE INDEX
- CREATE PROCEDURE
- CREATE SCHEMA
- CREATE SEQUENCE
- CREATE TABLE
- CREATE TRIGGER
- CREATE TYPE
- CREATE VIEW
- DECLARE GLOBAL TEMPORARY TABLE
- DROP
- GRANT
- LABEL
- REFRESH TABLE
- RENAME
- REVOKE

For more information, see Multithreaded applications in the Programming topic of the i5/OS Information Center.

Isolation level

The *isolation level* used during the execution of SQL statements determines the degree to which the activation group is isolated from concurrently executing activation groups.

Thus, when activation group P executes an SQL statement, the isolation level determines:

- The degree to which rows retrieved by P and database changes made by P are available to other concurrently executing activation groups.
- The degree to which database changes made by concurrently executing activation groups can affect P.

The isolation level can be explicitly specified on a DELETE, INSERT, SELECT INTO, UPDATE, or select-statement. If the isolation level is not explicitly specified, the isolation level used when the SQL statement is executed is the default isolation level.

DB2 for i provides several ways to specify the *default isolation level*:

Table 2. Default Isolation Level Interfaces

SQL Interface	Specification
Embedded SQL	COMMIT parameter on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to set the COMMIT values. (For more information about CRTSQLxxx commands, see Embedded SQL Programming.)
SQL functions and procedures	Static SQL statements in SQL functions and procedures use the isolation level that was in effect at the time the SQL function or procedure was created. The SET OPTION statement (COMMIT) can be used to set the isolation level.
Run SQL Statements	COMMIT parameter on the Run SQL Statements (RUNSQLSTM) command. (For more information about the RUNSQLSTM command, see SQL Programming.)
SET TRANSACTION SQL statement	Overrides the default isolation level within a unit of work. When the unit of work ends, the isolation level returns to the value it had at the beginning of the unit of work. This statement overrides any other specification of isolation level for static and dynamic SQL statements in the unit of work. (For more information about the SET TRANSACTION statement, see "SET TRANSACTION" on page 1115.)
isolation-clause	The <i>isolation-clause</i> on the SELECT, SELECT INTO, INSERT, UPDATE, DELETE, and DECLARE CURSOR statements overrides the default isolation level for a specific statement or cursor. The isolation level is in effect only for the execution of the statement containing the <i>isolation-clause</i> and has no effect on any pending changes in the current unit of work. (For more information about the <i>isolation-clause</i> , see "isolation-clause" on page 523.)
Call Level Interface (CLI) on the server	SQL_ATTR_COMMIT or SQL_TXN_ISOLATION environment variable or connection options (For more information about CLI, see SQL Call Level Interfaces (ODBC).)
JDBC or SQLJ on the server using IBM Developer Kit for Java	transaction isolation property object (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)
ODBC on a client using the System i Access Family ODBC Driver	Commit Mode in ODBC Setup (For more information about ODBC, see System i Access.)

Table 2. Default Isolation Level Interfaces (continued)

SQL Interface	Specification
JDBC on a client using the IBM Toolbox for Java	Isolation Level in JDBC Setup (For more information about JDBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)
OLE DB on a client using the System i Access Family OLE DB Provider	IsolationLevel Connection Object Property (For more information about OLE DB, see System i Access.)
ADO .NET on a client using the System i Access Family ADO .NET Provider	IsolationLevel in Connection Object Properties (For more information about ADO .NET, see System i Access.)

These isolation levels are supported by automatically locking the appropriate data. Depending on the type of lock, this limits or prevents access to the data by concurrent activation groups that use different commitment definitions. Each database manager supports at least two types of locks:

Share Limits concurrent activation groups that use different commitment definitions to read-only operations on the data.

Exclusive

Prevents concurrent activation groups using different commitment definitions from updating or deleting the data. Prevents concurrent activation groups using different commitment definitions that are running COMMIT(*RS), COMMIT(*CS), or COMMIT(*RR) from reading the data. Concurrent activation groups using different commitment definitions that are running COMMIT(*UR) or COMMIT(*NC) are allowed to read the data.

The following descriptions of isolation levels refer to locking data in row units. Individual implementations can lock data in larger physical units than base table rows. However, logically, locking occurs at the base-table row level across all products. Similarly, a database manager can escalate a lock to a higher level. An activation group is guaranteed at least the minimum requested lock level.

For a detailed description of record lock durations, see the discussion and table in the Commitment control topic of the SQL Programming topic collection.

DB2 for i supports five isolation levels. For all isolation levels except No Commit, the database manager places exclusive locks on every row that is inserted, updated, or deleted. This ensures that any row changed during a unit of work is not changed by any other activation group that uses a different commitment definition until the unit of work is complete.

Repeatable read

The Repeatable Read (RR) isolation level ensures:

 Any row read during a unit of work is not changed by other activation groups that use different commitment definitions until the unit of work is complete.

^{5.} For WITH HOLD cursors, these rules apply to when the rows were actually read. For read-only WITH HOLD cursors, the rows may have actually been read in a prior unit of work.

 Any row changed (or a row that is currently locked with an UPDATE row lock) by another activation group using a different commitment definition cannot be read until it is committed.

In addition to any exclusive locks, an activation group running at level RR acquires at least share locks on all the rows it reads. Furthermore, the locking is performed so that the activation group is completely isolated from the effects of concurrent activation groups that use different commitment definitions.

In the SQL 2003 Core standard, Repeatable Read is called Serializable.

DB2 for i supports repeatable read through COMMIT(*RR). Repeatable read isolation level is supported by locking the tables containing any rows that are read or updated.

Read stability

Like level RR, level Read Stability (RS) ensures that:

- Any row read during a unit of work is not changed by other activation groups that use different commitment definitions until the unit of work is complete.
- Any row changed (or a row that is currently locked with an UPDATE row lock) by another activation group using a different commitment definition cannot be read until it is committed.

Unlike RR, RS does not completely isolate the activation group from the effects of concurrent activation groups that use a different commitment definition. At level RS, activation groups that issue the same query more than once might see additional rows. These additional rows are called *phantom rows*.

For example, a phantom row can occur in the following situation:

- 1. Activation group P1 reads the set of rows *n* that satisfy some search condition.
- 2. Activation group P2 then INSERTs one or more rows that satisfy the search condition and COMMITs those INSERTs.
- 3. P1 reads the set of rows again with the same search condition and obtains both the original rows and the rows inserted by P2.

In addition to any exclusive locks, an activation group running at level RS acquires at least share locks on all the rows it reads.

In the SQL 2003 Core standard, Read Stability is called Repeatable Read.

DB2 for i supports read stability through COMMIT(*ALL) or COMMIT(*RS).

Cursor stability

Like levels RR and RS, level Cursor Stability (CS) ensures that any row that was changed (or a row that is currently locked with an UPDATE row lock) by another activation group using a different commitment definition cannot be read until it is committed. Unlike RR and RS, level CS only ensures that the current row of every updatable cursor is not changed by other activation groups using different commitment definitions. Thus, the rows that were read during a unit of work can be changed by other activation groups that use a different commitment definition.

^{6.} For WITH HOLD cursors, these rules apply to when the rows were actually read. For read-only WITH HOLD cursors, the rows may have actually been read in a prior unit of work.

In addition to any exclusive locks, an activation group running at level CS may acquire a share lock for the current row of every cursor.

In the SQL 2003 Core standard, Cursor Stability is called Read Committed.

DB2 for i supports cursor stability through COMMIT(*CS).

Uncommitted read

For a SELECT INTO, a FETCH with a read-only cursor, subquery, or fullselect used in an INSERT statement, level Uncommitted Read (UR) allows:

- Any row read during the unit of work to be changed by other activation groups that run under a different commitment definition.
- Any row changed (or a row that is currently locked with an UPDATE row lock) by another activation group running under a different commitment definition to be read even if the change has not been committed.

For other operations, the rules of level CS apply.

In the SQL 2003 Core standard, Uncommitted Read is called Read Uncommitted.

DB2 for i supports uncommitted read through COMMIT(*CHG) or COMMIT(*UR).

No commit

For all operations, the rules of level UR apply to No Commit (NC) except:

- Commit and rollback operations have no effect on SQL statements. Cursors are not closed, and LOCK TABLE locks are not released. However, connections in the release-pending state are ended.
- Any changes are effectively committed at the end of each successful change operation and can be immediately accessed or changed by other application groups using different commitment definitions.

DB2 for i supports No Commit through COMMIT(*NONE) or COMMIT(*NC).

Note: (*For distributed applications.*) When a requested isolation level is not supported by an application server, the isolation level is escalated to the next highest supported isolation level. For example, if RS is not supported by an application server, the RR isolation level is used.

Comparison of isolation levels

The following table summarizes information about isolation levels.

	NC	UR	CS	RS	RR
Can the application see uncommitted changes made by other application processes?	Yes	Yes	No	No	No
Can the application update uncommitted changes made by other application processes?	No	No	No	No	No
Can the re-execution of a statement be affected by other application processes? See phenomenon P3 (phantom) below.	Yes	Yes	Yes	Yes	No

	NC	UR	CS	RS	RR
Can "updated" rows be updated by other application processes?	Yes	No	No	No	No
Can "updated" rows be read by other application processes that are running at an isolation level other than UR and NC?	Yes	No	No	No	No
Can "updated" rows be read by other application processes that are running at the UR or NC isolation level?	Yes	Yes	Yes	Yes	Yes
Can "accessed" rows be updated by other application processes?	Yes	Yes	Yes	No	No
For RS, "accessed rows" typically means rows selected. For RR, see the product-specific documentation. <i>See phenomenon P2 (nonrepeatable read) below.</i>					
Can "accessed" rows be read by other application processes?	Yes	Yes	Yes	Yes	Yes
Can "current" row be updated or deleted by other application processes? <i>See phenomenon P1 (dirty-read) below.</i>	See Note below	See Note below	See Note below	No	No

Note: This depends on whether the cursor that is positioned on the "current" row is updatable:

- If the cursor is updatable, the current row cannot be updated or deleted by other application processes
- If the cursor is not updatable,
 - For UR or NC, the current row can be updated or deleted by other application processes.
 - For CS, the current row may be updatable in some circumstances.

Examples of Phenomena:

- P1 Dirty Read. Unit of work UW1 modifies a row. Unit of work UW2 reads that row before UW1 performs a COMMIT. UW1 then performs a ROLLBACK. UW2 has read a nonexistent row.
- P2 Nonrepeatable Read. Unit of work UW1 reads a row. Unit of work UW2 modifies that row and performs a COMMIT. UW1 then re-reads the row and obtains the modified data value.
- P3 Phantom. Unit of work UW1 reads the set of *n* rows that satisfies some search condition. Unit of work UW2 then INSERTs one or more rows that satisfies the search condition. UW1 then repeats the initial read with the same search condition and obtains the original rows plus the inserted rows.

Storage Structures

The System i product is an object-based system. All database objects in DB2 for i (tables and indexes for example) are objects in the IBM i operating system. The single-level storage manager manages all storage of objects of the database, so database specific storage structures (for example, table spaces) are unnecessary.

A distributed table allows data to be spread across different database partitions. The partitions included are determined by the nodegroup specified when the table is created or altered. A nodegroup is a group of one or more System i products. A partitioning map is associated with each nodegroup. The partitioning map is used

Storage Structures

by the database manager to determine which system from the nodegroup will store a given row of data. For more information about nodegroups and data partitioning see the DB2 Multisystem book.

A table can also include columns that register links to data that are stored in external files. The mechanism for this is the DataLink data type. A DataLink value which is recorded in a regular table points to a file that is stored in an external file server.

The DB2 File Manager on a file server works in conjunction with DB2 to provide the following optional functionality:

- Referential integrity to ensure that files currently linked to DB2 are not deleted or renamed.
- Security to ensure that only those with suitable SQL privileges on the DataLink column can read the files linked to that column.

The DataLinker comprises the following facilities:

DataLinks File Manager

Registers all the files in a particular file server that are linked to DB2.

DataLinks Filter

Filters file system commands to ensure that registered files are not deleted or renamed. Optionally, filters commands to ensure that proper access authority exists.

Character conversion

A string is a sequence of bytes that may represent characters. Within a string, all the characters are represented by a common coding representation. In some cases, it might be necessary to convert these characters to a different coding representation. The process of conversion is known as *character conversion*.

Character conversion can occur when an SQL statement is executed remotely.⁷ Consider, for example, these two cases:

- The values of variables sent from the application requester to the current server.
- The values of result columns sent from the current server to the application requester.

In either case, the string could have a different representation at the sending and receiving systems. Conversion can also occur during string operations on the same system.

Note that SQL statements are strings and are therefore subject to character conversion.

The following list defines some of the terms used when discussing character conversion.

character set

A defined set of characters. For example, the following character set appears in several code pages:

^{7.} Character conversion, when required, is automatic and is transparent to the application when it is successful. A knowledge of conversion is, therefore, unnecessary when all the strings involved in a statement's execution are represented in the same way. Thus, for many readers, character conversion may be irrelevant.

- 26 non-accented letters A through Z
- 26 non-accented letters a through z
- digits 0 through 9
- .,:;?()'"/-_&+=<>

code page

A set of assignments of characters to code points. In EBCDIC, for example, "A" is assigned code point X'C1' and "B" is assigned code point X'C2'. Within a code page, each code point has only one specific meaning.

code point

A unique bit pattern that represents a character within a code page.

coded character set

A set of unambiguous rules that establish a character set and the one-to-one relationships between the characters of the set and their coded representations.

encoding scheme

A set of rules used to represent character data. For example:

- Single-byte EBCDIC
- · Single-byte ASCII
- Double-byte EBCDIC
- Mixed single- and double-byte ASCII⁸
- Unicode (UTF-8, UCS-2, and UTF-16 universal coded character sets).

substitution character

A unique character that is substituted during character conversion for any characters in the source coding representation that do not have a match in the target coding representation.

Unicode

A universal encoding scheme for written characters and text that enables the exchange of data internationally. It provides a character set standard that can be used all over the world. It uses a 16-bit encoding form that provides code points for more than 65,000 characters and an extension called UTF-16 that allows for encoding as many as a million more characters. It provides the ability to encode all characters used for the written languages of the world and treats alphabetic characters, ideographic characters, and symbols equivalently because it specifies a numeric value and a name for each of its characters. It includes punctuation marks, mathematical symbols, technical symbols, geometric shapes, and dingbats. Three encoding forms are supported:

• UTF-8: Unicode Transformation Format, a 8-bit encoding form designed for ease of use with existing ASCII-based systems. UTF-8 data is stored in character data types. The CCSID value for data in UTF-8 format is 1208.

A UTF-8 character can be 1,2,3 or 4 bytes in length. A UTF-8 data string can contain any combination of SBCS and DBCS data, including surrogates and combining characters.

• UCS-2: Universal Character Set coded in 2 octets, which means that characters are represented in 16-bits per character. UCS-2 data is stored in graphic data types. The CCSID value for data in UCS-2 format is 13488.

^{8.} UTF-8 unicode data is also mixed data. In this book, however, mixed data refer to mixed single- and double-byte data.

Character conversion

UCS-2 is a subset of UTF-16. UCS-2 is identical to UTF-16 except that UTF-16 also supports combining characters and surrogates. Since UCS-2 is a simpler form of UTF-16, UCS-2 data will typically perform better than UTF-16.9

• UTF-16: Unicode Transformation Format, a 16-bit encoding form designed to provide code values for over a million characters. UTF-16 data is stored in graphic data types. The CCSID value for data in UTF-16 format is 1200.

Both UTF-8 and UTF-16 data can contain *combining characters*. Combining character support allows a resulting character to be comprised of more than one character. After the first character, hundreds of different non-spacing accent characters (umlauts, accents, etc.) can follow in the data string. The resulting character may already be defined in the character set. In this case, there are multiple representations for the same character. For example, in UTF-16, an \acute{e} can be represented either by X'00E9' (the normalized representation) or X'00650301' (the non-normalized combining character representation).

Since multiple representations of the same character will not compare equal, it is usually not a good idea to store both forms of the characters in the database. *Normalization* is a process that replaces the string of combining characters with equivalent characters that do not include combining characters. After normalization has occurred, only one representation of any specific character will exist in the data. For example, in UTF-16, any instances of X'00650301' (the non-normalized combining character representation of \acute{e}) will be converted to X'00E9' (the normalized representation of \acute{e}).¹⁰

In order to properly handle UTF-8 in predicates, normalization may occur.

Both UTF-8 and UTF-16 can contain 4 byte characters called *surrogates*. Surrogates are 4 byte sequences that can address one million more characters than would be available in a 2 byte character set.

Character sets and code pages

The following example shows how a typical character set might map to different code points in two different code pages.

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^{9.} UCS-2 can contain surrogates and combining characters, however, they are not recognized as such. Each 16-bits is considered to be a character.

^{10.} Since normalization can significantly affect performance (from 2.5 to 25 percent extra CPU), the default in column definitions is NOT NORMALIZED.

Cod	Code-Page: pp1 (ASCII) Code-Page: pp2 (EBCDIC)																			
	0	1	2	3	4	5		Е	F			0	1		А	В	С	D	Е	F
0				0	@	Р		Â			0					#				0
1				1	А	Q		Þ	α		1					\$	А	J		1
2			,,	2	В	R	_	Å	β		2				s	%	В	K	S	2
3				3	С	S		Á	γ		3				t	_	С	L	Т	3
4				4	D	Т		Ã	δ		4				u	*	D	М	U	4
5			%	5	Е	U		Ä	3		5				\ \	(Е	Ν	V	5
 	 	 	 		 	 	 			 				 	 	 		 	 - -	
; ; ;	 		 	' 			 	I i		i I I				 - 	i 	 	 	 		
Е				>	N			5/8	ö		Е					!	:	Â	}	
F			/	*	0			R			F				À	¢	;	Á	{	
Cod	Code Point: 2F— Character-Set ss1 (in code-page pp1)													er-Set		2)				

Even with the same encoding scheme there are many different coded character sets, and the same code point can represent a different character in different coded character sets. Furthermore, a byte in a character string does not necessarily represent a character from a single-byte character set (SBCS). Character strings are also used for mixed data (a mixture of single-byte characters and double-byte characters) and for data that is not associated with any character set (called bit data). This is not the case with graphic strings; the database manager assumes that every pair of bytes in every graphic string represents a character from a double-byte character set (DBCS) or universal coded character set (UCS-2 or UTF-16).

A coded character set identifier (CCSID) in a native encoding scheme is one of the coded character sets in which data may be stored at that site. A CCSID in a foreign encoding scheme is one of the coded character sets in which data cannot be stored at that site. For example, DB2 for i can store data in a CCSID with an EBCDIC encoding scheme, but not in an ASCII encoding scheme.

A variable containing data in a foreign encoding scheme (other than Unicode) is always converted to a CCSID in the native encoding scheme when the variable is used in a function or in the *select-list*. A variable containing data in a foreign encoding scheme is also effectively converted to a CCSID in the native encoding scheme when used in comparison or in an operation that combines strings. Which CCSID in the native encoding scheme the data is converted to is based on the foreign CCSID and the default CCSID.

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For details on character conversion, see:

- "Conversion rules for assignments" on page 95
- "Conversion rules for comparison:" on page 102
- "Conversion rules for operations that combine strings" on page 110
- "Data representation considerations" on page 45.

Coded character sets and CCSIDs

IBM's Character Data Representation Architecture (CDRA) deals with the differences in string representation and encoding. The Coded Character Set Identifier (CCSID) is a key element of this architecture. A CCSID is a 2-byte (unsigned) binary number that uniquely identifies an encoding scheme and one or more pairs of character sets and code pages.

A CCSID is an attribute of strings, just as length is an attribute of strings. All values of the same string column have the same CCSID.

Character conversion is described in terms of CCSIDs of the source and target. Each database manager provides support to identify valid source and target combinations and to perform the conversion from one coded character set to another. In some cases, no conversion is necessary even though the strings involved have different CCSIDs.

Different types of conversions may be supported by the database manager. Round-trip conversions attempt to preserve characters in one CCSID that are not defined in the target CCSID so that if the data is subsequently converted back to the original CCSID, the same original characters result. Enforced subset match conversions do not attempt to preserve such characters. For more information, see IBM's Character Data Representation Architecture (CDRA).

Default CCSID

Every application server and application requester has a default CCSID (or default CCSIDs in installations that support DBCS data).

The CCSID of the following types of strings is determined at the current server:

- String constants (including string constants that represent datetime values) when the CCSID of the source is in a foreign encoding scheme
- Special registers with string values (such as USER and CURRENT SERVER)
- CAST specifications where the result is a character or graphic string
- Results of CHAR, DATAPARTITIONNAME, DAYNAME, DBPARTITIONNAME, DIGITS, HEX, MONTHNAME, SOUNDEX, SPACE, and VARCHAR_FORMAT scalar functions
- Results of DECRYPT CHAR, DECRYPT DB, CHAR, GRAPHIC, VARCHAR, and VARGRAPHIC scalar functions when a CCSID is not specified as an argument
- Results of the CLOB and DBCLOB scalar functions when a CCSID is not specified as an argument¹¹

^{11.} If the default CCSID is 65535, the CCSID used will be the value of the DFTCCSID job attribute (or an associated CCSID of the DFTCCSID). If there is no associated mixed data CCSID,

[•] the CCSID used when FOR MIXED DATA is specified will be 65535,

[·] the CCSID for GRAPHIC and VARGRAPHIC will be 65535, and

the CCSID for DBCLOB will be 1200.

- String columns defined by the CREATE TABLE, ALTER TABLE, or DECLARE GLOBAL TEMPORARY TABLE statements when an explicit CCSID is not specified for the column¹¹
- Distinct types when the source type is a character or graphic string type
- String parameters defined by CREATE FUNCTION or CREATE PROCEDURE statements when an explicit CCSID is not specified for the parameter ¹¹

If one of the types of strings above is used in a CREATE VIEW statement, the default CCSID is determined at the time the view is created.

In a distributed application, the default CCSID of variables is determined by the application requester. In a non-distributed application, the default CCSID of variables is determined by the application server. On the IBM i operating system, the default CCSID is determined by the CCSID job attribute. For more information about CCSIDs, see the Work with CCSIDs topic in the Globalization topic collection.

Collating sequence

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A collating sequence (also called a sort sequence) defines how characters in a character set relate to each other when they are compared and ordered.

Different collating sequences are useful for those who want their data ordered for a specific language. For example, lists can be ordered as they are normally seen for a specific language. A collating sequence can also be used to treat certain characters as equivalent, for instance, **a** and **A**. A collating sequence works on all comparisons that involve:

- SBCS character data (including bit data)
- the SBCS portion of mixed data
- Unicode data (UTF-8, UCS-2, or UTF-16).

SBCS collating sequence support is implemented using a 256-byte table. Each byte in the table corresponds to a code point or character in a SBCS code page. Because the collating sequence is applicable to character data, a CCSID must be associated with the table. The bytes in the collating sequence table are set based on how each code point is to compare to other code points in that code page. For example, if the characters **a** and **A** are to be treated as equivalents for comparisons, the bytes in the collating sequence table for their code points contain the same value, or weight.

UCS-2 collating sequence support is implemented using a multi-byte table. A pair of bytes within the table corresponds to a character in the UCS-2 code page. Only a subset of the thousands of characters in UCS-2 are typically represented in the table. Only those characters that are to compare differently (and possibly other characters in the same ward) will be represented in the table. The bytes in the collating sequence table are set based on how each character is to compare with other characters in UCS-2.

When two or more bytes (or pair of bytes for UCS-2) in a collating sequence table have the same value, the collating sequence is a shared-weight collating sequence. If every byte (or pair of bytes for UCS-2) in a collating sequence table has a unique value, the collating sequence is a unique-weight collating sequence. For many languages, unique- and shared-weight collating sequences are shipped on the

Collating sequence

system as part of the operating system. If you need collating sequences for other languages or needs, you define them using the Create Table (CRTTBL) command.

UTF-8 and UTF-16 collating sequence support is implemented using ICU (International Components for Unicode). This is a standard API to sort Unicode. The API produces the same result for normalized and non-normalized data and returns a sort weight based on language specific rules. The IBM i operating system supports both ICU 2.3.1 and ICU 3.4 collating sequenced, but ICU 3.4 should be used. The ICU collating sequence table I34en_us (United States locale) will sort data differently than I34fr_FR (French locale).

If ICU is used, the LIKE predicate and the LOCATE, POSITION, POSSTR, and POSITION scalar functions are not supported.

If ICU 2.3.1 is used, the query cannot contain:

- EXCEPT or INTERSECT operations,
- VALUES in a fullselect,
- OLAP specifications,
- · recursive common table expressions,
- ORDER OF,
- scalar fullselects (scalar subselects are supported),
- full outer join,
- · LOBs in a GROUP BY, or
- grouping sets or super groups.

An ICU collating sequence table will generally produce results that are more culturally correct, however:

- The performance of SQL statements that use an ICU collating sequence table will generally perform worse than when using either an SBCS or UCS-2 collating sequence table. Indexes can be created with an ICU collating sequence table, however, to improve performance. In this case, the index key values will contain the ICU weighted value which will greatly reduce the number of times the system's ICU support is called.
- The storage necessary for indexes that use an ICU collating sequence table will generally be greater than when using either an SBCS or UCS-2 collating sequence table. The key values can be up to 3 times longer than the length of SBCS data used to produce the key and up to 6 times longer than the length of DBCS data used to produce the key.

It is important to remember that the data itself is not altered by the collating sequence. Instead, a weighted representation of the data is used for the comparison. In SQL, a collating sequence is specified on the CRTSQLxxx, STRSQL, and RUNSQLSTM commands. The SET OPTION statement can be used to specify the collating sequence within the source of a program containing embedded SQL. The collating sequence applies to all character comparisons performed in the SQL statements. The default collating sequence on the system is the internal sequence that occurs when the hexadecimal representation of characters are used. This is the sequence you get when the SRTSEQ(*HEX) is specified. For programs precompiled with a release of the product that is earlier than Version 2 Release 3, the collating sequence is *HEX.

Collating sequences do not apply to FOR BIT DATA or binary string columns.

The *collating sequence* is explicitly specified through the following interfaces:

Table 3. Collating Sequence Interfaces

SQL Interface	Specification
Embedded SQL	SRTSEQ parameter on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to set the SRTSEQ values. (For more information about CRTSQLxxx commands, see Embedded SQL Programming.)
Run SQL Statements	SRTSEQ parameter on the Run SQL Statements (RUNSQLSTM) command. (For more information about the RUNSQLSTM command, see SQL Programming.)
Call Level Interface (CLI) on the server	SQL_ATTR_JOB_SORT_SEQUENCE environment variable (For more information about CLI, see SQL Call Level Interfaces (ODBC).)
JDBC or SQLJ on the server using IBM Developer Kit for Java	job.sort.sequence property object (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)
ODBC on a client using the System i Access Family ODBC Driver	Sort Type in ODBC Setup (For more information about ODBC, see System i Access.)
JDBC on a client using the IBM Toolbox for Java	Sort Sequence Table in JDBC Setup (For more information about JDBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)
OLE DB on a client using the System i Access Family OLE DB Provider	Sort Sequence Connection Object Properties (For more information about OLE DB, see System i Access.)
ADO .NET on a client using the System i Access Family ADO .NET Provider	SortSequence in Connection Object Properties (For more information about ADO .NET, see System i Access.)

For more information about CCSIDs, see the Work with CCSIDs topic in the Globalization section of the i5/OS Information Center. For more information about collating sequences and the sequences shipped with the system, see the DB2 and SQL collating sequence topic in the i5/OS Information Center.

Distributed relational database

A distributed relational database consists of a set of tables and other objects that are spread across different but interconnected computer systems or logical partitions on the same computer system. Each computer system has a relational database manager that manages the tables in its environment. The database managers communicate and cooperate with each other in a way that allows a database manager to execute SQL statements on another computer system.

Distributed relational databases are built on formal requester-server protocols and functions. An application requester supports the application end of a connection. It transforms a database request from the application into communication protocols suitable for use in the distributed database network. These requests are received

Distributed relational database

and processed by an *application server* at the other end of the connection. ¹² Working together, the application requester and application server handle the communication and location considerations so that the application is isolated from these considerations and can operate as if it were accessing a local database. A simple distributed relational database environment is illustrated in Figure 8.

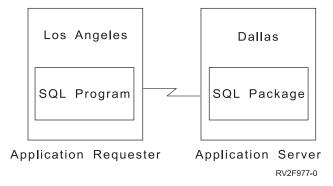


Figure 8. A Distributed Relational Database Environment

For more information about Distributed Relational Database Architecture[™] (DRDA) communication protocols, see Open Group Publications: DRDA Vol. 1: Distributed

Relational Database Architecture (DRDA)

Application servers

An activation group must be connected to the application server of a database manager before SQL statements can be executed.

A *connection* is an association between an activation group and a local or remote application server. A connection is also known as a session or an SQL session. Connections are managed by the application. The CONNECT statement can be used to establish a connection to an application server and make that application server the current server of the activation group.

An application server can be local to, or remote from, the environment where the activation group is started. (An application server is present, even when distributed relational databases are not used.) This environment includes a local directory that describes the application servers that can be identified in a CONNECT statement. For more information about the directory, see the relational database folders in System i Navigator or the directory commands (ADDRDBDIRE, CHGRDBDIRE, DSPRDBDIRE, RMVRDBDIRE, and WRKRDBDIRE) in the following i5/OS Information Center topics:

- SQL Programming
- Distributed Database Programming
- · CL commands

To execute a static SQL statement that references tables or views, an application server uses the bound form of the statement. This bound statement is taken from a package that the database manager previously created through a bind operation. The appropriate package is determined by the combination of:

^{12.} This is also known as a an application server.

• The internal consistency token that makes certain the package and program were created from the same source at the same time.

A DB2 relational database product may support a feature that is not supported by the version of the DB2 product that is connecting to the application server. Some of these features are product-specific, and some are shared by more than one product.

For the most part, an application can use the statements and clauses that are supported by the database manager of the application server to which it is currently connected, even though that application is running via the application requester of a database manager that does not support some of those statements and clauses. Restrictions are listed in Appendix B, "Characteristics of SQL statements," on page 1213.

CONNECT (Type 1) and CONNECT (Type 2)

There are two types of CONNECT statements with the same syntax but different semantics. CONNECT (Type 1) is used for remote unit of work. CONNECT (Type 2) is used for distributed unit of work.

See "CONNECT (Type 1) and CONNECT (Type 2) differences" on page 1223 for a summary of the differences.

Remote unit of work

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The *remote unit of work* facility provides for the remote preparation and execution of SQL statements. An activation group at computer system A can connect to an application server at computer system B. Then, within one or more units of work, that activation group can execute any number of static or dynamic SQL statements that reference objects at B. After ending a unit of work at B, the activation group can connect to an application server at computer system C, and so on.

Most SQL statements can be remotely prepared and executed with the following restrictions:

- All objects referenced in a single SQL statement must be managed by the same application server.
- All of the SQL statements in a unit of work must be executed by the same application server.

Remote unit of work connection management

An activation group is in one of three states at any time:

- · Connectable and connected
- · Unconnectable and connected
- · Connectable and unconnected

The following diagram shows the state transitions:

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Distributed relational database

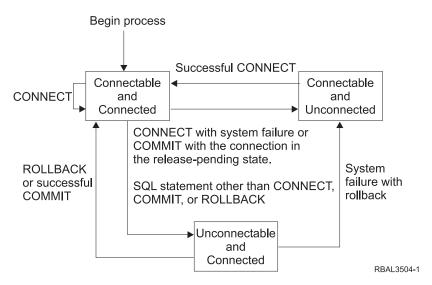


Figure 9. Remote Unit of Work Activation Group Connection State Transition

The initial state of an activation group is *connectable* and *connected*. The application server to which the activation group is connected is determined by the RDB parameter on the CRTSQLxxx and STRSQL commands and may involve an implicit CONNECT operation. An implicit CONNECT operation cannot occur if an implicit or explicit CONNECT operation has already successfully or unsuccessfully occurred. Thus, an activation group cannot be implicitly connected to an application server more than once.

The connectable and connected state

An activation group is connected to an application server and CONNECT statements can be executed. The activation group enters this state when it completes a rollback or successful commit from the unconnectable and connected state, or a CONNECT statement is successfully executed from the connectable and unconnected state.

The unconnectable and connected state

An activation group is connected to an application server, but a CONNECT statement cannot be successfully executed to change application servers. The activation group enters this state from the connectable and connected state when it executes any SQL statement other than CONNECT, COMMIT, or ROLLBACK.

The connectable and unconnected state

An activation group is not connected to an application server. The only SQL statement that can be executed is CONNECT.

The activation group enters this state when:

- The connection was previously released and a successful COMMIT is executed.
- The connection is disconnected using the SQL DISCONNECT statement.
- The connection was in a connectable state, but the CONNECT statement was unsuccessful.

Consecutive CONNECT statements can be executed successfully because CONNECT does not remove the activation group from the connectable state. A

CONNECT to the application server to which the activation group is currently connected is executed like any other CONNECT statement. CONNECT cannot execute successfully when it is preceded by any SQL statement other than CONNECT, COMMIT, DISCONNECT, SET CONNECTION, RELEASE, or ROLLBACK (unless running with COMMIT(*NC)). To avoid an error, execute a commit or rollback operation before a CONNECT statement is executed.

Application-directed distributed unit of work

The application-directed distributed unit of work facility also provides for the remote preparation and execution of SQL statements in the same fashion as remote unit of work. Like remote unit of work, an activation group at computer system A can connect to an application server at computer system B and execute any number of static or dynamic SQL statements that reference objects at B before ending the unit of work. All objects referenced in a single SQL statement must be managed by the same application server. However, unlike remote unit of work, any number of application servers can participate in the same unit of work. A commit or rollback operation ends the unit of work.

Distributed unit of work is fully supported for APPC and TCP/IP connections.

Application-directed distributed unit of work connection management

At any time:

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- An activation group is always in the *connected* or *unconnected* state and has a set of zero or more connections. Each connection of an activation group is uniquely identified by the name of the application server of the connection.
- An SQL connection is always in one of the following states:
 - Current and held
 - Current and release-pending
 - Dormant and held
 - Dormant and release-pending

Initial state of an activation group:

An activation group is initially in the connected state and has exactly one connection. The initial state of a connection is *current and held*.

The following diagram shows the state transitions:

Distributed relational database

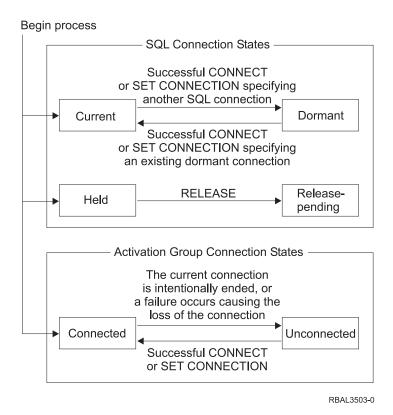


Figure 10. Application-Directed Distributed Unit of Work Connection and Activation Group Connection State Transitions

Connection states

If an application process successfully executes a CONNECT statement:

- The current connection is placed in the dormant state and held state.
- The server name is added to the set of connections and the new connection is placed in the current and held state.

If the server name is already in the set of existing connections of the activation group, an error is returned.

A connection in the dormant state is placed in the current state using the SET CONNECTION statement. When a connection is placed in the current state, the previous current connection, if any, is placed in the dormant state. No more than one connection in the set of existing connections of an activation group can be current at any time. Changing the state of a connection from current to dormant or from dormant to current has no effect on its held or release-pending state.

A connection is placed in the release-pending state by the RELEASE statement. When an activation group executes a commit operation, every release-pending connection of the activation group is ended. Changing the state of a connection from held to release-pending has no effect on its current or dormant state. Thus, a connection in the release-pending state can still be used until the next commit operation. There is no way to change the state of a connection from release-pending to held.

Activation group connection states

A different application server can be established by the explicit or implicit execution of a CONNECT statement. The following rules apply:

- An activation group cannot have more than one connection to the same application server at the same time.
- When an activation group executes a SET CONNECTION statement, the specified location name must be an existing connection in the set of connections of the activation group.
- · When an activation group executes a CONNECT statement, the specified server name must not be an existing connection in the set of connections of the activation group.

If an activation group has a current connection, the activation group is in the connected state. The CURRENT SERVER special register contains the name of the application server of the current connection. The activation group can execute SQL statements that refer to objects managed by that application server.

An activation group in the unconnected state enters the connected state when it successfully executes a CONNECT or SET CONNECTION statement.

If an activation group does not have a current connection, the activation group is in the unconnected state. The CURRENT SERVER special register contents are equal to blanks. The only SQL statements that can be executed are CONNECT, DISCONNECT, SET CONNECTION, RELEASE, COMMIT, and ROLLBACK.

An activation group in the connected state enters the unconnected state when its current connection is intentionally ended or the execution of an SQL statement is unsuccessful because of a failure that causes a rollback operation at the current server and loss of the connection. Connections are intentionally ended when an activation group successfully executes a commit operation and the connection is in the release-pending state, or when an application process successfully executes the DISCONNECT statement.

When a connection is ended

When a connection is ended, all resources that were acquired by the activation group through the connection and all resources that were used to create and maintain the connection are deallocated. For example, if application process P has placed the connection to application server X in the application server state, all cursors of P at X will be closed and deallocated when the connection is ended during the next commit operation.

A connection can also be ended as a result of a communications failure in which case the activation group is placed in the unconnected state. All connections of an activation group are ended when the activation group ends.

Data representation considerations

Different systems represent data in different ways. When data is moved from one system to another, data conversion must sometimes be performed. Products supporting DRDA will automatically perform any necessary conversions at the receiving system.

With numeric data, the information needed to perform the conversion is the data type and the sending system's environment type. For example, when a

Distributed relational database

floating-point variable from a DB2 for i application requester is assigned to a column of a table at an z/OS^{\otimes} application server, the number is converted from IEEE format to System/370* format.

With character and graphic data, the data type and the environment type of the sending system are not sufficient. Additional information is needed to convert character and graphic strings. String conversion depends on both the coded character set of the data and the operation to be done with that data. String conversions are done in accordance with the IBM Character Data Representation Architecture (CDRA). For more information about character conversion, refer to the book *Character Data Representation Architecture Reference and Registry*, SC09-2190.

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Chapter 2. Language elements

This section defines the basic syntax of SQL and language elements that are common to many SQL statements.

Characters

The basic symbols of keywords and operators in the SQL language are single-byte characters that are part of all character sets supported by the IBM relational database products.

Characters of the language are classified as letters, digits, or special characters.¹³

A *letter* is any of the 26 uppercase (A through Z) and 26 lowercase (a through z) letters of the English alphabet. 14

A *digit* is any of the characters 0 through 9.

A special character is any of the characters listed below:

	space or blank	-	minus sign
"	quotation mark or double-quote or double quotation mark		period
%	percent	/	slash
&	ampersand	:	colon
,	apostrophe or single quote or single quotation mark	;	semicolon
(left parenthesis	<	less than
)	right parenthesis	=	equals
*	asterisk	>	greater than
+	plus sign	?	question mark
,	comma	_	underline or underscore
1	vertical bar ¹⁶	٨	caret
!	exclamation mark ¹⁵	[left bracket
{	left brace]	right bracket
}	right brace	¬	not 15

^{13.} Note that if the SQL statement is encoded as Unicode data, all characters of the statement except for string constants will be converted to single-byte characters prior to processing. Tokens representing string constants may be processed as UTF-16 graphic strings without conversion to single-byte.

^{14.} Letters also include three code points reserved as alphabetic extenders for national languages (#, @, and \$ in the United States). These three code points should be avoided because they represent different characters depending on the CCSID.

^{15.} Using the not symbol (¬) and the exclamation point symbol (!) might inhibit code portability between IBM relational database products. Avoid using them because they are variant characters. Instead of ¬= or != use <>. Instead of ¬> or !> use <=. Instead of ¬< or !< use >=.

^{16.} Using the vertical bar (1) character might inhibit code portability between IBM relational database products. Use the CONCAT operator instead of the concatenation operator (11).

Tokens

The basic syntactical units of the language are called *tokens*. A token consists of one or more characters, excluding blanks, control characters, and characters within a string constant or delimited identifier. (These terms are defined later.)

Tokens are classified as ordinary or delimiter tokens:

• An *ordinary token* is a numeric constant, an ordinary identifier, a host identifier, or a keyword.

Examples

1 .1 +2 SELECT E 3

• A *delimiter token* is a string constant, a delimited identifier, an operator symbol, or any of the special characters shown in the syntax diagrams. A question mark (?) is also a delimiter token when it serves as a parameter marker, as explained under "PREPARE" on page 1020.

Examples

, 'Myst Island' "fld1" =

Spaces:

A *space* is a sequence of one or more blank characters.

Control Characters:

A *control character* is a special character that is used for string alignment. The following table contains the control characters that are handled by the database manager:

Table 4. Control Characters

Control Character	EBCDIC Hex Value	Unicode Graphic Hex Value
Tab	05	U+0009
Form Feed	0C	U+000C
Carriage Return	0D	U+000D
New Line	15	U+0085
Line Feed (New line)	25	U+000A
DBCS Space	_	U+3000

Tokens, other than string constants and certain delimited identifiers, must not include a control character or space. A control character or space can follow a token. A delimiter token, a control character, or a space *must* follow every ordinary token. If the syntax does not allow a delimiter token to follow an ordinary token, then a control character or a space must follow that ordinary token. The following examples illustrate the rule that is stated in this paragraph.

Here are some examples of combinations of the above ordinary tokens that, in effect, change the tokens:

1.1 .1+2 SELECTE .1E E3 SELECT1

This demonstrates why ordinary tokens must be followed by a delimiter token or a space.

1. .3

The period (.) is a delimiter token when it is used as a separator in the qualification of names. Here the dot is used in combination with an ordinary token of a numeric constant. Thus, the syntax does not allow an ordinary token to be followed by a delimiter token. Instead, the ordinary token must be followed by a space.

If the decimal point has been defined to be the comma, as described in "Decimal point" on page 116, the comma is interpreted as a decimal point in numeric constants. Here are some examples of these numeric constants:

1,2 ,1 1, 1,e1

If '1,2' and '1,e1' are meant to be two items, both the ordinary token (1) and the delimiter token (,) must be followed by a space, to prevent the comma from being interpreted as a decimal point. Although the comma is usually a delimiter token, the comma is part of the number when it is interpreted as a decimal point. Therefore, the syntax does not allow an ordinary token (1) to be followed by a delimiter token (,). Instead, an ordinary token must be followed by a space.

Comments:

Dynamic SQL statements can include SQL comments. Static SQL statements can include host language comments or SQL comments. Comments may be specified wherever a space may be specified, except within a delimiter token or between the keywords EXEC and SQL. In Java, SQL comments are not allowed within embedded Java expressions. There are two types of SQL comments:

simple comments

Simple comments are introduced by two consecutive hyphens (--). Simple comments cannot continue past the end of the line. For more information, see "SQL comments" on page 539.

bracketed comments

Bracketed comments are introduced by /* and end with */. A bracketed comment can continue past the end of the line. For more information, see "SQL comments" on page 539.

Uppercase and Lowercase:

Any token in an SQL statement may include lowercase letters, but a lowercase letter in an ordinary token is folded to uppercase, except for variables in the C and Java languages, which have case-sensitive identifiers. Delimiter tokens are never folded to uppercase. Thus, the statement:

```
select * from EMP where lastname = 'Smith';
is equivalent, after folding, to:
    SELECT * FROM EMP WHERE LASTNAME = 'Smith';
```

Identifiers

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An *identifier* is a token used to form a name. An identifier in an SQL statement is an SQL identifier, a system identifier, or a host identifier.

Note: \$, @, #, and all other variant characters should not be used in identifiers because the code points used to represent them vary depending on the CCSID of the string in which they are contained. If they are used, unpredictable results may occur. For more information about variant characters, see the DB2 and SQL sort sequence topic.

SQL identifiers

There are two types of SQL identifiers: ordinary identifiers and delimited identifiers.

- An ordinary identifier is an uppercase letter followed by zero or more characters, each of which is an uppercase letter, a digit, or the underscore character. Note that ordinary identifiers are converted to uppercase. An ordinary identifier should not be a reserved word. See Appendix I, "Reserved schema names and reserved words," on page 1487 for a list of reserved words. If a reserved word is used as an identifier in SQL, it should be specified in uppercase and should be a delimited identifier or specified in a variable.
- A *delimited identifier* is a sequence of one or more characters enclosed within SQL escape characters. The sequence must consist of one or more characters. Leading blanks in the sequence are significant. Trailing blanks in the sequence are not significant. The length of a delimited identifier does not include the two SQL escape characters. Note that delimited identifiers are not converted to uppercase. The escape character is the quotation mark (") except in the following cases where the escape character is the apostrophe ('):
 - Interactive SQL when the SQL string delimiter is set to the quotation mark in COBOL syntax checking statement mode
 - Dynamic SQL in a COBOL program when the CRTSQLCBL or CRTSQLCBLI parameter OPTION(*QUOTESQL) specifies that the string delimiter is the quotation mark (")
 - COBOL application program when the CRTSQLCBL or CRTSQLCBLI parameter OPTION(*QUOTESQL) specifies that the string delimiter is the quotation mark (")

The following characters are not allowed within delimited identifiers:

- X'00' through X'3F' and X'FF'

System identifiers

A system identifier is used to form the name of system objects in the IBM i operating system. There are two types of system identifiers: ordinary identifiers and delimited identifiers.

- The rules for forming a system ordinary identifier are identical to the rules for forming an SQL ordinary identifier.
- The rules for forming a system delimited identifier are identical to those for forming SQL delimited identifiers, except:
 - The following special characters are not allowed in a delimited system identifier:
 - A blank (X'40')
 - An asterisk (X'5C')
 - An apostrophe (X'7D')
 - A question mark (X'6F')
 - A quotation mark (X'7F')
 - The bytes required for the escape characters are included in the length of the identifier unless the characters within the delimiters would form an ordinary identifier.

For example, "PRIVILEGES" is in uppercase and the characters within the delimiters form an ordinary identifier; therefore, it has a length of 10 bytes and is a valid system name for a column. Alternatively, "privileges" is in lowercase, has a length of 12 bytes, and is not a valid system name for a column because the bytes required for the delimiters must be included in the length of the identifier.

Examples

WKLYSAL WKLY_SAL "WKLY_SAL" "UNION" "wkly_sal"

See "Naming conventions" on page 52 for information on the maximum length of identifiers.

Host identifiers

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A host-identifier is a name declared in the host program.

The rules for forming a host-identifier are the rules of the host language; except that DBCS characters cannot be used. For example, the rules for forming a host-identifier in a COBOL program are the same as the rules for forming a user-defined word in COBOL. Names beginning with the characters 'SQ', 'SQL', 'sql', 'RDI', or 'DSN' should not be used because precompilers generate host variables that begin with these characters. In Java, do not use names beginning with '_sJT_'.

See Table 5 on page 58 for the limits on the maximum size of the host identifier name imposed by DB2 for i.

^{17. &#}x27;SQ' is allowed in C, COBOL, and PL/I; it should not be used in RPG.

Naming conventions

The rules for forming a name depend on the type of the object designated by the name and the naming option (*SQL or *SYS). The naming option is specified on the CRTSQLxxx, RUNSQLSTM, and STRSQL commands. The SET OPTION statement can be used to specify the naming option within the source of a program containing embedded SQL. The syntax diagrams use different terms for different types of names.

The following list defines these terms.

alias-name

A qualified or unqualified name that designates an alias. The qualified form of an alias-name depends on the naming option. For SQL naming, the qualified form is a schema-name followed by a period (.) and an SQL identifier. For system naming, the qualified form is a schema-name followed by a slash (/) followed by an SQL identifier.

The unqualified form of an alias-name is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

An alias-name can specify either the name of the alias or the system object name of the alias.

authorization-name

A system identifier that designates a user or group of users. An authorization-name is a user profile name on the server. It must not be a delimited identifier that includes lowercase letters or special characters. See "Authorization IDs and authorization names" on page 64 for the distinction between an authorization-name and an authorization ID.

column-name

A qualified or unqualified name that designates a column of a table or a view. The unqualified form of a column-name is an SQL identifier. The qualified form is a qualifier followed by a period and an SQL identifier. The qualifier is a table name, a view name, or a correlation name.

Column names cannot be qualified with system names in the form schema-name/table-name.column-name, except in the COMMENT and LABEL statements. If column names need to be qualified, and correlation names are allowed in the statement, a correlation name must be used to qualify the column.

A column-name can specify either the column name or the system column name of a column of a table or view. If a column-name is delimited, the delimiters are considered to be part of the name when determining the length of the name.

constraint-name

A qualified or unqualified name that designates a constraint on a table. The qualified form of a *constraint-name* depends on the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a schema-name followed by a slash (/) followed by an SQL identifier.

The unqualified form of a constraint-name is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

The implicit or explicit qualifier must be the same as the schema name of the table.

correlation-name

An SQL identifier that designates a table, a view, or individual rows of a table or view.

cursor-name

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An SQL identifier that designates an SQL cursor.

descriptor-name

A variable name or string constant that designates an SQL descriptor area (SQLDA). A variable that designates an SQL descriptor area must not have an indicator variable. The form :host-variable:indicator-variable is not allowed. See "References to host variables" on page 136 for a description of a variable.

distinct-type-name

A qualified or unqualified name that designates a distinct type. The qualified form of a *distinct-type-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *distinct-type-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

For system naming, *distinct-type-names* cannot be qualified when used in a parameter data type of an SQL routine or in an SQL variable declaration in an SQL function, SQL procedure, or trigger.

external-program-name

A qualified name, unqualified name, or a character string that designates an external program. The qualified form of an *external-program-name* depends on the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and a system identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by a system identifier.

The unqualified form of an *external-program-name* is a system identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

The format of the character string form is either:

- An IBM i qualified program name ('library-name/program-name').
- An i qualified source file name, followed by a left parenthesis, followed by an i member name, and a right parenthesis ('library-name/source-file-name(member-name)'). This form is only valid when calling a REXX procedure.
- An i qualified service program name, followed by a left parenthesis, followed by an i entry-point-name, followed by a right parenthesis ('library-name/service-program-name(entry-point-name)').
- In Java, an optional *jar-name*, followed by a class identifier, followed by an exclamation point or period, followed by a method identifier ('class-id!method-id' or 'class-id.method-id').



jar-name

The *jar-name* is a case-sensitive string that identifies the jar schema when it was installed in the database. It can be either a simple identifier, or a schema qualified identifier. Examples are 'myJar' and 'myCollection.myJar'.

class-id

The *class-id* identifies the class identifier of the Java object. If the class is part of a Java package, the class identifier must include the complete Java package prefix. For example, if the class identifier is 'myPackage.StoredProcs', the Java virtual machine will look in the following directory for the StoredProcs class:

'/QIBM/UserData/OS400/SQLLib/ Function/myPackage/StoredProcs/'

method-id

The *method-id* identifies the method name of the public, static Java method to be invoked.

This form is only valid for Java procedures and Java functions.

function-name

A qualified or unqualified name that designates a user-defined function, a cast function that was generated when a distinct type was created, or a built-in function. The qualified form of a *function-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *function-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

For system naming, functions names can only be qualified in the form *schema-name/function-name* when the name is used in a CREATE, COMMENT, DROP, GRANT, or REVOKE statement.

host-label

A token that designates a label in a host program.

host-variable

A sequence of tokens that designates a host variable. A *host-variable* includes at least one *host-identifier*, as explained in "References to host variables" on page 136.

index-name

A qualified or unqualified name that designates an index. The qualified form of an *index-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of an *index-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

member-name

An unqualified identifier that designates a member of a database file. A member is also a partition of a partitioned table.

nodegroup-name

A qualified or unqualified name that designates a nodegroup. A nodegroup is a group of System i products across which a table will be distributed. For more information about distributed tables and nodegroups, see DB2 Multisystem.

The qualified form of a *nodegroup-name* depends on the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and a system identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by a system identifier.

The unqualified form of a *nodegroup-name* is a system identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

package-name

A qualified or unqualified name that designates a package. The qualified form of a *package-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and a system identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by a system identifier.

The unqualified form of a *package-name* is a system identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

parameter-name

An SQL identifier that designates a parameter for a function or procedure. If the *parameter-name* is for a procedure, the identifier may be preceded by a colon.

partition-name

An unqualified identifier that designates a partition of a partitioned table.

procedure-name

A qualified or unqualified name that designates a procedure. The qualified form of a *procedure-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *procedure-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

savepoint-name

An unqualified identifier that designates a savepoint.

schema-name

A qualified or unqualified name that provides a logical grouping for SQL objects. A schema name is used as a qualifier of the name of a table, view, index, procedure, function, trigger, constraint, alias, type, or package. The unqualified form of a *schema-name* is a system identifier. The qualified form of a *schema-name* depends on the naming option.

Naming conventions

For SQL names, the unqualified schema name in an SQL statement is implicitly qualified by the *server-name*. The qualified form is a *server-name* followed by a (.) and a system identifier. The *server-name* must identify the current server.

For system names, the unqualified schema name in an SQL statement is implicitly qualified by the *server-name*. The qualified form is a *server-name* followed by a slash (/) and a system identifier. The *server-name* must identify the current server.

Note: *schema-name* refers to either a schema created by the CREATE SCHEMA statement or to an IBM i library.

sequence-name

A qualified or unqualified name that designates a sequence. The qualified form of a *sequence-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier. For system naming, a *sequence-name* cannot be qualified when used in a NEXT VALUE or PREVIOUS VALUE expression (the qualified form is only allowed in SQL schema statements).

The unqualified form of a *sequence-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

A *sequence-name* can specify either the name of the sequence or the system object name of the sequence.

server-name

An SQL identifier that designates an application server. The identifier must start with a letter and must not include lowercase letters or special characters.

specific-name

A qualified or unqualified name that uniquely identifies a procedure or function. The qualified form of a *specific-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *specific-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

SQL-condition-name

An SQL identifier that designates a condition in an SQL procedure, SQL function, or trigger body.

SQL-descriptor-name

A variable name or character or graphic string constant that designates an SQL descriptor that was allocated using the ALLOCATE DESCRIPTOR statement.

If a variable is used to designate the SQL descriptor:

- The variable must not be a CLOB or DBCLOB.
- If the variable is a graphic string, it must be a Unicode graphic string.
- The length of the contents of the variable must not exceed the maximum length for an *SQL-descriptor-name*.

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- An indicator variable must not be specified. The form :host-variable:indicator-variable is not allowed.
- The contents of the variable are case-sensitive and are not converted to uppercase.

Leading and trailing blanks are trimmed from the variable or string. See "References to host variables" on page 136 for a description of a variable.

If a string constant is used to designate the SQL descriptor, the length of the constant must not exceed the maximum length for an *SQL-descriptor-name*.

SQL-label

An unqualified name that designates a label in an SQL procedure, SQL function, or trigger body. An SQL-label is an SQL identifier.

SQL-parameter-name

A qualified or unqualified name that designates a parameter in an SQL routine body. The unqualified form of an SQL-parameter-name is an SQL identifier. The qualified form is a procedure-name followed by a period (.) and an SOL identifier.

SQL-variable-name

A qualified or unqualified name that designates a variable in an SQL routine body. The unqualified form of an SQL-variable-name is an SQL identifier. The qualified form is an SQL-label followed by a period (.) and an SOL identifier.

statement-name

An SQL identifier that designates a prepared SQL statement.

system-column-name

An unqualified name that designates the IBM i column name of a table or a view. A system-column-name is a system identifier. System-column-names can be delimited identifiers, but the characters within the delimiters must not include lowercase letters or special characters.

system-object-name

An unqualified name that designates the i name of a table, view, index, sequence, or alias. A system-object-name is a system identifier.

If the unqualified name of the table, view, index, sequence, or alias is a valid system identifier, the system-object-name of the table, view, index, sequence, or alias is the unqualified name of the table, view, index, sequence, or alias.

table-name

A qualified or unqualified name that designates a table. The qualified form of a table-name depends upon the naming option. For SQL naming, the qualified form is a schema-name followed by a period (.) and an SQL identifier. For system naming, the qualified form is a schema-name followed by a slash (/) followed by an SQL identifier.

The unqualified form of a table-name is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

A table-name can specify either the name of the table or the system object name of the table.

trigger-name

A qualified or unqualified name that designates a trigger on a table. The

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qualified form of a *trigger-name* depends on the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and a system identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *trigger-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

version-id

An identifier of 1 to 64 characters that is assigned to a package when the package is created. A *version-id* is only assigned when packages are created from a server other than DB2 for i.

view-name

A qualified or unqualified name that designates a view. The qualified form of a *view-name* depends upon the naming option. For SQL naming, the qualified form is a *schema-name* followed by a period (.) and an SQL identifier. For system naming, the qualified form is a *schema-name* followed by a slash (/) followed by an SQL identifier.

The unqualified form of a *view-name* is an SQL identifier. The unqualified form is implicitly qualified based on the rules specified in "Qualification of unqualified object names" on page 60.

A *view-name* can specify either the name of the view or the system object name of the view.

Table 5. Identifier Length Limits (in bytes)

Identifier Type	Maximum Length
Longest authorization name ¹⁸	10
Longest correlation name	128
Longest cursor name	128
Longest external program name (string form)	279
Longest external program name (unqualified form) ¹⁹	10
Longest host identifier	64
Longest partition name	10
Longest savepoint name	128
Longest schema name	10
Longest server name	18
Longest SQL condition name	128
Longest SQL descriptor name	128
Longest SQL label	128
Longest statement name	128
Longest unqualified alias name	128
Longest unqualified column name	128
Longest unqualified constraint name	128
Longest unqualified distinct type name	128
Longest unqualified function name	128
Longest unqualified index name	128
Longest unqualified nodegroup name	10

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Naming conventions

Table 5. Identifier Length Limits (in bytes) (continued)

Identifier Type	Maximum Length
Longest unqualified package name	10
Longest package version-id	64
Longest unqualified procedure name	128
Longest unqualified sequence name	128
Longest unqualified specific name	128
Longest unqualified SQL parameter name	128
Longest unqualified SQL variable name	128
Longest unqualified system column name	10
Longest unqualified system object name	10
Longest unqualified table and view name	128
Longest unqualified trigger name	128

^{18.} As an application requester, the system can send an authorization name of up to 255 bytes.

^{19.} For REXX procedures, the limit is 33.

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SQL path

The SQL path is an ordered list of schema names. The database manager uses the path to resolve the schema name for unqualified distinct type names (both built-in types and distinct types), function names, and procedure names that appear in any context other than as the main object of an ALTER, CREATE, DROP, COMMENT, LABEL, GRANT or REVOKE statement.

For example, if the SQL path is SMITH, XGRAPHIC, QSYS, QSYS2 and an unqualified distinct type name MYTYPE was specified, database manager looks for MYTYPE first in schema SMITH, then XGRAPHIC, and then QSYS and QSYS2.

The SQL path used is depends on the SQL statement:

- For static SQL statements (except for a CALL variable statement), the path used is the value of the SQLPATH parameter on the CRTSQLxxx command. The SQLPATH can also be set using the SET OPTION statement.
- For dynamic SQL statements (and for a CALL variable statement), the path used is the value of the CURRENT PATH special register. For more information about the CURRENT PATH special register, see "CURRENT PATH" on page 124.

If the SQL path is not explicitly specified, the SQL path is the system path followed by the authorization ID of the statement.

For more information about the SQL path for dynamic SQL, see "CURRENT PATH" on page 124.

Qualification of unqualified object names

Unqualified object names are implicitly qualified. The rules for qualifying a name differ depending on the type of object that the name identifies.

Unqualified alias, constraint, external program, index, nodegroup, package, sequence, table, trigger, and view names

Unqualified alias, constraint, external program, index, nodegroup, package, sequence, table, trigger, and view names are implicitly qualified by the default schema.

The *default schema* is specified as follows:

- For static SQL statements:
 - If the DFTRDBCOL parameter is specified on the CRTSQLxxx command (or with the SET OPTION statement), the default schema is the schema-name that is specified for that parameter.
 - In all other cases, the *default schema* is based on the naming convention.
 - For SQL naming, the *default schema* is the authorization identifier of the statement.
 - For system naming, the *default schema* is the job library list (*LIBL).
- For dynamic SQL statements the default schema depends on whether a default schema has been explicitly specified. The mechanism for explicitly specifying this depends on the interface used to dynamically prepare and execute SQL statements.
 - If a *default schema* is not explicitly specified:
 - For SQL naming, the *default schema* is the run-time authorization identifier.
 - For system naming, the *default schema* is the job library list (*LIBL).

- The *default schema* is explicitly specified through the following interfaces:

Table 6. Default Schema Interfaces

SQL Interface	Specification
Embedded SQL	DFTRDBCOL parameter and DYNDFTCOL(*YES) on the Create SQL Program (CRTSQLxxx) and Create SQL Package (CRTSQLPKG) commands. The SET OPTION statement can also be used to set the DFTRDBCOL and DYNDFTCOL values. (For more information about CRTSQLxxx commands, see Embedded SQL Programming.)
Run SQL Statements	DFTRDBCOL parameter on the Run SQL Statements (RUNSQLSTM) command. (For more information about the RUNSQLSTM command, see SQL Programming.)
Call Level Interface (CLI) on the server	SQL_ATTR_DEFAULT_LIB or SQL_ATTR_DBC_DEFAULT_LIB environment or connection variables (For more information about CLI, see SQL Call Level Interfaces (ODBC).)
JDBC or SQLJ on the server using IBM Developer Kit for Java	libraries property object (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)
ODBC on a client using the System i Access Family ODBC Driver	SQL Default Library in ODBC Setup (For more information about ODBC, see System i Access.)
JDBC on a client using the IBM Toolbox for Java	SQL Default Library in JDBC Setup (For more information about JDBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)
OLE DB on a client using the System i Access Family OLE DB Provider	DefaultCollection in Connection Object Properties (For more information about OLE DB, see System i Access.)
ADO .NET on a client using the System i Access Family ADO .NET Provider	DefaultCollection in Connection Object Properties (For more information about ADO .NET, see System i Access.)
All interfaces	SET SCHEMA or QSQCHGDC (Change Dynamic Default Collection) API (For more information about QSQCHGDC, see the File APIs category.)

Unqualified distinct type, function, procedure, and specific names

The qualification of data type (both built-in types and distinct types), function, procedure, and specific names depends on the SQL statement in which the unqualified name appears.

- If an unqualified name is the main object of an ALTER, CREATE, COMMENT, DROP, GRANT, or REVOKE statement, the name is implicitly qualified using the same rules as for qualifying unqualified table names (See "Unqualified alias, constraint, external program, index, nodegroup, package, sequence, table, trigger, and view names" on page 60).
- Otherwise, the implicit schema name is determined as follows:

Naming conventions

- For distinct type names, database manager searches the SQL path and selects the first schema in the path such that the data type exists in the schema.
- For procedure names, database manager searches the SQL path and selects the first schema in the path such that the schema contains an authorized procedure with the same name and number of parameters.
- For function names, database manager uses the SQL path in conjunction with function resolution, as described under "Function resolution" on page 147.
- For specific names specified for sourced functions, see "CREATE FUNCTION (Sourced)" on page 693.

SQL names and system names: special considerations

The CL command Override Database File (OVRDBF) can be specified to override an SQL or system name with another object name for local data manipulation SQL statements. Overrides are ignored for data definition SQL statements and data manipulation SQL statements executing at a remote relational database.

See the Database file management topic for more information about the override function.

Aliases

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An *alias* can be thought of as an alternative name for a table, partition of a table, view, or member of a database file. A table or view in an SQL statement can be referenced by its name or by an alias. An alias can only refer to a table, partition of a table, view, or database file member within the same relational database.

An alias can be used wherever a table or view name can be used, except:

- Do not use an alias name where a new table or view name is expected, such as in the CREATE TABLE or CREATE VIEW statements. For example, if an alias name of PERSONNEL is created, then a subsequent statement such as CREATE TABLE PERSONNEL will cause an error.
- An alias that refers to an individual partition of a table or member of a database file can only be used in a select statement, CREATE INDEX, DELETE, INSERT, SELECT INTO, SET variable, UPDATE, or VALUES INTO statement.

Aliases can also help avoid using file overrides. Not only does an alias perform better than an override, but an alias is also a permanent object that only need be created once.

An alias can be created even though the object that the alias refers to does not exist. However, the object must exist when a statement that references the alias is executed. A warning is returned if the object does not exist when the alias is created. An alias cannot refer to another alias. An alias can only refer to a table, partition of a table, view, or database file member within the same relational database.

The option of referring to a table, partition of a table, view, or database file member by an alias name is not explicitly shown in the syntax diagrams or mentioned in the description of the SQL statements.

A new alias cannot have the same fully-qualified name as an existing table, view, index, file, or alias.

The effect of using an alias in an SQL statement is similar to that of text substitution. The alias, which must be defined before the SQL statement is executed, is replaced at statement preparation time by the qualified base table, partition of a table, view, or database file member name. For example, if PBIRD.SALES is an alias for DSPN014.DIST4_SALES_148, then at statement run time:

SELECT * FROM PBIRD.SALES

effectively becomes

SELECT * FROM DSPN014.DIST4_SALES_148

The effect of dropping an alias and recreating it to refer to another table depends on the statement that references the alias.

- SQL Data or SQL Data Change statements that refer to that alias will be implicitly rebound when they are next run.
- Indexes that reference the alias are not affected.
- Materialized query tables or views that reference the alias are not affected.

For syntax toleration of existing DB2 for z/OS applications, SYNONYM can be used in place of ALIAS in the CREATE ALIAS and DROP ALIAS statements.

Authorization IDs and authorization names

An authorization ID is a character string that is obtained by the database manager when a connection is established between the database manager and either an application process or a program preparation process. It designates a set of privileges. It may also designate a user or a group of users, but this property is not controlled by the database manager.

After a connection has been established, the authorization ID may be changed using the SET SESSION AUTHORIZATION statement.

Authorization ID's are used by the database manager to provide authorization checking of SQL statements.

An authorization ID applies to every SQL statement. The authorization ID that is used for authorization checking for a static SQL statement depends on the USRPRF value specified on the precompiler command:

- If USRPRF(*OWNER) is specified, or if USRPRF(*NAMING) is specified and SQL naming mode is used, the authorization ID of the statement is the owner of the non-distributed SQL program. For distributed SQL programs, it is the owner of the SQL package.
- If USRPRF(*USER) is specified, or if USRPRF(*NAMING) is specified and system naming mode is used, the authorization ID of the statement is the authorization ID of the user running the non-distributed SQL program. For distributed SQL programs, it is the authorization ID of the user at the current server.

The authorization ID that is used for authorization checking for a dynamic SQL statement also depends on where and how the statement is executed:

- If the statement is prepared and executed from a non-distributed program:
 - If the USRPRF value is *USER and the DYNUSRPRF value is *USER for the program, the authorization ID that applies is the ID of the user running the non-distributed program. This is called the *run-time authorization ID*.
 - If the USRPRF value is *OWNER and the DYNUSRPRF value is *USER for the program, the authorization ID that applies is the ID of the user running the non-distributed program.
 - If the USRPRF value is *OWNER and the DYNUSRPRF value is *OWNER for the program, the authorization ID that applies is the ID of the owner of the non-distributed program.
- If the statement is prepared and executed from a distributed program:
 - If the USRPRF value is *USER and the DYNUSRPRF value is *USER for the SQL package, the authorization ID that applies is the ID of the user running the SQL package at the current server. This is also called the run-time authorization ID.
 - If the USRPRF value is *OWNER and the DYNUSRPRF value is *USER for the SQL package, the authorization ID that applies is the ID of the user running the SQL package at the current server.
 - If the USRPRF value is *OWNER and the DYNUSRPRF value is *OWNER for the SQL package, the authorization ID that applies is the ID of the owner of the SQL package at the current server.
- If the statement is issued interactively, the authorization ID that applies is the ID of the user that issued the Start SQL (STRSQL) command.
- If the statement is executed from the RUNSQLSTM command, the authorization ID that applies is the ID of the user that issued the RUNSQLSTM command.

• If the statement is executed from REXX, the authorization ID that applies is the ID of the user that issued the STRREXPRC command.

On the IBM i operating system, the run-time authorization ID is the user profile of the job.

An *authorization-name* specified in an SQL statement should not be confused with the authorization ID of the statement. An authorization-name is an identifier that is used in GRANT and REVOKE statements to designate a target of the grant or revoke. The premise of a grant of privileges to *X* is that *X* will subsequently be the authorization ID of statements which require those privileges. A group user profile can also be used when checking authority for an SQL statement. For information about group user profiles, see Security Reference.

Example

Assume SMITH is your user ID; then SMITH is the authorization ID when you execute the following statement interactively:

GRANT SELECT ON TDEPT TO KEENE

SMITH is the authorization ID of the statement. Thus, the authority to execute the statement is checked against SMITH.

KEENE is an authorization-name specified in the statement. KEENE is given the SELECT privilege on SMITH.TDEPT.

Data types

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The smallest unit of data that can be manipulated in SQL is called a value.

How values are interpreted depends on the data type of their source, which includes the data type, length, precision, scale, and CCSID. The sources of values are:

- Columns
- Constants
- Expressions
- Functions
- · Special registers
- Variables (such as host variables, SQL variables, parameter markers and parameters of routines)

The DB2 relational database products support both built-in data types and user-defined data types. This section describes the built-in data types. For a description of distinct types, see "User-defined types" on page 82.

The following figure illustrates the various built-in data types supported by the DB2 for i program.

For information about specifying the data types of columns, see "CREATE TABLE" on page 768.

Nulls

All data types include the null value. Distinct from all non-null values, the null value is a special value that denotes the absence of a (non-null) value.

Except for grouping operations, a null value is also distinct from another null value. Although all data types include the null value, some sources of values cannot provide the null value. For example, constants and columns that are defined as NOT NULL cannot contain null values, the COUNT and COUNT_BIG functions cannot return a null value, and ROWID columns cannot store a null value although a null value can be returned for a ROWID column as the result of a query.

Numbers

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 The numeric data types are binary integer, decimal, decimal floating-point, and floating-point.

The numeric data types are categorized as follows:

- · Exact numerics: binary integer and decimal
- Decimal floating-point
- Approximate numerics: floating-point

Binary integer includes small integer, large integer, and big integer. Binary numbers are exact representations of integers. Decimal numbers are exact representations of numbers with a fixed precision and scale. Binary and decimal numbers are considered exact numeric types.

Decimal floating-point numbers can have a precision of 16 or 34. Decimal floating-point supports both exact representations of real numbers and approximations of real numbers and so is not considered either an exact numeric type or an approximate numeric type.

Floating-point includes single precision and double precision. Floating-point numbers are approximations of real numbers and are considered approximate numeric types.

All numbers have a sign, a precision, and a scale. For all numbers except decimal floating-point, if a column value is zero, the sign is positive. Decimal floating-point numbers include negative and positive zeros. Decimal floating-point has distinct values for a number and the same number with various exponents (for example: 0.0, 0.00, 0.0E5, 1.0, 1.00, 1.0000). The precision is the total number of digits excluding the sign. The scale is the total number of digits to the right of the decimal point. If there is no decimal point, the scale is zero.

Small integer

A small integer is a binary number composed of 2 bytes with a precision of 5 digits. The range of small integers is -32768 to +32767.

For small integers, decimal precision and scale are supported by COBOL, RPG, and IBM i system files. For information concerning the precision and scale of binary integers, see the DDS Reference topic.

Large integer

A large integer is a binary number composed of 4 bytes with a precision of 10 digits. The range of large integers is -2 147 483 648 to +2 147 483 647.

For large integers, decimal precision and scale are supported by COBOL, RPG, and IBM i system files. For information concerning the precision and scale of binary integers, see the DDS Reference topic.

Big integer

A big integer is a binary number composed of 8 bytes with a precision of 19 digits. The range of big integers is -9 223 372 036 854 775 808 to +9 223 372 036 854 775 807.

Decimal

A *decimal* value is a packed decimal or zoned decimal number with an implicit decimal point. The position of the decimal point is determined by the precision and the scale of the number. The scale, which is the number of digits in the fractional part of the number, cannot be negative or greater than the precision. The maximum precision is 63 digits.

All values of a decimal column have the same precision and scale. The range of a decimal variable or the numbers in a decimal column is -n to +n, where the absolute value of n is the largest number that can be represented with the applicable precision and scale.

The maximum range is negative $10^{63}+1$ to 10^{63} minus 1.

Floating-point

A *single-precision floating-point* number is a 32-bit approximate representation of a real number. The range of magnitude is approximately $1.17549436 \times 10^{-38}$ to $3.40282356 \times 10^{38}$.

A *double-precision floating-point* number is a IEEE 64-bit approximate representation of a real number. The range of magnitude is approximately $2.2250738585072014 \times 10^{-308}$ to $1.7976931348623158 \times 10^{308}$.

Single-precision floating-point is generally accurate to 7 digits of precision. Double-precision floating-point is generally accurate to 15 digits of precision.

Decimal floating-point

A *decimal floating-point* number is an IEEE 754R number with a decimal point. The position of the decimal point is stored in each decimal floating-point value. The maximum precision is 34 digits. The range of a decimal floating-point number is either 16 or 34 digits of precision, and an exponent range of 10^{-383} to 10^{384} or 10^{-6143} to 10^{6144} respectively.

The minimum exponent, E_{min} , for DECFLOAT values is -383 for DECFLOAT(16) and -6143 for DECFLOAT(34). The maximum exponent, E_{max} , for DECFLOAT values is 384 for DECFLOAT(16) and 6144 for DECFLOAT(34).

In addition to the finite numbers, decimal floating-point numbers can also represent the following three special values (see "Decimal floating-point constants" on page 113 for more information):

- Infinity A value that represents a number whose magnitude is infinitely large.
- Quiet NaN A value that represents undefined results which does not cause an invalid number warning.
- Signaling NaN A value that represents undefined results which will cause an invalid number warning if used in any numerical operation.²⁰

When a number has one of these special values, its coefficient and exponent are undefined. The sign of an infinity is significant (that is, it is possible to have both positive and negative infinity). The sign of a NaN has no meaning for arithmetic operations. INF can be used in place of INFINITY.

^{20.} The warning is only returned if *YES is specified for the SQL_DECFLOAT_WARNINGS query option.

See Table 84 on page 1207 for more information.

Numeric variables

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Small and large binary integer variables can be used in all host languages. Big integer variables can only be used in C, C++, ILE COBOL, and ILE RPG. Floating-point variables can be used in all host languages except RPG/400[®] and COBOL/400[®]. Decimal variables can be used in all supported host languages. Decimal floating-point variables can only be used in C.

String representations of numeric values

When a decimal, decimal floating-point, or floating-point number is cast to a string (for example, using a CAST specification) the implicit decimal point is replaced by the default decimal separator character in effect when the statement was prepared. When a string is cast to a decimal, decimal floating-point, or floating-point value (for example, using a CAST specification), the default decimal separator character in effect when the statement was prepared is used to interpret the string.

Subnormal numbers and underflow

The decimal floating-point data type has a set of non-zero numbers that fall outside the range of normal decimal floating-point values. These numbers are called subnormal.

Non-zero numbers whose adjusted exponents are less than E_{min} (-6143 for DECFLOAT(34) or -383 for DECFLOAT(16)), are called subnormal numbers. These subnormal numbers are accepted as operands for all operations and may result from any operation. If a result is subnormal before any rounding, the subnormal warning is returned.²¹

For a subnormal result, the minimum value of the exponent becomes E_{min} (precision - 1), called E_{tiny} , where precision is the precision of the decimal floating-point number. Hence, the smallest value of the exponent E_{tiny} = -6176 for DECFLOAT(34) and -398 for DECFLOAT(16). As the exponent E_{tiny} gets smaller, the number of digits available in the mantissa also decreases. The number of digits available in the mantissa for subnormal numbers is (precision - (- E_{tiny} + E_{min}).

The result will be rounded, if necessary, to ensure that the exponent is no smaller than E_{tiny} . If, during this rounding, the result becomes inexact, an underflow warning is returned.²¹ A subnormal result does not always return the underflow warning but will always return the subnormal warning.

When a number underflows to zero during a calculation, its exponent will be E_{tiny} . The maximum value of the exponent is unaffected.

The maximum value of the exponent for subnormal numbers is the same as the minimum value of the exponent which can arise during operations that do not result in subnormal numbers. This occurs where the length of the coefficient in decimal digits is equal to the precision.

^{21.} The warning is only returned if *YES is specified for the SQL_DECFLOAT_WARNINGS query option.

Character strings

A character string is a sequence of bytes. The length of the string is the number of bytes in the sequence. If the length is zero, the value is called the *empty string*. The empty string should not be confused with the null value.

Fixed-length character strings

When fixed-length character string distinct types, columns, and variables are defined, the length attribute is specified and all values have the same length. For a fixed-length character string, the length attribute must be between 1 through 32766 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

Varying-length character strings

The types of varying-length character strings are:

- VARCHAR
- CLOB

A Character Large OBject (CLOB) column is useful for storing large amounts of character data, such as documents written using a single character set.

Distinct types, columns, and variables all have length attributes. When varying-length character-string distinct types, columns, and variables are defined, the maximum length is specified and this becomes the length attribute. Actual values may have a smaller length. For a varying-length character string, the length attribute must be between 1 through 32 740 inclusive. For a CLOB string, the length attribute must be between 1 through 2 147 483 647 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

For the restrictions that apply to the use of long varying-length strings, see "Limitations on use of strings" on page 75.

Character-string variables

- Fixed-length character-string variables can be used in all host languages except REXX and Java. (In C or C++, fixed-length character-string variables are limited to a length of 1.)
- VARCHAR varying-length character-string variables can be used in C, C++, COBOL, PL/I, REXX, and RPG:
 - In PL/I, REXX, and ILE RPG, there is a varying-length character-string data
 - In COBOL, C, and C++ varying-length character strings are represented as structures.
 - In C and C++, varying-length character-string variables can also be represented by NUL-terminated strings.
 - In RPG/400, varying-length character-string variables can only be represented by VARCHAR columns included as a result of an externally described data structure.
- CLOB varying-length character-string variables can be defined in all host languages except REXX, RPG/400, and COBOL/400.
 - In ILE RPG, a CLOB varying-length character string is declared using the SQLTYPE keyword.
 - In all other languages, an SQL TYPE IS CLOB clause is used.

Character encoding schemes

Each character string is further defined as one of four types.

Bit data

Data that is not associated with a coded character set and is therefore never converted. The CCSID for bit data is 65535.

Note: Bit data is a form of character data. The pad character is a blank for assignments to bit data; the pad character is X'00' for assignments to binary data. It is recommended that the binary data type be used instead of character for bit data.

SBCS data

Data in which every character is represented by a single byte. Each SBCS data character string has an associated CCSID. If necessary, an SBCS string is converted before it is used in an operation with a character string that has a different CCSID.

Mixed data

Data that may contain a mixture of characters from a single-byte character set (SBCS) and a double-byte character set (DBCS). Each mixed string has an associated CCSID. If necessary, a mixed data character string is converted before an operation with a character string that has a different CCSID. If mixed data contains a DBCS character, it cannot be converted to SBCS data.

Unicode data

Data that contains characters represented by one or more bytes. Each Unicode character string is encoded using UTF-8. The CCSID for UTF-8 is 1208.

The database manager does not recognize subclasses of double-byte characters, and it does not assign any specific meaning to particular double-byte codes. However, if you choose to use mixed data, then two single-byte EBCDIC codes are given special meanings:

- X'0E', the "shift-out" character, is used to mark the beginning of a sequence of double-byte codes.
- X'0F', the "shift-in" character, is used to mark the end of a sequence of double-byte codes.

In order for the database manager to recognize double-byte characters in a mixed data character string, the following condition must be met:

• Within the string, the double-byte characters must be enclosed between paired shift-out and shift-in characters.

The pairing is detected as the string is read from left to right. The code X'0E' is recognized as a shift out character if X'0F' occurs later; otherwise, it is invalid. The first X'0F' following the X'0E' that is on a double-byte boundary is the paired shift-in character. Any X'0F' that is not on a double-byte boundary is not recognized.

There must be an even number of bytes between the paired characters, and each pair of bytes is considered to be a double-byte character. There can be more than one set of paired shift-out and shift-in characters in the string.

The length of a mixed data character string is its total number of bytes, counting two bytes for each double-byte character and one byte for each shift-out or shift-in character.

When the job CCSID indicates that DBCS is allowed, CREATE TABLE will create character columns as DBCS-Open fields, unless FOR BIT DATA, FOR SBCS DATA, or an SBCS CCSID is specified. The SQL user will see these as character fields, but the system database support will see them as DBCS-Open fields. For a definition of a DBCS-Open field, see the Database programming topic collection.

Graphic strings

A graphic string is a sequence of double-byte characters. The length of the string is the number of its characters. Like character strings, graphic strings can be empty.

Fixed-length graphic strings

When fixed-length graphic-string distinct types, columns, and variables are defined, the length attribute is specified and all values have the same length. For a fixed-length graphic string, the length attribute must be between 1 through 16 383 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

Varying-length graphic strings

- The types of varying-length graphic strings are:
- VARGRAPHIC
- DBCLOB

A Double-Byte Character Large OBject (DBCLOB) column is useful for storing large amounts of double-byte character data, such as documents written using a double-byte character set.

Distinct types, columns, and variables all have length attributes. When varying-length graphic-string distinct types, columns, and variables are defined, the maximum length is specified and this becomes the length attribute. Actual values may have a smaller length. For a varying-length graphic string, the length attribute must be between 1 through 16 370 inclusive. For a DBCLOB string, the length attribute must be between 1 through 1 073 741 823 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

For the restrictions that apply to the use of long varying-length strings, see "Limitations on use of strings" on page 75.

Graphic-string variables

- Fixed-length graphic-string variables can be defined in C, C++, ILE COBOL, and ILE RPG. (In C and C++, fixed-length graphic-string variables are limited to a length of 1.)
 - Although fixed-length graphic-string variables cannot be defined in PL/I, COBOL/400, and RPG/400, a character-string variable will be treated like a fixed-length graphic-string variable if it was generated in the source from a GRAPHIC column in the external definition of a file.
- VARGRAPHIC varying-length graphic-string variables can be defined in C, C++, ILE COBOL, REXX, and ILE RPG.
 - In REXX and ILE RPG, there is a varying-length graphic-string data type.
 - In C, C++, and ILE COBOL, varying-length graphic strings are represented as
 - In C and C++, varying-length graphic-string variables can also be represented by NUL-terminated graphic strings.

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- Although varying-length graphic-string variables cannot be defined in PL/I, COBOL/400, and RPG/400, a character-string variable will be treated like a varying-length graphic-string variable if it was generated in the source from a VARGRAPHIC column in the external definition of a file.
- DBCLOB varying-length character-string variables can be defined in all host languages except REXX, RPG/400, and COBOL/400.
 - In ILE RPG, a DBCLOB varying-length character string is declared using the SQLTYPE keyword.
 - In all other languages, an SQL TYPE IS DBCLOB clause is used.

Graphic encoding schemes

Each graphic string is further defined as one of two types.

DBCS data

Data in which every character is represented by a character from the double-byte character set (DBCS) that does not include the shift-out or shift-in characters.

Every DBCS graphic string has a CCSID that identifies a double-byte coded character set. If necessary, a DBCS graphic string is converted before it is used in an operation with a DBCS graphic string that has a different DBCS CCSID.

Unicode data

Data that contains characters represented by two or more bytes. Each Unicode graphic string is encoded using either UCS-2 or UTF-16. UCS-2 is a subset of UTF-16. The CCSID for UCS-2 is 13488. The CCSID for UTF-16 is 1200.

NCHAR, NVARCHAR, and NCLOB are synonyms for Unicode graphic data with a CCSID of 1200.

When graphic-string variables are not explicitly tagged with a CCSID, the associated DBCS CCSID for the job CCSID is used. If no associated DBCS CCSID exists, the variable is tagged with 65535. A graphic-string variable is never implicitly tagged with a UTF-16 or UCS-2 CCSID. See the DECLARE VARIABLE statement for information on how to tag a graphic variable with a CCSID.

Binary strings

A *binary string* is a sequence of bytes. Unlike a character string which usually contains text data, a binary string is used to hold non-traditional data such as pictures. The length of a binary string is the number of bytes in the sequence. A binary string has a CCSID of 65535. Only character strings of FOR BIT DATA are compatible with binary strings.

Fixed-length binary strings

When fixed-length binary-string distinct types, columns, and variables are defined, the length attribute is specified and all values have the same length. For a fixed-length binary string, the length attribute must be between 1 through 32 766 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

Varying-length binary strings

The types of varying-length binary strings are:

- VARBINARY
- BLOB

A Binary Large OBject (BLOB) column is useful for storing large amounts of noncharacter data, such as pictures, voice, and mixed media. Another use is to hold structured data for exploitation by distinct types and user-defined functions.

Distinct types, columns, and variables all have length attributes. When varying-length binary-string distinct types, columns, and variables are defined, the maximum length is specified and this becomes the length attribute. Actual values may have a smaller length. For a varying-length binary string, the length attribute must be between 1 through 32 740 bytes inclusive. For a BLOB string, the length attribute must be between 1 through 2 147 483 647 inclusive. See Appendix A, "SQL limits," on page 1205 for more information.

Binary-string variables

A variable with a binary string type can be defined in all host languages except REXX, RPG/400, and COBOL/400.

- · BINARY fixed-length binary-string variables can be defined in all host languages except REXX, RPG/400, and COBOL/400.
 - In ILE RPG, a BINARY fixed-length binary-string variable is declared using the SQLTYPE keyword.
 - In all other languages, an SQL TYPE IS BINARY clause is used.
- VARBINARY varying-length binary-string variables can be defined in all host languages except REXX, RPG/400, and COBOL/400.
 - In ILE RPG, a VARBINARY varying-length binary-string variable is declared using the SQLTYPE keyword.
 - In all other languages, an SQL TYPE IS VARBINARY clause is used.
- BLOB varying-length binary-string variables can be defined in all host languages except REXX, RPG/400, and COBOL/400.
 - In ILE RPG, a BLOB varying-length binary-string variable is declared using the SQLTYPE keyword.
 - In all other languages, an SQL TYPE IS BLOB clause is used.

Large objects

The term *large object* and the generic acronym *LOB* are used to refer to any CLOB, DBCLOB, or BLOB data type.

Manipulating large objects with locators

Since LOB values can be very large, the transfer of these values from the database server to client application program variables can be time consuming. Also, application programs typically process LOB values a piece at a time, rather than as a whole. For these cases, the application can reference a LOB value via a large object locator (LOB locator). 22

^{22.} There is no ability within a Java application to distinguish between a CLOB or BLOB that is represented by a LOB locator and one that is not.

A *large object locator* or LOB locator is a variable with a value that represents a single LOB value in the database server. LOB locators were developed to provide users with a mechanism by which they could easily manipulate very large objects in application programs without requiring them to store the entire LOB value on the client machine where the application program may be running.

For example, when selecting a LOB value, an application program could select the entire LOB value and place it into an equally large variable (which is acceptable if the application program is going to process the entire LOB value at once), or it could instead select the LOB value into a LOB locator. Then, using the LOB locator, the application program can issue subsequent database operations on the LOB value by supplying the locator value as input. The resulting output of the locator operation, for example the amount of data assigned to a client variable, would then typically be a small subset of the input LOB value.

LOB locators may also represent more than just base values; they can also represent the value associated with a LOB expression. For example, a LOB locator might represent the value associated with:

```
SUBSTR(lob_value_1 CONCAT lob_value_2 CONCAT lob_value_3, 42, 6000000)
```

For non-locator-based host variables in an application program, when a null value is selected into that host variable, the indicator variable is set to -1, signifying that the value is null. In the case of LOB locators, however, the meaning of indicator variables is slightly different. Since a LOB locator host variable itself can never be null, a negative indicator variable value indicates that the LOB value represented by the LOB locator is null. The null information is kept local to the client by virtue of the indicator variable value -- the server does not track null values with valid LOB locators.

It is important to understand that a LOB locator represents a value, not a row or location in the database. Once a value is selected into a LOB locator, there is no operation that one can perform on the original row or table that will affect the value which is referenced by the LOB locator. The value associated with a LOB locator is valid until the transaction ends, or until the LOB locator is explicitly freed, whichever comes first.

A LOB locator is only a mechanism used to refer to a LOB value during a transaction; it does not persist beyond the transaction in which it was created. Also, it is not a database type; it is never stored in the database and, as a result, cannot participate in views or check constraints. However, since a locator is a representation of a LOB type, there are SQLTYPEs for LOB locators so that they can be described within an SQLDA structure that is used by FETCH, OPEN, CALL, and EXECUTE statements.

For the restrictions that apply to the use of LOB strings, see "Limitations on use of strings."

Limitations on use of strings

Some varying-length string data types cannot be referenced in certain contexts.

The following varying-length string data types cannot be referenced in certain contexts:

- for character strings, any CLOB string
- for graphic strings, any DBCLOB string
- · for binary strings, any BLOB string.

Context of usage	LOB (CLOB, DBCLOB, or BLOB)
The definition of primary, unique, and foreign keys	Not allowed
Parameters of built-in functions	Some functions that allow varying-length character strings, varying-length graphic strings, or both types of strings as input arguments do not support CLOB or DBCLOB strings, or both as input. See the description of the individual functions in Chapter 3, "Built-in functions," on page 203 for the data types that are allowed as input to each function.

Datetime values

Although datetime values can be used in certain arithmetic and string operations and are compatible with certain strings, they are neither strings nor numbers.

Character string variables are normally used to contain date, time, and timestamp values. However, date, time, and timestamp variables can also be specified in Java as java.sql.Date, java.sql.Time, and java.sql.Timestamp, respectively.

Date

A date is a three-part value (year, month, and day) designating a point in time under the Gregorian calendar, which is assumed to have been in effect from the year 1 A.D.

The range of the year part is 0001 to 9999.²³ The date formats *JUL, *MDY, *DMY, and *YMD can only represent dates in the range 1940 through 2039. The range of the month part is 1 to 12. The range of the day part is 1 to x, where x is 28, 29, 30, or 31, depending on the month and year.

The internal representation of a date is a string of 4 bytes that contains an integer. The integer (called the Scaliger number) represents the date.

The length of a DATE column as described in the SQLDA is 6, 8, or 10 bytes, depending on which format is used. These are the appropriate lengths for string representations for the value.

Time

A time is a three-part value (hour, minute, and second) designating a time of day using a 24-hour clock.

The range of the hour part is 0 to 24, while the range of the minute and second parts is 0 to 59. If the hour is 24, the minute and second specifications are both zero.

The internal representation of a time is a string of 3 bytes. Each byte consists of two packed decimal digits. The first byte represents the hour, the second byte the minute, and the last byte the second.

^{23.} Note that historical dates do not always follow the Gregorian calendar. Dates between 1582-10-04 and 1582-10-15 are accepted as valid dates although they never existed in the Gregorian calendar.

The length of a TIME column as described in the SQLDA is 8 bytes, which is the appropriate length for a string representation of the value.

Timestamp

A *timestamp* is a seven-part value (year, month, day, hour, minute, second, and microsecond) that designates a date and time as defined previously, except that the time includes a fractional specification of microseconds.

The internal representation of a timestamp is a string of 10 bytes. The first 4 bytes represent the date, the next 3 bytes the time, and the last 3 bytes the microseconds (the last 3 bytes contain 6 packed digits).

The length of a TIMESTAMP column as described in the SQLDA is 26 bytes, which is the appropriate length for the string representation of the value.

Datetime values

Although datetime values can be used in certain arithmetic and string operations and are compatible with certain strings, they are neither strings nor numbers.

Character string variables are normally used to contain date, time, and timestamp values. However, date, time, and timestamp variables can also be specified in Java as java.sql.Date, java.sql.Time, and java.sql.Timestamp, respectively.

String representations of datetime values

Values whose data types are DATE, TIME, or TIMESTAMP are represented in an internal form that is transparent to the user of SQL. Dates, times, and timestamps, however, can also be represented by character or Unicode graphic strings.

Only ILE RPG and ILE COBOL support datetime variables. To be retrieved, a datetime value can be assigned to a string variable. The format of the resulting string will depend on the *default date format* and the *default time format* in effect when the statement was prepared. The default date and time formats are set based on the date format (DATFMT), the date separator (DATSEP), the time format (TIMFMT), and the time separator (TIMSEP) parameters.

When a valid string representation of a datetime value is used in an operation with an internal datetime value, the string representation is converted to the internal form of the date, time, or timestamp before the operation is performed. The *default date format* and *default time format* specifies the date and time format that will be used to interpret the string. If the CCSID of the string represents a foreign encoding scheme (for example, ASCII), it is first converted to the coded character set identified by the default CCSID before the string is converted to the internal form of the datetime value.

The following sections define the valid string representations of datetime values.

Date strings:

A string representation of a date is a character or a Unicode graphic string that starts with a digit and has a length of at least 6 characters. Trailing blanks can be included. Leading zeros can be omitted from the month and day portions when using the IBM SQL standard formats. Each IBM SQL standard format is identified by name and includes an associated abbreviation (for use by the CHAR function).

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Data types

Other formats do not have an abbreviation to be used by the CHAR function. The separators for two-digit year formats are controlled by the date separator (DATSEP) parameter.

Valid string formats for dates are listed in Table 8.

The database manager recognizes the string as a date when it is in one of the following formats:

- In the format specified by the default date format
- In one of the IBM SQL standard date formats
- · In the unformatted Julian format

Table 8. Formats for String Representations of Dates

Abbreviation	Date Format	Example
ISO	′yyyy-mm-dd′	′1987-10-12′
USA	'mm/dd/yyyy'	′10/12/1987′
EUR	'dd.mm.yyyy'	′12.10.1987′
JIS	'yyyy-mm-dd'	′1987-10-12′
_	′yyyyddd′	′1987285′
_	'yy/ddd'	′87/285′
_	'mm/dd/yy'	′10/12/87′
_	'dd/mm/yy'	′12/10/87′
_	'yy/mm/dd'	′87/12/10′
	ISO USA EUR	ISO 'yyyy-mm-dd' USA 'mm/dd/yyyy' EUR 'dd.mm.yyyy' JIS 'yyyy-mm-dd' - 'yyyyddd' - 'yy/ddd' - 'mm/dd/yy' - 'dd/mm/yy'

The default date format can be specified through the following interfaces:

Table 9. Default Date Format Interfaces

SQL Interface	Specification
Embedded SQL	The DATFMT and DATSEP parameters are specified on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to specify the DATFMT and DATSEP parameters within the source of a program containing embedded SQL. (For more information about CRTSQLxxx commands, see the Embedded SQL programming topic collection.)
Interactive SQL and Run SQL Statements	The DATFMT and DATSEP parameters on the Start SQL (STRSQL) command or by changing the session attributes. The DATFMT and DATSEP parameters on the Run SQL Statements (RUNSQLSTM) command. (For more information about STRSQL and RUNSQLSTM commands, see SQL programming.)
Call Level Interface (CLI) on the server	SQL_ATTR_DATE_FMT and SQL_ATTR_DATE_SEP environment or connection variables (For more information about CLI, see SQL Call Level Interfaces (ODBC).)
JDBC or SQLJ on the server using IBM Developer Kit for Java	Date Format and Date Separator connection property (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)

Table 9. Default Date Format Interfaces (continued)

SQL Interface	Specification
ODBC on a client using the System i Access Family ODBC Driver	Date Format and Date Separator in the Advanced Server Options in ODBC Setup (For more information about ODBC, see System i Access.)
JDBC on a client using the IBM Toolbox for Java	Format in JDBC Setup (For more information about JDBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)

Time strings:

A string representation of a time is a character or a Unicode graphic string that starts with a digit and has a length of at least 4 characters. Trailing blanks can be included; a leading zero can be omitted from the hour part of the time and seconds can be omitted entirely. If you choose to omit seconds, an implicit specification of 0 seconds is assumed. Thus, 13.30 is equivalent to 13.30.00.

Valid string formats for times are listed in Table 10. Each IBM SQL standard format is identified by name and includes an associated abbreviation (for use by the CHAR function). The other format (*HMS) does not have an abbreviation to be used by the CHAR function. The separator for the *HMS format is controlled by the time separator (TIMSEP) parameter.

The database manager recognizes the string as a time when it is in one of the following formats:

- · In the format specified by the default time format
- In one of the IBM SQL standard time formats

Table 10. Formats for String Representations of Times

Format Name	Abbreviation	Time Format	Example
International Standards Organization (*ISO)	ISO	'hh.mm.ss' ²⁴	′13.30.05′
IBM USA standard (*USA)	USA	'hh:mm AM' (or PM)	′1:30 PM′
IBM European standard (*EUR)	EUR	'hh.mm.ss'	′13.30.05′
Japanese industrial standard Christian era (*JIS)	JIS	'hh:mm:ss'	′13:30:05′
Hours, minutes, seconds (*HMS)	_	'hh:mm:ss'	′13:30:05′

The following additional rules apply to the USA time format:

- The hour must not be greater than 12 and cannot be 0 except for the special case of 00:00 AM.
- A single space character exists between the minutes portion of the time of day and the AM or PM.
- The minutes can be omitted entirely. If you choose to omit the minutes, an implicit specification of 0 minutes is assumed.

^{24.} This is an earlier version of the ISO format. JIS can be used to get the current ISO format.

Data types

In the USA format, using the ISO format of the 24-hour clock, the correspondence between the USA format and the 24-hour clock is as follows:

Table 11. USA Time Format

USA Format	24-Hour Clock
12:01 AM through 12:59 AM	00.01.00 through 00.59.00
01:00 AM through 11:59 AM	01:00.00 through 11:59.00
12:00 PM (noon) through 11:59 PM	12:00.00 through 23.59.00
12:00 AM (midnight)	24.00.00
00:00 AM (midnight)	00.00.00

The default time format can be specified through the following interfaces:

Table 12. Default Time Format Interfaces

SQL Interface	Specification
Embedded SQL	The TIMFMT and TIMSEP parameters are specified on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to specify the TIMFMT and TIMSEP parameters within the source of a program containing embedded SQL. (For more information about CRTSQLxxx commands, see the Embedded SQL programming topic collection.)
Interactive SQL and Run SQL Statements	The TIMFMT and TIMSEP parameters on the Start SQL (STRSQL) command or by changing the session attributes. The TIMFMT and TIMSEP parameters on the Run SQL Statements (RUNSQLSTM) command. (For more information about STRSQL and RUNSQLSTM commands, see the SQL programming topic collection.)
Call Level Interface (CLI) on the server	SQL_ATTR_TIME_FMT and SQL_ATTR_TIME_SEP environment or connection variables (For more information about CLI, see the SQL Call Level Interfaces (ODBC) topic collection.)
JDBC or SQLJ on the server using IBM Developer Kit for Java	Time Format and Time Separator connection property object (For more information about JDBC and SQLJ, see the IBM Developer Kit for Java topic collection.)
ODBC on a client using the System i Access Family ODBC Driver	Time Format and Time Separator in the Advanced Server Options in ODBC Setup (For more information about ODBC, see the System i Access Family topic collection.)
JDBC on a client using the IBM Toolbox for Java	Format in JDBC Setup (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java topic collection.)

Timestamp strings:

A string representation of a timestamp is a character or a Unicode graphic string that starts with a digit and has a length of at least 16 characters.

The complete string representation of a timestamp has one of the following forms:

Table 13. Formats for String Representations of Timestamps

Format Name	Time Format	Example	
ISO timestamp	'yyyy-mm-dd hh:mm:ss.nnnnnn'	'1990-03-02 08:30:00.010000'	
IBM SQL	'yyyy-mm-dd-hh.mm.ss.nnnnnn'	'1990-03-02-08.30.00.010000'	
14-character form	'yyyymmddhhmmss'	′19900302083000′	

Trailing blanks can be included. Leading zeros can be omitted from the month, day, hour, and second part of the timestamp when using the timestamp form with separators. Trailing zeros can be truncated or omitted entirely from microseconds. If you choose to omit any digit of the microseconds portion, an implicit specification of 0 is assumed. Thus, 1990-3-2-8.30.00.10 is equivalent to 1990-03-02-08.30.00.100000.

A timestamp whose time part is 24.00.00.000000 is also accepted.

DataLink values

A DataLink value is an encapsulated value that contains a logical reference from the database to a file stored outside the database.

The attributes of this encapsulated value are as follows:

link type

The currently supported type of link is a URL (Uniform Resource Locator).

scheme

For URLs, this is a value such as HTTP or FILE. The value, no matter what case it is entered in, is stored in the database in upper case.

file server name

The complete address of the file server. The value, no matter what case it is entered in, is stored in the database in upper case.

file path

The identity of the file within the server. The value is case sensitive and therefore it is not converted to upper case when stored in the database.

access control token

When appropriate, the access token is embedded within the file path. It is generated dynamically and is not a permanent part of the DataLink value that is stored in the database.

comment

Up to 254 bytes of descriptive information. This is intended for application specific uses such as further or alternative identification of the location of the data.

The characters used in a DataLink value are limited to the set defined for a URL. These characters include the uppercase (A through Z) and lower case (a through z) letters, the digits (0 through 9) and a subset of special characters (\$, -, _, @, ., &, +, !, *, ", ', (,), =, ;, /, #, ?, :, space, and comma).

The first four attributes are collectively known as the linkage attributes. It is possible for a DataLink value to have only a comment attribute and no linkage attributes. Such a value may even be stored in a column but, of course, no file will be linked to such a column.

Data types

It is important to distinguish between these DataLink references to files and the LOB file reference variables described in "References to LOB file reference variables" on page 141. The similarity is that they both contain a representation of a file. However:

- · DataLinks are retained in the database and both the links and the data in the linked files can be considered as a natural extension of data in the database.
- File reference variables exist temporarily and they can be considered as an alternative to a host program buffer.

Built-in scalar functions are provided to build a DataLink value (DLVALUE) and to extract the encapsulated values from a DataLink value (DLCOMMENT, DLLINKTYPE, DLURLCOMPLETE, DLURLPATH, DLURLPATHONLY, DLURLSCHEME, DLURLSERVER).

Row ID values

A row ID is a value that uniquely identifies a row in a table. A column or a variable can have a row ID data type. A ROWID column enables queries to be written that navigate directly to a row in the table.

Each value in a ROWID column must be unique. The database manager maintains the values permanently, even across table reorganizations. When a row is inserted into the table, the database manager generates a value for the ROWID column unless one is supplied. If a value is supplied, it must be a valid row ID value that was previously generated by either DB2 for z/OS or DB2 for i.

The internal representation of a row ID value is transparent to the user. The value is never subject to CCSID conversion because it is considered to contain BIT data. The length attribute of a ROWID column is 40.

User-defined types

A user-defined type is a data type that is defined to the database using a CREATE statement.

Distinct types

A distinct type is a user-defined data type that shares its internal representation with a built-in data type (its "source type"), but is considered to be a separate and incompatible type for most operations. For example, the semantics for a picture type, a text type, and an audio type that all use the built-in data type BLOB for their internal representation are quite different. A distinct type is created using "CREATE TYPE" on page 827.

For example, the following statement creates a distinct type named AUDIO: CREATE TYPE AUDIO AS BLOB (1M)

Although AUDIO has the same representation as the built-in data type BLOB, it is considered to be a separate type that is not comparable to a BLOB or to any other type. This inability to compare AUDIO to other data types allows functions to be created specifically for AUDIO and assures that these functions cannot be applied to other data types (such as pictures or text).

The name of a distinct type is qualified with a schema name. The implicit schema name for an unqualified name depends upon the context in which the distinct type appears. If an unqualified distinct type name is used:

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- In a CREATE TYPE statement or the object of the DROP, COMMENT, LABEL, GRANT, or REVOKE statement, the database manager uses the normal process of qualification by authorization ID to determine the schema name. For more information about qualification rules, see "Unqualified distinct type, function, procedure, and specific names" on page 61.
- In any other context, the database manager uses the SQL path to determine the schema name. The database manager searches the schemas in the path, in sequence, and selects the first schema that has a distinct type that matches. For a description of the SQL path, see "SQL path" on page 60.

A distinct type does not automatically acquire the functions and operators of its source type, since these may not be meaningful. (For example, the LENGTH function for an AUDIO type might return the length of its object in seconds rather than in bytes.) Instead, distinct types support *strong typing*. Strong typing ensures that only the functions and operators that are explicitly defined for a distinct type can be applied to that distinct type. However, a function or operator of the source type can be applied to the distinct type by creating an appropriate user-defined function. The user-defined function must be sourced on the existing function that has the source type as a parameter. For example, the following series of SQL statements shows how to create a distinct type named MONEY based on data type DECIMAL(9,2), how to define the + operator for the distinct type, and how the operator might be applied to the distinct type:

```
CREATE TYPE MONEY AS DECIMAL(9,2) WITH COMPARISONS
CREATE FUNCTION "+"(MONEY, MONEY)
RETURNS MONEY
SOURCE "+"(DECIMAL(9,2), DECIMAL(9,2))
CREATE TABLE SALARY_TABLE
(SALARY MONEY,
COMMISSION MONEY)
SELECT "+"(SALARY, COMMISSION) FROM SALARY TABLE
```

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A distinct type is subject to the same restrictions as its source type. For example, a table can only have one ROWID column. Therefore, a table with a ROWID column cannot also have a column with distinct type that is sourced on a row ID.

The comparison operators are automatically generated for distinct types, except for distinct types that are sourced on a DataLink. In addition, the database manager automatically generates functions for a distinct type that support casting from the source type to the distinct type and from the distinct type to the source type. For example, for the AUDIO type created above, these are the generated cast functions:

Name of generated cast		
function	Parameter list	Returns data type
schema-name.BLOB	schema-name.AUDIO	BLOB
schema-name.AUDIO	BLOB	schema-name.AUDIO

Promotion of data types

Data types can be classified into groups of related data types. Within such groups, an order of precedence exists where one data type is considered to precede another data type. This precedence enables the database manager to support the *promotion* of one data type to another data type that appears later in the precedence ordering. For example, the data type CHAR can be promoted to VARCHAR; INTEGER can be promoted to DOUBLE PRECISION; but CLOB is NOT promotable VARCHAR.

The database manager considers the promotion of data types when:

- performing function resolution (see "Function resolution" on page 147)
- casting distinct types (see "Casting between data types" on page 86)
- assigning distinct types to built-in data types (see "Distinct type comparisons" on page 103)

For each data type, Table 14 shows the precedence list (in order) that the database manager uses to determine the data types to which each data type can be promoted. The table indicates that the best choice is the same data type and not promotion to another data type. Note that the table also shows data types that are considered equivalent during the promotion process. For example, CHARACTER and GRAPHIC are considered to be equivalent data types.

Table 14. Data Type Precedence Table

Data Type	Data Type Precedence List (in best-to-worst order)
SMALLINT	SMALLINT, INTEGER, BIGINT, decimal, real, double, DECFLOAT
INTEGER	INTEGER, BIGINT, decimal, real, double, DECFLOAT
BIGINT	BIGINT, decimal, real, double, DECFLOAT
decimal	decimal, real, double, DECFLOAT
real	real, double, DECFLOAT
double	double, DECFLOAT
DECFLOAT	DECFLOAT
CHAR or GRAPHIC	CHAR or GRAPHIC, VARCHAR or VARGRAPHIC, CLOB or DBCLOB
VARCHAR or VARGRAPHIC	VARCHAR or VARGRAPHIC, CLOB or DBCLOB
CLOB or DBCLOB	CLOB or DBCLOB
CHAR FOR BIT DATA	CHAR, VARCHAR, CLOB, BINARY, VARBINARY, BLOB
VARCHAR FOR BIT DATA	VARCHAR, CLOB, VARBINARY, BLOB
BINARY	BINARY, VARBINARY, BLOB, CHAR FOR BIT DATA, VARCHAR FOR BIT DATA
VARBINARY	VARBINARY, BLOB, VARCHAR FOR BIT DATA
BLOB	BLOB
DATE	DATE
TIME	TIME
TIMESTAMP	TIMESTAMP
DATALINK	DATALINK
	

Promotion of data types

Table 14. Data Type Precedence Table (continued)

Data Type	Data Type Precedence List (in best-to-worst order)								
ROWID	ROWID								
udt	same udt								

Note:

The lower case types above are defined as follows:

decimal

= DECIMAL(p,s) or NUMERIC(p,s)

real = REAL or FLOAT(n) where n is a specification for single precision floating point

double = DOUBLE, DOUBLE PRECISION, FLOAT or FLOAT(n) where n is a specification for double precision floating point

udt = a user-defined type

Shorter and longer form synonyms of the data types listed are considered to be the same as the synonym listed.

Character and graphic strings are only compatible for Unicode data.

Casting between data types

There are many occasions when a value with a given data type needs to be cast (changed) to a different data type or to the same data type with a different length, precision, or scale.

Data type promotion, as described in "Promotion of data types" on page 84, is one example of when a value with one data type needs to be cast to a new data type. A data type that can be changed to another data type is *castable* from the source data type to the target data type.

The casting of one data type to another can occur implicitly or explicitly. The cast functions or CAST specification (see "CAST specification" on page 170) can be used to explicitly change a data type. The database manager might implicitly cast data types during assignments that involve a distinct type (see "Distinct type assignments" on page 98). In addition, when you create a sourced user-defined function, the data types of the parameters of the source function must be castable to the data types of the function that you are creating (see "CREATE FUNCTION (Sourced)" on page 693).

If truncation occurs when a character or graphic string is cast to another data type, a warning occurs if any non-blank characters are truncated. This truncation behavior is similar to retrieval assignment of character or graphic strings (see "Retrieval assignment:" on page 94).

If truncation occurs when a binary string is cast to another data type, a warning occurs. This truncation behavior is similar to retrieval assignment of binary strings (see "Retrieval assignment" on page 93).

For casts that involve a distinct type as either the data type to be cast to or from, Table 15 shows the supported casts. For casts between built-in data types, Table 16 on page 87 shows the supported casts.

Table 15. Supported Casts When a Distinct Type is Involved

Data Type	Is Castable to Data Type
Distinct type DT	Source data type of distinct type DT
Source data type of distinct type <i>DT</i>	Distinct type DT
Distinct type DT	Distinct type DT
Data type A	Distinct type <i>DT</i> where <i>A</i> is promotable to the source data type of distinct type <i>DT</i> (see "Promotion of data types" on page 84)
INTEGER	Distinct type <i>DT</i> if <i>DT</i> 's source type is SMALLINT
DOUBLE	Distinct type DT if DT's source data type is REAL
VARCHAR	Distinct type DT if DT's source data type is CHAR or GRAPHIC
VARGRAPHIC	Distinct type DT if DT's source data type is GRAPHIC or CHAR
VARBINARY	Distinct type DT if DT's source data type is BINARY

Character and graphic strings are only compatible for Unicode data. Character bit data and graphic strings are not compatible.

When a distinct type is involved in a cast, a cast function that was generated when the distinct type was created is used. How the database manager chooses the function depends on whether function notation or the CAST specification syntax is

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Casting between data types

used. For details, see "Function resolution" on page 147, and "CAST specification" on page 170. Function resolution is used for both. However, in a CAST specification, when an unqualified distinct type is specified as the target data type, the database manager resolves the schema name of the distinct type and then uses that schema name to locate the cast function.

The following table describes the supported casts between built-in data types.

Table 16. Supported Casts Between Built-In Data Types

Target Data Type → Source Data Type ↓	SMALLINT INTEGER BIGINT	DECIMAL NUMERIC	REAL	DECFLOAT	CHAR VARCHAR CLOB	GRAPHIC VARGRAPHIC DBCLOB	BINARY VARBINARY BLOB	DATE	TIME	TIMESTAMP	ROWID	DATALINK
SMALLINT	Y	Y	Y	Y	Y	Y^1						
INTEGER	Y	Y	Y	Y	Y	Y ¹						
BIGINT	Y	Y	<u>Т</u>	Y	Y	Y ¹						
DECIMAL	Y	Y	<u>Т</u> Ү	Y	Y	Y ¹						
NUMERIC	Y	Y	<u>Т</u>	Y	Y	Y ¹						
REAL	Y	Y	<u>Т</u>	Y	Y	Y ¹						
DOUBLE	Y	Y	Y	Y	Y	Y ¹						
DECFLOAT	Y	Y	Y	Y	Y	Y ¹						
CHAR	Y	Y	Y	Y	Y	Y ¹						
VARCHAR	Y	<u>т</u> Ү	<u>т</u> Ү	<u>т</u> Ү	Y	Y ¹	Y ²	<u>т</u> Ү	Y	Y	<u>т</u> Ү	
CLOB	Y	Y	Y	Y Y	Y	Y ¹		ĭ	Y	1	Y	
GRAPHIC	Y ¹	Y ¹	Y ¹	Y ¹	Y ¹				Y ¹			
	Y ¹	Y 1 Y 1	Y ¹ Y ¹	Y ¹ Y ¹	Y ¹	Y	Y	Y ¹ Y ¹	Y ¹			
VARGRAPHIC						Y	Y	Y 1	Y 1	Y ¹		
DBCLOB	Y ¹	Y ¹	Y ¹	Y ¹	Y ¹	Y	Y					
BINARY	_				Y^2	_	Y			_		
VARBINARY	_		_		Y ²	_	Y	_	_	_	_	
BLOB	_	_	_	_	_	_	Y	_	_	_	_	
DATE	_	_	_	_	Y	_	_	Y	_	Y	_	_
TIME	_	_	_	_	Y	_	_	_	Y	Y	_	_
TIMESTAMP	_	_	_	_	Y	_	_	Y	Y	Y	_	_
ROWID	_	_	_	_	Y		Y	_	_	_	Y	_
DATALINK	_	_	_	_	_	_	_	_	_	_	_	Y
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Notes:

The following table describes the rules for casting to a data type:

Table 17. Rules for Casting to a Data Type

Target Data Type	Rules
SMALLINT	See "SMALLINT" on page 415.
INTEGER	See "INTEGER or INT" on page 343.

¹ Conversion is only supported for Unicode graphic. If the other data type is FOR BIT DATA, conversion is not supported.

² Casting between character strings and binary strings is limited to FOR BIT DATA.

Casting between data types

Table 17. Rules for Casting to a Data Type (continued)

Target Data Type	Rules
BIGINT	See "BIGINT" on page 236.
DECIMAL	See "DECIMAL or DEC" on page 290.
NUMERIC	See "ZONED" on page 466.
REAL	See "REAL" on page 391.
DOUBLE	See "DOUBLE_PRECISION or DOUBLE" on page 308.
DECFLOAT	See "DECFLOAT" on page 287
CHAR	See "CHAR" on page 243.
VARCHAR	See the "VARCHAR" on page 449.
CLOB	See "CLOB" on page 251.
GRAPHIC	If the source data type is a character string, see the rules for string assignment to a variable in "Assignments and comparisons" on page 89.
	Otherwise, see "GRAPHIC" on page 326.
VARGRAPHIC	If the source data type is a character string, see the rules for string assignment to a variable in "Assignments and comparisons" on page 89.
	Otherwise, see "VARGRAPHIC" on page 457.
DBCLOB	See "DBCLOB" on page 280.
BINARY	See "BINARY" on page 238.
VARBINARY	See "VARBINARY" on page 448.
BLOB	See "BLOB" on page 240.
DATE	See "DATE" on page 271.
TIME	See "TIME" on page 428.
TIMESTAMP	If the source data type is a string, see "TIMESTAMP" on page 429, where one operand is specified.
	If the source data type is a DATE, the timestamp is composed of the specified date and a time of $00:00:00$.
	If the source data type is a TIME, the timestamp is composed of the CURRENT_DATE and the specified time.
DATALINK	See the rules for DataLink assignments in "Assignments and comparisons" on page 89.
ROWID	See "ROWID" on page 405.

Assignments and comparisons

The basic operations of SQL are assignment and comparison. Assignment operations are performed during the execution of CALL, INSERT, UPDATE, FETCH, SELECT, SET variable, and VALUES INTO statements. Comparison operations are performed during the execution of statements that include predicates and other language elements such as MAX, MIN, DISTINCT, GROUP BY, and ORDER BY.

The basic rule for both operations is that the data type of the operands involved must be compatible. The compatibility rule also applies to UNION, EXCEPT, INTERSECT, concatenation, CASE expressions, and the CONCAT, VALUE, COALESCE, IFNULL, MIN, and MAX scalar functions. The compatibility matrix is as follows:

I Table 18. Data Type Compatibility

 - - - -	Operands	Binary Integer	Decimal Number	Floating Point	Decimal Floating Point	Character String	Graphic String	Binary String	Date	Time	Timestamp	DataLink	Row ID	Distinct Type
1	Binary Integer	Y	Y	Y	Y	Y	1	_	_	_	_	_	_	4
1	Decimal Number ⁵	Y	Y	Y	Y	Y	1	_	_	_	_	_	_	4
1	Floating Point	Y	Y	Y	Y	Y	1	_	_	_	_	_	_	4
 	Decimal Floating-Point	Y	Y	Y	Y	Y	1	_	_	_	_	_	_	4
1	Character String	Y	Y	Y	Y	Y	1	2	3	3	3	_	_	4
1	Graphic String	1	1	1	1	1	Y	_	1 3	1 3	1 3	_	_	4
1	Binary String	_	_	_	_	2	_	Y	_	_	_	_	_	4
1	Date	_	_	_	_	3	1 3	_	Y	_	_	_	_	4
I	Time			_		3	1 3	_		Y				4
I	Timestamp			_		3	1 3				Y			4
I	DataLink			_		_		_			_	6	_	4
I	Row ID			_		_		_					7	4
I	Distinct Type	4	4	4	4	4	4	4	4	4	4	4	4	4

Assignments and comparisons

Table 18. Data Type Compatibility (continued)

 Operands 	Binary Integer	Decimal Number	Floating Point	Decimal Floating Point	Character String	Graphic String	Binary String	Date	Time	limestamp	DataLink	Row ID	Distinct Type
 	Bir	De	FIC	De	ರ	Gr	Bir	Da	Ë	ΞΞ	Da	Ro	Di

Notes:

- 1. Only Unicode graphic strings are compatible. Unicode and FOR BIT DATA are not compatible.
- 2. Character strings, except those with FOR BIT DATA, are not compatible with binary strings. FOR BIT DATA character strings and binary strings are considered compatible and any padding is performed based on the data type of the target. For example, when assigning a FOR BIT DATA column value to a fixed-length binary variable, any necessary padding uses a pad byte of X'00'.
- 3. The datetime values and strings are not compatible in concatenation or in the CONCAT scalar function.
- 4. A value with a distinct type is comparable only to a value that is defined with the same distinct type. In general, the database manager supports assignments between a distinct type value and its source data type. For additional information, see "Distinct type assignments" on page 98.
- 5. Decimal refers to both packed and zoned decimal.
- 6. A DataLink operand can only be assigned to another DataLink operand and cannot be compared to any data type.
- 7. A ROWID operand can only be assigned to another ROWID operand and cannot be compared to any data type.

A basic rule for assignment operations is that a null value cannot be assigned to:

- · a column that cannot contain null values
- a host variable that does not have an associated indicator variable
- a Java host variable that is a primitive type.

See "References to host variables" on page 136 for a discussion of indicator variables.

For any comparison that involves null values, see the description of the comparison operation for information about the specific handling of null values.

Numeric assignments

For numeric assignments, overflow is not allowed.

- When assigning to an exact numeric data type, overflow occurs if any digit of the whole part of the number would be eliminated. If necessary, the fractional part of a number is truncated.
- When assigning to an approximate numeric data type or decimal floating-point number, overflow occurs if the most significant digit of the whole part of the number is eliminated. For floating-point and decimal floating-point numbers, the whole part of the number is the number that would result if the floating-point or decimal floating-point number were converted to a decimal number with unlimited precision. If necessary, rounding may cause the least significant digits of the number to be eliminated.

For decimal floating-point numbers, truncation of the whole part of the number is allowed and results in infinity with a warning if *YES is specified for the SQL_DECFLOAT_WARNINGS query option.

Assignments and comparisons

For floating-point numbers, underflow is also not allowed. Underflow occurs for numbers between 1 and -1 if the most significant digit other than zero would be eliminated. For decimal floating point, underflow is allowed and depending on the rounding mode, results in zero or the smallest positive number or the largest negative number that can be represented. A warning is returned if *YES is specified for the SQL_DECFLOAT_WARNINGS query option.

For information about the decimal floating-point rounding mode, see "CURRENT DECFLOAT ROUNDING MODE" on page 122.

An overflow or underflow warning is returned instead of an error if an overflow or underflow occurs on assignment to a host variable with an indicator variable. In this case, the number is not assigned to the host variable and the indicator variable is set to negative 2.

Assignments to integer

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When a decimal, floating-point, or decimal floating-point number is assigned to a binary integer column or variable, the fractional part of the number is eliminated. As a result, a number between 1 and -1 is reduced to 0.

Assignments to decimal

When an integer is assigned to a decimal column or variable, the number is first converted to a temporary decimal number and then, if necessary, to the precision and scale of the target. The precision and scale of the temporary decimal number is 5,0 for a small integer, 11,0 for a large integer, or 19,0 for a big integer.

When a decimal number is assigned to a decimal column or variable, the number is converted, if necessary, to the precision and the scale of the target. The necessary number of leading zeros is added, and in the fractional part of the decimal number the necessary number of trailing zeros is added, or the necessary number of trailing digits is eliminated.

When a floating-point number is assigned to a decimal column or variable, the number is first converted to a temporary decimal number of precision 63 and scale of 63 - (p-s) where p and s are the precision and scale of the decimal column or variable. Then, if necessary, the temporary number is truncated to the precision and scale of the target. As a result, a number between 1 and -1 that is less than the smallest positive number or greater than the largest negative number that can be represented in the decimal column or variable is reduced to 0.

When a decimal floating-point number is assigned to a decimal column or variable, the number is rounded to the precision and scale of the decimal column or variable. As a result, a number between 1 and -1 that is less than the smallest positive number or greater than the largest negative number that can be represented in the decimal column or variable is reduced to 0 or rounded to the smallest positive or largest negative value that can be represented in the decimal column or variable, depending on the rounding mode.

Note: Decimal refers to both packed and zoned decimal. A binary integer with scale follows the rules for a assignments to decimal.

Note: When fetching decimal data from a file that was *not* created by an SQL CREATE TABLE statement, a decimal field may contain data that is not valid. In this case, the data will be returned as stored, without any warning

Assignments and comparisons

or error message being issued. A table that is created by the SQL CREATE TABLE statement does not allow decimal data that is not valid.

Assignments to floating-point

Floating-point numbers are approximations of real numbers. Hence, when an integer, decimal, floating-point, or decimal floating-point number is assigned to a floating-point column or variable, the result may not be identical to the original number. The number is rounded to the precision of the floating-point column or variable using floating-point arithmetic.

Assignments to decimal floating-point

When an integer number is assigned to a decimal floating-point column or variable, the number is first converted to a temporary decimal number and then to a decimal floating-point number. The precision and scale of the temporary decimal number is 5,0 for a small integer, 11,0 for a large integer, or 19,0 for a big integer. Rounding may occur when assigning a BIGINT to a DECFLOAT(16) column or variable.

When a decimal number is assigned to a decimal floating-point column or variable, the number is converted to the precision (16 or 34) of the target. Leading zeros are eliminated. Depending on the precision and scale of the decimal number and the precision of the target, the value might be rounded.

When a floating-point number is assigned to a decimal floating-point column or variable, the number is first converted to a temporary string representation of the floating-point number. The string representation of the number is then converted to decimal floating-point.

When a DECFLOAT(16) number is assigned to a DECFLOAT(34) column or variable, the resulting value is identical to the DECFLOAT(16) number.

When a DECFLOAT(34) number is assigned to a DECFLOAT(16) column or variable, the exponent of the source is converted to the corresponding exponent in the result format. The mantissa of the DECFLOAT(34) number is rounded to the precision of the target. For more information about the decimal floating-point rounding mode, see "CURRENT DECFLOAT ROUNDING MODE" on page 122.

Assignments to COBOL and RPG integers

Assignment to COBOL and RPG small or large integer host variables takes into account any scale specified for the host variable. However, assignment to integer host variables uses the full size of the integer. Thus, the value placed in the COBOL data item or RPG field might be larger than the maximum precision specified for the host variable.

Examples:

 In COBOL, assume that COL1 contains a value of 12345. The following SQL statement results in the value 12345 being placed in A, even though A has been defined with only 4 digits:

```
01 A PIC S9999 BINARY.
EXEC SQL SELECT COL1
        INTO :A
        FROM TABLEX
END-EXEC.
```

• Notice, however, that the following COBOL statement results in 2345 (and not 12345) being placed in A:

MOVE 12345 TO A.

Strings to numeric

When a string is assigned to a numeric data type, it is converted to the target numeric data type using the rules for a CAST specification. For more information, see "CAST specification" on page 170.

String assignments

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There are two types of string assignments.

- *Storage assignment* is when a value is assigned to a column or a parameter of a function or stored procedure.
- Retrieval assignment is when a value is assigned to a variable. 25

Binary string assignments

The following rules apply when the assignment target is a binary string.

Storage assignment

The basic rule is that the length of a string assigned to a column or parameter of a function or procedure must not be greater than the length attribute of the column or parameter. If the string is longer than the length attribute of that column or parameter, a error is returned. Trailing hexadecimal zeroes (X'00') are normally included in the length of the string. For storage assignments, however, trailing hexadecimal zeroes are not included in the length of the string.

When a string is assigned to a fixed-length binary-string column or parameter and the length of the string is less than the length attribute of the target, the string is padded on the right with the necessary number of hexadecimal zeroes.

Retrieval assignment

The length of a string assigned to a variable can be greater than the length attribute of the variable. When a string is assigned to a variable and the string is longer than the length attribute of the variable, the string is truncated on the right by the necessary number of bytes. When this occurs, an SQLSTATE of '01004' is assigned to the RETURNED_SQLSTATE condition area item in the SQL Diagnostics Area (or the value 'W' is assigned to the SQLWARN1 field of the SQLCA).

When a string is assigned to a fixed-length binary-string variable and the length of the string is less than the length attribute of the target, the string is padded on the right with the necessary number of hexadecimal zeroes.

When a string of length n is assigned to a varying-length string variable with a maximum length greater than n, the bytes after the nth byte of the variable are undefined.

Character and graphic string assignments

The following rules apply when the assignment target is a string.

^{25.} If assigning to an SQL-variable or SQL-parameter and the standards option is specified, storage assignment rules apply. For information about the standards option, see "Standards compliance" on page ix.

Assignments and comparisons

When a datetime data type is involved, see "Datetime assignments" on page 95. For the special considerations that apply when a distinct type is involved in an assignment, especially to a variable, see "Distinct type assignments" on page 98.

Numeric to strings:

When a number is assigned to a string data type, it is converted to the target string data type using the rules for a CAST specification. For more information, see "CAST specification" on page 170.

Storage assignment:

The basic rule is that the length of a string assigned to a column or parameter of a function or procedure must not be greater than the length attribute of the column or parameter. If the string is longer than the length attribute of that column or parameter, an error is returned. Trailing blanks are normally included in the length of the string. For storage assignments, however, trailing blanks are not included in the length of the string.

When a string is assigned to a fixed-length string column or parameter and the length of the string is less than the length attribute of the target, the string is padded on the right with the necessary number of single-byte, double-byte, or UTF-16 or UCS-2 blanks.²⁶ The pad character is always a blank, even for bit data.

Retrieval assignment:

The length of a string assigned to a variable can be greater than the length attribute of the variable. When a string is assigned to a variable and the string is longer than the length attribute of the variable, the string is truncated on the right by the necessary number of characters. When this occurs, an SQLSTATE of '01004' is assigned to the RETURNED_SQLSTATE condition area item in the SQL Diagnostics Area (or the value 'W' is assigned to the SQLWARN1 field of the SQLCA). Furthermore, if an indicator variable is provided, it is set to the original length of the string. If only the NUL-terminator is truncated for a C NUL-terminated host variable and the *NOCNULRQD option was specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement), an SQLSTATE of '01004' is assigned to the RETURNED_SQLSTATE condition area item in the SQL Diagnostics Area (or the value of 'N' is assigned to the SQLWARN1 field of the SQLCA) and a NUL is not placed in the variable.

When a string is assigned to a fixed-length variable and the length of the string is less than the length attribute of the target, the string is padded on the right with the necessary number of single-byte, double-byte, or UTF-16 or UCS-2 blanks.²⁶ The pad character is always a blank, even for bit data.

When a string of length *n* is assigned to a varying-length string variable with a maximum length greater than n, the characters after the nth character of the variable are undefined.

Assignments to mixed strings:

If a string contains mixed data, the assignment rules may require truncation within a sequence of double-byte codes. To prevent the loss of the shift-in character that

^{26.} UTF-16 or UCS-2 defines a blank character at code point X'0020' and X'3000'. The database manager pads with the blank at code point X'0020'. The database manager pads UTF-8 with a blank at code point X'20'

ends the double-byte sequence, additional characters may be truncated from the end of the string, and a shift-in character added. In the truncated result, there is always an even number of bytes between each shift-out character and its matching shift-in character.

Assignments to C NUL-terminated strings:

When a string of length n is assigned to a C NUL-terminated string variable with a length greater than n+1:

- If the *CNULRQD option was specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*YES) on the SET OPTION statement), the string is padded on the right with x-n-1 blanks where x is the length of the variable. The padded string is then assigned to the variable and the NUL-terminator is placed in the next character position.
- If the *NOCNULRQD precompiler option was specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement), the string is not padded on the right. The string is assigned to the variable and the NUL-terminator is placed in the next character position.

Conversion rules for assignments

A string assigned to a column, variable, or parameter is first converted, if necessary, to the coded character set of the target. Character conversion is necessary only if all of the following are true:

- The CCSIDs are different.
- Neither CCSID is 65535.
- The string is neither null nor empty.
- Conversion between the two CCSIDs is required. For more information, see "Coded character sets and CCSIDs" on page 36.

An error occurs if:

- Conversion between the pair of CCSIDs is not defined. For more information, see "Coded character sets and CCSIDs" on page 36.
- A character of the string cannot be converted, and the operation is assignment to a column or assignment to a host variable without an indicator variable. For example, a double-byte character (DBCS) cannot be converted to a column or host variable with a single-byte character (SBCS) CCSID.

A warning occurs if:

- A character of the string is converted to the substitution character.
- A character of the string cannot be converted, and the operation is assignment to a host variable with an indicator variable. For example, a DBCS character cannot be converted to a host variable with an SBCS CCSID. In this case, the string is not assigned to the host variable and the indicator variable is set to -2.

Datetime assignments

A value assigned to a DATE column, a DATE variable, or a DATE parameter must be a date or a valid string representation of a date. A date can be assigned only to a DATE column, a string column, a DATE variable, or a string variable. A value assigned to a TIME column, a TIME variable, or a TIME parameter must be a time or a valid string representation of a time. A time can be assigned only to a TIME column, a string column, a TIME variable, or a string variable. A value assigned to

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a TIMESTAMP column, a TIMESTAMP variable, or a TIMESTAMP parameter must be a timestamp or a valid string representation of a timestamp. A timestamp can be assigned only to a TIMESTAMP column, a string column, a TIMESTAMP variable, or a string variable.

When a datetime value is assigned to a string variable or column, it is converted to its string representation. Leading zeros are not omitted from any part of the date, time, or timestamp. The required length of the target varies depending on the format of the string representation. If the length of the target is greater than required, it is padded on the right with blanks. If the length of the target is less than required, the result depends on the type of datetime value involved and on the type of target.

• If the target is a string column, truncation is not allowed. The following rules apply:

DATE

- The length attribute of the column must be at least 10 if the date format is *ISO, USA, *EUR, or *JIS. If the date format is *YMD, *MDY, or *DMY, the length attribute of the column must be at least 8. If the date format is *JUL, the length of the variable must be at least 6.

- The length attribute of the column must be at least 8.

TIMESTAMP

- The length attribute of the column must be at least 26.
- When the target is a variable, the following rules apply:

DATE

- The length of the variable must be at least 10 if the date format is *ISO, *USA, *EUR, or *JIS. If the date format is *YMD, *MDY, or *DMY, the length of the variable must be at least 8. If the date format is *JUL, the length of the variable must be at least 6.

TIME

- If the *USA format is used, the length of the variable must not be less than 8. This format does not include seconds.
- If the *ISO, *EUR, *JIS, or *HMS time format is used, the length of the variable must not be less than 5. If the length is 5, 6, or 7, the seconds part of the time is omitted from the result, and SQLWARN1 is set to 'W'. In this case, the seconds part of the time is assigned to the indicator variable if one is provided, and, if the length is 6 or 7, blank padding occurs so that the value is a valid string representation of a time.

TIMESTAMP

- The length of the variable must not be less than 19. If the length is between 19 and 25, the timestamp is truncated like a string, causing the omission of one or more digits of the microsecond part. If the length is 20, the trailing decimal point is replaced by a blank so that the value is a valid string representation of a timestamp.

DataLink assignments

The assignment of a value to a DataLink column results in the establishment of a link to a file unless the linkage attributes of the value are empty or the column is defined with NO LINK CONTROL. In cases where a linked value already exists in the column, that file is unlinked. Assigning a null value where a linked value already exists also unlinks the file associated with the old value.

Assignments and comparisons

If the application provides the same data location as already exists in the column, the link is retained. There are two reasons that this might be done:

- · the comment is being changed
- if the table is placed in link pending state, the links in the table can be reinstated by providing linkage attributes identical to the ones in the column.

A DataLink value may be assigned to a column by using the DLVALUE scalar function. The DLVALUE scalar function creates a new DataLink value which can then be assigned a column. Unless the value contains only a comment or the URL is exactly the same, the act of assignment will link the file.

When assigning a value to a DataLink column, the following error conditions can occur:

- · Data Location (URL) format is invalid
- · File server is not registered with this database
- Invalid link type specified
- · Invalid length of comment or URL

Note that the size of a URL parameter or function result is the same on both input or output and is bound by the length of the DataLink column. However, in some cases the URL value returned has an access token attached. In situations where this is possible, the output location must have sufficient storage space for the access token and the length of the DataLink column. Hence, the actual length of the comment and URL in its fully expanded form provided on input should be restricted to accommodate the output storage space. If the restricted length is exceeded, this error is raised.

When the assignment is also creating a link, the following errors can occur:

- File server not currently available.
- File does not exist.
- · Referenced file cannot be accessed for linking.
- File already linked to another column.

Note that this error will be raised even if the link is to a different relational database.

In addition, when the assignment removes an existing link, the following errors can occur:

- File server not currently available.
- File with referential integrity control is not in a correct state according to the DB2 DataLinks File Manager.

A DataLink value may be retrieved from the database through the use of scalar functions (such as DLLINKTYPE and DLURLPATH). The results of these scalar functions can then be assigned to variables.

Note that usually no attempt is made to access the file server at retrieval time. ²⁷It is therefore possible that subsequent attempts to access the file server through file system commands might fail.

^{27.} It may be necessary to access the file server to determine the prefix name associated with a path. This can be changed at the file server when the mount point of a file system is moved. First access of a file on a server will cause the required values to be retrieved from the file server and cached at the database server for the subsequent retrieval of DataLink values for that file server. An error is returned if the file server cannot be accessed.

Assignments and comparisons

A warning may be returned when retrieving a DataLink value because the table is in link pending state.

Row ID assignments

A row ID value can only be assigned to a column, parameter, or variable with a row ID data type. For the value of the ROWID column, the column must be defined as GENERATED BY DEFAULT or OVERRIDING SYSTEM VALUE must be specified. A unique constraint is implicitly added to every table that has a ROWID column that guarantees that every ROWID value is unique. The value that is specified for the column must be a valid row ID value that was previously generated by DB2 for z/OS or DB2 for i.

Distinct type assignments

The rules that apply to the assignments of distinct types to variables are different than the rules for all other assignments that involve distinct types.

Assignments to variables

The assignment of a distinct type to a variable is based on the source data type of the distinct type. Therefore, the value of a distinct type is assignable to a variable only if the source data type of the distinct type is assignable to the variable.

Example:

Assume that distinct type AGE was created with the following SQL statement: CREATE TYPE AGE AS SMALLINT WITH COMPARISONS

When the statement is executed, the following cast functions are also generated:

```
AGE (SMALLINT) RETURNS AGE
AGE (INTEGER) RETURNS AGE
SMALLINT (AGE) RETURNS SMALLINT
```

Next, assume that column STU_AGE was defined in table STUDENTS with distinct type AGE. Now, consider this valid assignment of a student's age to host variable HV_AGE, which has an INTEGER data type:

```
SELECT STU AGE INTO :HV AGE FROM STUDENTS WHERE STU NUMBER = 200
```

The distinct type value is assignable to the host variable HV_AGE because the source data type of the distinct type (SMALLINT) is assignable to the host variable (INTEGER). If distinct type AGE had been sourced on a character data type such as CHAR(5), the above assignment would be invalid because a character type cannot be assigned to an integer type.

Assignments other than to variables

A distinct type can be either the source or target of an assignment. Assignment is based on whether the data type of the value to be assigned is castable to the data type of the target. "Casting between data types" on page 86 shows which casts are supported when a distinct type is involved. Therefore, a distinct type value can be assigned to any target other than a variable when:

- the target of the assignment has the same distinct type, or
- the distinct type is castable to the data type of the target.

Any value can be assigned to a distinct type when:

- the value to be assigned has the same distinct type as the target, or
- the data type of the assigned value is castable to the target distinct type.

Example:

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Assume that the source data type for distinct type AGE is SMALLINT:

CREATE TYPE AGE AS SMALLINT WITH COMPARISONS

Next, assume that two tables TABLE1 and TABLE2 were created with four identical column descriptions:

AGECOL AGE
SMINTCOL SMALLINT
INTCOL INTEGER
DECCOL DEC(6,2)

Using the following SQL statement and substituting various values for X and Y to insert values into various columns of TABLE1 from TABLE2, Table 19 shows whether the assignments are valid.

INSERT INTO TABLE1 (Y) SELECT X FROM TABLE2

Table 19. Assessment of various assignments (for example on INSERT)

TABLE2.X	TABLE1.Y	Valid	Reason
AGECOL	AGECOL	Yes	Source and target are same distinct type
SMINTCOL	AGECOL	Yes	SMALLINT can be cast to AGE (because AGE's source type is SMALLINT)
INTCOL	AGECOL	Yes	INTEGER can be cast to AGE (because AGE's source type is SMALLINT)
DECCOL	AGECOL	No	DECIMAL cannot be cast to AGE
AGECOL	SMINTCOL	Yes	AGE can be cast to its source type SMALLINT
AGECOL	INTCOL	No	AGE cannot be cast to INTEGER
AGECOL	DECCOL	No	AGE cannot be cast to DECIMAL

Assignments to LOB locators

When a LOB locator is used, it can refer to any string data. If a LOB locator is used for the first fetch of a cursor and the cursor is on a remote server, LOB locators must be used for all subsequent fetches unless the *NOOPTLOB precompile option is used.

Numeric comparisons

Numbers are compared algebraically; that is, with regard to sign. For example, –2 is less than +1.

If one number is an integer and the other number is decimal, the comparison is made with a temporary copy of the integer that has been converted to decimal.

Assignments and comparisons

When decimal or nonzero scale binary numbers with different scales are compared, the comparison is made with a temporary copy of one of the numbers that has been extended with trailing zeros so that its fractional part has the same number of digits as the other number.

If one number is floating point and the other is integer, decimal, or single-precision floating point, the comparison is made with a temporary copy of the second number converted to a double-precision floating-point number. However, if a single-precision floating-point column is compared to a constant and the constant can be represented by a single-precision floating-point number, the comparison is made with a single-precision form of the constant.

Two floating-point numbers are equal only if the bit configurations of their normalized forms are identical.

If one number is DECFLOAT and the other number is integer, decimal, single precision floating-point, or double precision floating-point, the comparison is made with a temporary copy of the second number converted to DECFLOAT.

If one number is DECFLOAT(16) and the other is DECFLOAT(34), the DECFLOAT(16) value is converted to DECFLOAT(34) before the comparison.

The DECFLOAT data type supports both positive and negative zero. Positive and negative zero have different binary representations, but the equal (=) predicate will return true for comparisons of positive and negative zero.

The DECFLOAT data type allows for multiple bit representations of the same number. For example, 2.00 and 2.0 are two numbers that are numerically equal but have different bit representations. The = (equal) predicate will return true for a comparison of 2.0 = 2.00. Given that 2.0 = 2.00 is true, 2.0 < 2.00 is false. The behavior that is described here holds true for all comparisons of DECFLOAT values (such as for UNION, SELECT DISTINCT, COUNT DISTINCT, basic predicates, IN predicates, and so on.) For example:

```
SELECT 2.0 FROM SYSIBM.SYSDUMMY UNION SELECT 2.00 FROM SYSIBM.SYSDUMMY
```

yields one row of data. For this query, the value (2.0 or 2.00) that is returned is unpredictable.

The functions COMPARE_DECFLOAT and TOTALORDER can be used to perform comparisons at a binary level. For example, for a comparison of 2.0<>2.00. With these functions, decimal floating-point values are compared in the following order: -NaN < -sNaN < -Infinity < -0.10 <-0.100 < -0 < 0 < 0.100 < 0.10 < Infinity < sNaN < NaN

The DECFLOAT data type also supports the specification of positive and negative NaN (quiet and signaling), and positive and negative Infinity. From an SQL perspective, infinity = infinity, NaN = NaN, and sNaN = sNaN.

The following rules are the comparison rules for these special values:

- Infinity compares equal only to infinity of the same sign (positive or negative)
- NaN compares equal only to NaN of the same sign (positive or negative)
- sNaN compares equal only to sNaN of the same sign (positive or negative)

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When string and numeric data types are compared, the string is converted to the numeric data type with the same precision and scale, and must contain a valid string representation of a number.

String comparisons

There are two different types of string comparisons.

Binary string comparisons

Binary string comparisons always use a collating sequence of *HEX and the corresponding bytes of each string are compared. Additionally, two binary strings are equal only if the lengths of the two strings are identical. If the strings are equal up to the length of the shorter string length, the shorter string is considered less than the longer string even when the remaining bytes in the longer string are hexadecimal zeros. Note that binary strings cannot be compared to character strings unless the character string is cast to a binary string.

Character and graphic string comparisons

Character and Unicode graphic string comparisons use the collating sequence in effect when the statement is executed for all SBCS data and the single-byte portion of mixed data. If the collating sequence is *HEX, the corresponding bytes of each string are compared. For all other collating sequences, the corresponding bytes of the weighted value of each string are compared.

If the strings have different lengths, a temporary copy of the shorter string is padded on the right with blanks before comparison. The padding makes each string the same length. The pad character is always a blank, regardless of the collating sequence. For bit data, the pad character is also a blank. For DBCS graphic data, the pad character is a DBCS blank (x'4040'). For Unicode graphic data, the pad character is a UTF-16 blank. ²⁸

Two strings are equal if any of the following are true:

- Both strings are empty.
- A *HEX collating sequence is used and all corresponding bytes are equal.
- A collating sequence other than *HEX is used and all corresponding bytes of the weighted value are equal.

An empty string is equal to a blank string. The relationship between two unequal strings is determined by a comparison of the first pair of unequal bytes (or bytes of the weighted value) from the left end of the string. This comparison is made according to the collating sequence in effect when the statement is executed.

In an application that will run in multiple environments, the same collating sequence (which depends on the CCSIDs of the environments) must be used to ensure identical results. The following table illustrates the differences between EBCDIC, ASCII, and the DB2 LUW default collating sequence for United States English by showing a list that is sorted according to each one.

^{28.} UTF-16 defines a blank character at code point X'0020' and X'3000'. The database manager pads with the blank at code point X'0020'.

ASCII and Unicode	EBCDIC	DB2 LUW Default
0000	0000	0000
9999	co-op	9999
0000	coop	0000
COOP	piano forte	co-op
PIANO-FORTE	piano-forte	COOP
co-op	COOP	coop
coop	PIANO-FORTE	piano forte
piano forte	0000	PIANO-FORTE
piano-forte	9999	piano-forte

Two varying-length strings with different lengths are equal if they differ only in the number of trailing blanks. In operations that select one value from a set of such values, the value selected is arbitrary. The operations that can involve such an arbitrary selection are DISTINCT, MAX, MIN, UNION, EXCEPT, INTERSECT, and references to a grouping column. See "group-by-clause" on page 485 for more information about the arbitrary selection involved in references to a grouping column.

Conversion rules for comparison:

When two strings are compared, one of the strings is first converted, if necessary, to the coded character set of the other string. Character conversion is necessary only if all of the following are true:

- The CCSIDs of the two strings are different.
- Neither CCSID is 65535.
- The string selected for conversion is neither null nor empty.
- Conversion between the two CCSIDs is required. For more information, see "Coded character sets and CCSIDs" on page 36.

If two strings with different encoding schemes are compared, any necessary conversion applies to the string as follows:

Table 21. Selecting the Resulting Encoding Scheme for Character Conversion

	Second Operand				
First Operand	SBCS Data	DBCS Data	Mixed Data	Unicode Graphic Data	
SBCS Data	see below	second	second	second	
DBCS Data	first	see below	second	second	
Mixed Data	first	first	see below	second	
Unicode Graphic Data	first	first	first	see below	

Otherwise, the string selected for conversion depends on the type of each operand. The following table shows which operand is selected for conversion, given the operand types:

Second Operand Derived Column Special Value First Operand Value Register Constant Variable Column Value second second second second second Derived Value first second second second second Special Register first first second second second Constant first first first second second Variable first first first first second

Table 22. Selecting the Operand for Character Conversion

A variable that contains data in a foreign encoding scheme is always effectively converted to the native encoding scheme before it is used in any operation. The above rules are based on the assumption that this conversion has already occurred.

An error is returned if a character of the string cannot be converted or if the conversion between the pair of CCSIDs is not defined. For more information, see "Coded character sets and CCSIDs" on page 36. A warning occurs if a character of the string is converted to the substitution character.

Datetime comparisons

A DATE, TIME, or TIMESTAMP value can be compared either with another value of the same data type or with a string representation of that data type. All comparisons are chronological, which means the farther a point in time is from January 1, 0001, the *greater* the value of that point in time.

Comparisons involving TIME values and string representations of time values always include seconds. If the string representation omits seconds, zero seconds are implied. The time 24:00:00 compares greater than the time 00:00:00.

Comparisons involving TIMESTAMP values are chronological without regard to representations that might be considered equivalent. Thus, the following predicate is true:

TIMESTAMP('1990-02-23-00.00.00') > '1990-02-22-24.00.00'

DataLink comparisons

A DATALINK operand cannot be directly compared to any data type. The DLCOMMENT, DLLINKTYPE, DLURLCOMPLETE, DLURLPATH, DLURLPATHONLY, DLURLSCHEME, and DLURLSERVER scalar functions can be used to extract character string values from a datalink which can then be compared to other strings.

Row ID comparisons

A ROWID operand cannot be directly compared to any data type. To compare the bit representation of a ROWID, first cast the ROWID to a character string.

Distinct type comparisons

A value with a distinct type can be compared only to another value with exactly the same distinct type.

For example, assume that distinct type YOUTH and table CAMP_DB2_ROSTER table were created with the following SQL statements:

Assignments and comparisons

CREATE TYPE YOUTH AS INTEGER WITH COMPARISONS

```
CREATE TABLE CAMP_DB2_ROSTER
  ( NAME
                       VARCHAR(20),
   ATTENDEE NUMBER
                       INTEGER NOT NULL,
                       YOUTH,
   HIGH SCHOOL LEVEL YOUTH)
```

The following comparison is valid because AGE and HIGH_SCHOOL_LEVEL have the same distinct type:

```
SELECT * FROM CAMP DB2 ROSTER
 WHERE AGE > HIGH_SCHOOL_LEVEL
```

The following comparison is not valid:

```
SELECT * FROM CAMP DB2 ROSTER
                                               ***INCORRECT***
 WHERE AGE > ATTENDEE_NUMBER
```

However, AGE can be compared to ATTENDEE_NUMBER by using a cast function or CAST specification to cast between the distinct type and the source type. All of the following comparisons are valid:

```
SELECT * FROM CAMP DB2 ROSTER
  WHERE AGE > YOUTH(ATTENDEE_NUMBER)
SELECT * FROM CAMP_DB2_ROSTER
 WHERE AGE > CAST ( ATTENDEE_NUMBER AS YOUTH)
SELECT * FROM CAMP_DB2_ROSTER
 WHERE INTEGER(AGE) > ATTENDEE_NUMBER
SELECT * FROM CAMP DB2 ROSTER
  WHERE CAST (AGE AS INTEGER) > ATTENDEE NUMBER
```

Rules for result data types

The data types of a result are determined by rules which are applied to the operands in an operation. This section explains those rules.

These rules apply to:

- Corresponding columns in UNION, UNION ALL, EXCEPT, or INTERSECT operations
- Result expressions of a CASE expression
- Arguments of the scalar functions COALESCE, IFNULL, MAX, MIN, and VALUE
- Expression values of the IN list of an IN predicate

For the result data type of expressions that involve the operators /, *, + and -, see "With arithmetic operators" on page 153. For the result data type of expressions that involve the CONCAT operator, see "With the concatenation operator" on page 157.

The data type of the result is determined by the data type of the operands. The data types of the first two operands determine an intermediate result data type, this data type and the data type of the next operand determine a new intermediate result data type, and so on. The last intermediate result data type and the data type of the last operand determine the data type of the result. For each pair of data types, the result data type is determined by the sequential application of the rules summarized in the tables that follow.

If neither operand column allows nulls, the result does not allow nulls. Otherwise, the result allows nulls.

If the data type and attributes of any operand column are not the same as those of the result, the operand column values are converted to conform to the data type and attributes of the result. The conversion operation is exactly the same as if the values were assigned to the result. For example,

- If one operand column is CHAR(10), and the other operand column is CHAR(5), the result is CHAR(10), and the values derived from the CHAR(5) column are padded on the right with five blanks.
- If the whole part of a number cannot be preserved then an error is returned.

Numeric operands

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Numeric types are compatible with other numeric and character-string and graphic-string data types.

If one operand column is	And the other operand is	The data type of the result column is		
SMALLINT	SMALLINT or String	SMALLINT		
INTEGER	SMALLINT, INTEGER, or String	INTEGER		
BIGINT	SMALLINT, INTEGER, BIGINT, or String	BIGINT		
DECIMAL(w,x)	SMALLINT	DECIMAL(p,x) where p = min(mp, x+max(w-x,5)) mp = 31 or 63 (See Note 1)		

Rules for result data types

If one operand column is	And the other operand is	The data type of the result column is		
DECIMAL(w,x)	INTEGER	DECIMAL(p,x) where p = min(mp, x+max(w-x,11)) mp = 31 or 63 (See Note 1)		
DECIMAL(w,x) BIGINT		DECIMAL(p,x) where p = min(mp, x+max(w-x,19)) mp = 31 or 63 (See Note 1)		
DECIMAL(w,x) DECIMAL(y,z) or NUMERIC(y,z,)		DECIMAL(p,s) where p = min(mp, max(x,z)+max(w-x,y-z)) s = max(x,z) mp = 31 or 63 (See Note 1)		
DECIMAL(w,x)	String	DECIMAL(w,x)		
NUMERIC(w,x)	SMALLINT	NUMERIC(p,x) where p = min(mp, x + max(w-x,5)) mp = 31 or 63 (See Note 1)		
NUMERIC(w,x)	INTEGER	NUMERIC(p,x) where p = min(mp, x + max(w-x,11)) mp = 31 or 63 (See Note 1)		
NUMERIC(w,x)	BIGINT	NUMERIC(p,x) where p = min(mp, x + max(w-x,19)) mp = 31 or 63 (See Note 1)		
NUMERIC(w,x)	NUMERIC(y,z)	NUMERIC(p,s) where p = min(mp, max(x,z) + max(w-x, y-z)) s = max(x,z) mp = 31 or 63 (See Note 1)		
NUMERIC(w,x)	String	NUMERIC(w,x)		
NONZERO SCALE BINARY	NONZERO SCALE BINARY	NONZERO SCALE BINARY (If either operand is nonzero scale binary, both operands must be binary with the same scale.)		
REAL	REAL	REAL		
REAL	SMALLINT, INTEGER, BIGINT, DECIMAL, NUMERIC, or String	DOUBLE		
DOUBLE	SMALLINT, INTEGER, BIGINT, DECIMAL, NUMERIC, REAL, DOUBLE, or String	DOUBLE		
DECFLOAT(n)	REAL, DOUBLE, INTEGER, or SMALLINT	DECFLOAT(n)		
DECFLOAT(n)	DECIMAL(p<=16,s) or NUMERIC(p<=16,s)	DECFLOAT(n)		
DECFLOAT(n)	BIGINT, DECIMAL(p>16,s), or NUMERIC(p>16,s)	DECFLOAT(34)		
DECFLOAT(n)	DECFLOAT(m)	DECFLOAT(max(n,m))		

If one operand column is... And the other operand is... The data type of the result column is...

Notes:

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- 1. The value of mp is 63 if:
 - either w or y is greater than 31, or
 - a value of 63 was specified for the maximum precision on the DECRESULT parameter of the CRTSQLxxx command, RUNSQLSTM command, or SET OPTION statement

Otherwise, the value of mp is 31.

Character and graphic string operands

Character and graphic strings are compatible with other character and graphic strings when there is a defined conversion between their corresponding CCSIDs. A character string and a graphic string are compatible if the encoding scheme of the graphic-string data type is Unicode and the character-string data type is not bit data.

If one operand And the other column is operand is		The data type of the result column is		
CHAR(x)	CHAR(y)	CHAR(z) where $z = max(x,y)$		
GRAPHIC(x)	CHAR(y) or GRAPHIC(y)	GRAPHIC(z) where $z = max(x,y)$		
VARCHAR(x)	CHAR(y) or VARCHAR(y)	VARCHAR(z) where $z = max(x,y)$		
VARCHAR(x)	GRAPHIC(y)	VARGRAPHIC(z) where $z = max(x,y)$		
VARGRAPHIC(x)	CHAR(y), VARCHAR(y), GRAPHIC(y), or VARGRAPHIC(y)	VARGRAPHIC(z) where $z = max(x,y)$		
CLOB(x)	CHAR(y), VARCHAR(y), or CLOB(y)	CLOB(z) where $z = max(x,y)$		
CLOB(x)	GRAPHIC(y) or VARGRAPHIC(y)	DBCLOB(z) where $z = max(x,y)$		
DBCLOB(x)	CHAR(y), VARCHAR(y), CLOB(y), GRAPHIC(y), VARGRAPHIC(y), or DBCLOB(y)	DBCLOB(z) where $z = max(x,y)$		

The CCSID of the result graphic string will be derived based on the "Conversion rules for operations that combine strings" on page 110.

Binary string operands

Binary strings are compatible only with other binary strings or character strings FOR BIT DATA. Other data types can be treated as a binary-string data type by using the BINARY, VARBINARY, or BLOB scalar functions to cast the data type to a binary string.

Rules for result data types

If one operand And the other column is operand is		The data type of the result column is		
BINARY(x)	BINARY(y) or CHAR(y) FOR BIT DATA	BINARY(z) where $z = max(x,y)$		
VARBINARY(x)	BINARY(y), VARBINARY(y), CHAR(y) FOR BIT DATA, or VARCHAR(y) FOR BIT DATA	VARBINARY(z) where $z = max(x,y)$		
VARCHAR(x) FOR BIT DATA	BINARY(y)	VARBINARY(z) where $z = max(x,y)$		
BLOB(x) BINARY(y), VARBINARY(y), BLOB(y), CHAR(y) FOR BIT DATA, or VARCHAR(y) FOR BIT DATA		BLOB(z) where $z = max(x,y)$		

Datetime operands

A DATE type is compatible with another DATE type or any character or Unicode graphic string expression that contains a valid string representation of a date. A string representation must not be a CLOB. The data type of the result is DATE.

A TIME type is compatible with another TIME type or any character or Unicode graphic string expression that contains a valid string representation of a time. A string representation must not be a CLOB. The data type of the result is TIME.

A TIMESTAMP type is compatible with another TIMESTAMP type or any character or Unicode graphic string expression that contains a valid string representation of a timestamp. A string representation must not be a CLOB. The data type of the result is TIMESTAMP.

If one operand column is	And the other operand is	The data type of the result column is
DATE	DATE, CHAR(y), VARCHAR(y), GRAPHIC(y), or VARGRAPHIC(y)	DATE
TIME	TIME, CHAR(y), VARCHAR(y), GRAPHIC(y), or VARGRAPHIC(y)	TIME
TIMESTAMP	TIMESTAMP, CHAR(y), VARCHAR(y), GRAPHIC(y), or VARGRAPHIC(y)	TIMESTAMP

DataLink operands

A DataLink is compatible with another DataLink. However, DataLinks with NO LINK CONTROL are only compatible with other DataLinks with NO LINK CONTROL; DataLinks with FILE LINK CONTROL READ PERMISSION FS are only compatible with other DataLinks with FILE LINK CONTROL READ PERMISSION FS; and DataLinks with FILE LINK CONTROL READ PERMISSION DB are only compatible with other DataLinks with FILE LINK CONTROL READ PERMISSION DB. The data type of the result is DATALINK. The length of the result DATALINK is the largest length of all the data types.

If one operand column is	And the other operand is	The data type of the result column is
DATALINK(x)	DATALINK(y)	DATALINK(z) where $z = max(x,y)$

ROWID operands

A ROWID is compatible with another ROWID. The data type of the result is ROWID.

Distinct type operands

A user-defined distinct type is compatible only with the same user-defined distinct type. The data type of the result is the user-defined distinct type.

If one operand column is	And the other operand is	The data type of the result column is
Distinct Type	Distinct Type	Distinct Type

Conversion rules for operations that combine strings

The operations that combine strings are concatenation, UNION, UNION ALL, EXCEPT, and INTERSECT. (These rules also apply to the MAX, MIN, VALUE, COALESCE, IFNULL, and CONCAT scalar functions and CASE expressions.) In each case, the CCSID of the result is determined at bind time, and the execution of the operation may involve conversion of strings to the coded character set identified by that CCSID.

The CCSID of the result is determined by the CCSIDs of the operands. The CCSIDs of the first two operands determine an intermediate result CCSID, this CCSID and the CCSID of the next operand determine a new intermediate result CCSID, and so on. The last intermediate result CCSID and the CCSID of the last operand determine the CCSID of the result string or column. For each pair of CCSIDs, the result CCSID is determined by the sequential application of the following rules:

- If the CCSIDs are equal, the result is that CCSID.
- If either CCSID is 65535, the result is 65535.²⁹
- · If one CCSID denotes data in an encoding scheme different from the other CCSID, the result is determined by the following table:

Table 23. Selecting the Encoding Scheme of the Intermediate Result

	Second Operand				
First Operand	SBCS Data	Unicode Graphic Data			
SBCS Data	see below	second	second	second	
DBCS Data	first	see below	second	second	
Mixed Data	first	first	see below	second	
Unicode Graphic Data	first	first	first	see below	

• Otherwise, the resulting CCSID is determined by the following tables:

Table 24. Selecting the CCSID of the Intermediate Result

	Second Operand				
First Operand	Column Value	Derived Value	Constant	Special Register	Variable
Column Value	first	first	first	first	first
Derived Value	second	first	first	first	first
Constant	second	second	first	first	first
Special Register	second	second	first	first	first
Variable	second	second	second	second	first

^{29.} If either operand is a CLOB or DBCLOB, the resulting CCSID is the job default CCSID.

A variable containing data in a foreign encoding scheme is effectively converted to the native encoding scheme before it is used in any operation. The above rules are based on the assumption that this conversion has already occurred.

Note that an intermediate result is considered to be a derived value operand. For example, assume COLA, COLB, and COLC are columns with CCSIDs 37, 278, and 500, respectively. The result CCSID of COLA CONCAT COLB CONCAT COLC is determined as follows:

- The result CCSID of COLA CONCAT COLB is first determined to be 37 because both operands are columns, so the CCSID of the first operand is chosen.
- 2. The result CCSID of "intermediate result" CONCAT COLC is determined to be 500, because the first operand is a derived value and the second operand is a column, so the CCSID of the second operand is chosen.

An operand of concatenation, or the result expression of the CASE expression, or the operands of the IN predicate, or the selected argument of the MAX, MIN, VALUE, COALESCE, IFNULL, or CONCAT scalar function is converted, if necessary, to the coded character set of the result string. Each string of an operand of UNION, UNION ALL, EXCEPT, or INTERSECT is converted, if necessary, to the coded character set of the result column. Character conversion is necessary only if all of the following are true:

- · The CCSIDs are different.
- Neither CCSID is 65535.
- The string is neither null nor empty.
- Conversion between the two CCSIDs is required. For more information, see "Coded character sets and CCSIDs" on page 36.

An error is returned if a character of the string cannot be converted or if the conversion between the pair of CCSIDs is not defined. For more information, see "Coded character sets and CCSIDs" on page 36. A warning occurs if a character of a string is converted to the substitution character.

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Constants

A constant (also called a literal) specifies a value. Constants are classified as string constants or numeric constants. String constants are further classified as character or graphic. Numeric constants are further classified as integer, floating point, or decimal.

All constants have the attribute NOT NULL. A negative sign in a numeric constant with a value of zero is ignored.

Integer constants

An integer constant specifies an integer as a signed or unsigned number with a maximum of 19 digits that does not include a decimal point. The data type of an integer constant is large integer if its value is within the range of a large integer. The data type of an integer constant is big integer if its value is outside the range of a large integer, but within the range of a big integer. A constant that is defined outside the range of big integer values is considered a decimal constant.

Examples

-15 +100 32767 720176 12345678901

In syntax diagrams, the term integer is used for a large integer constant that must not include a sign.

Decimal constants

A decimal constant specifies a decimal number as a signed or unsigned number that consists of no more than 63 digits and either includes a decimal point or is not within the range of binary integers.

The precision is the total number of digits (including leading and trailing zeros); the scale is the number of digits to the right of the decimal point (including trailing zeros). If the precision of the decimal constant is greater than the largest decimal precision and the scale is not greater than the largest decimal precision, then leading zeroes to the left of the decimal point are eliminated to reduce the precision to the largest decimal precision.

Examples

25.5 1000. -15. +37589.33333333333

Floating-point constants

A floating-point constant specifies a double-precision floating-point number as two numbers separated by an E. The first number can include a sign and a decimal point; the second number can include a sign but not a decimal point. The value of the constant is the product of the first number and the power of 10 specified by the second number; it must be within the range of floating-point numbers. The number of characters in the constant must not exceed 24. Excluding leading zeros, the number of digits in the first number must not exceed 17 and the number of digits in the second must not exceed 3.

Examples

15E1 2.E5 2.2E-1 +5.E+2

Decimal floating-point constants

A *decimal floating-point constant* specifies a decimal floating-point number as two numbers separated by an E. The first number can include a sign and a decimal point; the second number can include a sign but not a decimal point. The value of the constant is the product of the first number and the power of 10 specified by the second number; it must be within the range of DECFLOAT(34). The number of characters in the constant must not exceed 42. Excluding leading zeros, the number of digits in the first number must not exceed 34 and the number of digits in the second must not exceed 4.

A constant specified as two numbers separated by E is a decimal floating-point constant only if:

- Excluding leading zeros, the number of digits in the first number exceeds 17 (precision).
- The exponent is outside of the range of double floating-point numbers (smaller than -308 or larger than 308).

In addition to numeric constants, the following reserved keywords can be used to specify decimal floating-point special values. These special values are: INFINITY, NAN, and SNAN. INFINITY represents infinity, a number whose magnitude is infinitely large. INFINITY can be preceded by an optional sign. INF can be specified in place of INFINITY. NAN represents Not a Number (NaN) and is sometimes called quiet NaN. It is a value that represents undefined results which does not cause a warning or exception. SNAN represents signaling NaN (sNaN). It is a value that represents undefined results which will cause a warning or exception if used in any operation that is defined in any numerical operation. Both NAN and SNAN can be used in non-numerical operations without causing a warning or exception, for example in the VALUES list of an INSERT or as a constant compared in a predicate.

Examples

1.8E308 -1.23456789012345678E-2 SNAN -INFINITY

Character-string constants

A character-string constant specifies a varying-length character string.

The two forms of character-string constant follow:

- A sequence of characters that starts and ends with a string delimiter. The
 number of bytes between the string delimiters cannot be greater than 32740. Two
 consecutive string delimiters are used to represent one string delimiter within
 the character string. Two consecutive string delimiters that are not contained
 within a string represent the empty string.
- An X followed by a sequence of characters that starts and ends with a string delimiter. The characters between the string delimiters must be an even number of hexadecimal digits. Blanks between the string delimiters are ignored. The number of hexadecimal digits must not exceed 32762. A hexadecimal digit is a digit or any of the letters A through F (uppercase or lowercase). Under the conventions of hexadecimal notation, each pair of hexadecimal digits represents a character. This form of string constant allows you to specify characters that do not have a keyboard representation.

Constants

Character-string constants can contain mixed data. If the job CCSID supports mixed data, a character-string constant is classified as mixed data if it includes a DBCS substring. In all other cases, a character-string constant is classified as SBCS data.

The CCSID assigned to the constant is the CCSID of the source containing the constant unless the source is encoded in a foreign encoding scheme (such as ASCII). The data in the variable is converted from the foreign encoding scheme to the default CCSID of the current server. In this case, the CCSID assigned to the constant is the default CCSID of the current server.

The CCSID of the source is determined by the application requester. The CCSID of the source is:

- For STRSQL, the default CCSID of the application requester
- For the RUNSQLSTM or STRREXPRC commands, the CCSID of the specified source file
- For CRTSQLxxx:
 - For static SQL, the CCSID of the source is the CCSID of the source file used on the CRTSQLxxx command.
 - For dynamic SQL, the CCSID of the source is the CCSID of the variable specified on the PREPARE statement, or if a string constant is specified on the PREPARE statement, the default CCSID of the current server.

Character-string constants are used to represent constant datetime values in assignments and comparisons. For more information see "String representations of datetime values" on page 77.

Examples

'Peggy' '14.12.1990' '32' 'DON''T CHANGE' X'FFFF'

Graphic-string constants

There are two types of graphic-string constants: DBCS and UTF-16 graphic-string constants.

DBCS graphic-string constants

A graphic-string constant is a varying-length graphic string. The length of the specified string cannot be greater than 16370. The three forms of DBCS graphic-string constants are:

Context	Graphic String Constant	Empty String	Example	
All contexts	G ^{IS} ₀dbcs-string ^S _I I	G'SSI'	G'%元気ឡ	-
		G"		
		g'sos _I '		
		g"		00-1
PL/I	% dbcs-string GS _I	s _o / / Gs _I	% ′ 元気 ′ G⁵₁	RV3F000-1

In the normal form, the SQL delimiters and the G is an SBCS character. The SBCS ' is the EBCDIC apostrophe, X'7D'.

In the PL/I form, the apostrophes and the G are DBCS characters. Two consecutive DBCS string delimiters are used to represent one string delimiter within the string. Note that this PL/I form is only valid for static statements embedded in PL/I programs.

A hexadecimal DBCS graphic constant is also supported. The form of the hexadecimal DBCS graphic constant is:

In the constant GX'ssss', **ssss** represents a string from 0 to 32760 hexadecimal digits. The number of characters between the string delimiters must be an even multiple of 4. Blanks between the string delimiters are ignored. Each group of 4 digits represents a single DBCS graphic character. The hexadecimal for shift-in and shift-out ('0E'X and '0F'X) are not included in the string.

The CCSID assigned to constants is the DBCS CCSID associated with the CCSID of the source unless the source is encoded in a foreign encoding scheme (such as ASCII). In this case, the CCSID assigned to the constant is the DBCS CCSID associated with the default CCSID of the current server when the SQL statement containing the constant is prepared. If there is no DBCS CCSID associated with the CCSID of the source, the CCSID is 65535.

For information about associated DBCS CCSIDs, see the Use DBCS CCSIDs topic in the i5/OS Information Center. For information about the CCSID of the source, see Character String Constants.

Unicode graphic-string constants

There are two types of Unicode graphic-string constants: N and UX. The form of the Unicode graphic constant is:

N'ssss'

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| |

| | In the constant, **ssss** is a string of 16370 characters. The characters are converted from the source CCSID to the Unicode CCSID during processing.

The form of the hexadecimal Unicode graphic constant is:

UX'ssss'

In the constant, **ssss** represents a string from 0 to 32760 hexadecimal digits. The number of characters between the string delimiters must be an even multiple of 4. Blanks between the string delimiters are ignored. Each group of 4 or more digits represents a single Unicode graphic character.

The CCSID of a Unicode graphic-string constant is 13488 (UCS-2). If the standards option is specified, the CCSID is 1200 (UTF-16). For information about the standards option, see "Standards compliance" on page ix.

Binary-string constants

A binary-string constant specifies a varying-length binary string.

The two forms of a binary-string constant are:

 A BX followed by a sequence of characters that starts and ends with a string delimiter. The characters between the string delimiters must be an even number of hexadecimal digits. Blanks between the string delimiters are ignored. The

Constants

number of hexadecimal digits must not exceed 32740. A hexadecimal digit is a digit or any of the letters A through F (uppercase or lowercase).

An X followed by a sequence of characters that starts and ends with a string delimiter. The characters between the string delimiters must be an even number of hexadecimal digits. Blanks between the string delimiters are ignored. The number of hexadecimal digits must not exceed 32740. A hexadecimal digit is a digit or any of the letters A through F (uppercase or lowercase).

The CCSID assigned to the constant is 65535.

Note that the syntax of the second form of binary string constant is identical to the second form of a character constant. A constant of this form is only treated as a binary string constant if the standards option is specified. For information on the standards option, see "Standards compliance" on page ix.

Examples

BX'FFFF' X'FFFF'

Datetime constants

A datetime constant specifies a date, time, or timestamp.

Typically, character-string constants are used to represent constant datetime values in assignments and comparisons. For information on string representations of datetime values, see "String representations of datetime values" on page 77. However, the ANSI/ISO SQL standard form of a datetime constant can be used to specifically denote the constant as a datetime constant instead of a string constant.

The format for the three ANSI/ISO SQL standard datetime constants are:

- DATE 'yyyy-mm-dd' The data type of the value is DATE.
- TIME 'hh:mm:ss' The data type of the value is TIME.
- TIMESTAMP 'yyyy-mm-dd hh:mm:ss.nnnnn'

The data type of the value is TIMESTAMP.

Trailing zeros can be truncated or omitted entirely from microseconds. If you choose to omit any digit of the microseconds portion, an implicit specification of 0 is assumed. Thus, 1990-03-02 08:30:00.10 is equivalent to 1990-03-02 08:30:00.100000.

Leading zeros must not be omitted from any part of a standard datetime constant.

Example

DATE '2003-09-03'

Decimal point

You can specify a default decimal point.

The default decimal point can be specified:

To interpret numeric constants

- To determine the decimal point character to use when casting a character string to a number (for example, in the DECFLOAT, DECIMAL, DOUBLE_PRECISION, FLOAT, and REAL scalar functions and the CAST specification)
- to determine the decimal point character to use in the result when casting a number to a string (for example, in the CHAR, VARCHAR, CLOB, GRAPHIC, and VARGRAPHIC scalar functions and the CAST specification)

The default decimal point can be specified through the following interfaces:

Table 25. Default Decimal Point Interfaces

SQL Interface	Specification	
Embedded SQL	The *JOB, *PERIOD, *COMMA, or *SYSVAL value in the OPTION parameter is specified on the Create SQL Program (CRTSQLxxx) commands. The SET OPTION statement can also be used to specify the DECMPT parameter within the source of a program containing embedded SQL. (For more information about CRTSQLxxx commands, see Embedded SQL programming.)	
Interactive SQL and Run SQL Statements	The DECPNT parameter on the Start SQL (STRSQL) command or by changing the session attributes. The DECMPT parameter on the Run SQL Statements (RUNSQLSTM) command. (For more information about STRSQL and RUNSQLSTM commands, see SQL programming.)	
Call Level Interface (CLI) on the server	SQL_ATTR_DATE_FMT and SQL_ATTR_DATE_SEP environment or connection variables (For more information about CLI, see SQL Call Level Interfaces (ODBC).)	
JDBC or SQLJ on the server using IBM Developer Kit for Java	Decimal Separator conneciton property (For more information about JDBC and SQLJ, see IBM Developer Kit for Java.)	
ODBC on a client using the System i Access Family ODBC Driver	Decimal Separator in the Advanced Server Options in ODBC Setup (For more information about ODBC, see System i Access.)	
JDBC on a client using the IBM Toolbox for Java	Format in JDBC Setup (For more information about ODBC, see System i Access.) (For more information about the IBM Toolbox for Java, see IBM Toolbox for Java.)	

If the comma is the decimal point, the following rules apply:

- A period will also be allowed as a decimal point.
- A comma intended as a separator of numeric constants in a list must be followed by a space.
- A comma intended as a decimal point must not be followed by a space.

Thus, to specify a decimal constant without a fractional part, the trailing comma must be followed by a non-blank character. The non-blank character can be a separator comma, as in:

VALUES (9999999999,, 111)

Constants

Delimiters

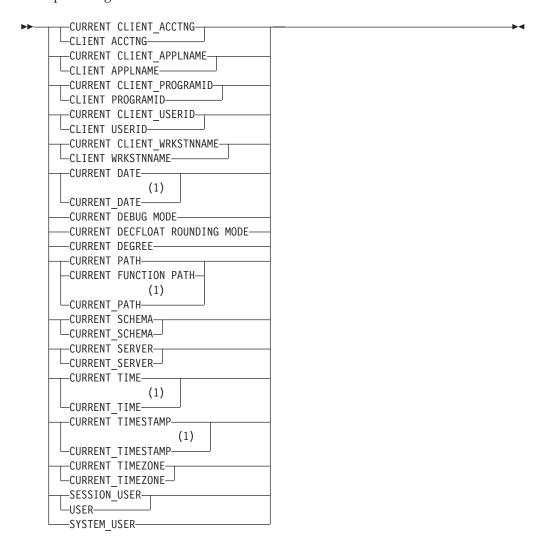
*APOST and *QUOTE are mutually exclusive COBOL precompiler options that name the string delimiter within COBOL statements. *APOST names the apostrophe (') as the string delimiter; *QUOTE names the quotation mark ("). *APOST and *QUOTE are mutually exclusive COBOL precompiler options that play a similar role for SQL statements embedded in COBOL programs. *APOST names the apostrophe (') as the SQL string delimiter; with this option, the quotation mark (") is the SQL escape character. *QUOTE names the quotation mark as the SQL string delimiter; with this option, the apostrophe is the SQL escape character. The values of *APOST and *QUOTE are respectively the same as the values of *APOST and *QUOTE.

In host languages other than COBOL, the usages are fixed. The string delimiter for the host language and for static SQL statements is the apostrophe ('); the SQL escape character is the quotation mark (").

Special registers

A *special register* is a storage area that is defined for an application process by database manager and is used to store information that can be referenced in SQL statements. A reference to a special register is a reference to a value provided by the current server. If the value is a string, its CCSID is a default CCSID of the current server.

The special registers can be referenced as follows:



Notes:

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1 The SQL 2003 Core standard uses the form with the underscore.

The value of these special registers cannot be null.

CURRENT CLIENT_ACCTNG

The CURRENT CLIENT_ACCTNG special register specifies a VARCHAR(255) value that contains the value of the accounting string from the client information specified for this connection.

Special registers

The default value of this register is the empty string. The value of the accounting string can be changed through three interfaces.

- The Set Client Information (SQLESETI) API can change the client special register.
- In CLI, SQLSetConnectAttr() can be used to set the SQL_ATTR_INFO_ACCTSTR connection attribute.
- In JDBC, the setClientInfo connection method can be used to set the ClientAccounting connection property.

Example

Get the current value of the accounting string for this connection

```
VALUES CURRENT CLIENT_ACCTNG
INTO :ACCT_STRING
```

CURRENT CLIENT_APPLNAME

The CURRENT CLIENT_APPLNAME special register specifies a VARCHAR(255) value that contains the value of the application name from the client information specified for this connection.

The default value of this register is the empty string. The value of the application name can be changed through three interfaces.

- The Set Client Information (SQLESETI) API can change the client special register.
- In CLI, SQLSetConnectAttr() can be used to set the SQL ATTR INFO APPLNAME connection attribute.
- In JDBC, the setClientInfo connection method can be used to set the ApplicationName connection property.

Example

Select the departments that are allowed to use the application being used in this connection.

```
SELECT DEPT
FROM DEPT_APPL_MAP
WHERE APPL NAME = CURRENT CLIENT_APPLNAME
```

CURRENT CLIENT_PROGRAMID

The CURRENT CLIENT_PROGRAMID special register specifies a VARCHAR(255) value that contains the value of the client program ID from the client information specified for this connection.

The default value of this register is the empty string. The value of the client program ID can be changed through three interfaces.

- The Set Client Information (SQLESETI) API can change the client special register.
- In CLI, SQLSetConnectAttr() can be used to set the SQL_ATTR_INFO_PROGRAMID connection attribute.
- In JDBC, the setClientInfo connection method can be used to set the ClientProgramID connection property.

Example

Get the program ID being used for this connection.

```
VALUES CURRENT CLIENT_PROGRAMID INTO : PGM ID
```

CURRENT CLIENT_USERID

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The CURRENT CLIENT_USERID special register specifies a VARCHAR(255) value that contains the value of the client user ID from the client information specified for this connection.

The default value of this register is the empty string. The value of the client user ID can be changed through three interfaces.

- The Set Client Information (SQLESETI) API can change the client special register.
- In CLI, SQLSetConnectAttr() can be used to set the SQL_ATTR_INFO_USERID connection attribute.
- In JDBC, the setClientInfo connection method can be used to set the ClientUser connection property.

Example

Find out in which department the current client user ID works.

```
SELECT DEPT
FROM DEPT_USERID_MAP
WHERE USER ID = CURRENT CLIENT_USERID
```

CURRENT CLIENT WRKSTNNAME

The CURRENT CLIENT_WRKSTNNAME special register specifies a VARCHAR(255) value that contains the value of the workstation name from the client information specified for this connection.

The default value of this register is the empty string. The value of the workstation name can be changed through three interfaces.

- The Set Client Information (SQLESETI) API can change the client special register.
- In CLI, SQLSetConnectAttr() can be used to set the SQL_ATTR_INFO_WRKSTNNAME connection attribute.
- In JDBC, the setClientInfo connection method can be used to set the ClientHostName connection property.

Example

Get the workstation name being used for this connection.

```
VALUES CURRENT CLIENT_WRKSTNNAME
INTO :WS NAME
```

CURRENT DATE

The CURRENT DATE special register specifies a date that is based on a reading of the time-of-day clock when the SQL statement is executed at the current server.

If this special register is used more than once within a single SQL statement, or used with CURRENT TIME, CURRENT TIMESTAMP, or the CURDATE, CURTIME, or NOW scalar functions within a single statement; all values are based on a single clock reading.³⁰

^{30.} LOCALDATE can be specified as a synonym for CURRENT_DATE.

Example

Using the PROJECT table, set the project end date (PRENDATE) of the MA2111 project (PROJNO) to the current date.

```
UPDATE PROJECT
 SET PRENDATE = CURRENT DATE
 WHERE PROJNO = 'MA2111'
```

CURRENT DEBUG MODE

The CURRENT DEBUG MODE special register specifies whether SQL or Java procedures should be created or altered so they can be debugged by the Unified Debugger.

Any explicit specification of the DEBUG MODE or the DBGVIEW option in the SET OPTION statement on the CREATE PROCEDURE or ALTER PROCEDURE statement overrides the value in the CURRENT DEBUG MODE special register. CURRENT DEBUG MODE affects static and dynamic SQL statements. The data type of the register is VARCHAR(8). The valid values include:

DISALLOW

Procedures will be created so they cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is DISALLOW, the procedure can be subsequently altered to change the DEBUG MODE attribute.

ALLOW

Procedures will be created so they can be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is ALLOW, the procedure can be subsequently altered to change the DEBUG MODE attribute.

Procedures will be created so they cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is DISABLE, the procedure cannot be subsequently altered to change the DEBUG MODE attribute.

The value can be changed by invoking the SET CURRENT DEBUG MODE statement. For details about this statement, see "SET CURRENT DEBUG MODE" on page 1071.

The initial value of CURRENT DEBUG MODE is DISALLOW.

Example

The following statement prevents subsequent creates or alters of SQL or Java procedures from being debuggable:

SET CURRENT DEBUG MODE = DISALLOW

CURRENT DECFLOAT ROUNDING MODE

The CURRENT DECFLOAT ROUNDING MODE special register specifies the rounding mode that is used when DECFLOATs are manipulated in dynamically prepared SQL statements.

The data type of the register is VARCHAR(128). The rounding modes supported are:

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ROUND_CEILING

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Round toward +infinity. If all of the discarded digits are zero or if the sign is negative, the result is unchanged other than the removal of the discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

ROUND DOWN

Round toward zero (truncation). The discarded digits are ignored.

ROUND_FLOOR

Round toward -infinity. If all of the discarded digits are zero or if the sign is positive, the result is unchanged other than the removal of the discarded digits. Otherwise, the sign is negative and the result coefficient is incremented by one.

ROUND_HALF_DOWN

Round to nearest; if equidistant, round down. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

ROUND HALF EVEN

Round to nearest; if equidistant, round so that the final digit is even. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). If they represent less than half, then the result coefficient is not adjusted (that is, the discarded digits are ignored). Otherwise (they represent exactly half), the result coefficient is unaltered if its rightmost digit is even, or incremented by one (rounded up) if its rightmost digit is odd (to make an even digit).

ROUND HALF UP

Round to nearest; if equidistant, round up. If the discarded digits represent greater than or equal to half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

ROUND UP

Round away from zero. If all of the discarded digits are zero, the result is unchanged other than the removal of discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

The initial value of CURRENT DECFLOAT ROUNDING MODE in an activation group is established by the first SQL statement that is executed in the activation group.

- If the first SQL statement in an activation group is executed from an SQL program or SQL package, the CURRENT DECFLOAT ROUNDING MODE special register is set to the value of the DECFLTRND parameter.
- Otherwise, the initial value is ROUND HALF EVEN.

The DECFLTRND parameter on the CRTSQLxxx command or SET OPTION is used for static SQL statements.

Example

Set the CURRENT DECFLOAT ROUNDING MODE to ROUND_UP.

SET CURRENT DECFLOAT ROUNDING MODE = ROUND UP

CURRENT DEGREE

The CURRENT DEGREE special register specifies the degree of I/O or Symmetric MultiProcessing (SMP) parallelism for the execution of queries, index creates, index rebuilds, index maintenance, and reorganizes.

CURRENT DEGREE affects static and dynamic SQL statements. The data type of the register is CHAR(5). The valid values include:

1 No parallel processing is allowed.

2 through 32767

Specifies the degree of parallelism that will be used.

ANY

Specifies that the database manager can choose to use any number of tasks for either I/O or SMP parallel processing.

Use of parallel processing and the number of tasks used is determined based on the number of processors available in the system, this job's share of the amount of active memory available in the pool in which the job is run, and whether the expected elapsed time for the operation is limited by CPU processing or I/O resources. The database manager chooses an implementation that minimizes elapsed time based on the job's share of the memory in the pool.

NONE

No parallel processing is allowed.

The database manager can choose to use any number of tasks for either I/O or SMP parallel processing. MAX is similar to ANY except the database manager assumes that all active memory in the pool can be used.

IO Any number of tasks can be used when the database manager chooses to use I/O parallel processing for queries. SMP is not allowed.

The initial value of CURRENT DEGREE is determined by the current degree in effect from the CHGQRYA CL command, PARALLEL_DEGREE parameter in the current query options file (QAQQINI), or the QQRYDEGREE system value.

The value can be changed by invoking the SET CURRENT DEGREE statement. For details about this statement, see "SET CURRENT DEGREE" on page 1075.

Example

The following statement inhibits parallelism:

SET CURRENT DEGREE = '1'

CURRENT PATH

The CURRENT PATH special register specifies the SQL path used to resolve unqualified distinct type names, function names, and procedure names in dynamically prepared SQL statements.

It is also used to resolve unqualified procedure names that are specified as variables in SQL CALL statements (CALL variable). The data type is VARCHAR(3483).

The CURRENT PATH special register contains the value of the SQL path, which is a list of one or more schema names. Each schema name is enclosed in delimiters and separated from the following schema by a comma (any delimiters within the string are repeated as they are in any delimited identifier). The delimiters and commas are included in the length of the special register. The maximum number of schema names in the path is 268.

For information about when the SQL path is used to resolve unqualified names in both dynamic and static SQL statements and the effect of its value, see "Unqualified distinct type, function, procedure, and specific names" on page 61.

The initial value of the CURRENT PATH special register in an activation group is established by the first SQL statement that is executed.

- If the first SQL statement in an activation group is executed from an SQL program or SQL package and the SQLPATH parameter was specified on the CRTSQLxxx command, the path is the value specified in the SQLPATH parameter. The SQLPATH value can also be specified using the SET OPTION statement.
- · Otherwise,

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- For SQL naming, "QSYS", "QSYS2", "SYSPROC", "SYSIBMADM", "the value of the authorization ID of the statement".
- For system naming, "*LIBL".

The value of the special register can be changed by executing the SET PATH statement. For details about this statement, see "SET PATH" on page 1103. For portability across the platforms, it is recommended that a SET PATH statement be issued at the beginning of an application.

Example

Set the special register so that schema SMITH is searched before schemas QSYS and QSYS2 (SYSTEM PATH).

SET CURRENT PATH SMITH, SYSTEM PATH

CURRENT SCHEMA

The CURRENT SCHEMA special register specifies a VARCHAR(128) value that identifies the schema name used to qualify unqualified database object references where applicable in dynamically prepared SQL statements.

CURRENT SCHEMA is not used to qualify names in programs where the DYNDFTCOL has been specified. If DYNDFTCOL is specified in a program, its schema name is used instead of the CURRENT SCHEMA schema name. 31

The initial value of CURRENT SCHEMA is the authorization ID of the current session user.

The value of the special register can be changed by executing the SET SCHEMA statement. For more information, see "SET SCHEMA" on page 1109.

The DFTRDBCOL keyword controls the schema name used to qualify unqualified database object references where applicable for static SQL statements.

^{31.} For compatibility with DB2 for z/OS, the special register CURRENT SQLID is treated as a synonym for CURRENT SCHEMA.

Example

Set the schema for object qualification to 'D123'.

SET CURRENT SCHEMA = 'D123'

CURRENT SERVER

The CURRENT SERVER special register specifies a VARCHAR(18) value that identifies the current application server.

CURRENT SERVER can be changed by the CONNECT (Type 1), CONNECT (Type 2), or SET CONNECTION statements, but only under certain conditions. See the description in "CONNECT (Type 1)" on page 642, "CONNECT (Type 2)" on page 647, and "SET CONNECTION" on page 1068.

CURRENT SERVER cannot be specified unless the local relational database is named by adding the entry to the relational database directory using the ADDRDBDIRE or WRKRDBDIRE command.

Example

Set the host variable APPL_SERVE (VARCHAR(18)) to the name of the current

SELECT CURRENT SERVER INTO : APPL SERVE FROM SYSIBM.SYSDUMMY1

CURRENT TIME

The CURRENT TIME special register specifies a time that is based on a reading of the time-of-day clock when the SQL statement is executed at the current server.

If this special register is used more than once within a single SQL statement, or used with CURRENT DATE, CURRENT TIMESTAMP, or the CURDATE, CURTIME, or NOW scalar functions within a single statement; all values are based on a single clock reading.³²

Example

Using the CL_SCHED table, select all the classes (CLASS_CODE) that start (STARTING) later today. Today's classes have a value of 3 in the DAY column.

```
SELECT CLASS CODE FROM CL SCHED
 WHERE STARTING > CURRENT TIME AND DAY = 3
```

CURRENT TIMESTAMP

The CURRENT TIMESTAMP special register specifies a timestamp that is based on a reading of the time-of-day clock when the SQL statement is executed at the current server.

If this special register is used more than once within a single SQL statement, or used with CURRENT DATE, CURRENT TIME, or the CURDATE, CURTIME, or NOW scalar functions within a single statement; all values are based on a single clock reading.³³

^{32.} LOCALTIME and LOCALTIME(0) can be specified as a synonyms for CURRENT_TIME.

^{33.} LOCALTIMESTAMP and LOCALTIMESTAMP(6) can be specified as a synonym for CURRENT_TIMESTAMP.

Example

Insert a row into the IN_TRAY sample table. The value of the RECEIVED column should be a timestamp that indicates when the row was inserted. The values for the other three columns come from the host variables SRC (CHAR(8)), SUB (CHAR(64)), and TXT (VARCHAR(200)).

```
INSERT INTO IN_TRAY
VALUES (CURRENT TIMESTAMP, :SRC, :SUB, :TXT)
```

CURRENT TIMEZONE

The CURRENT TIMEZONE special register specifies the difference between UTC and local time at the current server.

The difference is represented by a time duration (a decimal number in which the first two digits are the number of hours, the next two digits are the number of minutes, and the last two digits are the number of seconds).³⁴ The number of hours is between -24 and 24 exclusive. Subtracting CURRENT TIMEZONE from a local time converts that local time to UTC.

Example

Using the IN_TRAY table, select all the rows from the table and adjust the value to UTC.

```
SELECT RECEIVED - CURRENT TIMEZONE, SOURCE,
SUBJECT, NOTE_TEXT FROM IN_TRAY
```

SESSION_USER

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The SESSION_USER special register specifies the run-time authorization ID at the current server. The data type of the special register is VARCHAR(128).

The initial value of SESSION_USER for a new connection is the same as the value of the SYSTEM_USER special register.

The value can be changed by executing the SET SESSION AUTHORIZATION statement. For more information, see "SET SESSION AUTHORIZATION" on page 1112.

Example

Select all notes from the IN TRAY table that the user placed there himself.

```
SELECT * FROM IN_TRAY
WHERE SOURCE = SESSION_USER
```

SYSTEM USER

The SYSTEM_USER special register specifies the authorization ID that connected to the current server. The data type of the special register is VARCHAR(128).

Example

Select all notes from the IN TRAY table that the user placed there himself.

```
SELECT * FROM IN_TRAY
WHERE SOURCE = SYSTEM_USER
```

^{34.} Coordinated Universal Time, formerly known as GMT.

USER

The USER special register specifies the run-time authorization ID at the current server. The data type of the special register is VARCHAR(18).

The initial value of USER for a new connection is the same as the value of the SYSTEM_USER special register.

The value can be changed by executing the SET SESSION AUTHORIZATION statement. For more information, see "SET SESSION AUTHORIZATION" on page 1112.

Example

Select all notes from the IN_TRAY table that the user placed there himself.

SELECT * FROM IN_TRAY
WHERE SOURCE = USER

128

Column names

The meaning of a column name depends on its context.

A column name can be used to:

- Declare the name of a column, as in a CREATE TABLE statement.
- · Identify a column, as in a CREATE INDEX statement.
- Specify values of the column, as in the following contexts:
 - In an aggregate function, a column name specifies all values of the column in the group or intermediate result table to which the function is applied.
 Groups and intermediate result tables are explained under Chapter 4, "Queries," on page 469. For example, MAX(SALARY) applies the function MAX to all values of the column SALARY in a group.
 - In a GROUP BY or ORDER BY clause, a column name specifies all values in the intermediate result table to which the clause is applied. For example, ORDER BY DEPT orders an intermediate result table by the values of the column DEPT.
 - In an expression, a search condition, or a scalar function, a column name specifies
 a value for each row or group to which the construct is applied. For example,
 when the search condition CODE = 20 is applied to some row, the value
 specified by the column name CODE is the value of the column CODE in that
 row.
- Provide a column name for an expression to temporarily rename a column, as in the *correlation-clause* of a *table-reference* in a FROM clause, or in the AS clause in the *select-clause*.

Qualified column names

A qualifier for a column name can be a table name, a view name, an alias name, or a correlation name.

Whether a column name can be qualified depends on its context:

- In the COMMENT and LABEL statements, the column name must be qualified.
- Where the column name specifies values of the column, a column name can be qualified.
- In the assignment-clause of an UPDATE statement, it may be qualified.
- In the *column-name-list* of an INSERT statement, it may be qualified.
- In all other contexts, a column name must not be qualified.

Where a qualifier is optional it can serve two purposes. See "Column name qualifiers to avoid ambiguity" on page 131 and "Column name qualifiers in correlated references" on page 133 for details.

Correlation names

A correlation name can be defined in the FROM clause of a query and after the target table-name or view-name in an UPDATE or DELETE statement.

For example, the clause shown below establishes Z as a correlation name for X.MYTABLE:

FROM X.MYTABLE Z

Column names

A correlation name is associated with a table or view only within the context in which it is defined. Hence, the same correlation name can be defined for different purposes in different statements, or in different clauses of the same statement.

As a qualifier, a correlation name can be used to avoid ambiguity or to establish a correlated reference. A correlation name can also be used as a shorter name for a table or view. In the example that is shown above, Z might have been used merely to avoid having to enter X.MYTABLE more than once.

If a correlation name is specified for a table or view, any qualified reference to a column of that instance of the table or view must use the correlation name, rather than the table name or view name. For example, the reference to EMPLOYEE.PROJECT in the following example is incorrect, because a correlation name has been specified for EMPLOYEE:

```
FROM EMPLOYEE E ***INCORRECT***
WHERE EMPLOYEE.PROJECT='ABC'
```

The qualified reference to PROJECT should instead use the correlation name, "E", as shown below:

```
FROM EMPLOYEE E
WHERE E.PROJECT='ABC'
```

Names specified in a FROM clause are either *exposed* or *non-exposed*. A correlation name is always an exposed name. A table name or view name is said to be *exposed* in that FROM clause if a correlation name is not specified. For example, in the following FROM clause, a correlation name is specified for EMPLOYEE but not for DEPARTMENT, so DEPARTMENT is an exposed name, and EMPLOYEE is not:

```
FROM EMPLOYEE E, DEPARTMENT
```

A table name or view name that is exposed in a FROM clause must not be the same as any other table name or view name exposed in that FROM clause or any correlation name in the FROM clause. The names are compared after qualifying any unqualified table or view names.

The first two FROM clauses shown below are correct, because each one contains no more than one reference to EMPLOYEE that is exposed:

1. Given the FROM clause:

```
FROM EMPLOYEE E1, EMPLOYEE
```

a qualified reference such as EMPLOYEE.PROJECT denotes a column of the second instance of EMPLOYEE in the FROM clause. A qualified reference to the first instance of EMPLOYEE must use the correlation name "E1" (E1.PROJECT).

2. Given the FROM clause:

```
FROM EMPLOYEE, EMPLOYEE E2
```

a qualified reference such as EMPLOYEE.PROJECT denotes a column of the first instance of EMPLOYEE in the FROM clause. A qualified reference to the second instance of EMPLOYEE must use the correlation name "E2" (E2.PROJECT).

3. Given the FROM clause:

```
FROM EMPLOYEE, EMPLOYEE ***INCORRECT***
```

the two exposed table names included in this clause (EMPLOYEE and EMPLOYEE) are the same, and this is not allowed.

4. Given the following statement:

the qualified reference EMPLOYEE.PROJECT is incorrect, because both instances of EMPLOYEE in the FROM clause have correlation names. Instead, references to PROJECT must be qualified with either correlation name (E1.PROJECT or E2.PROJECT).

5. Given the FROM clause:

```
FROM EMPLOYEE, X.EMPLOYEE
```

a reference to a column in the second instance of EMPLOYEE must use X.EMPLOYEE (X.EMPLOYEE.PROJECT). This FROM clause is only valid if the authorization ID of the statement is not X.

A correlation name specified in a FROM clause must not be the same as:

- · Any other correlation name in that FROM clause
- Any unqualified table name or view name exposed in the FROM clause
- The second SQL identifier of any qualified table name or view name that is exposed in the FROM clause.

For example, the following FROM clauses are incorrect:

```
FROM EMPLOYEE E, EMPLOYEE E
FROM EMPLOYEE DEPARTMENT, DEPARTMENT ***INCORRECT***
FROM X.T1, EMPLOYEE T1
```

The following FROM clause is technically correct, though potentially confusing: **FROM** EMPLOYEE DEPARTMENT, DEPARTMENT EMPLOYEE

The use of a correlation name in the FROM clause also allows the option of specifying a list of column names to be associated with the columns of the result table. As with a correlation name, these listed column names become the exposed names of the columns that must be used for references to the columns throughout the query. If a column name list is specified, then the column names of the underlying table become non-exposed.

Given the FROM clause:

```
FROM DEPARTMENT D (NUM, NAME, MGR, ANUM, LOC)
```

a qualified reference such as D.NUM denotes the first column of the DEPARTMENT table that is defined in the table as DEPTNO. A reference to D.DEPTNO using this FROM clause is incorrect since the column name DEPTNO is a non-exposed column name.

If a list of columns is specified, it must consist of as many names as there are columns in the *table-reference*. Each column name must be unique and unqualified.

Column name qualifiers to avoid ambiguity

In the context of a function, a GROUP BY clause, an ORDER BY clause, an expression, or a search condition, a column name refers to values of a column in some target table or view in a DELETE or UPDATE statement or *table-reference* in a FROM clause.

Column names

The tables, views, and table-references 35 that might contain the column are called the object tables of the context. Two or more object tables might contain columns with the same name. One reason for qualifying a column name is to designate the object from which the column comes. For information about avoiding ambiguity between SQL parameters and variables and column names, see "References to SQL parameters and SQL variables" on page 1145.

A nested table expression which is preceded by a LATERAL or TABLE keyword will consider table-references that precede it in the FROM clause as object tables. The table-references that follow the nested table expression are not considered as object tables.

Table designators

A qualifier that designates a specific object table is called a table designator. The clause that identifies the object tables also establishes the table designators for

For example, the object tables of an expression in a SELECT clause are named in the FROM clause that follows it:

```
SELECT CORZ.COLA, OWNY.MYTABLE.COLA
  FROM OWNX.MYTABLE CORZ, OWNY.MYTABLE
```

Table designators in the FROM clause are established as follows:

- · A name that follows a table or view name is both a correlation name and a table designator. Thus, CORZ is a table designator. CORZ is used to qualify the first column name in the select list.
- In SQL naming, an exposed table or view name is a table designator. Thus, OWNY.MYTABLE is a table designator. OWNY.MYTABLE is used to qualify the second column name in the select list.
- In system naming, the table designator for an exposed table or view name is the unqualified table or view name. In the following example MYTABLE is the table designator for OWNY/MYTABLE.

```
SELECT CORZ.COLA, MYTABLE.COLA
  FROM OWNX/MYTABLE CORZ, OWNY/MYTABLE
```

Two or more object tables can be instances of the same table. In this case, distinct correlation names must be used to unambiguously designate the particular instances of the table. In the following FROM clause, X and Y are defined to refer, respectively, to the first and second instances of the table EMPLOYEE:

```
SELECT * FROM EMPLOYEE X, EMPLOYEE Y
```

Avoiding undefined or ambiguous references

When a column name refers to values of a column, it must be possible to resolve that column name to exactly one object table.

The following situations are considered errors:

- No object table contains a column with the specified name. The reference is
- The column name is qualified by a table designator, but the table designated does not include a column with the specified name. Again the reference is undefined.

^{35.} In the case of a joined-table, each table-reference within the joined-table is an object table.

- The name is unqualified and more than one object table includes a column with that name. The reference is ambiguous.
- The column name is qualified by a table designator, but the table designated is not unique in the FROM clause and both occurrences of the designated table include the column. The reference is ambiguous.
- The column name is in a nested table expression which is not preceded by the LATERAL or TABLE keyword or a table function or nested table expression that is the right operand of a right outer join, full outer join, or a right exception join and the column name does not refer to a column of a table-reference within the nested table expression's fullselect. The reference is undefined.

Avoid ambiguous references by qualifying a column name with a uniquely defined table designator. If the column is contained in several object tables with different names, the object table names can be used as designators. Ambiguous references can also be avoided without the use of the table designator by giving unique names to the columns of one of the object tables using the column name list following the correlation name.

When qualifying a column with the exposed table name form of a table designator, either the qualified or unqualified form of the exposed table name may be used. However, the qualifier used and the table used must be the same after fully qualifying the table name or view name and the table designator.

1. If the authorization ID of the statement is CORPDATA, then:

```
SELECT CORPDATA.EMPLOYEE.WORKDEPT FROM EMPLOYEE
```

is a valid statement.

2. If the authorization ID of the statement is REGION, then:

```
SELECT CORPDATA.EMPLOYEE.WORKDEPT
FROM EMPLOYEE
***INCORRECT***
```

is invalid, because EMPLOYEE represents the table REGION.EMPLOYEE, but the qualifier for WORKDEPT represents a different table, CORPDATA.EMPLOYEE.

3. If the authorization ID of the statement is REGION, then:

```
SELECT EMPLOYEE.WORKDEPT
FROM CORPDATA.EMPLOYEE ***INCORRECT***
```

is invalid, because EMPLOYEE in the select list represents the table REGION.EMPLOYEE, but the explicitly qualified table name in the FROM clause represents a different table, CORPDATA.EMPLOYEE. In this case, either omit the table qualifier in the select list, or define a correlation name for the table designator in the FROM clause and use that correlation name as the qualifier for column names in the statement.

Column name qualifiers in correlated references

A *subselect* is a form of a query that can be used as a component of various SQL statements.

Refer to Chapter 4, "Queries," on page 469 for more information about subselects. A *subquery* is a form of a fullselect that is enclosed within parentheses. For example, a *subquery* can be used in a search condition. A fullselect used in the FROM clause of a query is called a *nested table expression*.

A subquery can include search conditions of its own, and these search conditions can, in turn, include subqueries. Therefore, an SQL statement can contain a hierarchy of subqueries. Those elements of the hierarchy that contain subqueries are said to be at a higher level than the subqueries they contain.

Every element of the hierarchy has a clause that establishes one or more table designators. This is the FROM clause, except in the highest level of an UPDATE or DELETE statement. A search condition, the select list, the join clause, an argument of a table function in a subquery, or a nested table expression that is preceded by the LATERAL keyword can reference not only columns of the tables identified by the FROM clause of its own element of the hierarchy, but also columns of tables identified at any level along the path from its own element to the highest level of the hierarchy. A reference to a column of a table identified at a higher level is called a correlated reference. A reference to a column of a table identified at the same level from a nested table expression through the use of the LATERAL keyword is called lateral correlation.

A correlated reference to column C of table T can be of the form C, T.C, or Q.C, if Q is a correlation name defined for T. However, a correlated reference in the form of an unqualified column name is not good practice. The following explanation is based on the assumption that a correlated reference is always in the form of a qualified column name and that the qualifier is a correlation name.

Q.C is a correlated reference only if these three conditions are met:

- Q.C is used in a search condition, select list, join clause, or an argument of a table function in a subquery.
- Q does not designate a table used in the FROM clause of that subquery, select list, join clause, or an argument of a table function in a subquery.
- Q does designate a table used at some higher level.

Q.C refers to column C of the table or view at the level where Q is used as the table designator of that table or view. Because the same table or view can be identified at many levels, unique correlation names are recommended as table designators. If Q is used to designate a table at more than one level, Q.C refers to the lowest level that contains the subquery that includes Q.C.

In the following statement, Q is used as a correlation name for T1 and T2, but Q.C refers to the correlation name associated with T2, because it is the lowest level that contains the subquery that includes Q.C.

```
SELECT *
 FROM T1 Q
 WHERE A < ALL (SELECT B
                   FROM T2 Q
                   WHERE B < ANY (SELECT D
                                    FROM T3
                                    WHERE D = 0.C)
```

Unqualified column names in correlated references

An unqualified column name can also be a correlated reference.

If the column:

- · Is used in a search condition of a subquery
- Is not contained in a table used in the FROM clause of that subquery
- Is contained in a table used at some higher level

Column names

Unqualified correlated references are not recommended because it makes the SQL statement difficult to understand. The column will be implicitly qualified when the statement is prepared depending on which table the column was found in. Once this implicit qualification is determined it will not change until the statement is re-prepared. When an SQL statement that has an unqualified correlated reference is prepared or executed, a warning is returned (SQLSTATE 01545).

References to variables

A *variable* in an SQL statement specifies a value that can be changed when the SQL statement is executed.

There are several types of variables used in SQL statements:

host variable

Host variables are defined by statements of a host language. For more information about how to refer to host variables see "References to host variables."

transition variable

Transition variables are defined in a trigger and refer to either the old or new values of columns. For more information about how to refer to transition variables see "CREATE TRIGGER" on page 813.

SQL variable

SQL variables are defined by an SQL compound statement in an SQL function, SQL procedure, or trigger. For more information about SQL variables, see "References to SQL parameters and SQL variables" on page 1145.

SQL parameter

SQL parameters are defined in an CREATE FUNCTION (SQL Scalar), CREATE FUNCTION (SQL Table), or CREATE PROCEDURE (SQL) statement. For more information about SQL parameters, see "References to SQL parameters and SQL variables" on page 1145.

parameter marker

Variables cannot be referenced in dynamic SQL statements. Parameter markers are defined in an SQL descriptor and used instead. For more information about parameter markers, see Parameter Markers.

References to host variables

A *host variable* is a COBOL data item, an RPG field, or a PLI, REXX, C++, C, or Java variable that is referenced in an SQL statement. Host variables are defined by statements of the host language.

Host variables cannot be referenced in dynamic SQL statements; instead, parameter markers must be used. For more information on parameter markers, see "Variables in dynamic SQL" on page 140.

A *host variable* in an SQL statement must identify a host variable described in the program according to the rules for declaring host variables.

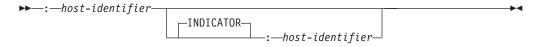
All host variables used in an SQL statement should be declared in an SQL declare section in all host languages other than Java, REXX, and RPG. Variables do not have to be declared in REXX. In Java and RPG, there is no declare section, and host variables may be declared throughout the program. No variables may be declared outside an SQL declare section with names identical to variables declared inside an SQL declare section. An SQL declare section begins with BEGIN DECLARE SECTION and ends with END DECLARE SECTION.

For further information about using host variables, see the Embedded SQL programming topic.

A variable in the INTO clause of a FETCH, a SELECT INTO, a SET variable, a GET DESCRIPTOR, or a VALUES INTO statement identifies a host variable to which a value from a result column is assigned. A variable in the GET DIAGNOSTICS statement identifies a host variable to which a diagnostic value is assigned. A host variable in a CALL or in an EXECUTE statement can be an output argument that is assigned a value after execution of the procedure, an input argument that provides an input value for the procedure, or both an input and output argument. In all other contexts a variable specifies a value to be passed to the database manager from the application program.

Non-Java variable references:

The general form of a variable reference in all languages other than Java is:



Each host-identifier must be declared in the source program. The variable designated by the second host-identifier is called an indicator variable and must have a data type of small integer. Indicator variables appear in two forms: normal indicator variables and extended indicator variables.

The purposes of normal indicator variable are to:

- Specify a non-null value. A 0 (zero), or positive value of the indicator variable specifies that the associated, first, host-identifier provides the value of this host variable reference.
- Specify the null value. A negative value of the indicator variable specifies the null value.
- On output, indicate that one of the following numeric conversion errors:
 - Numeric conversion error (underflow or overflow)
 - Arithmetic expression error (division by 0)
 - A numeric value that is not valid

A -2 value of the indicator variable indicates a null result because of one of these warnings.

- On output, indicate one of the following string errors:
 - Characters could not be converted
 - Mixed data not properly formed

A -2 value of the indicator variable indicates a null result because of one of these warnings.

- On output, indicate one of the following datetime errors:
 - Date or timestamp conversion error (a date or timestamp that is not within the valid range of the dates for the specified format)
 - String representation of the datetime value is not valid

A -2 value of the indicator variable indicates a null result because of one of these warnings.

- On output, indicate one of the following miscellaneous errors:
 - Argument of SUBSTR scalar function is out of range
 - Argument of a decryption function contains a data type that is not valid.

References to variables

A -2 value of the indicator variable indicates a null result because of one of these warnings.

- On output, record the original length of a string if the string is truncated on assignment to a host variable. If the string is truncated and there is no indicator variable, no error condition results.
- On output, record the seconds portion of a time if the time is truncated on assignment to a host variable. If the time is truncated and there is no indicator variable, no error condition results.

For example, if :V1:V2 is used to specify an insert or update value, and if V2 is negative, the value specified is the null value. If V2 is not negative the value specified is the value of V1.

Similarly, if :V1:V2 is specified in a CALL, FETCH, SELECT INTO, or VALUES INTO statement and the value returned is null, V1 is undefined, and V2 is set to a negative value. The negative value is:

- -1 if the value selected was the null value, or
- -2 if the null value was returned due to data mapping errors in the select list of an outer subselect. ³⁶

If the value returned is not null, that value is assigned to V1 and V2 is set to zero (unless the assignment to V1 requires string truncation, in which case, V2 is set to the original length of the string). If an assignment requires truncation of the seconds part of time, V2 is set to the number of seconds.

If the second *host-identifier* is omitted, the *host variable* does not have an indicator variable. The value specified by the *host variable*:V1 is always the value of V1, and null values cannot be assigned to the variable. Thus, this form should not be used unless the corresponding result column cannot contain null values. If this form is used and the column contains nulls, the database manager will return an error at run-time (SQLSTATE 23502).

Extended indicator variables are limited to input host variables. Their purposes are:

- Specify a non-null value. A 0 (zero) value specifies that the associated *host identifier* provides that value of this host variable reference.
- Specify the null value. A -1, -2, -3, -4, and -6 value specifies the null value.
- Specify the DEFAULT value. A -5 value specifies that the target column for this host variable is to be set to its default value.
- Specify an UNASSIGNED value. A -7 value specifies that the target column for this host variable is to be treated as if it hadn't been specified in the statement.

Extended indicator variables are only enabled if requested. Otherwise all indicator variables are normal indicator variables. In comparison to normal indicator variables, extended indicator variables have no additional restrictions for where null and non-null values can be used. Extended indicators can be used in indicator structures with host structures. Restrictions on where the extended indicator variable values of DEFAULT and UNASSIGNED are allowed apply uniformly, no matter how they are represented in the host application. The DEFAULT and UNASSIGNED extended indicator variables can only be used as an expression

^{36.} It should be noted that although the null value returned for data mapping errors can be returned on certain scalar functions and for arithmetic expressions, the result column is not considered null capable unless an argument of the arithmetic expression or scalar function is null capable.

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containing a single host parameter that is being assigned to a column. Output indicator variable values are never extended indicator variables.

When extended indicator variables are enabled, indicator variable values other than positive values, zero, and the six negative values listed previously must not be used. The DEFAULT and UNASSIGNED values must not appear in contexts where they are not supported.

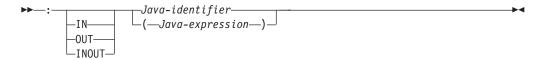
An SQL statement that references host variables in C, C++, ILE RPG, and PL/I, must be within the scope of the declaration of those host variables. For host variables referenced in the SELECT statement of a cursor, that rule applies to the OPEN statement rather than to the DECLARE CURSOR statement.

The CCSID of a string host variable is either:

- The CCSID specified in the DECLARE VARIABLE statement, or
- If a DECLARE VARIABLE with a CCSID clause is not specified for the host variable, the default CCSID of the application requester at the time the SQL statement that contains the host variable is executed unless the CCSID is for a foreign encoding scheme other than Unicode (such as ASCII). In this case, the host variable is converted to the default CCSID of the current server.

Java variable references:

The general form of a host variable reference in Java is:



In Java, indicator variables are not used. Instead, instances of a Java class can be set to a null value. Variables defined as Java primitive types cannot be set to a null value.

If IN, OUT, or INOUT is not specified, the default depends on the context in which the variable is used. If the Java variable is used in an INTO clause, OUT is the default. Otherwise, IN is the default. For more information about Java variables, see IBM Developer Kit for Java.

Example

Using the PROJECT table, set the host variable PNAME (VARCHAR(26)) to the project name (PROJNAME), the host variable STAFF (DECIMAL(5,2)) to the mean staffing level (PRSTAFF), and the host variable MAJPROJ (CHAR(6)) to the major project (MAJPROJ) for project (PROJNO) 'IF1000'. Columns PRSTAFF and MAJPROJ may contain null values, so provide indicator variables STAFF_IND (SMALLINT) and MAJPROJ_IND (SMALLINT).

```
SELECT PROJNAME, PRSTAFF, MAJPROJ
 INTO :PNAME, :STAFF :STAFF_IND, :MAJPROJ :MAJPROJ_IND
  FROM PROJECT
 WHERE PROJNO = 'IF1000'
```

Variables in dynamic SQL

In dynamic SQL statements, parameter markers are used instead of variables. A parameter marker is a question mark (?) that represents a position in a dynamic SQL statement where the application will provide a value; that is, where a variable would be found if the statement string were a static SQL statement.

The following examples shows a static SQL that uses host variables and a dynamic statement that uses parameter markers:

```
INSERT INTO DEPT
  VALUES( :HV_DEPTNO, :HV_DEPTNAME, :HV_MGRNO:IND_MGRNO, :HV_ADMRDEPT)
INSERT INTO DEPT
  VALUES( ?, ?, ?, ? )
```

For more information about parameter markers, see Parameter Markers.

References to LOB variables

You can define regular LOB variables, LOB locator variables, and LOB file reference variables.

The following host languages Regular LOB variables, LOB locator variables, and LOB file reference variables can be defined in the following host languages:

- C
- C++
- ILE RPG
- ILE COBOL
- PL/I

Where LOBs are allowed, the term *variable* in a syntax diagram can refer to a regular variable, a locator variable, or a file reference variable. Since these variables are not native data types in host programming languages, SQL extensions are used and the precompilers generate the host language constructs necessary to represent each variable.

When it is possible to define a variable that is large enough to hold an entire LOB value and the performance benefit of delaying the transfer of data from the server is not required, a LOB locator is not needed. However, it is often not acceptable to store an entire LOB value in temporary storage due to host language restrictions, storage restrictions, or performance requirements. When storing a entire LOB value at one time is not acceptable, a LOB value can be referred to by a LOB locator and portions of the LOB value can be accessed.

References to LOB locator variables

A LOB *locator variable* is a variable that contains the locator representing a LOB value on the application server.

LOB locator variables can be defined in the following host languages:

- C
- C++
- ILE RPG
- ILE COBOL
- PL/I

See "Manipulating large objects with locators" on page 74 for information about how locators can be used to manipulate LOB values.

A locator variable in an SQL statement must identify a LOB locator variable described in the program according to the rules for declaring locator variables. This is always indirectly through an SQL statement. For example, in C:

```
static volatile SQL TYPE IS CLOB_LOCATOR *loc1;
```

Like all other variables, a LOB locator variable can have an associated indicator variable. Indicator variables for LOB locator variables behave in the same way as indicator variables for other data types. When a null value is returned from the database, the indicator variable is set and the variable is unchanged. When the indicator variable associated with a LOB locator is null, the value of the referenced LOB is null. This means that a locator can never point to a null value.

If a locator variable does not currently represent any value, an error occurs when the locator variable is referenced.

At transaction commit or any transaction termination, all LOB locators that were acquired by the transaction are released.

It is the application programmer's responsibility to guarantee that any LOB locator is only used in SQL statements that are executed at the same application server that originally generated the LOB locator. For example, assume that a LOB locator is returned from one application server and assigned to a LOB locator variable. If that LOB locator variable is subsequently used in an SQL statement that is executed at a different application server, unpredictable results will occur.

References to LOB file reference variables

A LOB file reference variable is used for direct file input and output for a LOB

A LOB file reference variable can be defined in the following host languages:

- C
- C++
- ILE RPG
- ILE COBOL
- PL/I

Since these are not native data types, SQL extensions are used and the precompilers generate the host language constructs necessary to represent each variable.

A file reference variable represents (rather than contains) the file, just as a LOB locator represents, rather than contains, the LOB data. Database queries, updates, and inserts may use file reference variables to store or to retrieve single column values. The file referenced must exist at the application requester.

Like all other variables, a file reference variable can have an associated indicator variable. Indicator variables for file reference variables behave in the same way as indicator variables for other data types. When a null value is returned from the database, the indicator variable is set and the variable is unchanged. When the indicator variable associated with a file reference variable is null, the value of the referenced LOB is null. This means that a file reference variable can never point to a null value.

The length attribute of a file reference variable is assumed to be the maximum length of a LOB.

File reference variables are currently supported in the root (/), QOpenSys, and UDFS file systems. When a file is created, it is given the CCSID of the data that is being written to the file. Currently, mixed CCSIDs are not supported. To use a file created with a file reference variable, the file should be opened in binary mode.

For more information about file reference variables, see the SQL programming topic collection.

Host structures

A host structure is a COBOL group, PL/I, C, or C++ structure, or RPG data structure that is referenced in an SQL statement. In Java and REXX, there is no equivalent to a host structure.

Host structures are defined by statements of the host language, as explained in the Embedded SQL programming topic collection. As used here, the term host structure does not include an SQLCA or SQLDA.

The form of a host structure reference is identical to the form of a host variable reference. The reference :S1:S2 is a host structure reference if S1 names a host structure. If S1 designates a host structure, S2 must be either a small integer variable, or an array of small integer variables. S1 is the host structure and S2 is its indicator array.

A host structure can be referenced in any context where a list of host variables can be referenced. A host structure reference is equivalent to a reference to each of the host variables contained within the structure in the order which they are defined in the host language structure declaration. The nth variable of the indicator array is the indicator variable for the *n*th variable of the host structure.

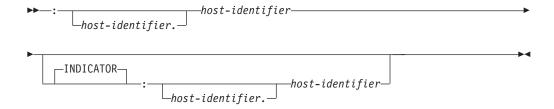
In C, for example, if V1, V2, and V3 are declared as variables within the structure S1, the statement:

```
EXEC SQL FETCH CURSOR1 INTO :S1;
is equivalent to:
   EXEC SQL FETCH CURSOR1 INTO :V1, :V2, :V3;
```

If the host structure has *m* more variables than the indicator array, the last *m* variables of the host structure do not have indicator variables. If the host structure has m fewer variables than the indicator array, the last m variables of the indicator array are ignored. These rules also apply if a reference to a host structure includes an indicator variable or if a reference to a host variable includes an indicator array. If an indicator array or indicator variable is not specified, no variable of the host structure has an indicator variable.

In addition to structure references, individual host variables in the host structure or indicator variables in the indicator array can be referenced by qualified names. The qualified form is a host identifier followed by a period and another host identifier. The first host identifier must name a host structure, and the second host identifier must name a host variable within that host structure.

The general form of a host variable or host structure reference is:



A *host-variable* in an expression must identify a host variable (not a structure) described in the program according to the rules for declaring host variables.

The following C example shows a references to host structure, host indicator array, and a host variable:

```
struct { char empno[7];
                struct
                                  { short int firstname_len;
                                    char firstname text[12];
                                  } firstname;
                char midint,
                struct
                                  { short int lastname len;
                                    char lastname text[15];
                                   lastname;
                char workdept[4];
       } pemp1;
short ind[14];
short eind
struct { short ind1;
         short ind2;
       } indstr;
strcpy(pemp1.empno,"000220");
EXEC SQL
  SELECT *
    INTO :pemp1:ind
    FROM corpdata.employee
    WHERE empno=:pemp1.empno;
```

In the example above, the following references to host variables and host structures are valid:

```
:pemp1 :pemp1.empno :pemp1.empno:eind :pemp1.empno:indstr.ind1
```

For more information about how to refer to host structures in C, C++, COBOL, PL/I, and RPG, see the Embedded SQL programming topic collection.

Host structure arrays

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In PL/I, C++, and C, a host structure array is a structure name having a dimension attribute. In COBOL, it is a one-dimensional table. In RPG, it is an occurrence data structure. In ILE RPG, it can also be a data structure with the keyword DIM.

A host structure array can only be referenced in the FETCH statement when using a multiple-row fetch, or in an INSERT statement when using a multiple-row insert. Host structure arrays are defined by statements of the host language, as explained in the Embedded SQL programming topic collection.

The form of a host structure array is identical to the form of a host variable reference. The reference :S1:S2 is a reference to host structure array if S1 names a host structure array. If S1 designates a host structure, S2 must be either a small

References to variables

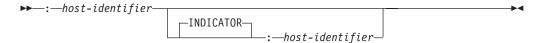
integer host variable, an array of small integer host variables, or a two dimensional array of small integer host variables. In the following example, S1 is the host structure array and S2 is its indicator array.

```
EXEC SQL FETCH CURSOR1 FOR 5 ROWS
          INTO :S1:S2;
```

The dimension of the host structure and the indicator array must be equal.

If the host structure has m more variables than the indicator array, the last mvariables of the host structure do not have indicator variables. If the host structure has m fewer variables than the indicator array, the last m variables of the indicator array are ignored. If an indicator array or variable is not specified, no variable of the host structure array has an indicator variable.

The following diagram specifies the syntax of references to an array of host structures:



Arrays of host structures are not supported in REXX.

A *function* is an operation denoted by a function name followed by one or more operands that are enclosed in parentheses. It represents a relationship between a set of input values and a set of result values. The input values to a function are called *arguments*. For example, a function can be passed two input arguments that have date and time data types and return a value with a timestamp data type as the result.

Types of functions

There are several ways to classify functions.

One way to classify functions is as built-in, user-defined, or generated user-defined functions for distinct types.

Built-in functions are functions that come with the database manager. These
functions provide a single-value result. Built-in functions include operator
functions such as "+", aggregate functions such as AVG, and scalar functions
such as SUBSTR. For a list of the built-in aggregate and scalar functions and
information about these functions, see Chapter 3, "Built-in functions," on page
203.

The built-in functions are part of schema QSYS2. 37

User-defined functions are functions that are created using the CREATE
FUNCTION statement and registered to the database manager in catalog table
QSYS2.SYSROUTINES and catalog view QSYS2.SYSFUNCS. For more
information, see "CREATE FUNCTION" on page 655. These functions allow
users to extend the function of the database manager by adding their own or
third party vendor function definitions.

A user-defined function is either an *SQL*, *external*, or *sourced* function. An *SQL* function is defined to the database using only *SQL* statements. An external function is defined to the database with a reference to an external program or service program that is executed when the function is invoked. A sourced function is defined to the database with a reference to a built-in function or another user-defined function. Sourced functions can be used to extend built-in aggregate and scalar functions for use on distinct types.

A user-defined function resides in the schema in which it was created. The schema cannot be QSYS, QSYS2, or QTEMP.

Generated user-defined functions for distinct types are functions that the database
manager automatically generates when a distinct type is created using the
CREATE TYPE statement. These functions support casting from the distinct type
to the source type and from the source type to the distinct type. The ability to
cast between the data types is important because a distinct type is compatible
only with itself.

The generated cast functions reside in the same schema as the distinct type for which they were created. The schema cannot be QSYS, QSYS2, or QTEMP. For more information about the functions that are generated for a distinct type, see "CREATE TYPE" on page 827.

Another way to classify functions is as aggregate, scalar, or table functions, depending on the input data values and result values.

^{37.} Built-in functions are implemented internally by the database manager, so an associated program or service program object does not exist for a built-in function. Furthermore, the catalog does not contain information about built-in functions. However, built-in functions can be treated as if they exist in QSYS2 and a built-in function name can be qualified with QSYS2.

Functions

- An aggregate function receives a set of values for each argument (such as the
 values of a column) and returns a single-value result for the set of input values.
 Aggregate functions are sometimes called *column functions*. Built-in functions and
 user-defined sourced functions can be aggregate functions.
- A scalar function receives a single value for each argument and returns a single-value result. Built-in functions and user-defined functions can be scalar functions. Generated user-defined functions for distinct types are also scalar functions.
- A table function returns a table for the set of arguments it receives. Each
 argument is a single value. A table function can only be referenced in the FROM
 clause of a subselect. A table function can be defined as an external function or
 as an SQL function, but a table function cannot be a sourced function.

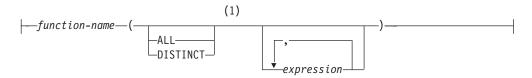
Table functions can be used to apply SQL language processing power to data that is not stored in the database or to allow access to such data as if it were stored in a table. For example, a table function can read a file, get data from the Web, or access a Lotus Notes[®] database and return a result table.

Function invocation

Each reference to a scalar or aggregate function (either built-in or user-defined) conforms to specific syntax.

The syntax is as follows: 38

function-invocation:



Notes:

1 The ALL or DISTINCT keyword can be specified only for an aggregate function or a user-defined function that is sourced on an aggregate function.

Each reference to a table function conforms to the following syntax:



In the above syntax, *expression* is the same as it is for a scalar or aggregate function. See "Expressions" on page 152 for other rules for *expression*.

When the function is invoked, the value of each of its parameters is assigned, using storage assignment, to the corresponding parameter of the function. Control is passed to external functions according to the calling conventions of the host language. When execution of a user-defined aggregate or scalar function is

^{38.} A few functions allow keywords instead of expressions. For example, the CHAR function allows a list of keywords to indicate the desired date format. A few functions use keywords instead of commas in a comma separated list of expressions. For example, the EXTRACT, TRIM, and POSITION functions use keywords.

complete, the result of the function is assigned, using storage assignment, to the result data type. For details on the assignment rules, see "Assignments and comparisons" on page 89.

Table functions can be referenced only in the FROM clause of a subselect. For more details on referencing a table function, see the description of the FROM clause in "table-reference" on page 475.

Function resolution

A function is invoked by its function name, which is implicitly or explicitly qualified with a schema name, followed by parentheses that enclose the arguments to the function.

Within the database, each function is uniquely identified by its function signature, which is its schema name, function name, the number of parameters, and the data types of the parameters. Thus, a schema can contain several functions that have the same name but each of which have a different number of parameters, or parameters with different data types. Or, a function with the same name, number of parameters, and types of parameters can exist in multiple schemas. When any function is invoked, the database manager must determine which function to execute. This process is called *function resolution*.

Function resolution is similar for functions that are invoked with a qualified or unqualified function name with the exception that for an unqualified name, the database manager needs to search more than one schema.

- Qualified function resolution: When a function is invoked with a function name and a schema name, the database manager only searches the specified schema to resolve which function to execute. The database manager selects candidate functions based on the following criteria:
 - The name of the function instance matches the name in the function invocation.
 - The number of input parameters in the function instance matches the number of arguments in the function invocation.
 - The authorization ID of the statement must have the EXECUTE privilege to the function instance.
 - The data type of each input argument of the function invocation matches or is promotable to the data type of the corresponding parameter of the function instance.

If no function in the schema meets these criteria, an error is returned. If a function is selected, its successful use depends on it being invoked in a context in which the returned result is allowed. For example, if the function returns an integer data type where a character data type is required, or returns a table where a table is not allowed, an error is returned.

- Unqualified function resolution: When a function is invoked with only a function name, the database manager needs to search more than one schema to resolve the function instance to execute. The SQL path contains the list of schemas to search. For each schema in the SQL path (see "SQL path" on page 60), the database manager selects candidate functions based on the following criteria:
 - The name of the function instance matches the name in the function invocation.
 - The number of input parameters in the function instance matches the number of function arguments in the function invocation.

Functions

- The authorization ID of the statement must have the EXECUTE privilege to the function instance.
- The data type of each input argument of the function invocation matches or is promotable to the data type of the corresponding parameter of the function instance.

If no function in the schema meets these criteria, an error is returned. If a function is selected, its successful use depends on it being invoked in a context in which the returned result is allowed. For example, if the function returns an integer data type where a character data type is required, or returns a table where a table is not allowed, an error is returned.

After the database manager identifies the candidate functions, it selects the candidate with the best fit as the function instance to execute (see "Determining the best fit"). If more than one schema contains the function instance with the best fit (the function signatures are identical except for the schema name), the database manager selects the function whose schema is earliest in the SQL path.

Function resolution applies to all functions, including built-in functions. Built-in functions logically exist in schema QSYS2. If schema QSYS2 is not explicitly specified in the SQL path, the schema is implicitly assumed at the front of the path. When an unqualified function name is specified, the SQL path must be set to a list of schemas in the desired search order so that the intended function is selected.

In a CREATE VIEW or CREATE TABLE statement, function resolution occurs at the time the view or materialized table is created. If another function with the same name is subsequently created, the view or materialized query table is not affected, even if the new function is a better fit than the one chosen at the time the view or materialized table was created. In a CREATE FUNCTION, CREATE PROCEDURE, or CREATE TRIGGER statement, function resolution occurs at the time the function, procedure, or trigger is created. The schema of the function that was chosen is saved in the function, procedure, or trigger. If another function with the same name is subsequently created, the function, procedure, or trigger is only affected if the new function is created in the same schema and is a better fit than the one chosen at the time the function, procedure, or trigger was created.

Determining the best fit

There might be more than one function with the same name that is a candidate for execution. In that case, the database manager determines which function is the best fit for the invocation by comparing the argument and parameter data types. Note that the data type of the result of the function or the type of function (aggregate, scalar, or table) under consideration does not enter into this determination.

If the data types of all the parameters for a given function are the same as those of the arguments in the function invocation, that function is the best fit. When determining whether the data types of the parameters are the same as the arguments:

- Synonyms of data types match. For example, REAL and FLOAT, and DOUBLE and FLOAT are considered to be the same.
- Attributes of a data type such as length, precision, scale, and CCSID are ignored. Therefore, CHAR(8) and CHAR(35) are considered to be the same, as are DECIMAL(11,2), and DECIMAL(4,3).

. | | | • The character and graphic types are considered to be the same. For example, the following are considered to be the same type: CHAR and GRAPHIC, VARCHAR and VARGRAPHIC, and CLOB and DBCLOB. CHAR(13) and GRAPHIC(8) are considered to be the same type.

If there is no match, the database manager compares the data types in the parameter lists from left to right, using the following method:

- 1. Compare the data type of the first argument in the function invocation to the data type of the first parameter in each function. (The rules previously mentioned are used to determine whether the data types are the same.)
- 2. For this argument, if one function has a data type that fits the function invocation better than the data types in the other functions, that function is the best fit. The precedence list for the promotion of data types in "Promotion of data types" on page 84 shows the data types that fit each data type in best-to-worst order.
- 3. If the data type of the first parameter for more than one candidate function fits the function invocation equally well, repeat this process for the next argument of the function invocation. Continue for each argument until a best fit is found.

The following examples illustrate function resolution.

Example 1: Assume that MYSCHEMA contains two functions, both named FUNA, that were created with these partial CREATE FUNCTION statements.

```
CREATE FUNCTION MYSCHEMA.FUNA (VARCHAR(10), INT, DOUBLE) ... CREATE FUNCTION MYSCHEMA.FUNA (VARCHAR(10), REAL, DOUBLE) ...
```

Also assume that a function with three arguments of data types VARCHAR(10), SMALLINT, and DECIMAL is invoked with a qualified name:

```
MYSCHEMA.FUNA ( VARCHARCOL, SMALLINTCOL, DECIMALCOL ) ...
```

Both MYSCHEMA.FUNA functions are candidates for this function invocation because they meet the criteria specified in "Function resolution" on page 147. The data types of the first parameter for the two function instances in the schema, which are both VARCHAR, fit the data type of the first argument of the function invocation, which is VARCHAR, equally well. However, for the second parameter, the data type of the first function (INT) fits the data type of the second argument (SMALLINT) better than the data type of second function (REAL). Therefore, the database manager selects the first MYSCHEMA.FUNA function as the function instance to execute.

Example 2: Assume that functions were created with these partial CREATE FUNCTION statements:

```
1. CREATE FUNCTION SMITH.ADDIT (CHAR(5), INT, DOUBLE) ...
2. CREATE FUNCTION SMITH.ADDIT (INT, INT, DOUBLE) ...
3. CREATE FUNCTION SMITH.ADDIT (INT, INT, DOUBLE, INT) ...
4. CREATE FUNCTION JOHNSON.ADDIT (INT, DOUBLE, DOUBLE) ...
5. CREATE FUNCTION JOHNSON.ADDIT (INT, INT, DOUBLE) ...
6. CREATE FUNCTION TODD.ADDIT (REAL) ...
7. CREATE FUNCTION TAYLOR.SUBIT (INT, INT, DECIMAL) ...
```

Also assume that the SQL path at the time an application invokes a function is "TAYLOR", "JOHNSON", "SMITH". The function is invoked with three data types (INT, INT, DECIMAL) as follows:

```
SELECT ... ADDIT(INTCOL1, INTCOL2, DECIMALCOL) ...
```

Function 5 is chosen as the function instance to execute based on the following evaluation:

- Function 6 is eliminated as a candidate because schema TODD is not in the SQL path.
- Function 7 in schema TAYLOR is eliminated as a candidate because it does not have the correct function name.
- Function 1 in schema SMITH is eliminated as a candidate because the INT data type is not promotable to the CHAR data type of the first parameter of Function 1.
- Function 3 in schema SMITH is eliminated as a candidate because it has the wrong number of parameters.
- Function 2 is a candidate because the data types of its parameters match or are promotable to the data types of the arguments.
- Both Function 4 and 5 in schema JOHNSON are candidates because the data types of their parameters match or are promotable to the data types of the arguments. However, Function 5 is chosen as the better candidate because although the data types of the first parameter of both functions (INT) match the first argument (INT), the data type of the second parameter of Function 5 (INT) is a better match of the second argument (INT) than the data type of Function 4 (DOUBLE).
- Of the remaining candidates, Function 2 and 5, the database manager selects
 Function 5 because schema JOHNSON comes before schema SMITH in the SQL
 path.

Example 3: Assume that functions were created with these partial CREATE FUNCTION statements:

```
1. CREATE FUNCTION BESTGEN.MYFUNC (INT, DECIMAL(9,0)) ...
```

- 2. CREATE FUNCTION KNAPP.MYFUNC (INT, NUMERIC(8,0))...
- 3. CREATE FUNCTION ROMANO.MYFUNC (INT, NUMERIC(8,0))...
- 4. CREATE FUNCTION ROMANO.MYFUNC (INT, FLOAT) ...

Also assume that the SQL path at the time an application invokes a function is "ROMANO", "KNAPP", "BESTGEN" and that the authorization ID of the statement has the EXECUTE privilege to Functions 1, 2, and 4. The function is invoked with two data types (SMALLINT, DECIMAL) as follows:

```
SELECT ... MYFUNC(SINTCOL1, DECIMALCOL) ...
```

Function 2 is chosen as the function instance to execute based on the following evaluation:

- Function 3 is eliminated. It is not a candidate for this function invocation because the authorization ID of the statement does not have the EXECUTE privilege to the function. The remaining three functions are candidates for this function invocation because they meet the criteria specified in "Function resolution" on page 147.
- Function 4 in schema ROMANO is eliminated because the second parameter (FLOAT) is not as good a fit for the second argument (DECIMAL) as the second parameter of either Function 1 (DECIMAL) or Function 2 (NUMERIC).
- The second parameters of Function 1 (DECIMAL) and Function 2 (NUMERIC) are equally good fits for the second argument (DECIMAL).
- Function 2 is finally chosen because "KNAPP" precedes "BESTGEN" in the SQL path.

| | | |

Best fit considerations

Once the function is selected, there are still possible reasons why the use of the function may not be permitted. Each function is defined to return a result with a specific data type. If this result data type is not compatible within the context in which the function is invoked, an error will occur.

For example, given functions named STEP defined with different data types as the result:

```
STEP(SMALLINT) RETURNS CHAR(5)
STEP(DOUBLE) RETURNS INTEGER
```

and the following function reference (where S is a SMALLINT column):

```
SELECT ... 3 +STEP(S)
```

then, because there is an exact match on argument type, the first STEP is chosen. An error occurs on the statement because the result type is CHAR(5) instead of a numeric type as required for an argument of the addition operator.

In cases where the arguments of the function invocation were not an exact match to the data types of the parameters of the selected function, the arguments are converted to the data type of the parameter at execution using the same rules as assignment to columns (see "Assignments and comparisons" on page 89). This includes the case where precision, scale, length, or CCSID differs between the argument and the parameter.

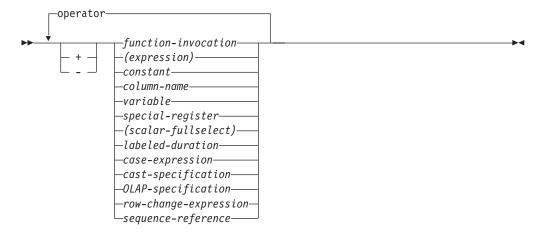
An error also occurs in the following examples:

- The function is referenced in the TABLE clause of a FROM clause, but the function selected by the function resolution step is a scalar or aggregate function.
- The function referenced in an SQL statement requires a scalar or aggregate function, but the function selected by the function resolution step is a table function.

An expression specifies a value.

Authorization: The use of some of the expressions, such as a *scalar-fullselect*, *sequence-reference*, *function-invocation*, or *cast-specification* may require having the appropriate authorization. For these expressions, the privileges held by the authorization ID of the statement must include the following authorization:

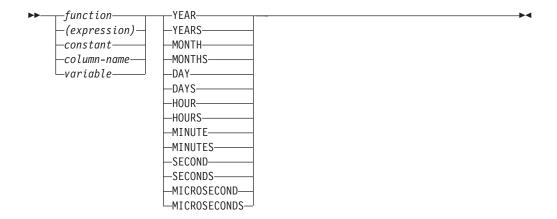
- *scalar-fullselect*. For information about authorization considerations, see Chapter 4, "Queries," on page 469.
- *sequence-reference*. The authorization to reference the sequence. For information about authorization considerations, see "Notes" on page 180.
- *function-invocation*. The authorization to execute a user-defined function. For information about authorization considerations, see "Function invocation" on page 146.
- *cast-specification*. The authorization to reference a user-defined type. For information about authorization considerations, see "CAST specification" on page 170.



operator:



labeled-duration:



Without operators

If no operators are used, the result of the expression is the specified value.

Example

SALARY :SALARY 'SALARY' MAX (SALARY)

With arithmetic operators

If arithmetic operators are used, the result of the expression is a number derived from the application of the operators to the values of the operands.

If any operand can be null, the result can be null. If any operand has the null value, the result of the expression is the null value.

If one operand of an arithmetic operator is numeric, the other operand can be a string. The string is first converted to the data type of the numeric operand and must contain a valid string representation of a number.

The prefix operator + (*unary plus*) does not change its operand. The prefix operator - (*unary minus*) reverses the sign of a nonzero non-decimal floating-point operand. The prefix operator - (unary minus) reverses the sign of all decimal floating-point operands, including zero and special values; that is, signalling and non-signalling NaNs and plus and minus infinity. If the data type of A is small integer, the data type of - A is large integer. The first character of the token following a prefix operator must not be a plus or minus sign.

The *infix operators*, +, -, *, /, and **, specify addition, subtraction, multiplication, division, and exponentiation, respectively. The value of the second operand of division must not be zero.

In COBOL, blanks must precede and follow a minus sign to avoid any ambiguity with COBOL host variable names (which allow use of a dash).

The result of an exponentiation (**) operator is a double-precision floating-point number. The result of the other operators depends on the type of the operand.

Operands with a NUMERIC data type are converted to DECIMAL operands prior to performing the arithmetic operation.

Two integer operands

If both operands of an arithmetic operator are integers with zero scale, the operation is performed in binary, and the result is a large integer unless either (or both) operand is a big integer, in which case the result is a big integer. Any remainder of division is lost. The result of an integer arithmetic operation (including unary minus) must be within the range of large or big integers. If either integer operand has nonzero scale, it is converted to a decimal operand with the same precision and scale.

Integer and decimal operands

If one operand is an integer with zero scale and the other is decimal, the operation is performed in decimal using a temporary copy of the integer that has been converted to a decimal number with precision and scale 0.

This is defined in the following table:

Operand	Precision of Decimal Copy
Column or variable: big integer	19
Column or variable: large integer	11
Column or variable: small integer	5
Constant (including leading zeros)	Same as the number of digits in the constant

If one operand is an integer with nonzero scale, it is first converted to a decimal operand with the same precision and scale.

Two decimal operands

If both operands are decimal, the operation is performed in decimal. The result of any decimal arithmetic operation is a decimal number with a precision and scale that are dependent on the operation and the precision and scale of the operands. If the operation is addition or subtraction and the operands do not have the same scale, the operation is performed with a temporary copy of one of the operands. The copy of the shorter operand is extended with trailing zeros so that its fractional part has the same number of digits as the longer operand.

Unless specified otherwise, all functions and operations that accept decimal numbers allow a precision of up to 63 digits. The result of a decimal operation must not have a precision greater than 63.

Decimal arithmetic in SQL

The following formulas define the precision and scale of the result of decimal operations in SQL. The symbols p and s denote the precision and scale of the first operand and the symbols p' and s' denote the precision and scale of the second operand.

The symbol mp denotes the maximum precision. The value of mp is 63 if:

- either w or y is greater than 31, or
- a value of 63 was explicitly specified for the maximum precision.

Otherwise, the value of *mp* is 31.

The symbol ms denotes the maximum scale. The default value of ms is 31. ms can be explicitly set to any number from 0 to the maximum precision.

The symbol *mds* denotes the minimum divide scale. The default value of *mds* is 0. mds can be explicitly set to any number from 0 to the maximum scale.

The maximum precision, maximum scale, and minimum divide scale can be explicitly specified on the DECRESULT parameter of the CRTSQLxxx command, RUNSQLSTM command, or SET OPTION statement. They can also be specified in ODBC data sources, JDBC properties, OLE DB properties, .NET properties.

Addition and subtraction

The scale of the result of addition and subtraction is max (s,s'). The precision is $\min(mp,\max(p-s,p'-s') + \max(s,s')+1).$

Multiplication

The precision of the result of multiplication is min (mp,p+p') and the scale is $\min(ms,s+s')$.

Division

The precision of the result of division is $(p-s+s') + \max(mds, \min(ms, mp - (p-s+s')))$). The scale is max(mds, min(ms, mp - (p-s+s'))). The scale must not be negative.

Floating-point operands

If either operand of an arithmetic operator is floating point and neither operand is decimal floating point, the operation is performed in floating point. The operands are first converted to double-precision floating-point numbers, if necessary. Thus, if any element of an expression is a floating-point number, the result of the expression is a double-precision floating-point number.

An operation involving a floating-point number and an integer is performed with a temporary copy of the integer converted to double-precision floating point. An operation involving a floating-point number and a decimal number is performed with a temporary copy of the decimal number that has been converted to double-precision floating point. The result of a floating-point operation must be within the range of floating-point numbers.

The order in which floating-point operands (or arguments to functions) are processed can slightly affect results because floating-point operands are approximate representations of real numbers. Since the order in which operands are processed may be implicitly modified by the optimizer (for example, the optimizer may decide what degree of parallelism to use and what access plan to use), an application should not depend on the results being precisely the same each time an SQL statement is executed that uses floating-point operands.

Decimal floating-point operands

If either operand of an arithmetic operator is decimal floating-point, the operation is performed in decimal floating-point.

Integer and DECFLOAT(n) operands

If one operand is a small integer and the other is DECFLOAT, the operation is performed in DECFLOAT(n) using a temporary copy of the integer that has been converted to a DECFLOAT(n) number. If one operand is a big integer and the other is DECFLOAT, then a temporary copy of the big integer is converted to a

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Expressions

DECFLOAT(34) number. The rules for two DECFLOAT operands are then applied.

Decimal and DECFLOAT(n) operands

If one operand is a decimal and the other is DECFLOAT, the operation is performed in DECFLOAT using a temporary copy of the decimal number that has been converted to a DECFLOAT number based on the precision of the decimal number. If the decimal number has a precision < 17, the decimal number is converted to DECFLOAT(16). Otherwise, the decimal number is converted to a DECFLOAT(34) number. The rules for two DECFLOAT operands are then applied.

Floating-point and DECFLOAT(n) operands

If one operand is floating-point (real or double) and the other is DECFLOAT, the operation is performed in DECFLOAT(n) using a temporary copy of the floating-point number that has been converted to a DECFLOAT(n) number.

Two DECFLOAT operands

If both operands are DECFLOAT(n), the operation is performed in DECFLOAT(n). If one operand is DECFLOAT(16) and the other is DECFLOAT(34), the operation is performed in DECFLOAT(34).

General arithmetic operation rules for DECFLOAT

The following general rules apply to all arithmetic operations on the DECFLOAT data type.

• Every operation on finite numbers is carried out (as described under the individual operations) as though an exact mathematical result is computed, using integer arithmetic on the coefficient where possible.

If the coefficient of the theoretical exact result has no more than the number of digits that reflect its precision (16 or 34), then (unless there is an underflow or overflow) it is used for the result without change. Otherwise, it is rounded (shortened) to exactly the number of digits that reflect its precision (16 or 34) and the exponent is increased by the number of digits removed.

Rounding uses the DECFLOAT rounding mode. For more information, see "CURRENT DECFLOAT ROUNDING MODE" on page 122.

If the value of the adjusted exponent of the result is less than E_{min} , then a warning is returned. ³⁹ In this case, the calculated coefficient and exponent form the result, unless the value of the exponent is less than E_{tiny} , in which case the exponent will be set to E_{tiny} , the coefficient is rounded (possibly to zero) to match the adjustment of the exponent, and the sign is unchanged. If this rounding gives an inexact result then an underflow warning is returned. ³⁹

If the value of the adjusted exponent of the result is larger than E_{max} then an overflow exception is returned. In this case, the result may be infinite. It will have the same sign as the theoretical result.

- Arithmetic using the special value Infinity follows the usual rules, where negative Infinity is less than every finite number and positive Infinity is greater than every finite number. Under these rules, an infinite result is always exact. Certain uses of Infinity raise an invalid operation warning.³⁹
- Signaling NaNs always raise the invalid operation code when used as an operand of an arithmetic operation.

^{39.} The warning is only returned if *YES is specified for the SQL_DECFLOAT_WARNINGS query option.

- The result of an arithmetic operation which has an operand which is a NaN, is NaN. The sign of the result is copied from the first operand which is a NaN. Whenever the result is a NaN, the sign of the result depends only on the copied operand.
- The sign of the result of a multiplication or division will be negative only if the operands have different signs and neither is a NaN.
- The sign of the result of an addition or subtraction will be negative only if the result is less than zero and neither operand is a NaN.

Examples involving special values

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```
INFINITY + 1
                 = INFINITY
INFINITY + INFINITY
                      = INFINITY
                     = NAN -- exception
INFINITY + -INFINITY
NAN + 1
             = NAN
NAN + INFINITY = NAN
1 - INFINITY = -INFINITY
INFINITY - INFINITY = NAN -- exception
-INFINITY - -INFINITY = NAN -- exception
-0.0 - 0.0E1 = -0.0
-1.0 * 0.0E1
                 = -0.0
               = INFINITY
1.0E1 / 0
-1.0E5 / 0.0 = -INFINITY
1.0E5 / -0 = -INFINITY
INFINITY / -INFINITY = NAN -- exception
INFINITY / 0 = INFINITY
-INFINITY / 0
                   = -INFINITY
-INFINITY / -0 = INFINITY
```

Distinct type operands

A distinct type cannot be used with arithmetic operators even if its source data type is numeric. To perform an arithmetic operation, create a function with the arithmetic operator as its source. For example, if there were distinct types INCOME and EXPENSES, both of which had DECIMAL(8,2) data types, then the following user-defined function, REVENUE, could be used to subtract one from the other.

```
CREATE FUNCTION REVENUE ( INCOME, EXPENSES )
RETURNS DECIMAL(8,2) SOURCE "-" ( DECIMAL, DECIMAL)
```

Alternately, the - (minus) operator could be overloaded using a user-defined function to subtract the new data types.

```
CREATE FUNCTION "-" ( INCOME, EXPENSES )
RETURNS DECIMAL(8,2) SOURCE "-" ( DECIMAL, DECIMAL)
```

Alternatively, the distinct type can be cast to a built-in type, and the result can be used as an operand of an arithmetic operator.

With the concatenation operator

If the concatenation operator (CONCAT or | | |) is used, the result of the expression is a string.

The operands of concatenation must be compatible strings or numeric data types. ⁴⁰ The operands must not be distinct types. If a numeric operand is specified, it is

^{40.} Using the vertical bar (|) character might inhibit code portability between relational database products. Use the CONCAT operator in place of the || operator. Alternatively, if conformance to SQL 2003 Core standard is of primary importance, use the || operator).

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CAST to the equivalent character string prior to concatenation. Note that a binary string cannot be concatenated with a character string unless the character string is defined as FOR BIT DATA.

The data type of the result is determined by the data types of the operands. The data type of the result is summarized in the following table:

Table 26. Result Data Types With Concatenation

If one operand column is	And the other operand is	The data type of the result column is
DBCLOB(x)	CHAR(y)* or VARCHAR(y)* or CLOB(y)* or GRAPHIC(y) or VARGRAPHIC(y) or DBCLOB(y)	DBCLOB(z) where $z = MIN(x + y, maximum length of a DBCLOB)$
VARGRAPHIC(x)	CHAR(y)* or VARCHAR(y)* or GRAPHIC(y) or VARGRAPHIC(y)	VARGRAPHIC(z) where $z = MIN(x + y, maximum length of a VARGRAPHIC)$
GRAPHIC(x)	CHAR(y)* mixed data	VARGRAPHIC(z) where $z = MIN(x + y, maximum length of a VARGRAPHIC)$
GRAPHIC(x)	CHAR(y)* SBCS data or GRAPHIC(y)	GRAPHIC(z) where $z = MIN(x + y, maximum length of a GRAPHIC)$
CLOB(x)*	GRAPHIC(y) or VARGRAPHIC(y)	DBCLOB(z) where $z = MIN(x + y, maximum length of a DBCLOB)$
VARCHAR(x)*	GRAPHIC(y)	VARGRAPHIC(z) where $z = MIN(x + y, maximum length of a VARGRAPHIC)$
CLOB(x)	CHAR(y) or VARCHAR(y) or CLOB(y)	CLOB(z) where $z = MIN(x + y, maximum length of a CLOB)$
VARCHAR(x)	CHAR(y) or VARCHAR(y)	VARCHAR(z) where $z = MIN(x + y, maximum length of a VARCHAR)$
CHAR(x) mixed data	CHAR(y)	VARCHAR(z) where $z = MIN(x + y, maximum length of a VARCHAR)$
CHAR(x) SBCS data	CHAR(y)	CHAR(z) where $z = MIN(x + y, maximum length of a CHAR)$
BLOB(x)	BINARY(y) or VARBINARY(y) or BLOB(y) or CHAR(y) FOR BIT DATA or VARCHAR(y) FOR BIT DATA	BLOB(z) where $z = MIN(x + y, maximum length of a BLOB)$
VARBINARY(x)	BINARY(y) or VARBINARY(y) or CHAR(y) FOR BIT DATA or VARCHAR(y) FOR BIT DATA	VARBINARY(z) where $z = MIN(x + y, maximum length of a VARBINARY)$
BINARY(x)	VARCHAR(y) FOR BIT DATA	VARBINARY(z) where $z = MIN(x + y, maximum length of a VARBINARY)$
BINARY(x)	BINARY(y) or CHAR(y) FOR BIT DATA	BINARY(z) where $z = MIN(x + y, maximum length of a BINARY)$

Table 26. Result Data Types With Concatenation (continued)

If one operand column is	And the other operand is	The data type of the result column is	
Note:			
* Character strings are only allowed when the other operand is a graphic string if the graphic string is Unicode.			

Table 27. Result Encoding Schemes With Concatenation

If one operand column is	And the other operand is	The data type of the result column is
Unicode data	Unicode data or DBCS or mixed or SBCS data	Unicode data
DBCS data	DBCS data	DBCS data
bit data	mixed or SBCS or bit data	bit data
mixed data	mixed or SBCS data	mixed data
SBCS data	SBCS data	SBCS data

If the sum of the lengths of the operands exceeds the maximum length attribute of the resulting data type:

- The length attribute of the result is the maximum length of the resulting data type. 41
- If only blanks are truncated no warning or error occurs.
- If non-blanks are truncated, an error occurs.

If either operand can be null, the result can be null, and if either is null, the result is the null value. Otherwise, the result consists of the first operand string followed by the second.

With mixed data this result will not have redundant shift codes "at the seam". Thus, if the first operand is a string ending with a "shift-in" character (X'0F'), while the second operand is a character string beginning with a "shift-out" character (X'0E'), these two bytes are eliminated from the result.

The actual length of the result is the sum of the lengths of the operands unless redundant shifts are eliminated; in which case, the actual length is two less than the sum of the lengths of the operands.

The CCSID of the result is determined by the CCSID of the operands as explained under "Conversion rules for operations that combine strings" on page 110. Note that as a result of these rules:

- If any operand is bit data, the result is bit data.
- If one operand is mixed data and the other is SBCS data, the result is mixed data. However, this does not necessarily mean that the result is well-formed mixed data.

^{41.} If the expression is in the select-list, the length attribute may be further reduced in order to fit within the maximum record size. For more information, see "Maximum row sizes" on page 807.

Example

Concatenate the column FIRSTNME with a blank and the column LASTNAME. FIRSTNME CONCAT ' ' CONCAT LASTNAME

Scalar fullselect

A scalar fullselect as supported in an expression is a fullselect, enclosed in parentheses, that returns a single row consisting of a single column value. If the fullselect does not return a row, the result of the expression is the null value. If the select list element is an expression that is simply a column name, the result column name is based on the name of the column. Otherwise, the result column is unnamed.

See "fullselect" on page 506 for more information.

A scalar fullselect is not allowed if the query specifies:

- · a distributed table,
- · a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- · a logical file built over multiple physical file members.

If the scalar fullselect is a subselect, it is also referred to as a scalar subselect. See "subselect" on page 470 for more information.

Datetime operands and durations

Datetime values can be incremented, decremented, and subtracted. These operations may involve decimal numbers called *durations*. A *duration* is a positive or negative number representing an interval of time.

There are four types of durations:

Labeled durations (see diagram on page 125)

A *labeled duration* represents a specific unit of time as expressed by a number (which can be the result of an expression) followed by one of the seven duration keywords: YEARS, MONTHS, DAYS, HOURS, MINUTES, SECONDS, or MICROSECONDS⁴². The number specified is converted as if it were assigned to a DECIMAL(15,0) number.

A labeled duration can only be used as an operand of an arithmetic operator in which the other operand is a value of data type DATE, TIME, or TIMESTAMP. Thus, the expression HIREDATE + 2 MONTHS + 14 DAYS is valid whereas the expression HIREDATE + (2 MONTHS + 14 DAYS) is not. In both of these expressions, the labeled durations are 2 MONTHS and 14 DAYS.

Date duration

A *date duration* represents a number of years, months, and days, expressed as a DECIMAL(8,0) number. To be properly interpreted, the number must have the format *yyyymmdd*, where *yyyy* represents the number of years, *mm*

^{42.} Note that the singular form of these keywords is also acceptable: YEAR, MONTH, DAY, HOUR, MINUTE, SECOND, and MICROSECOND.

the number of months, and *dd* the number of days. The result of subtracting one date value from another, as in the expression HIREDATE - BRTHDATE, is a date duration.

Time duration

A *time duration* represents a number of hours, minutes, and seconds, expressed as a DECIMAL(6,0) number. To be properly interpreted, the number must have the format *hhmmss* where *hh* represents the number of hours, *mm* the number of minutes, and *ss* the number of seconds. The result of subtracting one time value from another is a time duration.

Timestamp duration

A timestamp duration represents a number of years, months, days, hours, minutes, seconds, and microseconds, expressed as a DECIMAL(20,6) number. To be properly interpreted, the number must have the format yyyymmddhhmmsszzzzzz, where yyyy, mm, dd, hh, mm, ss, and zzzzzz represent, respectively, the number of years, months, days, hours, minutes, seconds, and microseconds. The result of subtracting one timestamp value from another is a timestamp duration.

Datetime arithmetic in SQL

The only arithmetic operations that can be performed on datetime values are addition and subtraction. If a datetime value is the operand of addition, the other operand must be a duration.

The specific rules governing the use of the addition operator with datetime values follow:

- If one operand is a date, the other operand must be a date duration or labeled duration of years, months, or days.
- If one operand is a time, the other operand must be a time duration or a labeled duration of hours, minutes, or seconds.
- If one operand is a timestamp, the other operand must be a duration. Any type of duration is valid.
- Neither operand of the addition operator can be an untyped parameter marker.

The rules for the use of the subtraction operator on datetime values are not the same as those for addition because a datetime value cannot be subtracted from a duration, and because the operation of subtracting two datetime values is not the same as the operation of subtracting a duration from a datetime value. The specific rules governing the use of the subtraction operator with datetime values follow:

- If the first operand is a date, the second operand must be a date, a date duration, a string representation of a date, or a labeled duration of years, months, or days.
- If the second operand is a date, the first operand must be a date, or a string representation of a date.
- If the first operand is a time, the second operand must be a time, a time duration, a string representation of a time, or a labeled duration of hours, minutes, or seconds.
- If the second operand is a time, the first operand must be a time, or string representation of a time.
- If the first operand is a timestamp, the second operand must be a timestamp, a string representation of a timestamp, or a duration.
- If the second operand is a timestamp, the first operand must be a timestamp or a string representation of a timestamp.

 Neither operand of the subtraction operator can be an untyped parameter marker.

Date arithmetic

Dates can be subtracted, incremented, or decremented.

Subtracting dates

If $DAY(DATE2) \leftarrow DAY(DATE1)$

The result of subtracting one date (DATE2) from another (DATE1) is a date duration that specifies the number of years, months, and days between the two dates. The data type of the result is DECIMAL(8,0). If DATE1 is greater than or equal to DATE2, DATE2 is subtracted from DATE1. If DATE1 is less than DATE2, however, DATE1 is subtracted from DATE2, and the sign of the result is made negative. The following procedural description clarifies the steps involved in the operation RESULT = DATE1 - DATE2.

```
then DAY(RESULT) = DAY(DATE1) - DAY(DATE2).
If DAY(DATE2) > DAY(DATE1)
  then DAY(RESULT) = N + DAY(DATE1) - DAY(DATE2)
    where N = the last day of MONTH(DATE2).
  MONTH(DATE2) is then incremented by 1.
If MONTH(DATE2) <= MONTH(DATE1)
  then MONTH(RESULT) = MONTH(DATE1) - MONTH(DATE2).
If MONTH(DATE2) > MONTH(DATE1)
  then MONTH(RESULT) = 12 + MONTH(DATE1) - MONTH(DATE2).
  YEAR(DATE2) is then incremented by 1.
```

For example, the result of DATE('3/15/2000') - '12/31/1999' is 215 (or, a duration of 0 years, 2 months, and 15 days).

Incrementing and decrementing dates

YEAR(RESULT) = YEAR(DATE1) - YEAR(DATE2).

The result of adding a duration to a date, or of subtracting a duration from a date, is itself a date. (For the purposes of this operation, a month denotes the equivalent of a calendar page. Adding months to a date, then, is like turning the pages of a calendar, starting with the page on which the date appears.) The result must fall between the dates January 1, 0001 and December 31, 9999 inclusive. If a duration of years is added or subtracted, only the year portion of the date is affected. The month is unchanged, as is the day unless the result would be February 29 of a non-leap-year. In this case, the day is changed to 28, an SQLSTATE of '01506' is assigned to the RETURNED_SQLSTATE condition area item in the SQL Diagnostics Area (or SQLWARN6 in the SQLCA is set to 'W') to indicate the end-of-month adjustment.

Similarly, if a duration of months is added or subtracted, only months and, if necessary, years are affected. The day portion of the date is unchanged unless the result would be invalid (September 31, for example). In this case, the day is set to the last day of the month, and SQLWARN6 in the SQLCA is set to 'W' to indicate the end-of-month adjustment.

Adding or subtracting a duration of days will, of course, affect the day portion of the date, and potentially the month and year. Adding a labeled duration of DAYS will not cause an end-of-month adjustment.

Date durations, whether positive or negative, may also be added to and subtracted from dates. As with labeled durations, the result is a valid date, and a warning indicator is set in the SQLCA whenever an end-of-month adjustment is necessary.

When a positive date duration is added to a date, or a negative date duration is subtracted from a date, the date is incremented by the specified number of years, months, and days, in that order. Thus DATE1 + X, where X is a positive DECIMAL(8,0) number, is equivalent to the expression:

• DATE1 + YEAR(X) YEARS + MONTH(X) MONTHS + DAY(X) DAYS

When a positive date duration is subtracted from a date, or a negative date duration is added to a date, the date is decremented by the specified number of days, months, and years, in that order. Thus, DATE1 - X, where X is a positive DECIMAL(8,0) number, is equivalent to the expression:

• DATE1 - DAY(X) DAYS - MONTH(X) MONTHS - YEAR(X) YEARS

When adding durations to dates, adding one month to a given date gives the same date one month later *unless* that date does not exist in the later month. In that case, the date is set to that of the last day of the later month. For example, January 28 plus one month gives February 28; and one month added to January 29, 30, or 31 results in either February 28 or, for a leap year, February 29.

Note: If one or more months is added to a given date and then the same number of months is subtracted from the result, the final date is not necessarily the same as the original date.

Also note that logically equivalent expressions may not produce the same result. For example:

• (DATE('2002–01–31') + 1 MONTH) + 1 MONTH will result in a date of 2002–03–28.

does not produce the same result as

• DATE('2002-01-31') + 2 MONTHS will result in a date of 2002-03-31.

The order in which labeled date durations are added to and subtracted from dates can affect the results. For compatibility with the results of adding or subtracting date durations, a specific order must be used. When labeled date durations are added to a date, specify them in the order of YEARS + MONTHS + DAYS. When labeled date durations are subtracted from a date, specify them in the order of DAYS - MONTHS - YEARS. For example, to add one year and one day to a date, specify:

• DATE1 + 1 YEAR + 1 DAY

To subtract one year, one month, and one day from a date, specify:

• DATE1 - 1 DAY - 1 MONTH - 1 YEAR

Time arithmetic

Times can be subtracted, incremented, or decremented.

Subtracting times

The result of subtracting one time (TIME2) from another (TIME1) is a time duration that specifies the number of hours, minutes, and seconds between the two times. The data type of the result is DECIMAL(6,0). If TIME1 is greater than or equal to TIME2, TIME2 is subtracted from TIME1. If TIME1 is less than TIME2, however, TIME1 is subtracted from TIME2, and the sign of the result is made negative. The following procedural description clarifies the steps involved in the operation RESULT = TIME1 - TIME2.

```
If SECOND(TIME2) <= SECOND(TIME1)
  then SECOND(RESULT) = SECOND(TIME1) - SECOND(TIME2).
If SECOND(TIME2) > SECOND(TIME1)
  then SECOND(RESULT) = 60 + SECOND(TIME1) - SECOND(TIME2).
  MINUTE(TIME2) is then incremented by 1.
If MINUTE(TIME2) <= MINUTE(TIME1)
  then MINUTE(RESULT) = MINUTE(TIME1) - MINUTE(TIME2).
If MINUTE(TIME2) > MINUTE(TIME1)
  then MINUTE(RESULT) = 60 + MINUTE(TIME1) - MINUTE(TIME2).
  HOUR(TIME2) is then incremented by 1.
HOUR(RESULT) = HOUR(TIME1) - HOUR(TIME2).
```

For example, the result of TIME('11:02:26') - '00:32:56' is 102930 (a duration of 10 hours, 29 minutes, and 30 seconds).

Incrementing and decrementing times

The result of adding a duration to a time, or of subtracting a duration from a time, is itself a time. Any overflow or underflow of hours is discarded, thereby ensuring that the result is always a time. If a duration of hours is added or subtracted, only the hours portion of the time is affected. The minutes and seconds are unchanged.

Similarly, if a duration of minutes is added or subtracted, only minutes and, if necessary, hours are affected. The seconds portion of the time is unchanged.

Adding or subtracting a duration of seconds will, of course, affect the seconds portion of the time, and potentially the minutes and hours.

Time durations, whether positive or negative, also can be added to and subtracted from times. The result is a time that has been incremented or decremented by the specified number of hours, minutes, and seconds, in that order. TIME1 + X, where "X" is a DECIMAL(6,0) number, is equivalent to the expression:

```
TIME1 + HOUR(X) HOURS + MINUTE(X) MINUTES + SECOND(X) SECONDS
```

Timestamp arithmetic

Timestamps can be subtracted, incremented, or decremented.

Subtracting timestamps

The result of subtracting one timestamp (TS2) from another (TS1) is a timestamp duration that specifies the number of years, months, days, hours, minutes, seconds, and microseconds between the two timestamps. The data type of the result is

DECIMAL(20,6). If TS1 is greater than or equal to TS2, TS2 is subtracted from TS1. If TS1 is less than TS2, however, TS1 is subtracted from TS2 and the sign of the result is made negative. The following procedural description clarifies the steps involved in the operation RESULT = TS1 - TS2.

```
If MICROSECOND(TS2) <= MICROSECOND(TS1)
     then MICROSECOND(RESULT) = MICROSECOND(TS1) -
    MICROSECOND(TS2).
```

```
If MICROSECOND(TS2) >MICROSECOND(TS1)
      then MICROSECOND(RESULT) = 1000000 +
      MICROSECOND(TS1) - MICROSECOND(TS2)
      and SECOND(TS2) is incremented by 1.
```

The seconds and minutes part of the timestamps are subtracted as specified in the rules for subtracting times.

```
If HOUR(TS2) <= HOUR(TS1)
     then HOUR(RESULT) = HOUR(TS1) - HOUR(TS2).
If HOUR(TS2) > HOUR(TS1)
     then HOUR(RESULT) = 24 + HOUR(TS1) - HOUR(TS2)
     and DAY(TS2) is incremented by 1.
```

The date part of the timestamps is subtracted as specified in the rules for subtracting dates.

Incrementing and decrementing timestamps

The result of adding a duration to a timestamp, or of subtracting a duration from a timestamp, is itself a timestamp. Date and time arithmetic is performed as previously defined, except that an overflow or underflow of hours is carried into the date part of the result, which must be within the range of valid dates. Microseconds overflow into seconds.

Precedence of operations

Expressions within parentheses are evaluated first. When the order of evaluation is not specified by parentheses, exponentiation is applied after prefix operators (such as -, unary minus) and before multiplication and division. Multiplication and division are applied before addition and subtraction. Operators at the same precedence level are applied from left to right.

The following table shows the priority of all operators.

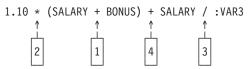
Priority	Operators
1	+, - (when used for signed numeric values)
2	**
3	*, /, CONCAT,
4	+, - (when used between two operands)

Example 1:

In this example, the first operation is the addition in (SALARY + BONUS) because it is within parenthesis. The second operation is multiplication because it is at a

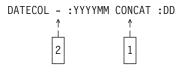
Expressions

higher precedence level than the second addition operator and it is to the left of the division operator. The third operation is division because it is at a higher precedence level than the second addition operator. Finally, the remaining addition is performed.



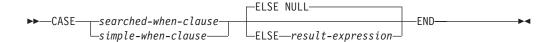
Example 2:

In this example, the first operation (CONCAT) combines the character strings in the variables YYYYMM and DD into a string representing a date. The second operation (-) then subtracts that date from the date being processed in DATECOL. The result is a date duration that indicates the time elapsed between the two dates.

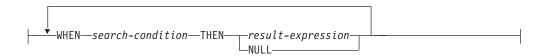


CASE expression

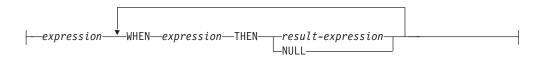
CASE expressions allow an expression to be selected based on the evaluation of one or more conditions.



searched-when-clause:



simple-when-clause:



In general, the value of the *case-expression* is the value of the *result-expression* following the first (leftmost) *when-clause* that evaluates to true. If no *when-clause* evaluates to true and the ELSE keyword is present then the result is the value of the ELSE *result-expression* or NULL. If no *when-clause* evaluates to true and the ELSE keyword is not present then the result is NULL. Note that when a *when-clause* evaluates to unknown (because of nulls), the *when-clause* is not true and hence is treated the same way as a *when-clause* that evaluates to false.

searched-when-clause

Specifies a *search-condition* that is applied to each row or group of table data presented for evaluation, and the result when that condition is true.

simple-when-clause

Specifies that the value of the *expression* prior to the first WHEN keyword is tested for equality with the value of the *expression* that follows each WHEN keyword. It also specifies the result when that condition is true.

The data type of the *expression* prior to the first WHEN keyword:

- must be compatible with the data types of the *expression* that follows each WHEN keyword.
- must not include a function that is non-deterministic or has an external action.

result-expression or NULL

Specifies the value that follows the THEN keyword and ELSE keywords. There must be at least one *result-expression* in the CASE expression with a defined data type. NULL cannot be specified for every case.

All *result-expressions* must have compatible data types, where the attributes of the result are determined based on the "Rules for result data types" on page 105.

search-condition

Specifies a condition that is true, false, or unknown about a row or group of table data.

The search-condition must not include a subquery in an EXISTS or IN predicate.

There are two scalar functions, NULLIF and COALESCE, that are specialized to handle a subset of the functionality provided by CASE. The following table shows the equivalent expressions using CASE or these functions.

Table 28. Equivalent CASE Expressions

CASE Expression	Equivalent Expression
CASE WHEN e1=e2 THEN NULL ELSE e1 END	NULLIF(e1,e2)
CASE WHEN e1 IS NOT NULL THEN e1 ELSE e2 END	COALESCE(e1,e2)
CASE WHEN e1 IS NOT NULL THEN e1 ELSE COALESCE(e2,,eN) END	COALESCE(e1,e2,,eN)

Examples

 If the first character of a department number is a division in the organization, then a CASE expression can be used to list the full name of the division to which each employee belongs:

```
SELECT EMPNO, LASTNAME,
CASE SUBSTR(WORKDEPT,1,1)
WHEN 'A' THEN 'Administration'
WHEN 'B' THEN 'Human Resources'
WHEN 'C' THEN 'Accounting'
WHEN 'D' THEN 'Design'
WHEN 'E' THEN 'Operations'
END
FROM EMPLOYEE
```

 The number of years of education are used in the EMPLOYEE table to give the education level. A CASE expression can be used to group these and to show the level of education.

```
SELECT EMPNO, FIRSTNME, MIDINIT, LASTNAME,
CASE
WHEN EDLEVEL < 15 THEN 'SECONDARY'
WHEN EDLEVEL < 19 THEN 'COLLEGE'
ELSE 'POST GRADUATE'
END
FROM EMPLOYEE
```

 Another interesting example of CASE statement usage is in protecting from division by 0 errors. For example, the following code finds the employees who earn more than 25% of their income from commission, but who are not fully paid on commission:

```
SELECT EMPNO, WORKDEPT, SALARY+COMM
FROM EMPLOYEE
WHERE (CASE WHEN SALARY=0 THEN NULL
ELSE COMM/SALARY
END) > 0.25
```

• The following CASE expressions are equivalent:

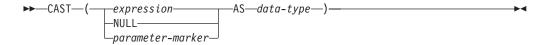
```
SELECT LASTNAME,
  CASE
  WHEN LASTNAME = 'Haas' THEN 'President'
  ...
  ELSE 'Unknown'
  END
FROM EMPLOYEE
```

Expressions

```
SELECT LASTNAME,
CASE LASTNAME
WHEN 'Haas' THEN 'President'
ELSE 'Unknown'
END
FROM EMPLOYEE
```

CAST specification

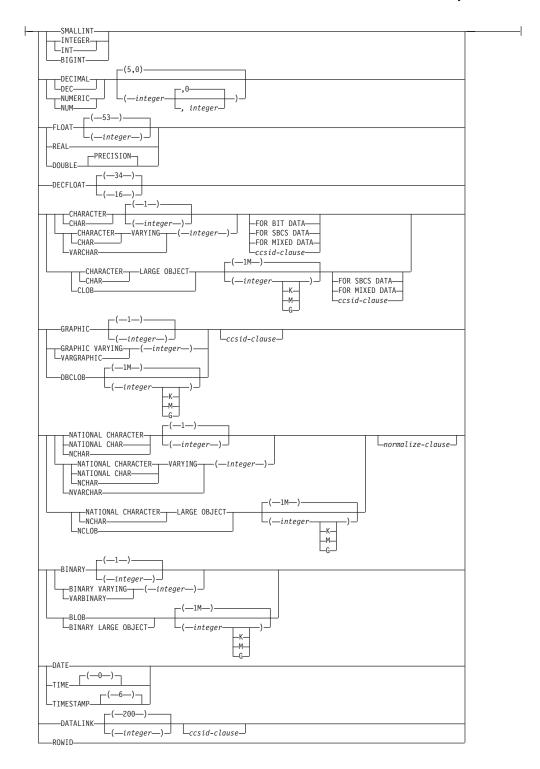
The CAST specification returns the cast operand (the first operand) cast to the type specified by the data-type.



data-type:

```
-built-in-type-
└distinct-type ┘
```

built-in-type:



ccsid-clause:

I

normalize-clause:

-NOT NORMALIZED-NORMALIZED-

The CAST specification returns the cast operand (the first operand) cast to the type specified by the *data-type*. If the data type of either operand is a distinct type, the privileges held by the authorization ID of the statement must include USAGE authority on the distinct type.

expression

Specifies that the cast operand is an expression other than NULL or a parameter marker. The result is the argument value converted to the specified target data type.

The supported casts are shown in "Casting between data types" on page 86, where the first column represents the data type of the cast operand (source data type) and the data types across the top represent the target data type of the CAST specification. If the cast is not supported, an error is returned.

When casting character or graphic strings to a character or graphic string with a different length, a warning is returned if truncation of other than trailing blanks occurs.

NULL

Specifies that the cast operand is the null value. The result is a null value that has the specified *data-type*.

parameter-marker

A parameter marker (specified as a question mark character) is normally considered an expression, but is documented separately in this case because it has a special meaning. If the cast operand is a parameter-marker, the specified data-type is considered a promise that the replacement will be assignable to the specified data-type (using storage assignment rules, see "Assignments and comparisons" on page 89). Such a parameter marker is called a typed parameter marker. Typed parameter markers will be treated like any other typed value for the purpose of DESCRIBE of a select list or for column assignment.

data-type

Specifies the data type of the result. If the data type is not qualified, the SQL path is used to find the appropriate data type. For more information, see "Unqualified distinct type, function, procedure, and specific names" on page 61. For a description of data-type, see "CREATE TABLE" on page 768. (For portability across operating systems, when specifying a floating-point data type, use REAL or DOUBLE instead of FLOAT.)

Restrictions on the supported data types are based on the specified cast operand.

- For a cast operand that is an *expression*, see Table 16 on page 87 for the target data types that are supported based on the data type of the cast operand.
- For a cast operand that is the keyword NULL, the target data type can be any data type.
- For a cast operand that is a parameter marker, the target data type can be any data type. If the data type is a distinct type, the application that uses the parameter marker will use the source data type of the distinct type.

If the CCSID attribute is not specified, then:

- If the *data-type* is BINARY, VARBINARY, or BLOB, a CCSID of 65535 is used.
- If FOR BIT DATA is specified, a CCSID of 65535 is used.

- If FOR SBCS DATA is specified, the single-byte CCSID associated with the CCSID of the *expression* is used.
- If FOR MIXED DATA is specified, the mixed-byte CCSID associated with the CCSID of the *expression* is used.
- Otherwise, the CCSID of the *expression* is used.
- If the *expression* is a character string, and the *data-type* is GRAPHIC, VARGRAPHIC, or DBCLOB; the CCSID 1200 is used.
- If the *expression* is a graphic string, and the *data-type* is GRAPHIC, VARGRAPHIC, or DBCLOB; the CCSID of the *expression* is used.
- Otherwise, the default CCSID of the current server is used.

If the CCSID attribute is specified, the data will be converted to that CCSID. If NORMALIZED is specified, the data will be normalized.

For information about which casts between data types are supported and the rules for casting to a data type see "Casting between data types" on page 86.

Examples

• An application is only interested in the integer portion of the SALARY column (defined as DECIMAL(9,2)) from the EMPLOYEE table. The following CAST specification will convert the SALARY column to INTEGER.

```
SELECT EMPNO, CAST(SALARY AS INTEGER)
FROM EMPLOYEE
```

• Assume that two distinct types exist. T_AGE was sourced on SMALLINT and is the data type for the AGE column in the PERSONNEL table. R_YEAR was sourced on INTEGER and is the data type for the RETIRE_YEAR column in the same table. The following UPDATE statement could be prepared.

```
UPDATE PERSONNEL SET RETIRE_YEAR = ?
WHERE AGE = CAST( ? AS T AGE )
```

The first parameter is an untyped parameter marker that would have a data type of R_YEAR. An explicit CAST specification is not required in this case because the parameter marker value is assigned to the distinct type.

The second parameter marker is a typed parameter marker that is cast to distinct type T_AGE. An explicit CAST specification is required in this case because the parameter marker value is compared to the distinct type.

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OLAP specifications

On-Line Analytical Processing (OLAP) specifications provide the ability to return ranking and row numbering as a scalar value in a query result.

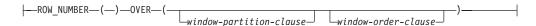
OLAP-specification:

-ordered-OLAP-specification--numbering-specification-

ordered-OLAP-specification:



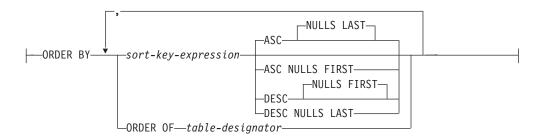
numbering-specification:



window-partition-clause:



window-order-clause:



An OLAP specification can be included in an expression in a select-list or the ORDER BY clause of a select-statement. The query result to which the OLAP specification is applied is the result table of the innermost subselect that includes the OLAP specification. OLAP specifications are sometimes referred to as window functions.

An OLAP specification is not valid in a WHERE, VALUES, GROUP BY, HAVING, or SET clause, or join-condition in an ON clause of a joined table. An OLAP specification cannot be used as an argument of an aggregate function in the select-list.

When invoking an OLAP specification, a window is specified that defines the rows over which the function is applied, and in what order.

The data type of the result of RANK, DENSE_RANK, or ROW_NUMBER is BIGINT. The result cannot be null.

ordered-OLAP-specification

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Specifies OLAP operations that required a window-order-clause.

RANK or DENSE_RANK

Specifies that the ordinal rank of a row within the window is computed. Rows that are not distinct with respect to the ordering within their window are assigned the same rank. The results of ranking may be defined with or without gaps in the numbers resulting from duplicate values.

RANK

Specifies that the rank of a row is defined as 1 plus the number of rows that strictly precede the row. Thus, if two or more rows are not distinct with respect to the ordering, then there will be one or more gaps in the sequential rank numbering.

DENSE_RANK

Specifies that the rank of a row is defined as 1 plus the number of preceding rows that are distinct with respect to the ordering. Therefore, there will be no gaps in the sequential rank numbering.

numbering-specification

Specifies an OLAP operation that returns sequential numbers for each row.

ROW NUMBER

Specifies that a sequential row number is computed for the row within the window defined by the ordering, starting with 1 for the first row. If the ORDER BY clause is not specified in the window, the row numbers are assigned to the rows in arbitrary order, as returned by the subselect (not according to any ORDER BY clause in the select-statement).

window-partition-clause

Defines the partition within which the OLAP operation is applied.

PARTITION BY (partitioning-expression,...)

Defines the partition within which the OLAP operation is applied. A partitioning-expression is an expression used in defining the partitioning of the result set. Each column name referenced in a partitioning-expression must unambiguously reference a result set column of the OLAP specification subselect statement. A partitioning-expression cannot include a scalar-fullselect or any function that is not deterministic or has an external action.

window-order-clause

Defines the ordering of rows within a partition that is used to determine the value of the OLAP specification. It does not define the ordering of the result table.

ORDER BY (sort-key-expression,...)

A sort-key-expression is an expression used in defining the ordering of the rows within a window partition. Each column name referenced in a sort-key-expression must unambiguously reference a column of the result table of the subselect, including the OLAP specification. A sort-key-expression cannot include a scalar-fullselect or any function that is not deterministic or that has an external action.

Specifies that the values of the *sort-key-expression* are used in ascending order.

Expressions

DESC

Specifies that the values of the *sort-key-expression* are used in descending order.

NULLS FIRST

Specifies that the window ordering considers null values before all non-null values in the sort order.

NULLS LAST

Specifies that the window ordering considers null values after all non-null values in the sort order.

ORDER OF table-designator

Specifies that the same ordering used in *table-designator* should be applied to the result table of the subselect. There must be a table reference matching *table-designator* in the FROM clause of the subselect that specifies this clause and the table reference must identify a *nested-table-expression* or *common-table-expression*. The subselect (or fullselect) corresponding to the specified *table-designator* must include an ORDER BY clause that is dependent on the data. The ordering that is applied is the same as if the columns of the ORDER BY clause in the nested subselect (or fullselect) were included in the outer subselect (or fullselect), and these columns were specified in place of the ORDER OF clause.

Partitioning and ordering are performed in accordance with the comparison rules described in "Assignments and comparisons" on page 89.

If a collating sequence other than *HEX is in effect when the statement that contains the OLAP expression is executed, and the *partitioning-expressions* or the *sort-key-expressions* are SBCS data, mixed data, or Unicode data, then the results are determined using the weighted values. The weighted values are derived by applying the collating sequence to the *partitioning-expressions* and the *sort-key-expressions*.

An OLAP specification is not allowed if the query specifies:

- · a distributed table,
- a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

Note: Syntax alternatives: DENSERANK can be specified in place of DENSE_RANK, and ROWNUMBER can be specified in place of ROW_NUMBER.

Examples

• Display the ranking of employees, in order by surname, according to their total salary (based on salary plus bonus) that have a total salary more than \$30,000:

```
SELECT EMPNO, LASTNAME, FIRSTNME, SALARY+BONUS AS TOTAL_SALARY, RANK() OVER (ORDER BY SALARY+BONUS DESC) AS RANK_SALARY FROM EMPLOYEE
WHERE SALARY+BONUS > 30000
ORDER BY LASTNAME
```

Note that if the result is to be ordered by the ranking, then replace ORDER BY LASTNAME with:

ORDER BY RANK SALARY

or:

```
ORDER BY RANK() OVER (ORDER BY SALARY+BONUS DESC)
```

• Rank the departments according to their average total salary:

```
SELECT WORKDEPT, AVG(SALARY+BONUS) AS AVG_TOTAL_SALARY,
RANK() OVER (ORDER BY AVG( SALARY+BONUS) DESC) AS RANK_AVG_SAL
FROM EMPLOYEE
GROUP BY WORKDEPT
ORDER BY RANK AVG SAL
```

Rank the employees within a department according to their education level.
 Having multiple employees with the same rank in the department should not increase the next ranking value:

```
SELECT WORKDEPT, EMPNO, LASTNAME, FIRSTNME, EDLEVEL,

DENSE_RANK() OVER (PARTITION BY WORKDEPT ORDER BY EDLEVEL DESC) AS RANK_EDLEVEL
FROM EMPLOYEE
ORDER BY WORKDEPT, LASTNAME
```

Provide row numbers in the result of a query:

```
SELECT ROW_NUMBER() OVER (ORDER BY WORKDEPT, LASTNAME ) AS NUMBER,
LASTNAME, SALARY
FROM EMPLOYEE
ORDER BY WORKDEPT, LASTNAME
```

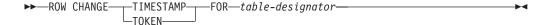
• List the top five wage earners:

```
SELECT EMPNO, LASTNAME, FIRSTNME, TOTAL_SALARY, RANK_SALARY
FROM (SELECT EMPNO, LASTNAME, FIRSTNME, SALARY+BONUS AS TOTAL_SALARY,
RANK() OVER (ORDER BY SALARY+BONUS DESC) AS RANK_SALARY
FROM EMPLOYEE) AS RANKED_EMPLOYEE
WHERE RANK_SALARY < 6
ORDER BY RANK_SALARY
```

Note that a nested table expression was used to first compute the result, including the rankings, before the rank could be used in the WHERE clause. A common table expression could also have been used.

ROW CHANGE expression

A ROW CHANGE expression returns a token or a timestamp that represents the last change to a row.



ROW CHANGE TIMESTAMP

Specifies that a timestamp is returned that represents the last time when a row was changed. If the row has not been changed, the result is the time that the initial value was inserted. If the table does not have a row change timestamp, this expression is not allowed.

ROW CHANGE TOKEN

Specifies that a token that is a BIGINT value is returned that represents a relative point in the modification sequence of a row. If the row has not been changed, the result is a token that represents when the initial value was inserted.

The result can be the null value. These expressions are not deterministic.

FOR *table-designator*

Specifies a table designator of the subselect. For more information about table designators, see "Table designators" on page 132. In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified. The table designator cannot identify a table function or a *data-change-table-reference*. If the table designator identifies a view or a nested table expression, the expression returns the ROW CHANGE TOKEN or ROW CHANGE TIMESTAMP of its base table.

Example

• Find all rows that have been changed in the last day:

```
SELECT *
FROM ORDERS
WHERE ROW CHANGE TIMESTAMP FOR ORDERS > CURRENT TIMSTAMP - 24 HOURS
```

Sequence reference

A sequence is referenced by using the NEXT VALUE and PREVIOUS VALUE expressions specifying the name of the sequence.

sequence-reference:



prevval-expression:

```
----PREVIOUS VALUE--FOR--sequence-name-
```

A sequence is referenced by using the NEXT VALUE and PREVIOUS VALUE expressions specifying the name of the sequence.

nextval-expression

A NEXT VALUE expression generates and returns the next value for a specified sequence. A new value is generated for a sequence when a NEXT VALUE expression specifies the name of the sequence. However, if there are multiple instances of a NEXT VALUE expression specifying the same sequence name within a query, the sequence value is incremented only once for each row of the result, and all instances of NEXT VALUE return the same value for a row of the result. NEXT VALUE is a non-deterministic expression with external actions since it causes the sequence value to be incremented.

When the next value for the sequence is generated, if the maximum value for an ascending sequence or the minimum value for a descending sequence of the logical range of the sequence is exceeded and the NO CYCLE option is in effect, then an error is returned.

The data type and length attributes of the result of a NEXT VALUE expression are the same as for the specified sequence. The result cannot be null.

prevval-expression

A PREVIOUS VALUE expression returns the most recently generated value for the specified sequence for a previous statement within the current application process. This value can be repeatedly referenced by using PREVIOUS VALUE expressions and specifying the name of the sequence. There may be multiple instances of PREVIOUS VALUE expressions specifying the same sequence name within a single statement and they all return the same value.

A PREVIOUS VALUE expression can be used only if a NEXT VALUE expression specifying the same sequence name has already been referenced in the current application process.

The data type and length attributes of the result of a PREVIOUS VALUE expression are the same as for the specified sequence. The result cannot be null.

sequence-name

Identifies the sequence to be referenced. The sequence-name must identify a sequence that exists at the current server.

Notes

Authorization: If a sequence is referenced in a statement, the privileges held by the authorization ID of the statement must include at least one of the following:

- · For the sequence identified in the statement,
 - The USAGE privilege on the sequence, and
 - The system authority *EXECUTE on the library containing the sequence
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Sequence.

Generating values with NEXT VALUE: When a value is generated for a sequence, that value is consumed, and the next time that a value is requested, a new value will be generated. This is true even when the statement containing the NEXT VALUE expression fails or is rolled back.

Scope of PREVIOUS VALUE: The PREVIOUS VALUE value persists until the next value is generated for the sequence in the current session, the sequence is dropped or altered, or the application session ends. The value is unaffected by COMMIT or ROLLBACK statements.

If a client application or middleware product manages a pool of connections and routes individual transactions to an arbitrary connection in the pool, the application should only rely on the PREVIOUS VALUE for a sequence until the end of the transaction.

Use as a Unique Key Value: The same sequence number can be used as a unique key value in two separate tables by referencing the sequence number with a NEXT VALUE expression for the first row (this generates the sequence value), and a PREVIOUS VALUE expression for the other rows (the instance of PREVIOUS VALUE refers to the sequence value most recently generated in the current session), as shown below:

```
INSERT INTO ORDER (ORDERNO, CUSTNO)
  VALUES (NEXT VALUE FOR ORDER_SEQ, 123456)

INSERT INTO LINE_ITEM (ORDERNO, PARTNO, QUANTITY)
  VALUES (PREVIOUS VALUE FOR ORDER SEQ, 987654, 1)
```

Allowed use of NEXT VALUE and PREVIOUS VALUE: NEXT VALUE and PREVIOUS VALUE expressions can be specified in the following places:

- Within the select-clause of a SELECT statement or SELECT INTO statement as long as the statement does not contain a DISTINCT keyword, a GROUP BY clause, an ORDER BY clause, a UNION keyword, an INTERSECT keyword, or EXCEPT keyword
- Within a VALUES clause of a *fullselect* (NEXT VALUE is not allowed)
- · Within a VALUES clause of an INSERT statement
- Within the select-clause of the fullselect of an INSERT statement
- Within the SET clause of a searched or positioned UPDATE statement, though NEXT VALUE cannot be specified in the *select-clause* of the subselect of an expression in the SET clause

A PREVIOUS VALUE expression can be specified anywhere within a SET clause of an UPDATE statement, but a NEXT VALUE expression can be specified only

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in a SET clause if it is not within the *select-clause* of the fullselect of an expression. For example, the following uses of sequence expressions are supported:

```
UPDATE T SET C1 = (SELECT PREVIOUS VALUE FOR S1 FROM T)

UPDATE T SET C1 = PREVIOUS VALUE FOR S1

UPDATE T SET C1 = NEXT VALUE FOR S1
```

The following use of a sequence expression is not supported:

```
UPDATE T SET C1 = (SELECT NEXT VALUE FOR S1 FROM T)
```

• Within an *assignment-statement*, except within the *select-clause* of the fullselect of an expression. The following uses of sequence expressions are supported:

```
SET :ORDERNUM = NEXT VALUE FOR INVOICE

SET :ORDERNUM = PREVIOUS VALUE FOR INVOICE
```

The following use of a sequence expression is not supported:

```
SET :X = (SELECT NEXT VALUE FOR S1 FROM T)

SET :X = (SELECT PREVIOUS VALUE FOR S1 FROM T)
```

- Within a VALUES or VALUES INTO statement though not within the *select-clause* of the fullselect of an expression
- Within the SQL-routine-body of a CREATE PROCEDURE statement
- Within the *SQL-trigger-body* of a CREATE TRIGGER statement (PREVIOUS VALUE is not allowed)

Restrictions on the use of NEXT VALUE and PREVIOUS VALUE: NEXT VALUE and PREVIOUS VALUE expressions cannot be specified in the following places:

- Within a materialized query table definition in a CREATE TABLE or ALTER TABLE statement
- · Within a CHECK constraint
- Within a view definition
- Within the SQL-routine-body of a CREATE FUNCTION statement

In addition, the NEXT VALUE expression cannot be specified in the following places:

CASE expression

- Parameter list of an aggregate function
- · Subquery in a context other than those explicitly allowed
- SELECT statement for which the outer SELECT contains a DISTINCT operator or a GROUP BY clause
- SELECT statement for which the outer SELECT is combined with another SELECT statement using the UNION, INTERSECT, or EXCEPT operator
- Join condition of a join
- · Nested table expression
- · Parameter list of a table function
- *select-clause* of the fullselect of an expression in the SET clause of an UPDATE statement
- WHERE clause of the outermost SELECT statement or a DELETE, or UPDATE statement
- ORDER BY clause of the outermost SELECT statement

IF, WHILE, DO . . . UNTIL, or CASE statements in an SQL routine

Using sequence expressions with a cursor: Normally, a SELECT NEXT VALUE FOR ORDER_SEQ FROM T1 would produce a result table containing as many generated values from the sequence ORDER_SEQ as the number of rows retrieved from T1. A reference to a NEXT VALUE expression in the SELECT statement of a cursor refers to a value that is generated for a row of the result table. A sequence value is generated for a NEXT VALUE expression each time a row is retrieved.

If blocking is done at a client in a DRDA environment, sequence values may get generated at the DB2 server before the processing of an application's FETCH statement. If the client application does not explicitly FETCH all the rows that have been retrieved from the database, the application will never see all those generated values of the sequence (as many as the rows that were not FETCHed). These values may constitute a gap in the sequence.

A reference to the PREVIOUS VALUE expression in a SELECT statement of a cursor is evaluated at OPEN time. In other words, a reference to the PREVIOUS VALUE expression in the SELECT statement of a cursor refers to the last value generated by this application process for the specified sequence prior to the opening of the cursor. Once evaluated at OPEN time, the value returned by PREVIOUS VALUE within the body of the cursor will not change from FETCH to FETCH, even if NEXT VALUE is invoked within the body of the cursor. After the cursor is closed, the value of PREVIOUS VALUE will be the last NEXT VALUE generated by the application process.

Syntax alternatives: The keywords NEXTVAL and PREVVAL can be used as alternatives for NEXT VALUE and PREVIOUS VALUE respectively.

Examples

 Assume that there is a table called ORDER, and that a sequence called ORDER_SEQ is created as follows:

```
CREATE SEQUENCE ORDER SEQ
 START WITH 1
 INCREMENT BY 1
 NO MAXVALUE
 NO CYCLE
 CACHE 24
```

Following are some examples of how to generate an ORDER_SEQ sequence number with a NEXT VALUE expression:

```
INSERT INTO ORDER (ORDERNO, CUSTNO)
  VALUES (NEXT VALUE FOR ORDER SEQ, 123456)
UPDATE ORDER
  SET ORDERNO = NEXT VALUE FOR ORDER SEQ
  WHERE CUSTNO = 123456
VALUES NEXT VALUE FOR ORDER
  INTO :HV SEQ
```

Predicates

A predicate specifies a condition that is true, false, or unknown about a given row or group.

The following rules apply to all types of predicates:

- Predicates are evaluated after the expressions that are operands of the predicate.
- All values specified in the same predicate must be compatible.
- The value of a variable may be null (that is, the variable may have a negative indicator variable).
- The CCSID conversion of operands of predicates involving two or more operands are done according to "Conversion rules for comparison:" on page 102.
- Use of a DataLink value is limited to the NULL predicate.

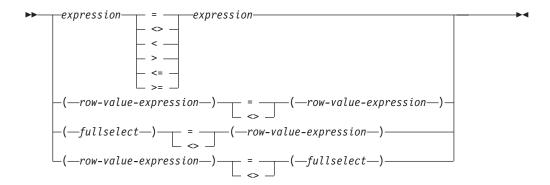
Row-value expression: The operand of several predicates (basic, quantified, and IN) can be a *row-value-expression*:



A row-value-expression returns a single row that consists of one or more column values. The values can be specified as a list of expressions. The number of columns that are returned by the row-value-expression is equal to the number of expressions that are specified in the list.

Basic predicate

A basic predicate compares two values or compares a set of values with another set of values.



Notes:

¹ Other comparison operators are also supported. ⁴³

When a single *expression* is specified on the left side of the operator, another expression must be specified on the right side. The data types of the corresponding expressions must be compatible. The value of the expression on the left side is compared with the value of the expression on the right side. If the value of either operand is null, the result of the predicate is unknown. Otherwise the result is either true or false.

When a *row-value-expression* is specified on the left side of the operator (= or <>) and another row-value-expression is specified on the right side of the operator, both row-value-expressions must have the same number of value expressions. The data types of the corresponding expressions of the row-value-expressions must be compatible. The value of each expression on the left side is compared with the value of its corresponding expression on the right side.

When a row-value-expression is specified and a fullselect is also specified:

- SELECT * is not allowed in the outermost select lists of the *fullselect*.
- The result table of the *fullselect* must have the same number of columns as the row-value-expression. The data types of the corresponding expressions of the row-value-expression and the fullselect must be compatible. The value of each expression on the left side is compared with the value of its corresponding expression on the right side.

The result of the predicate depends on the operator:

- If the operator is =, the result of the predicate is:
 - True if all pairs of corresponding value expressions evaluate to true.

^{43.} The following forms of the comparison operators are also supported in basic and quantified predicates: !=, !<, !>, -=, -<, and -> are supported. All these product-specific forms of the comparison operators are intended only to support existing SQL statements that use these operators and are not recommended for use when writing new SQL statements.

Some keyboards must use the hex values for the not (7) symbol. The hex value varies and is dependent on the keyboard that is used. A not sign (¬) or the character that must be used in its place in certain countries, can cause parsing errors in statements passed from one database server to another. The problem occurs if the statement undergoes character conversion with certain combinations of source and target CCSIDs. To avoid this problem, substitute an equivalent operator for any operator that includes a not sign. For example, substitute '<>' for '¬=', '<=' for '¬>', and '>=' for '¬<'.

- False if any one pair of corresponding value expressions evaluates to false.
- Otherwise, unknown (that is, if at least one comparison of corresponding value expressions is unknown because of a null value and no pair of corresponding value expressions evaluates to false).
- If the operator is <>, the result of the predicate is:
 - True if any one pair of corresponding value expressions evaluates to false.
 - False if all pairs of corresponding value expressions evaluate to true.
 - Otherwise, unknown (that is, if at least one comparison of corresponding value expressions is unknown because of a null value and no pair of corresponding value expressions evaluates to true).

If the corresponding operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence.

For values x and y:

Predicate

Is true if and only if...

```
x = y x is equal to y
x<> y x is not equal to y
x < y x is less than y
x > y x is greater than y
x>= y x is greater than or equal to y
x<= y x is less than or equal to y</pre>
```

Examples

```
Example 1

EMPNO = '528671'

PRTSTAFF <> :VAR1

SALARY + BONUS + COMM < 20000

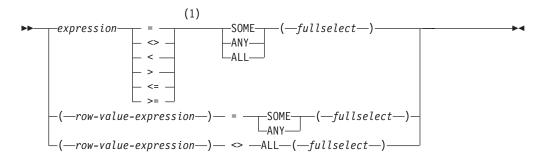
SALARY > (SELECT AVG(SALARY)

FROM EMPLOYEE)
```

Example 2: List the name, first name, and salary of the employee who is responsible for the 'OP1000' project.

Quantified predicate

A quantified predicate compares a value or values with a set of values.



Notes:

1 Other comparison operators are also supported. 43

When *expression* is specified, the fullselect must return a single result column. The fullselect can return any number of values, whether null or not null. The result depends on the operator that is specified:

- When ALL is specified, the result of the predicate is:
 - True if the result of the fullselect is empty, or if the specified relationship is true for every value returned by the fullselect.
 - False if the specified relationship is false for at least one value returned by the fullselect.
 - Unknown if the specified relationship is not false for any values returned by the fullselect and at least one comparison is unknown because of a null value.
- When SOME or ANY is specified, the result of the predicate is:
 - True if the specified relationship is true for at least one value returned by the fullselect.
 - False if the result of the fullselect is empty, or if the specified relationship is false for every value returned by the fullselect.
 - Unknown if the specified relationship is not true for any of the values returned by the fullselect and at least one comparison is unknown because of a null value.

When *row-value-expression* is specified, the number of result columns returned by the fullselect must be the same as the number of value expressions specified by *row-value-expression*. The fullselect can return any number of rows of values. The data types of the corresponding expressions of the row value expressions must be compatible. The value of each expression from *row-value-expression* is compared with the value of the corresponding result column from the fullselect. SELECT * is not allowed in the outermost select lists of the *fullselect*. The value of the predicate depends on the operator that is specified:

- When ALL is specified, the result of the predicate is:
 - True if the result of the fullselect is empty or if the specified relationship is true for every row returned by fullselect.
 - False if the specified relationship is false for at least one row returned by the fullselect.
 - Unknown if the specified relationship is not false for any row returned by the fullselect and at least one comparison is unknown because of a null value.
- When SOME or ANY is specified, the result of the predicate is:

1

| |

- True if the specified relationship is true for at least one row returned by the fullselect.
- False if the result of the fullselect is empty or if the specified relationship is false for every row returned by the fullselect.
- Unknown if the specified relationship is not true for any of the rows returned by the fullselect and at least one comparison is unknown because of a null value.

If the corresponding operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence.

Examples

```
Table TBLA

COLA

1
2
3
4
null

Table TBLB

COLB
----
2
```

Example 1

3

```
SELECT * FROM TBLA WHERE COLA = ANY(SELECT COLB FROM TBLB)
```

Results in 2,3. The fullselect returns (2,3). COLA in rows 2 and 3 equals at least one of these values.

Example 2

```
SELECT * FROM TBLA WHERE COLA > ANY (SELECT COLB FROM TBLB)
```

Results in 3,4. The fullselect returns (2,3). COLA in rows 3 and 4 is greater than at least one of these values.

Example 3

```
SELECT * FROM TBLA WHERE COLA > ALL(SELECT COLB FROM TBLB)
```

Results in 4. The fullselect returns (2,3). COLA in row 4 is the only one that is greater than both these values.

Example 4

```
SELECT * FROM TBLA WHERE COLA > ALL(SELECT COLB FROM TBLB WHERE COLB<0)
```

Results in 1,2,3,4 and null. The fullselect returns no values. Thus, the result of the predicate is true for all rows in TBLA.

Example 5

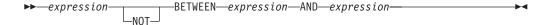
Quantified predicate

SELECT * FROM TBLA WHERE COLA > ANY (SELECT COLB FROM TBLB WHERE COLB<0)

Results in the empty set. The fullselect returns no values. Thus, the result of the predicate is false for all rows in TBLA.

BETWEEN predicate

The BETWEEN predicate compares a value with a range of values.



If the data types of the operands are not the same, all values are converted to the data type that would result by applying the "Rules for result data types" on page 105.

If the operands of the BETWEEN predicate are strings with different CCSIDs, operands are converted as if the below logically-equivalent search conditions were specified.

The BETWEEN predicate:

value1 BETWEEN value2 AND value3

is logically equivalent to the search condition:

value1 >= value2 AND value1 <= value3</pre>

The BETWEEN predicate:

value1 NOT BETWEEN value2 AND value3

is logically equivalent to the search condition:

NOT (value1 BETWEEN value2 AND value3)

If the operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence.

Examples

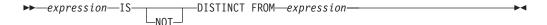
I

EMPLOYEE.SALARY BETWEEN 20000 AND 40000

SALARY **NOT BETWEEN** 20000 + :HV1 **AND** 40000

DISTINCT predicate

The DISTINCT predicate compares a value with another value.



When the predicate is IS DISTINCT, the result of the predicate is true if the comparison of the expressions evaluates to true. Otherwise, the result of the predicate is false. The result cannot be unknown.

When the predicate IS NOT DISTINCT FROM, the result of the predicate is true if the comparison of the expressions evaluates to true (null values are considered equal to null values). Otherwise, the result of the predicate is false. The result cannot be unknown.

The DISTINCT predicate:

```
value1 IS NOT DISTINCT FROM value2
```

is logically equivalent to the search condition:

The DISTINCT predicate:

value1 IS DISTINCT FROM value2

is logically equivalent to the search condition:

```
NOT (value1 IS NOT DISTINCT FROM value2)
```

If the operands of the DISTINCT predicate are strings with different CCSIDs, operands are converted as if the above logically-equivalent search conditions were specified.

If the operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence.

Example

Assume that table T1 exists and it has a single column C1, and three rows with the following values for C1: 1, 2, null. The following query produces the following results:

SELECT * FROM T1
WHERE C1 IS DISTINCT FROM :HV

C1	:HV	Result
1	2	True
2	2	False
1	Null	True
Null	Null	False

| | |

The following query produces the following results:

SELECT * FROM T1

WHERE C1 IS NOT DISTINCT FROM :HV

C1	:HV	Result
1	2	False
2	2	True
1	Null	False
Null	Null	True

EXISTS predicate

The EXISTS predicate tests for the existence of certain rows.

```
►►—EXISTS—( fullselect )—
```

The fullselect may specify any number of columns, and

- The result is true only if the number of rows specified by the fullselect is not zero.
- The result is false only if the number of rows specified by the fullselect is zero.
- The result cannot be unknown.

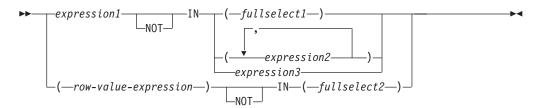
The values returned by the fullselect are ignored.

Example

```
EXISTS (SELECT *
        FROM EMPLOYEE WHERE SALARY > 60000)
```

IN predicate

The IN predicate compares a value or values with a set of values.



When *expression1* is specified, the IN predicate compares a value with a set of values. When *fullselect1* is specified, the fullselect must return a single result column, and can return any number of values, whether null or not null. The data type of *expression1* and the data type of the result column of the *fullselect1*, *expression2*, or *expression3* must be compatible. Each variable must identify a structure or variable that is described in accordance with the rule for declaring host structures or variables.

When a *row-value-expression* is specified, the IN predicate compares values with a collection of values.

- SELECT * is not allowed in the outermost select list of *fullselect*2.
- The result table of the *fullselect2* must have the same number of columns as *row-value-expression*. The data types of the corresponding expressions of *row-value-expression* and of its the corresponding result column of *fullselect2* must be compatible. The value of each expression in *row-value-expression* is compared with the value of its corresponding result column of *fullselect2*.

The value of the predicate depends on the operator that is specified:

- When the operator is IN, the result of the predicate is:
 - True if at least one row returned from the *fullselect2* is equal to the *row-value-expression*.
 - False if the result of *fullselect2* is empty or if no row returned from the *fullselect2* is equal to the *row-value-expression*.
 - Otherwise, unknown (that is, if the comparison of row-value-expression to the row returned from fullselect2 evaluates to unknown because of a null value for at least one row returned from fullselect2 and no row returned from fullselect2 is equal to the row-value-expression).
- When the operator is NOT IN, the result of the predicate is:
 - True if the result of *fullselect2* is empty or if the *row-value-expression* is not equal to any of the rows returned by *fullselect2*.
 - False if the *row-value-expression* is equal to at least one row returned by *fullselect*2.
 - Otherwise, unknown (that is, if the comparison of row-value-expression to the row returned from fullselect2 evaluates to unknown because of a null value for at least one row returned from fullselect2 and the comparison of row-value-expression to the row returned from fullselect2 is not true for any row returned by fullselect2).

IN predicate	Equivalent predicate	
expression IN (expression)	expression = expression	
expression IN (fullselect)	expression = ANY (fullselect)	
expression NOT IN (fullselect)	expression <> ALL (fullselect)	
expression IN (expression1, expression2,, expressionn)	expression IN (SELECT * FROM R)	
	Where T is a table with a single row and R is a temporary table formed by the following fullselect:	
	SELECT expression1 FROM T UNION SELECT expression2 FROM T UNION	
row-value-expression IN (fullselect)	row-value-expression = SOME (fullselect)	
row-value-expression IN (fullselect)	row-value-expression = ANY (fullselect)	
row-value-expression NOT IN (fullselect)	row-value-expression <> ALL (fullselect)	

If the operands of the IN predicate have different data types or attributes, the rules used to determine the data type for evaluation of the IN predicate are those for UNION, UNION ALL, EXCEPT, and INTERSECT. For a description, see "Rules for result data types" on page 105.

If the operands of the IN predicate are strings with different CCSIDs, the rules used to determine which operands are converted are those for operations that combine strings. For a description, see "Conversion rules for operations that combine strings" on page 110.

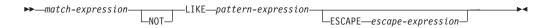
If the corresponding operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence.

Examples

```
DEPTNO IN ('D01', 'B01', 'C01')
EMPNO IN(SELECT EMPNO FROM EMPLOYEE WHERE WORKDEPT = 'E11')
```

LIKE predicate

The LIKE predicate searches for strings that have a certain pattern. The pattern is specified by a string in which the underscore and percent sign have special meanings. Trailing blanks in a pattern are a part of the pattern.



If the value of any of the arguments is null, the result of the LIKE predicate is unknown.

The match-expression, pattern-expression, and escape-expression must identify strings or numbers. A numeric argument is cast to a character string before evaluating the predicate. For more information about converting numeric to a character string, see "VARCHAR" on page 449. The values for match-expression, pattern-expression, and escape-expression must either all be binary strings or none can be binary strings. The three arguments can include a mixture of character strings and graphic strings.

None of the expressions can yield a distinct type. However, it can be a function that casts a distinct type to its source type.

If the operands of the predicate are SBCS data, mixed data, or Unicode data, and if the collating sequence in effect at the time the statement is executed is not *HEX, then the comparison of the operands is performed using weighted values for the operands. The weighted values are based on the collating sequence. An ICU collating sequence is not allowed with a LIKE predicate.

With character strings, the terms character, percent sign, and underscore in the following discussion refer to single-byte characters. With graphic strings, the terms refer to double-byte or Unicode characters. With binary strings, the terms refer to the code points of those single-byte characters.

match-expression

An expression that specifies the string that is to be examined to see if it conforms to a certain pattern of characters.

LIKE pattern-expression

An expression that specifies the string that is to be matched.

Simple description: A simple description of the LIKE pattern is as follows:

- The underscore sign (_) represents any single character.
- The percent sign (%) represents a string of zero or more characters.
- Any other character represents itself.

If the pattern-expression needs to include either the underscore or the percent character, the escape-expression is used to specify a character to precede either the underscore or percent character in the pattern.

Rigorous description: Let x denote a value of match-expression and y denote the value of pattern-expression.

The string y is interpreted as a sequence of the minimum number of substring specifiers so each character of y is part of exactly one substring specifier. A substring specifier is an underscore, a percent sign, or any nonempty sequence of characters other than an underscore or a percent sign.

The result of the predicate is unknown if x or y is the null value. Otherwise, the result is either true or false. The result is true if x and y are both empty strings or if there exists a partitioning of *x* into substrings such that:

- A substring of x is a sequence of zero or more contiguous characters and each character of *x* is part of exactly one substring.
- If the *n*th substring specifier is an underscore, the *n*th substring of *x* is any single character.
- If the *n*th substring specifier is a percent sign, the *n*th substring of *x* is any sequence of zero or more characters.
- If the *n*th substring specifier is neither an underscore nor a percent sign, the *n*th substring of *x* is equal to that substring specifier and has the same length as that substring specifier.
- The number of substrings of x is the same as the number of substring specifiers.

It follows that if y is an empty string and x is not an empty string, the result is false. Similarly, it follows that if y is an empty string and x is not an empty string consisting of other than percent signs, the result is false.

The predicate x NOT LIKE y is equivalent to the search condition NOT(x LIKE *y*).

If necessary, the CCSID of the match-expression, pattern-expression, and escape-expression are converted to the compatible CCSID between the match-expression and pattern-expression.

Mixed data: If the column is mixed data, the pattern can include both SBCS and DBCS characters. The special characters in the pattern are interpreted as follows:

- An SBCS underscore refers to one SBCS character.
- A DBCS underscore refers to one DBCS character.
- · A percent sign (either SBCS or DBCS) refers to any number of characters of any type, either SBCS or DBCS.
- Redundant shifts in match-expression and pattern-expression are ignored.⁴⁴

Unicode data: For Unicode, the special characters in the pattern are interpreted as follows:

- · An SBCS or DBCS underscore refers to one character (a character can be one or more bytes)
- A percent sign (either SBCS or DBCS) refers to a string of zero or more characters (a character can be one or more bytes).

When the LIKE predicate is used with Unicode data, the Unicode percent sign and underscore use the code points indicated in the following table:

Table 29.

Character	UTF-8	UTF-16 or UCS-2
Half-width %	X'25'	X'0025'
Full-width %	X'EFBC85'	X'FF05'
Half-width _	X'5F'	X'005F'

^{44.} Redundant shifts are normally ignored. To guarantee that they are ignored, however, specify the IGNORE_LIKE_REDUNDANT_SHIFTS query attribute. See Database Performance and Query Optimization for information about setting query attributes.

Table 29. (continued)

Character	UTF-8	UTF-16 or UCS-2
Full-width _	X'EFBCBF'	X'FF3F'

The full-width or half-width % matches zero or more characters. The full-width or half width _ character matches exactly one character. (For EBCDIC data, a full-width _ character matches one DBCS character.)

Binary data: If the column is binary data, the pattern contains bytes. The special bytes in the pattern are interpreted as follows:

- The code point for an SBCS underscore (X'6D') refers to one byte.
- The code point for an SBCS percent (X'6C') refers to any number of bytes.

Parameter marker:

When the pattern specified in a LIKE predicate is a parameter marker, and a fixed-length character variable is used to replace the parameter marker; specify a value for the variable that is the correct length. If a correct length is not specified, the select will not return the intended results.

For example, if the variable is defined as CHAR(10), and the value WYSE% is assigned to that variable, the variable is padded with blanks on assignment. The pattern used is

```
'WYSE% '
```

This pattern requests the database manager to search for all values that start with WYSE and end with five blank spaces. If you intended to search for only the values that start with 'WYSE' you should assign the value 'WYSE%%%%%%' to the variable.

ESCAPE *escape-expression*

An expression that specifies a character to be used to modify the special meaning of the underscore (_) and percent (%) characters in the pattern-expression. This allows the LIKE predicate to be used to match values that contain the actual percent and underscore characters. The following rules apply the use of the ESCAPE clause and the *escape-expression*:

- The escape-expression must be a string of length 1.⁴⁵
- The *pattern-expression* must not contain the escape character except when followed by the escape character, percent, or underscore.

For example, if '+' is the escape character, any occurrences of '+' other than '++', '+_', or '+ in the *pattern-expression* is an error.

• The *escape-expression* can be a parameter marker.

The following example shows the effect of successive occurrences of the escape character, which in this case is the plus sign (+).

When the pattern string is	The actual pattern is
+%	A percent sign
++%	A plus sign followed by zero or more arbitrary characters
+++%	A plus sign followed by a percent sign

Examples

Example 1

Search for the string 'SYSTEMS' appearing anywhere within the PROJNAME column in the PROJECT table.

```
SELECT PROJNAME
FROM PROJECT
WHERE PROJECT.PROJNAME LIKE '%SYSTEMS%'
```

Example 2

Search for a string with a first character of 'J' that is exactly two characters long in the FIRSTNME column of the EMPLOYEE table.

```
SELECT FIRSTNME
FROM EMPLOYEE
WHERE EMPLOYEE.FIRSTNME LIKE 'J_'
```

Example 3

In this example:

```
SELECT *
FROM TABLEY
WHERE C1 LIKE 'AAAA+%BBB%' ESCAPE '+'
```

'+' is the escape character and indicates that the search is for a string that starts with 'AAAA. The '+ is interpreted as a single occurrence of ' in the pattern.

Example 4

In the following table of EBCDIC examples, assume COL1 is mixed data. The table shows the results when the predicates in the first column are evaluated using the COL1 values from the second column:

Predicates	COL1 Values	Result
WHERE COL1 LIKE 'aaa %AB%C ^S I'		
	'aaa [©] ABDZC [©] 1'	True
WHERE COL1 LIKE 'aaa % AB \$1% % C \$1'	'aaa [§] o AB [§] r dzx [§] o C [§] r '	True
WHERE COL1 LIKE 'a% SOCSI'	'a ^s ₀C ^s ₁ '	True
	'ax ^s ₀C ^s ı'	True
	'ab $^{\circ}_{\circ}$ DE $^{\circ}_{\mathrm{I}}$ fg $^{\circ}_{\circ}$ C $^{\circ}_{\mathrm{I}}$ '	True
WHERE COL1 LIKE 'a_\$\C^\$_1'	'a% ^S ₀C ^S ₁'	True
	'a ^{\$} ₀XC ^{\$} _I '	False
WHERE COL1 LIKE 'a ^S ₀ C ^S _I '	'a ^s ₀XC ^s ₁'	True
	'ax ^s o C ^s ı'	False
WHERE COL1 LIKE 'SS'	Empty string	True
WHERE COL1 LIKE 'ab % C S _ '	'ab ^S o⊂ ^S ɪ d '	True
	'ab %SISOCSI d'	True
		RV3F001-0

Example 5

Assume that a distinct type named ZIP_TYPE with a source data type of CHAR(5) exists and an ADDRZIP column with data type ZIP_TYPE exists in some table TABLEY. The following statement selects the row if the zip code (ADDRZIP) begins with '9555'.

```
SELECT *
  FROM TABLEY
  WHERE CHAR(ADDRZIP) LIKE '9555%'
```

Example 6

The RESUME column in sample table EMP_RESUME is defined as a CLOB. If the variable LASTNAME has a value of 'JONES', the following statement selects the RESUME column when the string JONES appears anywhere in the column.

```
SELECT RESUME
FROM EMP_RESUME
WHERE RESUME LIKE '%'||LASTNAME||'%'
```

NULL predicate

The NULL predicate tests for null values.



The result of a NULL predicate cannot be unknown. If the value of the expression is null, the result is true. If the value is not null, the result is false.

If NOT is specified, the result is reversed.

Examples

EMPLOYEE.PHONE IS NULL

SALARY IS NOT NULL

Search conditions

A search condition specifies a condition that is true, false, or unknown about a given row or group.





The result of a search condition is derived by application of the specified *logical operators* (AND, OR, NOT) to the result of each specified predicate. If logical operators are not specified, the result of the search condition is the result of the specified predicate.

AND and OR are defined in the following table in which P and Q are any predicates:

Table 30. Truth Tables for AND and OR

P	Q	P AND Q	P OR Q
True	True	True	True
True	False	False	True
True	Unknown	Unknown	True
False	True	False	True
False	False	False	False
False	Unknown	False	Unknown
Unknown	True	Unknown	True
Unknown	False	False	Unknown
Unknown	Unknown	Unknown	Unknown

NOT(true) is false, NOT(false) is true, and NOT(unknown) is unknown.

Search conditions within parentheses are evaluated first. If the order of evaluation is not specified by parentheses, NOT is applied before AND, and AND is applied before OR. The order in which operators at the same precedence level are evaluated is undefined to allow for optimization of search conditions.

Examples

In the examples, the numbers on the second line indicate the order in which the operators are evaluated.

Example 1

Search conditions

Example 2



Chapter 3. Built-in functions

This chapter contains syntax diagrams, semantic descriptions, rules, and examples of the use of the *built-in functions* listed in the following tables.

For more information about functions, see "Functions" on page 145.

Table 31. Aggregate Functions

Function	Description	Reference
AVG	Returns the average of a set of numbers	"AVG" on page 212
COUNT	Returns the number of rows or values in a set of rows or values	"COUNT" on page 214
COUNT_BIG	Returns the number of rows or values in a set of rows or values (COUNT_BIG is similar to COUNT except that the result can be greater than the maximum value of integer)	"COUNT_BIG" on page 215
GROUPING	Returns a value that indicates whether a row was generated as a summary row for a grouping set.	"GROUPING" on page 216
MAX	Returns the maximum value in a set of values in a group	"MAX" on page 218
MIN	Returns the minimum value in a set of values in a group	"MIN" on page 219
STDDEV	Returns the biased standard deviation of a set of numbers	"STDDEV_POP or STDDEV" on page 220
STDDEV_SAMP	Returns the sample standard deviation of a set of numbers	"STDDEV_SAMP" on page 221
SUM	Returns the sum of a set of numbers	"SUM" on page 222
VARIANCE or VAR	Returns the biased variance of a set of numbers	"VAR_POP or VARIANCE or VAR" on page 223
VARIANCE_SAMP or VAR_SAMP	Returns the sample variance of a set of numbers	"VARIANCE_SAMP or VAR_SAMP" on page 224

Table 32. Cast Scalar Functions

Function	Description	Reference
BIGINT	Returns a big integer representation of a number	"BIGINT" on page 236
BINARY	Returns a BINARY representation of a string of any type	"BINARY" on page 238
BLOB	Returns a BLOB representation of a string of any type	"BLOB" on page 240
CHAR	Returns a CHARACTER representation of a value	"CHAR" on page 243
CLOB	Returns a CLOB representation of a value	"CLOB" on page 251
DATE	Returns a DATE from a value	"DATE" on page 271
DBCLOB	Returns a DBCLOB representation of a string	"DBCLOB" on page 280
DECFLOAT	Returns a DECFLOAT representation of a number	"DECFLOAT" on page 287
DECIMAL	Returns a DECIMAL representation of a number	"DECIMAL or DEC" on page 290

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Built-in functions

Table 32. Cast Scalar Functions (continued)

Function	Description	Reference
DOUBLE_PRECISION or DOUBLE	Returns a DOUBLE PRECISION representation of a number	"DOUBLE_PRECISION or DOUBLE" on page 308
FLOAT	Returns a FLOAT representation of a number	"FLOAT" on page 322
GRAPHIC	Returns a GRAPHIC representation of a string	"GRAPHIC" on page 326
INTEGER or INT	Returns an INTEGER representation of a number	"INTEGER or INT" on page 343
REAL	Returns a REAL representation of a number	"REAL" on page 391
ROWID	Returns a Row ID from a value	"ROWID" on page 405
SMALLINT	Returns a SMALLINT representation of a number	"SMALLINT" on page 415
TIME	Returns a TIME from a value	"TIME" on page 428
TIMESTAMP	Returns a TIMESTAMP from a value or a pair of values	"TIMESTAMP" on page 429
TIMESTAMP_ISO	Returns a timestamp value from a datetime value	"TIMESTAMP_ISO" on page 433
VARBINARY	Returns a VARBINARY representation of a string of any type	"VARBINARY" on page 448
VARCHAR	Returns a VARCHAR representative of a value	"VARCHAR" on page 449
VARGRAPHIC	Returns a VARGRAPHIC representation of a value	"VARGRAPHIC" on page 457
ZONED	Returns a zoned decimal representation of a number	"ZONED" on page 466

Table 33. Datalink Scalar Functions

Function	Description	Reference
DLCOMMENT	Returns the comment value from a DataLink value	"DLCOMMENT" on page 299
DLLINKTYPE	Returns the link type value from a DataLink value	"DLLINKTYPE" on page 300
DLURLCOMPLETE	Returns the complete URL value from a DataLink value with a link type of URL	"DLURLCOMPLETE" on page 301
DLURLPATH	Returns the path and file name necessary to access a file within a given server from a DataLink value with a linktype of URL	"DLURLPATH" on page 302
DLURLPATHONLY	Returns the path and file name necessary to access a file within a given server from a DataLink value with a linktype of URL without a file access token	"DLURLPATHONLY" on page 303
DLURLSCHEME	Returns the scheme from a DataLink value with a linktype of URL	"DLURLSCHEME" on page 304
DLURLSERVER	Returns the file server from a DataLink value with a linktype of URL	"DLURLSERVER" on page 305
DLVALUE	Returns a DataLink value	"DLVALUE" on page 306

Table 34. Datetime Scalar Functions

Function	Description	Reference
ADD_MONTHS	Returns a date that represents the date argument plus the number of months argument	"ADD_MONTHS" on page 228
CURDATE	Returns a date based on a reading of the time-of-day clock	"CURDATE" on page 266
CURTIME	Returns a time based on a reading of the time-of-day clock	"CURTIME" on page 267
DAY	Returns the day part of a value	"DAY" on page 273
DAYNAME	Returns the name of the day part of a value	"DAYNAME" on page 274
DAYOFMONTH	Returns an integer that represents the day of the month	"DAYOFMONTH" on page 275
DAYOFWEEK	Returns the day of the week from a value, where 1 is Sunday and 7 is Saturday	"DAYOFWEEK" on page 276
DAYOFWEEK_ISO	Returns the day of the week from a value, where 1 is Monday and 7 is Sunday	"DAYOFWEEK_ISO" on page 277
DAYOFYEAR	Returns the day of the year from a value	"DAYOFYEAR" on page 278
DAYS	Returns an integer representation of a date	"DAYS" on page 279
EXTRACT	Returns a datetime portion of a value	"EXTRACT" on page 320
HOUR	Returns the hour part of a value	"HOUR" on page 335
JULIAN_DAY	Returns an integer value representing a number of days from January 1, 4712 B.C. to the date specified in the argument	"JULIAN_DAY" on page 345
LAST_DAY	Returns a date that represents the last day of the month of the date argument	"LAST_DAY" on page 347
MICROSECOND	Returns the microsecond part of a value	"MICROSECOND" on page 362
MIDNIGHT_SECONDS	Returns an integer value representing the number of seconds between midnight and a specified time value	"MIDNIGHT_SECONDS" on page 363
MINUTE	Returns the minute part of a value	"MINUTE" on page 365
MONTH	Returns the month part of a value	"MONTH" on page 368
MONTHNAME	Returns the name of the month part of a value	"MONTHNAME" on page 369
MONTHS_BETWEEN	Returns an estimate of the number of months between two dates	"MONTHS_BETWEEN" on page 370
NEXT_DAY	Returns a timestamp that represents the first weekday, named by the second argument, after the date argument	"NEXT_DAY" on page 373
NOW	Returns a timestamp based on a reading of the time-of-day clock	"NOW" on page 376
QUARTER	Returns an integer that represents the quarter of the year in which a date resides	"QUARTER" on page 387
ROUND_TIMESTAMP	Returns a timestamp rounded to the specified unit.	"ROUND_TIMESTAMP" on page 402
SECOND	Returns the seconds part of a value	"SECOND" on page 411
TIMESTAMP_FORMAT	Returns a timestamp from a character string representation of a timestamp according to the specified format of the string.	"TIMESTAMP_FORMAT" on page 431

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Built-in functions

Table 34. Datetime Scalar Functions (continued)

Function	Description	Reference
TIMESTAMPDIFF	Returns an estimated number of intervals based on the difference between two timestamps	"TIMESTAMPDIFF" on page 434
TRUNC_TIMESTAMP	Returns a timestamp truncated to the specified unit.	"TRUNC_TIMESTAMP" on page 444
VARCHAR_FORMAT	Returns a character string representation of a timestamp, with the string in a specified format	"VARCHAR_FORMAT" on page 455
WEEK	Returns the week of the year from a value, where the week starts with Sunday	"WEEK" on page 462
WEEK_ISO	Returns the week of the year from a value, where the week starts with Monday	"WEEK_ISO" on page 463
YEAR	Returns the year part of a value	"YEAR" on page 465

Table 35. Partitioning Scalar Functions

Function	Description	Reference
DATAPARTITIONNAME	Returns the partition name where a row is located	"DATAPARTITIONNAME" on page 269
DATAPARTITIONNUM	Returns the partition number of a row	"DATAPARTITIONNUM" on page 270
DBPARTITIONNAME	Returns the relational database name where a row is located	"DBPARTITIONNAME" on page 285
DBPARTITIONNUM	Returns the node number of a row	"DBPARTITIONNUM" on page 286
HASH	Returns the partition number of a set of values	"HASH" on page 331
HASHED_VALUE	Returns the partition map index number of a row	"HASHED_VALUE" on page 332

Table 36. Miscellaneous Scalar Functions

Function	Description	Reference
COALESCE	Returns the first argument that is not null	"COALESCE" on page 256
CONTAINS	Returns an indication of whether a match was found in a text index.	"CONTAINS" on page 260
DATABASE	Returns the current server	"DATABASE" on page 268
GENERATE_UNIQUE	Returns a bit character string that is unique compared to any other execution of the function	"GENERATE_UNIQUE" on page 324
HEX	Returns a hexadecimal representation of a value	"HEX" on page 333
IDENTITY_VAL_LOCAL	Returns the most recently assigned value for an identity column	"IDENTITY_VAL_LOCAL" on page 336
IFNULL	Returns the first argument that is not null	"IFNULL" on page 340
LENGTH	Returns the length of a value	"LENGTH" on page 351
MAX	Returns the maximum value in a set of values	"MAX" on page 361
MIN	Returns the minimum value in a set of values	"MIN" on page 364
NULLIF	Returns a null value if the arguments are equal, otherwise it returns the value of the first argument	"NULLIF" on page 377

Table 36. Miscellaneous Scalar Functions (continued)

Function	Description	Reference
RAISE_ERROR	Raises an error with the specified SQLSTATE and message text	"RAISE_ERROR" on page 389
RID	Returns the relative record number of a row as BIGINT.	"RID" on page 397
RRN	Returns the relative record number of a row as DECIMAL(15,0)	"RRN" on page 406
SCORE	Returns an indication of how frequently a match was found in a text index.	"SCORE" on page 408
VALUE	Returns the first argument that is not null	"VALUE" on page 447

Table 37. Numeric Scalar Functions

Function	Description	Reference
ABS	Returns the absolute value of a number	"ABS" on page 226
ACOS	Returns the arc cosine of a number, in radians	"ACOS" on page 227
ANTILOG	Returns the anti-logarithm (base 10) of a number	"ANTILOG" on page 230
ASIN	Returns the arc sine of a number, in radians	"ASIN" on page 232
ATAN	Returns the arc tangent of a number, in radians	"ATAN" on page 233
ATANH	Returns the hyperbolic arc tangent of a number, in radians	"ATANH" on page 234
ATAN2	Returns the arc tangent of x and y coordinates as an angle expressed in radians	"ATAN2" on page 235
CEILING	Returns the smallest integer value that is greater than or equal to a number	"CEILING" on page 242
COMPARE_DECFLOAT	Returns an indication of how two decimal floating-point values compare	"COMPARE_DECFLOAT" on page 257
COS	Returns the cosine of a number	"COS" on page 263
COSH	Returns the hyperbolic cosine of a number	"COSH" on page 264
COT	Returns the cotangent of a number	"COT" on page 265
DECFLOAT_SORTKEY	Returns an integer value that can be used to sort decimal floating-point values.	"DECFLOAT_SORTKEY" on page 289
DEGREES	Returns the number of degrees of an angle	"DEGREES" on page 296
DIGITS	Returns a character-string representation of the absolute value of a number	"DIGITS" on page 298
EXP	Returns a value that is the base of the natural logarithm (e) raised to a power specified by the argument	"EXP" on page 319
FLOOR	Returns the largest integer value that is less than or equal to a number	"FLOOR" on page 323
LN	Returns the natural logarithm of a number	"LN" on page 353
LOG10	Returns the common logarithm (base 10) of a number	"LOG10" on page 357
MOD	Returns the remainder of the first argument divided by the second argument	"MOD" on page 366
MULTIPLY_ALT	Multiplies the first argument by the second argument and returns the product	"MULTIPLY_ALT" on page 371

Built-in functions

Table 37. Numeric Scalar Functions (continued)

Returns a decimal floating-point value in its simplest form "NORMALIZE_D page 375"		
Returns the value of π	"PI" on page 379	
Returns the result of raising the first argument to the power of the second argument	"POWER" on page 384	
Returns a decimal floating-point value formatted according to a provided value	"QUANTIZE" on page 385	
Returns the number of radians for an argument that is expressed in degrees	"RADIANS" on page 388	
Returns a random number	"RAND" on page 390	
Returns a numeric value that has been rounded to the specified number of decimal places	"ROUND" on page 400	
Returns the sign of a number	"SIGN" on page 412	
Returns the sine of a number	"SIN" on page 413	
Returns the hyperbolic sine of a number	"SINH" on page 414	
Returns the square root of a number	"SQRT" on page 419	
Returns the tangent of a number "TAN" on page 4		
Returns the hyperbolic tangent of a number	"TANH" on page 427	
Returns an ordering indication for two decimal floating-point values	"TOTALORDER" on page 437	
Returns a number value that has been truncated at a specified number of decimal places "TRUNCATE or TRU page 442"		
	Returns the value of π Returns the result of raising the first argument to the power of the second argument Returns a decimal floating-point value formatted according to a provided value Returns the number of radians for an argument that is expressed in degrees Returns a random number Returns a numeric value that has been rounded to the specified number of decimal places Returns the sign of a number Returns the sine of a number Returns the square root of a number Returns the tangent of a number Returns the hyperbolic tangent of a number Returns an ordering indication for two decimal floating-point values Returns a number value that has been truncated	

Table 38. String Scalar Functions

Function	Description	Reference	
ASCII	Returns the ASCII code value of the leftmost character of the argument as an integer	"ASCII" on page 231	
BIT_LENGTH	Returns the length of a string expression in bits	"BIT_LENGTH" on page 239	
CHARACTER_LENGTH	Returns the length of a string expression	"CHARACTER_LENGTH" on page 249	
CHR	Returns the character that has the ASCII code value specified by the argument.	"CHR" on page 250	
CONCAT	Returns a string that is the concatenation of two strings	"CONCAT" on page 259	
DECRYPT_BIT, DECRYPT_BINARY, DECRYPT_CHAR, and DECRYPT_DB	Decrypts an encrypted string	"DECRYPT_BIT, DECRYPT_BINARY, DECRYPT_CHAR and DECRYPT_DB" on page 293	
DIFFERENCE	Returns a value representing the difference between the sounds of two strings	"DIFFERENCE" on page 297	
ENCRYPT and ENCRYPT_RC2	Encrypts a string using the RC2 encryption algorithm	"ENCRYPT_RC2" on page 313	
ENCRYPT_AES	Encrypts a string using the AES encryption algorithm	"ENCRYPT_AES" on page 310	
ENCRYPT_TDES	Encrypts a string using the Triple DES encryption algorithm	"ENCRYPT_TDES" on page 316	

Table 38. String Scalar Functions (continued)

Function	Description	Reference	
GETHINT	Returns a hint from an encrypted string	"GETHINT" on page 325	
INSERT	Returns a string where a substring is deleted and a new string inserted in its place	"INSERT" on page 341	
LAND	Returns a string that is the logical AND of the argument strings	"LAND" on page 346	
LCASE	Returns a string in which all the characters have been converted to lowercase characters	"LCASE" on page 348	
LEFT	Returns the leftmost characters from the string	"LEFT" on page 349	
LNOT	Returns a string that is the logical NOT of the argument string	"LNOT" on page 354	
LOCATE	Returns the starting position of one string within another string	"LOCATE" on page 355	
LOR	Returns a string that is the logical OR of the argument strings	"LOR" on page 358	
LOWER	Returns a string in which all the characters have been converted to lowercase characters	"LOWER" on page 359	
LTRIM	Returns a string in which blanks or hexadecimal zeroes have been removed from the beginning of another string	"LTRIM" on page 360	
OCTET_LENGTH	Returns the length of a string expression in octets	"OCTET_LENGTH" on page 378	
POSITION	Returns the starting position of one string within another string	"POSITION" on page 380	
POSSTR	Returns the starting position of one string within another string	"POSSTR" on page 382	
REPEAT	Returns a string composed of another string repeated a number of times	"REPEAT" on page 393	
REPLACE	Returns a string where all occurrences of one string are replaced by another string	"REPLACE" on page 395	
RIGHT	Returns the rightmost characters from the string	"RIGHT" on page 398	
RTRIM	Returns a string in which blanks or hexadecimal zeroes have been removed from the end of another string	"RTRIM" on page 407	
SOUNDEX	Returns a character code representing the sound of the words in the argument	"SOUNDEX" on page 417	
SPACE	Returns a character string that consists of a specified number of blanks	er string that consists of a "SPACE" on page 418	
STRIP	Removes blanks or another specified character from the end or beginning of a string expression	"STRIP" on page 420	
SUBSTR	Returns a substring of a string	"SUBSTR" on page 421	
SUBSTRING	Returns a substring of a string	"SUBSTRING" on page 424	
TRANSLATE	Returns a string in which one or more characters in a string are converted to other characters	"TRANSLATE" on page 438	
TRIM	Removes blanks or another specified character from the end or beginning of a string expression	"TRIM" on page 440	
UCASE	Returns a string in which all the characters have been converted to uppercase characters "UCASE" on page 445		

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Built-in functions

Table 38. String Scalar Functions (continued)

Function	Description	Reference
UPPER	Returns a string in which all the characters have been converted to uppercase characters	"UPPER" on page 446
XOR	Returns a string that is the logical XOR of the argument strings	"XOR" on page 464

An aggregate function takes a set of values (like a column of data) and returns a single value result from the set of values.

The following information applies to all aggregate functions other than COUNT(*) and COUNT_BIG(*).

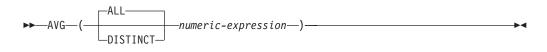
- The argument of an aggregate function is a set of values derived from an expression. The expression may include columns but cannot include another aggregate function. The scope of the set is a group or an intermediate result table as explained in Chapter 4, "Queries".
- If a GROUP BY clause is specified in a query and the intermediate result of the FROM, WHERE, GROUP BY, and HAVING clauses is the empty set, then the aggregate functions are not applied, the result of the query is the empty set.
- If a GROUP BY clause is not specified in a query and the intermediate result of the FROM, WHERE, and HAVING clauses is the empty set, then the aggregate functions are applied to the empty set. For example, the result of the following SELECT statement is applied to the empty set because department D01 has no employees:

```
SELECT COUNT(DISTINCT JOB)
FROM EMPLOYEE
WHERE WORKDEPT = 'D01'
```

- The keyword DISTINCT is not considered an argument of the function, but rather a specification of an operation that is performed before the function is applied. If DISTINCT is specified, redundant duplicate values are eliminated. If ALL is implicitly or explicitly specified, redundant duplicate values are not eliminated.
 - When interpreting the DISTINCT clause for decimal floating-point values that are numerically equal, the number of significant digits in the value is not considered. For example, the decimal floating-point number 123.00 is not distinct from the decimal floating-point number 123. The representation of the number returned from the query will be any one of the representations encountered (for example, either 123.00 or 123).
- An aggregate function can be used in a WHERE clause only if that clause is part
 of a subquery of a HAVING clause and the column name specified in the
 expression is a correlated reference to a group. If the expression includes more
 than one column name, each column name must be a correlated reference to the
 same group.

AVG

The AVG function returns the average of a set of numbers.



numeric-expression

The argument values must be any built-in numeric data type and their sum must be within the range of the data type of the result.

The data type of the result is the same as the data type of the argument values, except that:

- The result is DECFLOAT(34) if the argument values are DECFLOAT(16).
- The result is double-precision floating point if the argument values are single-precision floating point.
- The result is large integer if the argument values are small integers.
- The result is decimal if the argument values are decimal or nonzero scale binary with precision p and scale s. The precision of the result is $p-s+\min(ms, mp-p+s)$. The scale of the result is $\min(ms, mp-p+s)$.

For information about the values of p, s, ms, and mp, see "Decimal arithmetic in SQL" on page 154.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is used, duplicate values are eliminated.

If the data type of the argument is decimal floating-point and a special value of sNaN or -sNaN, or both +Infinity and -Infinity are included in the aggregation, an error is signaled. Otherwise, if +NaN or -NaN is found, the result is +NaN or -NaN. If +Infinity or -Infinity is found, the result is +Infinity or -Infinity.

The result can be null. If set of values is empty, the result is the null value. Otherwise, the result is the average value of the set.

The order in which the values are aggregated is undefined, but every intermediate result must be within the range of the result data type.

If the type of the result is integer, the fractional part of the average is lost.

Examples

• Using the PROJECT table, set the host variable AVERAGE (DECIMAL(5,2)) to the average staffing level (PRSTAFF) of projects in department (DEPTNO) 'D11'.

```
SELECT AVG(PRSTAFF)
INTO :AVERAGE
FROM PROJECT
WHERE DEPTNO = 'D11'
```

Results in AVERAGE being set to 4.25 (that is, 17/4).

 Using the PROJECT table, set the host variable ANY_CALC to the average of each unique staffing value (PRSTAFF) of projects in department (DEPTNO) 'D11'.

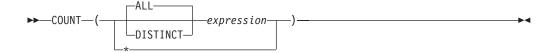
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SELECT AVG(DISTINCT PRSTAFF)
 INTO :ANY_CALC FROM PROJECT WHERE DEPTNO = 'D11'

Results in ANY_CALC being set to 4.66 (that is, 14/3).

COUNT

The COUNT function returns the number of rows or values in a set of rows or values.



expression

The argument values can be of any built-in data type other than a DataLink.

The result of the function is a large integer and it must be within the range of large integers. The result cannot be null. If the table is a distributed table, then the result is DECIMAL(15,0). For more information about distributed tables, see the DB2 Multisystem topic collection.

The argument of COUNT(*) is a set of rows. The result is the number of rows in the set. A row that includes only null values is included in the count.

The argument of COUNT(expression) or COUNT(ALL expression) is a set of values. The function is applied to the set derived from the argument values by the elimination of null values. The result is the number of non-null values in the set including duplicates.

The argument of COUNT(DISTINCT expression) is a set of values. The function is applied to the set of values derived from the argument values by the elimination of null values and duplicate values. The result is the number of values in the set.

If a collating sequence other than *HEX is in effect when the statement that contains the COUNT(DISTINCT expression) is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence.

Examples

• Using the EMPLOYEE table, set the host variable FEMALE (INTEGER) to the number of rows where the value of the SEX column is 'F'.

```
SELECT COUNT(*)
 INTO :FEMALE
  FROM EMPLOYEE
 WHERE SEX = 'F'
```

Results in FEMALE being set to 19.

 Using the EMPLOYEE table, set the host variable FEMALE_IN_DEPT (INTEGER) to the number of departments (WORKDEPT) that have at least one female as a member.

```
SELECT COUNT(DISTINCT WORKDEPT)
  INTO :FEMALE IN DEPT
  FROM EMPLOYEE
  WHERE SEX='F'
```

Results in FEMALE_IN_DEPT being set to 6. (There is at least one female in departments A00, C01, D11, D21, E11, and E21.)

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COUNT_BIG

The COUNT_BIG function returns the number of rows or values in a set of rows or values. It is similar to COUNT except that the result can be greater than the maximum value of integer.



expression

The argument values can be of any built-in data type other than a DataLink.

The result of the function is a decimal with precision 31 and scale 0. The result cannot be null.

The argument of COUNT_BIG(*) is a set of rows. The result is the number of rows in the set. A row that includes only null values is included in the count.

The argument of COUNT_BIG(expression) is a set of values. The function is applied to the set derived from the argument values by the elimination of null values. The result is the number of values in the set.

If a collating sequence other than *HEX is in effect when the statement that contains the COUNT_BIG(DISTINCT *expression*) is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence.

Examples

- Refer to COUNT examples and substitute COUNT_BIG for occurrences of COUNT. The results are the same except for the data type of the result.
- To count on a specific column, a sourced function must specify the type of the
 column. In this example, the CREATE FUNCTION statement creates a sourced
 function that takes any column defined as CHAR, uses COUNT_BIG to perform
 the counting, and returns the result as a double precision floating-point number.
 The query shown counts the number of unique departments in the sample
 employee table.

```
CREATE FUNCTION RICK.COUNT(CHAR()) RETURNS DOUBLE
SOURCE QSYS2.COUNT_BIG(CHAR());
```

SET CURRENT PATH RICK, SYSTEM PATH

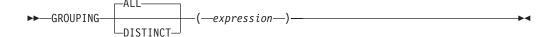
SELECT COUNT(DISTINCT WORKDEPT FROM EMPLOYEE;

The empty parenthesis in the parameter list for the new function (RICK.COUNT) means that the input parameter for the new function is the same type as the input parameter for the function named in the SOURCE clause. The empty parenthesis in the parameter list in the SOURCE clause (COUNT_BIG) means that the length attribute of the CHAR parameter of the COUNT_BIG function is ignored when DB2 locates the COUNT_BIG function.

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GROUPING

Used in conjunction with grouping-sets and super-groups, the GROUPING aggregate function returns a value that indicates whether a row returned in a GROUP BY answer set is a row generated by a grouping set that excludes the column represented by *expression*.



expression

The argument values can be any built-in data type, but must be an item of a GROUP BY clause.

The data type of the result is a small integer. It is set to one of the following values:

- The value of *expression* in the returned row is a null value, and the row was generated by the super-group. This generated row can be used to provide subtotal values for the GROUP BY expression.
- **0** The value is other than the above.

Example

The following query:

```
SELECT SALES_DATE, SALES_PERSON,
SUM(SALES) AS UNITS_SOLD,
GROUPING(SALES_DATE) AS DATE_GROUP,
GROUPING(SALES_PERSON) AS SALES_GROUP
FROM SALES
GROUP BY CUBE( SALES_DATE, SALES_PERSON)
ORDER BY SALES_DATE, SALES_PERSON
```

Results in:

SALES_DATE	SALES_PERSON	UNITS_SOLD	DATE_GROUP	SALES_GROUP
12/31/1995	GOUNOT	1	0	0
12/31/1995	LEE	6	0	0
12/31/1995	LUCCHESSI	1	0	0
12/31/1995	-	8	0	1
03/29/1996	GOUNOT	11	0	0
03/29/1996	LEE	12	0	0
03/29/1996	LUCCHESSI	4	0	0
03/29/1996	-	27	0	1
03/30/1996	GOUNOT	21	0	0
03/30/1996	LEE	21	0	0
03/30/1996	LUCCHESSI	4	0	0
03/30/1996	-	46	0	1
03/31/1996	GOUNOT	3	0	0
03/31/1996		27	0	0
03/31/1996	LUCCHESSI	1	0	0
03/31/1996	-	31	0	1
04/01/1996	GOUNOT	14	0	0
04/01/1996	LEE	25	0	0
04/01/1996	LUCCHESSI	4	0	0
04/01/1996	-	43	0	1
-	GOUNOT	50	1	0

-	LEE	91	1	0
-	LUCCHESSI	14	1	0
-	-	155	1	1

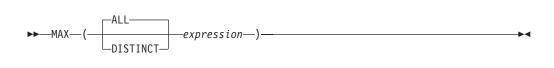
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| | An application can recognize a SALES_DATE subtotal row by the fact that the value of DATE_GROUP is 0 and the value of SALES_GROUP is 1. A SALES_PERSON subtotal row can be recognized by the fact that the value of DATE_GROUP is 1 and the value of SALES_GROUP is 0. A grand total row can be recognized by the fact that the value of both DATE_GROUP and SALES_GROUP is 1.

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MAX

The MAX aggregate function returns the maximum value in a set of values in a



expression

The argument values can be any built-in data type other than a DataLink.

The data type and length attribute of the result are the same as the data type and length attribute of the argument values. When the argument is a string, the result has the same CCSID as the argument.

If a collating sequence other than *HEX is in effect when the statement that contains the MAX function is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence.

If the data type of the argument is decimal floating-point and positive or negative Infinity, sNaN, or NaN is found, the maximum value is determined using decimal floating-point ordering rules. See "Numeric comparisons" on page 99. If multiple representations of the same decimal floating-point value are found (for example, 2.00 and 2.0), it is unpredictable which representation will be returned.

The function is applied to the set of values derived from the argument values by the elimination of null values.

The result can be null. If the function is applied to the empty set, the result is a null value. Otherwise, the result is the maximum value in the set.

The specification of DISTINCT has no effect on the result and is not advised.

Examples

 Using the EMPLOYEE table, set the host variable MAX_SALARY (DECIMAL(7,2)) to the maximum monthly salary (SALARY / 12) value.

```
SELECT MAX(SALARY) /12
  INTO : MAX SALARY
  FROM EMPLOYEE
```

Results in MAX_SALARY being set to 4395.83.

• Using the PROJECT table, set the host variable LAST_PROJ (CHAR(24)) to the project name (PROJNAME) that comes last in the sort sequence.

```
SELECT MAX (PROJNAME)
  INTO : LAST PROJ
  FROM PROJECT
```

Results in LAST_PROJ being set to 'WELD LINE PLANNING'.

MIN

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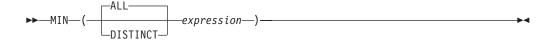
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The MIN aggregate function returns the minimum value in a set of values in a group.



expression

The argument values can be any built-in data type other than a DataLink.

The data type and length attribute of the result are the same as the data type and length attribute of the argument values. When the argument is a string, the result has the same CCSID as the argument. The result can be null.

If a collating sequence other than *HEX is in effect when the statement that contains the MIN function is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set.

If the data type of the argument is decimal floating-point and positive or negative Infinity, sNaN, or NaN is found, the minimum value is determined using decimal floating-point ordering rules. See "Numeric comparisons" on page 99. If multiple representations of the same decimal floating-point value are found (for example, 2.00 and 2.0), it is unpredictable which representation will be returned.

The function is applied to the set of values derived from the argument values by the elimination of null values.

If the function is applied to the empty set, the result is a null value. Otherwise, the result is the minimum value in the set.

The specification of DISTINCT has no effect on the result and is not advised.

Examples

 Using the EMPLOYEE table, set the host variable COMM_SPREAD (DECIMAL(7,2)) to the difference between the maximum and minimum commission (COMM) for the members of department (WORKDEPT) 'D11'.

```
SELECT MAX(COMM) - MIN(COMM)
INTO :COMM_SPREAD
FROM EMPLOYEE
WHERE WORKDEPT = 'D11'
```

Results in COMM_SPREAD being set to 1118 (that is, 2580 - 1462).

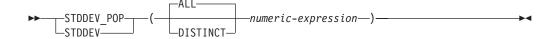
• Using the PROJECT table, set the host variable FIRST_FINISHED (CHAR(10)) to the estimated ending date (PRENDATE) of the first project scheduled to be completed.

```
SELECT MIN(PRENDATE)
INTO :FIRST_FINISHED
FROM PROJECT
```

Results in FIRST_FINISHED being set to '1982-09-15'.

STDDEV_POP or STDDEV

The STDDEV_POP function returns the biased standard deviation (/n) of a set of numbers.



The formula used to calculate the biased standard deviation is: STDDEV_POP = SQRT(VAR_POP)

where SQRT(VAR_POP) is the square root of the variance.

numeric-expression

The argument values must be any built-in numeric data type.

If the argument is DECFLOAT(n), the result of the function is DECFLOAT(34). Otherwise, the data type of the result is double-precision floating point.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is specified, duplicate values are eliminated.

The result can be null. If the function is applied to the empty set, the result is a null value. Otherwise, the result is the standard deviation of the values in the set.

The order in which the values are added is undefined, but every intermediate result must be within the range of the result data type.

Notes:

Syntax alternatives: STDEV_POP should be used for conformance to the SQL 2003 standard.

Example

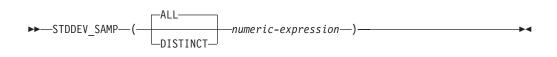
 Using the EMPLOYEE table, set the host variable DEV (double-precision floating point) to the standard deviation of the salaries for those employees in department A00.

```
SELECT STDDEV_POP(SALARY)
INTO :DEV
FROM EMPLOYEE
WHERE WORKDEPT = 'A00';
```

Results in DEV being set to approximately 9742.43.

STDDEV_SAMP

The STDDEV_SAMP function returns the sample standard deviation (/n-1) of a set of numbers.



The formula used to calculate the sample standard deviation is: STDDEV SAMP = SQRT(VAR SAMP)

where SQRT(VAR_SAMP) is the square root of the sample variance.

numeric-expression

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The argument values must be any built-in numeric data type.

If the argument is DECFLOAT(n), the result of the function is DECFLOAT(34). Otherwise, the data type of the result is double-precision floating point.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is specified, duplicate values are eliminated.

The result can be null. If the function is applied to the empty set or a set with only one row, the result is a null value. Otherwise, the result is the standard deviation of the values in the set.

The order in which the values are added is undefined, but every intermediate result must be within the range of the result data type.

Example

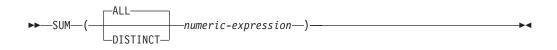
 Using the EMPLOYEE table, set the host variable DEV (double-precision floating point) to the sample standard deviation of the salaries for those employees in department A00.

```
SELECT STDDEV_SAMP(SALARY)
INTO :DEV
FROM EMPLOYEE
WHERE WORKDEPT = 'A00';
```

Results in DEV being set to approximately 10892.37.

SUM

The SUM function returns the sum of a set of numbers.



numeric-expression

The argument values must be any built-in numeric data type.

The data type of the result is the same as the data type of the argument values except that the result is:

- DECFLOAT(34) if the argument values are DECFLOAT(16).
- A double-precision floating point if the argument values are single-precision floating point
- A large integer if the argument values are small integers
- A decimal with precision mp and scale s if the argument values are decimal or nonzero scale binary numbers with precision p and scale s.

For information about the values of p, s, and mp, see "Decimal arithmetic in SQL" on page 154.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is specified, duplicate values are eliminated.

If the data type of the argument is decimal floating-point and a special value of sNaN or -sNaN, or both +Infinity and -Infinity are included in the aggregation, an error is signaled. Otherwise, if +NaN or -NaN is found, the result is +NaN or -NaN. If +Infinity or -Infinity is found, the result is +Infinity or -Infinity.

The result can be null. If the function is applied to the empty set, the result is a null value. Otherwise, the result is the sum of the values in the set.

The order in which the values are added is undefined, but every intermediate result must be within the range of the result data type.

Example

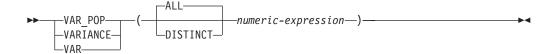
 Using the EMPLOYEE table, set the host variable JOB_BONUS (DECIMAL(9,2)) to the total bonus (BONUS) paid to clerks (JOB='CLERK').

```
SELECT SUM (BONUS)
 INTO : JOB BONUS
  FROM EMPLOYEE
 WHERE JOB = 'CLERK'
```

Results in JOB_BONUS being set to 4000.

VAR_POP or VARIANCE or VAR

The VAR_POP function returns the biased variance (/n) of a set of numbers.



The formula used to calculate the biased variance is:

```
VAR POP = SUM(X**2)/COUNT(X) - (SUM(X)/COUNT(X))**2
```

numeric-expression

The argument values must be any built-in numeric data type.

If the argument is DECFLOAT(n), the result of the function is DECFLOAT(34). Otherwise, the data type of the result is double-precision floating point.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is specified, duplicate values are eliminated.

The result can be null. If the function is applied to the empty set, the result is a null value. Otherwise, the result is the variance of the values in the set.

The order in which the values are added is undefined, but every intermediate result must be within the range of the result data type.

Notes

Syntax alternatives: VAR_POP should be used for conformance to the SQL 2003 standard.

Example

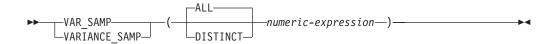
• Using the EMPLOYEE table, set the host variable VARNCE (double-precision floating point) to the variance of the salaries for those employees in department A00.

```
SELECT VAR_POP(SALARY)
INTO :VARNCE
FROM EMPLOYEE
WHERE WORKDEPT = 'A00';
```

Results in VARNCE being set to approximately 94 915 000.

VARIANCE_SAMP or VAR_SAMP

The VAR_SAMP function returns the sample variance (/n-1) of a set of numbers.



The formula used to calculate the sample variance is:

```
VAR SAMP = (SUM(X**2) - ((SUM(X)**2) / (COUNT(*)))) / (COUNT(*) - 1)
```

numeric-expression

The argument values must be any built-in numeric data type.

If the argument is DECFLOAT(n), the result of the function is DECFLOAT(34). Otherwise, the data type of the result is double-precision floating point.

The function is applied to the set of values derived from the argument values by the elimination of null values. If DISTINCT is specified, duplicate values are eliminated.

The result can be null. If the function is applied to the empty set or a set with only one row, the result is a null value. Otherwise, the result is the variance of the values in the set.

The order in which the values are added is undefined, but every intermediate result must be within the range of the result data type.

Note

Syntax alternatives: VAR_SAMP should be used for conformance to the SQL 2003 standard.

Example

• Using the EMPLOYEE table, set the host variable VARNCE (double-precision floating point) to the sample variance of the salaries for those employees in department A00.

```
SELECT VAR_SAMP(SALARY)
  INTO : VARNCE
  FROM EMPLOYEE
  WHERE WORKDEPT = 'A00';
```

Results in VARNCE being set to approximately 1 186 437 500.

Scalar functions

A *scalar function* takes input argument(s) and returns a single value result. A scalar function can be used wherever an expression can be used.

The restrictions on the use of aggregate functions do not apply to scalar functions, because a scalar function is applied to single parameter values rather than to sets of values. The argument of a scalar function can be a function. However, the restrictions that apply to the use of expressions and aggregate functions also apply when an expression or aggregate function is used within a scalar function. For example, the argument of a scalar function can be an aggregate function only if an aggregate function is allowed in the context in which the scalar function is used.

Example

The result of the following SELECT statement has as many rows as there are employees in department D01:

```
SELECT EMPNO, LASTNAME, YEAR(CURRENT DATE - BIRTHDATE)
FROM EMPLOYEE
WHERE WORKDEPT = 'D01'
```

ABS

The ABS function returns the absolute value of a number.

▶►—ABS—(—expression—)—

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values, the special values are treated as follows:

- ABS(NaN) and ABS(-NaN) return NaN.
- ABS(Infinity) and ABS(-Infinity) return Infinity.
- ABS(sNaN) and ABS(-sNaN) return sNaN.

The data type and length attribute of the result are the same as the data type and length attribute of the argument value, except that the result is a large integer if the argument value is a small integer, and the result is double-precision floating point if the argument value is single-precision floating point.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: ABSVAL is a synonym for ABS. It is supported only for compatibility with previous DB2 releases.

Example

• Assume the host variable PROFIT is a large integer with a value of -50000.

SELECT ABS(:PROFIT)
FROM SYSIBM.SYSDUMMY1

Returns the value 50000.

ACOS

The ACOS function returns the arc cosine of the argument as an angle expressed in radians. The ACOS and COS functions are inverse operations.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. The value must be greater than or equal to -1 and less than or equal to 1.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is greater than or equal to 0 and less than or equal to π .

Example

• Assume the host variable ACOSINE is a DECIMAL(10,9) host variable with a value of 0.070737202.

SELECT ACOS(:ACOSINE)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 1.49.

ADD_MONTHS

The ADD_MONTHS function returns a date or timestamp that represents *expression* plus *numeric-expression* months.

```
▶▶—ADD MONTHS—(—expression—,—numeric-expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

numeric-expression

An expression that returns a value of a built-in numeric data type with zero scale. A negative numeric value is allowed.

The result of the function is a timestamp if *expression* is a timestamp. Otherwise, the result of the function is a date. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

If *expression* is the last day of the month or if the resulting month has fewer days than the day component of *expression*, then the result is the last day of the resulting month. Otherwise, the result has the same day component as *expression*.

Example

• Assume today is January 31, 2000. Set the host variable ADD_MONTH with the last day of January plus 1 month.

```
SET :ADD_MONTH = ADD_MONTHS(LAST_DAY(CURRENT_DATE), 1 )
```

The host variable ADD_MONTH is set with the value representing the end of February, 2000-02-29.

• Assume DATE is a host variable with the value July 27, 1965. Set the host variable ADD_MONTH with the value of that day plus 3 months.

```
SET :ADD MONTH = ADD_MONTHS(:DATE, 3)
```

The host variable ADD_MONTH is set with the value representing the day plus 3 months, 1965-10-27.

 It is possible to achieve similar results with the ADD_MONTHS function and date arithmetic. The following examples demonstrate the similarities and contrasts.

```
SET :DATEHV = DATE('2000-2-28') + 4 MONTHS
SET :DATEHV ADD_MONTHS('2000-2-28', 4)
```

In both cases, the host variable DATEHV is set with the value '2000-06-28'.

Now consider the same examples but with the date '2000-2-29' as the argument.

```
SET : DATEHV = DATE('2000-2-29') + 4 MONTHS
```

The host variable DATEHV is set with the value '2000-06-29'.

```
SET : DATEHV ADD MONTHS ('2000-2-29', 4)
```

The host variable DATEHV is set with the value '2000–06–30'.

ADD_MONTHS

In this case, the ADD_MONTHS function returns the last day of the month, which is June 30, 2000, instead of June 29, 2000. The reason is that February 29 is the last day of the month. So, the ADD_MONTHS function returns the last day of June.

ANTILOG

The ANTILOG function returns the anti-logarithm (base 10) of a number. The ANTILOG and LOG functions are inverse operations.

►►—ANTILOG—(—expression—)—

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values the special values are treated as follows:

- ANTILOG(NaN) returns NaN.
- ANTILOG(-NaN) returns -NaN.
- ANTILOG(Infinity) returns Infinity.
- ANTILOG(-Infinity) returns 0.
- ANTILOG(sNaN) and ANTILOG(-sNaN) return a warning or error.

If the data type of the argument is DECFLOAT(n), the result is DECFLOAT(n). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

Assume the host variable ALOG is a DECIMAL(10,9) host variable with a value of 1.499961866.

SELECT ANTILOG(:ALOG) FROM SYSIBM.SYSDUMMY1

Returns the approximate value 31.62.

^{46.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option, NaN and -NaN are returned respectively with a warning.

ASCII

The ASCII function returns the ASCII code value of the leftmost character of the argument as an integer.

►►—ASCII—(—expression—)—

expression

An expression that specifies the string containing the character to evaluate. *expression* must be any built-in numeric or string data type. The first character of the string will be converted to ASCII CCSID 367 for processing by the function.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Return the integer value for the ASCII representation of 'A'.

SELECT ASCII('A')
 FROM SYSIBM.SYSDUMMY1

Returns the value 65.

expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. The value must be greater than or equal to -1 and less than or equal to 1.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is greater than or equal to $-\pi/2$ and less than or equal to $\pi/2$.

Example

• Assume the host variable ASINE is a DECIMAL(10,9) host variable with a value of 0.997494987.

SELECT ASIN(:ASINE) FROM SYSIBM.SYSDUMMY1

Returns the approximate value 1.50.

The ATAN function returns the arc tangent of the argument as an angle expressed in radians. The ATAN and TAN functions are inverse operations.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is greater than or equal to $-\pi/2$ and less than or equal to $\pi/2$.

Example

• Assume the host variable ATANGENT is a DECIMAL(10,8) host variable with a value of 14.10141995.

SELECT ATAN(:ATANGENT)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 1.50.

The ATANH function returns the hyperbolic arc tangent of a number, in radians. The ATANH and TANH functions are inverse operations.

►►—ATANH—(—expression—)—

expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. The value must be greater than -1 and less than 1.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable HATAN is a DECIMAL(10,9) host variable with a value of 0.905148254.

SELECT ATANH(:HATAN)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 1.50.

1 | | | |

ATAN2

The ATAN2 function returns the arc tangent of x and y coordinates as an angle expressed in radians. The first and second arguments specify the x and y coordinates, respectively.

 \rightarrow ATAN2—(—expression-1—,—expression-2—)—

expression-1

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information on converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. If one argument is 0, the other argument must not be 0.

expression-2

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information on converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. If one argument is 0, the other argument must not be 0.

The data type of the result is double-precision floating point. If any argument can be null, the result can be null; if any argument is null, the result is the null value.

Example

 Assume that host variables HATAN2A and HATAN2B are DOUBLE host variables with values of 1 and 2, respectively.

```
SELECT ATAN2(:HATAN2A,:HATAN2B)
FROM SYSIBM.SYSDUMMY1
```

Returns a double precision floating-point number with an approximate value of 1.1071487.

BIGINT

The BIGINT function returns a big integer representation.

Numeric to Big Integer

▶►—BIGINT—(—numeric-expression—)—

String to Big Integer

▶►—BIGINT—(—string-expression—)

The BIGINT function returns a big integer representation of:

- A number
- · A character or graphic string representation of a decimal number
- A character or graphic string representation of an integer
- · A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to Big Integer

numeric-expression

An expression that returns a numeric value of any built-in numeric data type.

The result is the same number that would occur if the argument were assigned to a big integer column or variable. If the whole part of the argument is not within the range of big integers, an error is returned. The fractional part of the argument is truncated.

String to Big Integer

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number.

The result is the same number that would result from CAST(*string-expression* AS BIGINT). Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant. If the whole part of the argument is not within the range of big integers, an error is returned. Any fractional part of the argument is truncated.

The result of the function is a big integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

• Using the EMPLOYEE table, select the EMPNO column in big integer form for further processing in the application.

1

BIGINT

SELECT BIGINT(SALARY) FROM EMPLOYEE

BINARY

The BINARY function returns a BINARY representation of a string of any type.



The result of the function is a fixed-length binary string. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

string-expression

A *string-expression* whose value must be a built-in character string, graphic string, binary string, or row ID data type.

integer

An integer constant that specifies the length attribute for the resulting binary string. The value must be between 1 and 32766.

If integer is not specified:

- If the *string-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument, unless the argument is a graphic string. In this case, the length attribute of the result is twice the length attribute of the argument.

The actual length is the same as the length attribute of the result. If the length of the *string-expression* is less than the length of the result, the result is padded with hexadecimal zeroes up to the length of the result. If the length of the *string-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the first input argument is a character string and all the truncated characters are blanks, or the first input argument is a graphic string and all the truncated characters are double-byte blanks, or the first input argument is a binary string and all the truncated bytes are hexadecimal zeroes.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the length is specified. For more information, see "CAST specification" on page 170.

Example

• The following function returns a BINARY for the string 'This is a BINARY'.

```
SELECT BINARY('This is a BINARY')
FROM SYSIBM.SYSDUMMY1
```

See "LENGTH" on page 351, "CHARACTER_LENGTH" on page 249, and "OCTET_LENGTH" on page 378 for similar functions.

expression

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is DECIMAL(31). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is the number of bits (bytes * 8) in the argument. The length of a string includes trailing blanks. The length of a varying-length string is the actual length in bits (bytes * 8), not the maximum length.

Example

• Assume table T1 has a GRAPHIC(10) column called C1.

```
SELECT BIT_LENGTH( C1 ) FROM T1
```

Returns the value 160.

| | |

BLOB

The BLOB function returns a BLOB representation of a string of any type.



string-expression

A *string-expression* whose value can be a character string, graphic string, binary string, or row ID.

integer

An integer constant that specifies the length attribute for the resulting binary string. The value must be between 1 and 2 147 483 647.

If integer is not specified:

- If the *string-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument, unless the argument is a graphic string. In this case, the length attribute of the result is twice the length attribute of the argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of the expression (or twice the length of the expression when the input is graphic data). If the length of the *string-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the first input argument is a character string and all the truncated characters are blanks, or the first input argument is a graphic string and all the truncated characters are double-byte blanks, or the first input argument is a binary string and all the truncated bytes are hexadecimal zeroes.

The result of the function is a BLOB. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the length is specified. For more information, see "CAST specification" on page 170.

Example

• The following function returns a BLOB for the string 'This is a BLOB'.

```
SELECT BLOB('This is a BLOB')
FROM SYSIBM.SYSDUMMY1
```

• The following function returns a BLOB for the large object that is identified by locator myclob_locator.

```
SELECT BLOB(:myclob_locator)
FROM SYSIBM.SYSDUMMY1
```

 Assume that a table has a BLOB column named TOPOGRAPHIC_MAP and a VARCHAR column named MAP_NAME. Locate any maps that contain the string 'Pellow Island' and return a single binary string with the map name concatenated in front of the actual map. The following function returns a BLOB for the large object that is identified by locator myclob_locator.

1

BLOB

SELECT BLOB(MAP_NAME CONCAT ': 'CONCAT TOPOGRAPHIC_MAP)
FROM ONTARIO_SERIES_4
WHERE TOPOGRAPHIC_MAP LIKE '%Pellow Island%'

1

CEILING

The CEIL or CEILING function returns the smallest integer value that is greater than or equal to expression.

```
-CEILING--
          −(—expression—)-
```

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values, the special values are treated as follows:

- CEILING(NaN) returns NaN.
- CEILING(-NaN) returns -NaN.
- CEILING(Infinity) returns Infinity.
- CEILING(-Infinity) returns -Infinity.
- CEILING(sNaN) and CEILING(-sNaN) return a warning or error.⁴⁷

The result of the function has the same data type and length attribute as the argument except that the scale is 0 if the argument is DECIMAL or NUMERIC. For example, an argument with a data type of DECIMAL(5,5) will result in DECIMAL(5,0).

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Find the highest monthly salary for all the employees. Round the result up to the next integer. The SALARY column has a decimal data type

```
SELECT CEIL (MAX (SALARY) / 12)
  FROM EMPLOYEE
```

This example returns 4396.00 because the highest paid employee is Christine Haas who earns \$52750.00 per year. Her average monthly salary before applying the CEIL function is 4395.83.

• Use CEILING on both positive and negative numbers.

```
SELECT CEILING( 3.5),
       CEILING( 3.1),
       CEILING(-3.1),
       CEILING(-3.5),
  FROM SYSIBM.SYSDUMMY1
```

This example returns:

```
04. 04. -03. -03.
```

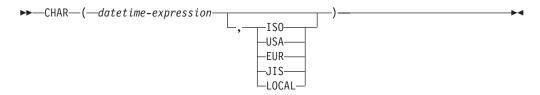
^{47.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option, NaN and -NaN are returned respectively with a warning.

CHAR

Ī

The CHAR function returns a fixed-length character-string representation.

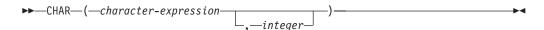
Datetime to Character



Graphic to Character



Character to Character



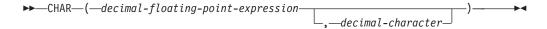
Integer to Character



Decimal to Character



Decimal floating-point to Character



Floating-point to Character



The CHAR function returns a fixed-length character-string representation of:

- An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT.
- A decimal number if the first argument is a decimal number.
- A decimal floating-point number if the first argument is a DECFLOAT.
- A double-precision floating-point number if the first argument is a DOUBLE or REAL.

- A character string if the first argument is any type of character string.
- A graphic string if the first argument is any type of graphic string.
- A date value if the first argument is a DATE.
- A time value if the first argument is a TIME.
- A timestamp value if the first argument is a TIMESTAMP.
- A row ID value if the first argument is a ROWID.

The first argument must be a built-in data type other than a BINARY, VARBINARY, or BLOB.

The result of the function is a fixed-length character string. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Datetime to Character

datetime-expression

An expression that is one of the following three built-in data types

The result is the character-string representation of the date in the date format specified by the second argument. If the second argument is not specified, the format used is the default date format. If the format is ISO, USA, EUR, or JIS, the length of the result is 10. Otherwise the length of the result is the length of the default date format. For more information see "String representations of datetime values" on page 77.

time The result is the character-string representation of the time in the format specified by the second argument. If the second argument is not specified, the format used is the default time format. The length of the result is 8. For more information see "String representations of datetime values" on page 77.

timestamp

The second argument is not applicable and must not be specified.

The result is the character-string representation of the timestamp. The length of the result is 26.

The CCSID of the string is the default SBCS CCSID at the current server.

ISO, EUR, USA, or JIS

Specifies the date or time format of the resulting character string. For more information, see "String representations of datetime values" on page 77.

LOCAL

Specifies that the date or time format of the resulting character string should come from the DATFMT, DATSEP, TIMFMT, and TIMSEP attributes of the job at the current server.

Graphic to Character

graphic-expression

An expression that returns a value that is a built-in graphic-string data type.

integer

An integer constant that specifies the length attribute for the resulting fixed length character string. The value must be between 1 and 32766 (32765 if nullable).

If the second argument is not specified:

- If the *graphic-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length is the same as the length attribute of the result. If the length of the *graphic-expression* is less than the length of the result, the result is padded with blanks up to the length of the result. If the length of the *graphic-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

The CCSID of the string is the default CCSID of the current server.

Character to Character

character-expression

An expression that returns a value that is a built-in character-string data type. 48

integer

An integer constant that specifies the length attribute for the resulting fixed length character string. The value must be between 1 and 32766 (32765 if nullable). If the first argument is mixed data, the second argument cannot be less than 4.

If the second argument is not specified:

- If the *character-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length is the same as the length attribute of the result. If the length of the *character-expression* is less than the length of the result, the result is padded with blanks up to the length of the result. If the length of the *character-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

The CCSID of the string is the CCSID of the *character-expression*.

Integer to Character

integer-expression

An expression that returns a value that is a built-in integer data type (either SMALLINT, INTEGER, or BIGINT).

The result is the fixed-length character-string representation of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. The result is left justified.

- If the argument is a small integer:
 - The length of the result is 6. If the number of characters in the result is less than 6, then the result is padded on the right with blanks.
- If the argument is a large integer:

The length of the result is 11. If the number of characters in the result is less than 11, then the result is padded on the right with blanks.

^{48.} A binary string is also allowed if a CCSID of 65535 is explicitly specified.

• If the argument is a big integer:

The length of the result is 20. If the number of characters in the result is less than 20, then the result is padded on the right with blanks.

The CCSID of the string is the default SBCS CCSID at the current server.

Decimal to Character

decimal-expression

An expression that returns a value that is a built-in decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length character string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the *decimal-expression* with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length of the result is 2+p where p is the precision of the *decimal-expression*. This means that a positive value will always include one trailing blank.

The CCSID of the string is the default SBCS CCSID at the current server.

Decimal floating-point to Character

decimal-floating-point expression

An expression that returns a value that is a built-in decimal floating-point data type (DECFLOAT).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length character-string representation of the argument in the form of a decimal floating-point constant.

The length attribute of the result is 42. The actual length of the result is the smallest number of characters that represents the value of the argument, including the sign, digits, and *decimal-character*. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0.

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

If the number of characters in the result is less than 42, then the result is padded on the right with blanks.

| | | |

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The CCSID of the string is the default SBCS CCSID at the current server.

Floating-point to Character

floating-point expression

An expression that returns a value that is a built-in floating-point data type (DOUBLE or REAL).

decimal-character

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| | Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length character-string representation of the argument in the form of a floating-point constant. The length of the result is 24. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0E0. Otherwise, the result includes the smallest number of characters that can be used to represent the value of the argument such that the mantissa consists of a single digit other than zero followed by a *decimal-character* and a sequence of digits.

If the number of characters in the result is less than 24, then the result is padded on the right with blanks.

The CCSID of the string is the default SBCS CCSID at the current server.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length argument is specified. For more information, see "CAST specification" on page 170.

Examples

• Assume the column PRSTDATE has an internal value equivalent to 1988-12-25. The date format is *MDY and the date separator is a slash (/).

```
SELECT CHAR(PRSTDATE, USA)
FROM PROJECT
```

Results in the value '12/25/1988'.

```
SELECT CHAR(PRSTDATE)
FROM PROJECT
```

Results in the value '12/25/88'.

• Assume the column STARTING has an internal value equivalent to 17.12.30, the host variable HOUR_DUR (DECIMAL(6,0)) is a time duration with a value of 050000 (that is, 5 hours).

```
SELECT CHAR(STARTING, USA)
FROM CL_SCHED

Results in the value '5:12 PM'.

SELECT CHAR(STARTING + :HOUR_DUR, JIS)
FROM CL_SCHED
```

Results in the value '10:12:00'.

 Assume the column RECEIVED (timestamp) has an internal value equivalent to the combination of the PRSTDATE and STARTING columns.

```
SELECT CHAR (RECEIVED)
FROM IN TRAY
```

Results in the value '1988-12-25-17.12.30.000000'.

• Use the CHAR function to make the type fixed-length character and reduce the length of the displayed results to 10 characters for the LASTNAME column (defined as VARCHAR(15)) of the EMPLOYEE table.

```
SELECT CHAR(LASTNAME,10)
FROM EMPLOYEE
```

For rows having a LASTNAME with a length greater than 10 characters (excluding trailing blanks), a warning (SQLSTATE 01004) that the value is truncated is returned.

• Use the CHAR function to return the values for EDLEVEL (defined as SMALLINT) as a fixed length string.

```
SELECT CHAR(EDLEVEL)
FROM EMPLOYEE
```

An EDLEVEL of 18 would be returned as the CHAR(6) value '18 ' (18 followed by 4 blanks).

• Assume that the same SALARY subtracted from 20000.25 is to be returned with a comma as the decimal character.

```
SELECT CHAR(20000.25 - SALARY, ',')
FROM EMPLOYEE
```

A SALARY of 21150 returns the value '–1149,75 ' (–1149,75 followed by 3 blanks).

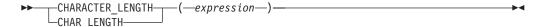
• Assume a host variable, DOUBLE_NUM, has a double precision floating-point data type and a value of -987.654321E-35.

```
SELECT CHAR(:DOUBLE_NUM)
FROM SYSIBM.SYSDUMMY1
```

Results in the character value '-9.8765432100000002E-33'.

CHARACTER_LENGTH

The CHARACTER_LENGTH or CHAR_LENGTH function returns the length of a string expression.



See "LENGTH" on page 351 for a similar function.

expression

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

If *expression* is a character string or graphic string, the result is the number of characters in the argument (not the number of bytes). A single character is either an SBCS, DBCS, or multiple-byte character. If *expression* is a binary string, the result is the number of bytes in the argument. The length of strings includes trailing blanks or hexadecimal zeroes. The length of a varying-length string is the actual length, not the maximum length.

Example

• Assume that NAME is a VARCHAR(128) column, encoded in Unicode UTF-8, that contains the value 'Jürgen'.

```
SELECT CHARACTER_LENGTH(NAME), LENGTH(NAME)
FROM T1
WHERE NAME = 'Jürgen'
```

Returns the value 6 for CHARACTER_LENGTH and 7 for LENGTH.

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CHR

The CHR function returns the character that has the ASCII code value specified by the argument. If expression is 0, the result is the blank character (X'20').

▶►—CHR—(—expression—)—

expression

An expression that returns a value of a BIGINT, INTEGER, or SMALLINT data type. The value of the argument should be between 0 and 255; otherwise, the return value is null. The value is interpreted as the code point for a character in ASCII CCSID 367.

The result of the function is CHAR(1). The result can be null; if the argument is null, the result is the null value.

The CCSID of the result is the default SBCS CCSID of the current server.

Examples

Return the character corresponding to the ASCII CCSID 367 code point 65.
 SELECT CHR(65)
 FROM SYSIBM.SYSDUMMY1

Returns the value 'A'.

CLOB

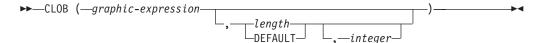
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The CLOB function returns a character-string representation.

Character to CLOB



Graphic to CLOB



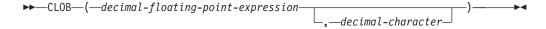
Integer to CLOB



Decimal to CLOB



Decimal floating-point to CLOB



Floating-point to CLOB



The CLOB function returns a character-string representation of:

- An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT
- A decimal number if the first argument is a packed or zoned decimal number
- A decimal floating-point number if the first argument is DECFLOAT
- A double-precision floating-point number if the first argument is a DOUBLE or REAL
- A character string if the first argument is any type of character string
- · A graphic string if the first argument is a Unicode graphic string

The result of the function is a CLOB. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Character to CLOB

character-expression

An expression that returns a value that is a built-in character-string data type.

length

An integer constant that specifies the length attribute for the resulting varying length character string. The value must be between 1 and 2 147 483 647. If the first argument is mixed data, the second argument cannot be less than 4.

If the second argument is not specified or DEFAULT is specified:

- If the character-expression is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *character-expression*. If the length of the character-expression is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a valid SBCS CCSID or mixed data CCSID. If the third argument is an SBCS CCSID, then the result is SBCS data. If the third argument is a mixed CCSID, then the result is mixed data. If the third argument is a SBCS CCSID, then the first argument cannot be a DBCS-either or DBCS-only string. The third argument cannot be 65535.

If the third argument is not specified, the first argument must not have a CCSID of 65535:

- If the first argument is bit data, an error is returned.
- If the first argument is SBCS data, then the result is SBCS data. The CCSID of the result is the same as the CCSID of the first argument.
- If the first argument is mixed data (DBCS-open, DBCS-only, or DBCS-either), then the result is mixed data. The CCSID of the result is the same as the CCSID of the first argument.

Graphic to CLOB

graphic-expression

An expression that returns a value that is a built-in graphic-string data type. It must not be DBCS-graphic data.

length

An integer constant that specifies the length attribute for the resulting varying length character string. The value must be between 1 and 2 147 483 647. If the result is mixed data, the second argument cannot be less than 4.

If the second argument is not specified or DEFAULT is specified, the length attribute of the result is determined as follows (where *n* is the length attribute of the first argument):

- If the graphic-expression is the empty graphic string constant, the length attribute of the result is 1.
- If the result is SBCS data, the result length is *n*.
- If the result is mixed data, the result length is (2.5*(n-1)) + 4.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *graphic-expression*. If the length of the *graphic-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a valid SBCS CCSID or mixed data CCSID. If the third argument is an SBCS CCSID, then the result is SBCS data. If the third argument is a mixed CCSID, then the result is mixed data. The third argument cannot be 65535.

If the third argument is not specified, the CCSID of the result is the default CCSID at the current server. If the default CCSID is mixed data, then the result is mixed data. If the default CCSID is SBCS data, then the result is SBCS data.

Integer to CLOB

integer-expression

An expression that returns a value that is a built-in integer data type (either SMALLINT, INTEGER, or BIGINT).

The result is a varying-length character string of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. The result is left justified.

- If the argument is a small integer, the length attribute of the result is 6.
- If the argument is a large integer, the length attribute of the result is 11.
- If the argument is a big integer, the length attribute of the result is 20.

The actual length of the result is the smallest number of characters that can be used to represent the value of the argument. Leading zeroes are not included. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the *decimal-character*.

The CCSID of the result is the default SBCS CCSID at the current server.

Decimal to CLOB

decimal-expression

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An expression that returns a value that is a built-in decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the *decimal-expression* with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length attribute of the result is 2+p where p is the precision of the *decimal-expression*. The actual length of the result is the smallest number of characters that can be used to represent the result, except that trailing characters

are included. Leading zeros are not included. If the argument is negative, the result begins with a minus sign. Otherwise, the result begins with a digit or the decimal-character.

The CCSID of the result is the default SBCS CCSID at the current server.

Decimal floating-point to CLOB

decimal floating-point expression

An expression that returns a value that is a built-in decimal floating-point data type.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument in the form of a decimal floating-point constant.

The length attribute of the result is 42. The actual length of the result is the smallest number of characters that represents the value of the argument, including the sign, digits, and decimal-character. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the decimal-character. If the argument is zero, the result is 0.

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

The CCSID of the result is the default SBCS CCSID at the current server.

Floating-point to CLOB

floating-point expression

An expression that returns a value that is a built-in floating-point data type (DOUBLE or REAL).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 24. The actual length of the result is the smallest number of characters that can represent the value of the argument such that the mantissa consists of a single digit other than zero followed by the decimal-character and a sequence of digits. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the decimal-character. If the argument is zero, the result is 0E0.

The CCSID of the result is the default SBCS CCSID at the current server.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length attribute is specified. For more information, see "CAST specification" on page 170.

Example

• The following function returns a CLOB for the string 'This is a CLOB'. **SELECT CLOB(**'This is a CLOB')

FROM SYSIBM.SYSDUMMY1

COALESCE

The COALESCE function returns the value of the first non-null expression.



The arguments must be compatible. Character-string arguments are compatible with datetime values. For more information about data type compatibility, see "Assignments and comparisons" on page 89.

expression-1

An expression that returns a value of any built-in or user-defined data type. 49 expression-2

An expression that returns a value of any built-in or user-defined data type. ⁴⁹

The arguments are evaluated in the order in which they are specified, and the result of the function is the first argument that is not null. The result can be null only if all arguments can be null, and the result is null only if all arguments are null.

The selected argument is converted, if necessary, to the attributes of the result. The attributes of the result are determined by all the operands as explained in "Rules for result data types" on page 105.

Examples

 When selecting all the values from all the rows in the DEPARTMENT table, if the department manager (MGRNO) is missing (that is, null), then return a value of 'ABSENT'.

```
SELECT DEPTNO, DEPTNAME, COALESCE (MGRNO, 'ABSENT'), ADMRDEPT
  FROM DEPARTMENT
```

When selecting the employee number (EMPNO) and salary (SALARY) from all the rows in the EMPLOYEE table, if the salary is missing (that is null), then return a value of zero.

```
SELECT EMPNO, COALESCE (SALARY, 0)
  FROM EMPLOYEE
```

^{49.} This function cannot be used as a source function when creating a user-defined function. Because it accepts any compatible data types as arguments, it is not necessary to create additional signatures to support distinct types.

COMPARE_DECFLOAT

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The COMPARE_DECFLOAT function returns an ordering for DECFLOAT values.

```
►►—COMPARE_DECFLOAT—(—expression-1—,—expression-2—)————
```

The COMPARE_DECFLOAT function returns a small integer value that indicates how *expression-1* compares with *expression-2*.

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the argument is not DECFLOAT(34), it is logically converted to DECFLOAT(34) for processing.

expression-2

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the argument is not DECFLOAT(34), it is logically converted to DECFLOAT(34) for processing.

The first argument is compared with the second argument and the result is returned according to the following rules.

- If both operands are finite, the comparison is algebraic and follows the procedure for DECFLOAT subtraction. If the difference is exactly zero with either sign, the arguments are equal. If a nonzero difference is positive, the first argument is greater than the second argument. If a nonzero difference is negative, the first argument is less than the second.
- Positive zero and negative zero compare equal.
- Positive Infinity compares equal to positive infinity.
- Positive Infinity compares greater than any finite number.
- Negative Infinity compares equal to negative infinity.
- Negative Infinity compares less than any finite number.
- Numeric comparison is exact. The result is determined for finite operands as if range and precision were unlimited. Overflow or underflow cannot occur.
- If either argument is a NaN or sNaN (positive or negative), the result is unordered.

The result value is set as follows:

```
o if the arguments are exactly equal.
if expression1 is less than expression2.
if expression1 is greater than expression2.
if the arguments are unordered.
```

The result of the function is SMALLINT. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Examples

The following examples demonstrate the values that will be returned when the function is used:

COMPARE_DECFLOAT

COMPARE_DECFLOAT	(INFINITY,	INFINITY)	=	0
COMPARE_DECFLOAT	(INFINITY,	-INFINITY)	=	2
COMPARE DECFLOAT	(DECFLOAT(-2),	INFINITY)	=	1
COMPARE_DECFLOAT	(NAN,	NAN)	=	3
COMPARE DECFLOAT	(DECFLOAT(-0.1),	SNAN)	=	3

CONCAT

The CONCAT function combines two arguments.

```
▶▶—CONCAT—(—expression-1—,—expression-2—)—
```

The arguments must be compatible. Character-string arguments are not compatible with datetime values. For more information about data type compatibility, see "Assignments and comparisons" on page 89.

expression-1

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

expression-2

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is a string that consists of the first argument string followed by the second. The data type of the result is determined by the data types of the arguments. For more information, see "With the concatenation operator" on page 157. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Note

Syntax alternatives: The CONCAT function is identical to the CONCAT operator. For more information, see "With the concatenation operator" on page 157.

Example

• Concatenate the column FIRSTNME with the column LASTNAME.

```
SELECT CONCAT(FIRSTNME, LASTNAME)
FROM EMPLOYEE
WHERE EMPNO ='000010'
```

Returns the value 'CHRISTINEHAAS'.

CONTAINS

The CONTAINS function searches a text search index using criteria that are specified in a search argument and returns a result about whether or not a match was found.

```
► CONTAINS—(—column-name—,—search-argument——,—search-argument—)———
```

search-argument-options-string:

Notes:

1 The same clause must not be specified more than once.

column-name

Specifies a qualified or unqualified name of a column that has a text search index that is to be searched. The column must exist in the table or view that is identified in the FROM clause in the statement and the column of the table, or the column of the underlying base table of the view must have an associated text search index. The underlying expression of the column of a view must be a simple column reference to the column of an underlying table, directly or through another nested view.

search-argument

An expression that returns a character-string data type or graphic-string data type that contains the terms to be searched for. It must not be the empty string or contain all blanks. The actual length of the string must not exceed 32 740 and must not exceed the text search limitations or terms as specified in the search argument syntax. For information on *search-argument* syntax, see Appendix G, "Text search argument syntax," on page 1473.

search-argument-options

A character string or graphic string value that contains the search argument options to use for the search. It must be a constant or a variable.

The options that can be specified as part of the search-argument-options are:

QUERYLANGUAGE = value

Specifies the language value. The value can be any of the supported language codes. If QUERYLANGUAGE is not specified, the default is the language value of the text search index that is used when the function is invoked. If the language value of the text search index is AUTO, the default value for QUERYLANGUAGE is en_US. For more information on the query language option, see "Text search language options" on page 1483.

RESULTLIMIT = value

Specifies the maximum number of results that are to be returned from the underlying search engine. The *value* must be an integer from 1 to 2 147 483 647. If RESULTLIMIT is not specified, no result limit is in effect for the query.

CONTAINS may or may not be called for each row of the result table, depending on the plan that the optimizer chooses. If CONTAINS is called once for the query to the underlying search engine, a result set of all of the ROWIDs or primary keys that match are returned from the search engine. This result set is then joined to the table containing the column to identify the result rows. In this case, the RESULTLIMIT value acts like a FETCH FIRST *n* ROWS ONLY from the underlying text search engine and can be used as an optimization. If CONTAINS is called for each row of the result because the optimizer determines that is the best plan, then the RESULTLIMIT option has no effect. SYNONYM = OFF or SYNONYNM = ONSpecifies whether to use a synonym dictionary associated with the text search index. The default is OFF. **OFF** Do not use a synonym dictionary. ON Use the synonym dictionary associated with the text search index. If search-argument-options is the empty string or the null value, the function is evaluated as if search-argument-options were not specified. The result of the function is a large integer. If search-argument can be null, the result can be null; if search-argument is null, the result is the null value. The result is 1 if the column contains a match for the search criteria specified by the search-argument. Otherwise, the result is 0. If the column contains the null value or search-argument contains only blanks or is the empty string, the result is 0. CONTAINS is a non-deterministic function. Note fields of the text search index.

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1 Rules: If a view, nested table expression, or common table expression provides a text search column for a CONTAINS or SCORE scalar function and the applicable view, nested table expression, or common table expression has a DISTINCT clause on the outermost SELECT, the SELECT list must contain all the corresponding key

If a view, nested table expression, or common table expression provides a text search column for a CONTAINS or SCORE scalar function, the applicable view, nested table expression, or common table expression cannot have a UNION, EXCEPT, or INTERSECT at the outermost SELECT.

If a common table expression provides a text search column for a CONTAINS or SCORE scalar function, the common table expression cannot be subsequently referenced again in the entire query unless that reference does not provide a text search column for a CONTAINS or SCORE scalar function.

CONTAINS and SCORE scalar functions are not allowed if the query specifies:

- · a distributed table,
- · a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or

CONTAINS

• a logical file built over multiple physical file members.

Examples

 The following statement finds all of the employees who have "COBOL" in their resume. The text search argument is not case-sensitive.

```
SELECT EMPNO
 FROM EMP RESUME
WHERE RESUME FORMAT = 'ascii'
   AND CONTAINS (RESUME, 'cobol') = 1
```

 Find 10 students at random whose online essay contains the phrase "fossil fuel" in Spanish, that is "combustible fósil", to be invited for a radio interview. Since any 10 students can be selected, optimize the query to using RESULTLIMIT to limit the number of results from the search.

```
SELECT FIRSTNME, LASTNAME
  FROM STUDENT ESSAYS
WHERE CONTAINS (TERM_PAPER, 'combustible fósil'
                'QUERYLANGUAGE = es ES RESULTLIMIT = 10 SYNONYM = ON') = 1
```

• Find the string 'ate' in the COMMENT column. Use a host variable to supply the search argument.

```
char search_arg[100];
EXEC SQL DECLARE C1 CURSOR FOR
  SELECT CUSTKEY
    FROM CUSTOMERS
    WHERE CONTAINS(COMMENT, :search arg) = 1
   ORDER BY CUSTKEY;
EXEC SQL SET :search_arg = 'ate';
EXEC SQL OPEN C1;
```

The COS function returns the cosine of the argument, where the argument is an angle expressed in radians. The COS and ACOS functions are inverse operations.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable COSINE is a DECIMAL(2,1) host variable with a value of 1.5.

SELECT COS(:COSINE)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 0.07.

COSH

The COSH function returns the hyperbolic cosine of the argument, where the argument is an angle expressed in radians.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable HCOS is a DECIMAL(2,1) host variable with a value of 1.5.

```
SELECT COSH(:HCOS)
FROM SYSIBM.SYSDUMMY1
```

Returns the approximate value 2.35.

The COT function returns the cotangent of the argument, where the argument is an angle expressed in radians.

expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable COTAN is a DECIMAL(2,1) host variable with a value of 1.5.

```
SELECT COT(:COTAN)
FROM SYSIBM.SYSDUMMY1
```

Returns the approximate value 0.07.

CURDATE

The CURDATE function returns a date based on a reading of the time-of-day clock when the SQL statement is executed at the current server. The value returned by the CURDATE function is the same as the value returned by the CURRENT DATE special register.



The data type of the result is a date. The result cannot be null.

If this function is used more than once within a single SQL statement, or used with the CURTIME or NOW scalar functions or the CURRENT_DATE, CURRENT_TIME, or CURRENT_TIMESTAMP special registers within a single statement, all values are based on a single clock reading.

Note

Syntax alternatives: The CURRENT_DATE special register should be used for maximal portability. For more information, see "Special registers" on page 119.

Example

Return the current date based on the time-of-day clock.

SELECT CURDATE()
FROM SYSIBM.SYSDUMMY1

CURTIME

The CURTIME function returns a time based on a reading of the time-of-day clock when the SQL statement is executed at the current server. The value returned by the CURTIME function is the same as the value returned by the CURRENT TIME special register.



The data type of the result is a time. The result cannot be null.

If this function is used more than once within a single SQL statement, or used with the CURDATE or NOW scalar functions or the CURRENT_DATE, CURRENT_TIME, or CURRENT_TIMESTAMP special registers within a single statement, all values are based on a single clock reading.

Note

Syntax alternatives: The CURRENT_TIME special register should be used for maximal portability. For more information, see "Special registers" on page 119.

Example

• Return the current time based on the time-of-day clock.

```
SELECT CURTIME()
FROM SYSIBM.SYSDUMMY1
```

DATABASE

The DATABASE function returns the current server.



The result of the function is a VARCHAR(18). The result cannot be null.

The CCSID of the string is the default SBCS CCSID at the current server.

Note

Syntax alternatives: The DATABASE function returns the same result as the CURRENT SERVER special register.

Examples

• Assume that the current server is 'RCHASGMA'.

SELECT DATABASE()
FROM SYSIBM.SYSDUMMY1

Results in a value of 'RCHASGMA'.

DATAPARTITIONNAME

The DATAPARTITIONNAME function returns the partition name of where a row is located. If the argument identifies a non-partitioned table, an empty string is returned.

▶▶──DATAPARTITIONNAME—(—table-designator—)

For more information about partitions, see the DB2 Multisystem topic collection.

table-designator

A table designator of the subselect. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the relational database name of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the relational database name of the first table in the outer subselect of the view, common table expression, or nested table expression.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The DATAPARTITIONNAME function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is VARCHAR(18). The result can be null.

The CCSID of the result is the default CCSID of the current server.

Example

 Join the EMPLOYEE and DEPARTMENT tables, select the employee number (EMPNO) and determine the partition from which each row involved in the join originated.

SELECT EMPNO, DATAPARTITIONNAME(X), DATAPARTITIONNAME(Y)
FROM EMPLOYEE X, DEPARTMENT Y
WHERE X.DEPTNO=Y.DEPTNO

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DATAPARTITIONNUM

The DATAPARTITIONNUM function returns the data partition number of a row. If the argument identifies a non-partitioned table, the value 0 is returned.

►► DATAPARTITIONNUM—(—table-designator—)————

For more information about data partitions, see the DB2 Multisystem topic collection.

table-designator

A table designator of the subselect. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the data partition number of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the data partition number of the first table in the outer subselect of the view, common table expression, or nested table expression.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The DATAPARTITIONNUM function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is a large integer. The result can be null.

Example

• Determine the partition number and employee name for each row in the EMPLOYEE table. If this is a partitioned table, the number of the partition where the row exists is returned.

SELECT DATAPARTITIONNUM(EMPLOYEE), LASTNAME FROM EMPLOYEE

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, a graphic string, or any numeric data

- If expression is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be one of the following:
 - A valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.
 - A string with an actual length of 7 that represents a valid date in the form yyyynnn, where yyyy are digits denoting a year, and nnn are digits between 001 and 366 denoting a day of that year.
- If expression is a number, it must be a positive number less than or equal to 3 652 059.

The result of the function is a date. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a timestamp: The result is the date part of the timestamp.
- If the argument is a date:

The result is that date.

- If the argument is a number:
 - The result is the date that is *n*-1 days after January 1, 0001, where *n* is the integral part of the number.
- If the argument is a character or graphic string:

The result is the date represented by the string or the date part of the timestamp value represented by the string.

When a string representation of a date is SBCS data with a CCSID that is not the same as the default CCSID for SBCS data, that value is converted to adhere to the default CCSID for SBCS data before it is interpreted and converted to a date value.

When a string representation of a date is mixed data with a CCSID that is not the same as the default CCSID for mixed data, that value is converted to adhere to the default CCSID for mixed data before it is interpreted and converted to a date value.

When a string representation of a date is graphic data, that value is converted to adhere to the default CCSID for SBCS data before it is interpreted and converted to a date value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the argument is a date, timestamp, or character string. For more information, see "CAST specification" on page 170.

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Examples

Assume that the column RECEIVED (TIMESTAMP) has an internal value equivalent to '1988-12-25-17.12.30.000000'.

```
SELECT DATE (RECEIVED)
 FROM IN TRAY
 WHERE SOURCE = 'BADAMSON'
```

Results in a date data type with a value of '1988-12-25'.

• The following DATE scalar function applied to an ISO string representation of a date:

```
SELECT DATE('1988-12-25')
 FROM SYSIBM.SYSDUMMY1
```

Results in a date data type with a value of '1988-12-25'.

· The following DATE scalar function applied to an EUR string representation of a date:

```
SELECT DATE('25.12.1988')
 FROM SYSIBM.SYSDUMMY1
```

Results in a date data type with a value of '1988-12-25'.

• The following DATE scalar function applied to a positive number:

```
SELECT DATE (35)
  FROM SYSIBM.SYSDUMMY1
```

Results in a date data type with a value of '0001-02-04'.

The DAY function returns the day part of a value.

```
▶►—DAY—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a date duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a date, timestamp, or valid character-string representation of a date or timestamp:
 - The result is the day part of the value, which is an integer between 1 and 31.
- If the argument is a date duration or timestamp duration:

 The result is the day part of the value, which is an integer between -99 and 99.

 A nonzero result has the same sign as the argument.

Examples

Using the PROJECT table, set the host variable END_DAY (SMALLINT) to the
day that the WELD LINE PLANNING project (PROJNAME) is scheduled to stop
(PRENDATE).

```
SELECT DAY(PRENDATE)
INTO :END_DAY
FROM PROJECT
WHERE PROJNAME = 'WELD LINE PLANNING'
```

Results in END_DAY being set to 15.

• Return the day part of the difference between two dates:

```
SELECT DAY( DATE('2000-03-15') - DATE('1999-12-31') )
FROM SYSIBM.SYSDUMMY1
```

Results in the value 15.

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is VARCHAR(100). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the result is the default CCSID of the current server.

Note

National language considerations: The name of the day that is returned is based on the language used for messages in the job. This name of the day is retrieved from message CPX9034 in message file QCPFMSG in library *LIBL.

Examples

Assume that the language used is US English.

```
SELECT DAYNAME( '2003-01-02' )
FROM SYSIBM.SYSDUMMY1
```

Results in 'Thursday'.

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DAYOFMONTH

The DAYOFMONTH function returns an integer between 1 and 31 that represents the day of the month.



expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

 Using the PROJECT table, set the host variable END_DAY (SMALLINT) to the day that the WELD LINE PLANNING project (PROJNAME) is scheduled to stop (PRENDATE).

```
SELECT DAYOFMONTH(PRENDATE)
INTO :END_DAY
FROM PROJECT
WHERE PROJNAME = 'WELD LINE PLANNING'
```

Results in END_DAY being set to 15.

DAYOFWEEK

The DAYOFWEEK function returns an integer between 1 and 7 that represents the day of the week, where 1 is Sunday and 7 is Saturday.

```
▶► DAYOFWEEK—(—expression—)—
```

For another alternative, see "DAYOFWEEK_ISO" on page 277.

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

 Using the EMPLOYEE table, set the host variable DAY_OF_WEEK (INTEGER) to the day of the week that Christine Haas (EMPNO='000010') started (HIREDATE).

```
SELECT DAYOFWEEK(HIREDATE)
INTO :DAY_OF_WEEK
FROM EMPLOYEE
WHERE EMPNO = '000010'
```

Results in DAY_OF_WEEK being set to 6, which represents Friday.

• The following query returns four values: 1, 2, 1, and 2.

```
SELECT DAYOFWEEK(CAST('10/11/1998' AS DATE)),

DAYOFWEEK(TIMESTAMP('10/12/1998','01.02')),

DAYOFWEEK(CAST(CAST('10/11/1998' AS DATE) AS CHAR(20))),

DAYOFWEEK(CAST(TIMESTAMP('10/12/1998','01.02') AS CHAR(26)))

FROM SYSIBM.SYSDUMMY1
```

| | |

DAYOFWEEK_ISO

The DAYOFWEEK_ISO function returns an integer between 1 and 7 that represents the day of the week, where 1 is Monday and 7 is Sunday.

```
►►—DAYOFWEEK ISO—(—expression—)—
```

For another alternative, see "DAYOFWEEK_ISO."

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Using the EMPLOYEE table, set the host variable DAY_OF_WEEK (INTEGER) to the day of the week that Christine Haas (EMPNO='000010') started (HIREDATE).

```
SELECT DAYOFWEEK_ISO(HIREDATE)
INTO :DAY_OF_WEEK
FROM EMPLOYEE
WHERE EMPNO = '000010'
```

Results in DAY_OF_WEEK being set to 5, which represents Friday.

• The following query returns four values: 7, 1, 7, and 1.

```
SELECT DAYOFWEEK_ISO(CAST('10/11/1998' AS DATE)),

DAYOFWEEK_ISO(TIMESTAMP('10/12/1998','01.02')),

DAYOFWEEK_ISO(CAST(CAST('10/11/1998' AS DATE) AS CHAR(20))),

DAYOFWEEK_ISO(CAST(TIMESTAMP('10/12/1998','01.02') AS CHAR(26)))

FROM SYSIBM.SYSDUMMY1
```

| | |

DAYOFYEAR

The DAYOFYEAR function returns an integer between 1 and 366 that represents the day of the year where 1 is January 1.

▶►—DAYOFYEAR—(—expression—)—

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

 Using the EMPLOYEE table, set the host variable AVG_DAY_OF_YEAR (INTEGER) to the average of the day of the year that employees started on (HIREDATE).

SELECT AVG(DAYOFYEAR(HIREDATE))
INTO :AVG_DAY_OF_YEAR
FROM EMPLOYEE

Results in AVG_DAY_OF_YEAR being set to 197.

| | | |

DAYS

The DAYS function returns an integer representation of a date.

```
▶►—DAYS—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is 1 more than the number of days from January 1, 0001 to *D*, where *D* is the date that would occur if the DATE function were applied to the argument.

Examples

Using the PROJECT table, set the host variable EDUCATION_DAYS (INTEGER) to the number of elapsed days (PRENDATE - PRSTDATE) estimated for the project (PROJNO) 'IF2000'.

```
SELECT DAYS(PRENDATE) - DAYS(PRSTDATE)
INTO :EDUCATION_DAYS
FROM PROJECT
WHERE PROJNO = 'IF2000'
```

Results in EDUCATION_DAYS being set to 396.

 Using the PROJECT table, set the host variable TOTAL_DAYS (INTEGER) to the sum of elapsed days (PRENDATE - PRSTDATE) estimated for all projects in department (DEPTNO) 'E21'.

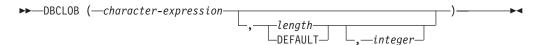
```
SELECT SUM(DAYS(PRENDATE) - DAYS(PRSTDATE))
INTO :TOTAL_DAYS
FROM PROJECT
WHERE DEPTNO = 'E21'
```

Results in TOTAL_DAYS being set to 1584.

DBCLOB

The DBCLOB function returns a graphic-string representation.

Character to DBCLOB



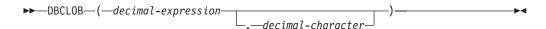
Graphic to DBCLOB



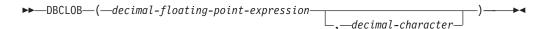
Integer to DBCLOB



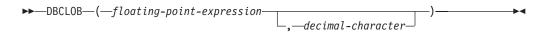
Decimal to DBCLOB



Decimal floating-point to DBCLOB



Floating-point to DBCLOB



The DBCLOB function returns a graphic-string representation of:

- · An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT
- · A decimal number if the first argument is a packed or zoned decimal number
- · A decimal floating-point number if the first argument is a DECFLOAT
- A double-precision floating-point number if the first argument is a DOUBLE or REAL
- A character string if the first argument is any type of character string
- · A graphic string if the first argument is any type of graphic string

The result of the function is a DBCLOB. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Character to DBCLOB

character-expression

An expression that returns a value that is a built-in character-string data type. It cannot be CHAR or VARCHAR bit data. If the expression is an empty string or the EBCDIC string X'0E0F', the result is an empty string.

length

An integer constant that specifies the length attribute for the resulting varying length character string. The value must be between 1 and 1 073 741 823.

If the second argument is not specified or DEFAULT is specified:

- If the *character-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *character-expression*. If the length of the *character-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID for the resulting varying-length graphic string. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535.

In the following rules, S denotes one of the following:

- If the string expression is a host variable containing data in a foreign encoding scheme, S is the result of the expression after converting the data to a CCSID in a native encoding scheme. (See "Character conversion" on page 32 for more information.)
- If the string expression is data in a native encoding scheme, S is that string expression.

If the third argument is not specified and the first argument is character, then the CCSID of the result is determined by a mixed CCSID. Let M denote that mixed CCSID. M is determined as follows:

- If the CCSID of S is a mixed CCSID, M is that CCSID.
- If the CCSID of S is an SBCS CCSID:
 - If the CCSID of S has an associated mixed CCSID, M is that CCSID.
 - Otherwise the operation is not allowed.

The following table summarizes the result CCSID based on M.

M	Result CCSID	Description	DBCS Substitution Character
930	300	Japanese EBCDIC	X'FEFE'
933	834	Korean EBCDIC	X'FEFE'
935	837	S-Chinese EBCDIC	X'FEFE'
937	835	T-Chinese EBCDIC	X'FEFE'
939	300	Japanese EBCDIC	X'FEFE'
5026	4396	Japanese EBCDIC	X'FEFE'
5035	4396	Japanese EBCDIC	X'FEFE'

If the result is DBCS-graphic data, the equivalence of SBCS and DBCS characters depends on M. Regardless of the CCSID, every double-byte code point in the argument is considered a DBCS character, and every single-byte code point in the argument is considered an SBCS character with the exception of the EBCDIC mixed data shift codes X'0E' and X'0F'.

- If the nth character of the argument is a DBCS character, the nth character of the result is that DBCS character.
- If the nth character of the argument is an SBCS character that has an equivalent DBCS character, the nth character of the result is that equivalent DBCS character.
- If the nth character of the argument is an SBCS character that does not have an equivalent DBCS character, the nth character of the result is the DBCS substitution character.

If the result is Unicode graphic data, each character of the argument determines a character of the result. The nth character of the result is the UTF-16 or UCS-2 equivalent of the nth character of the argument.

Graphic to DBCLOB

graphic-expression

An expression that returns a value that is a built-in graphic-string data type.

An integer constant that specifies the length attribute for the resulting varying length character string. The value must be between 1 and 1 073 741 823.

If the second argument is not specified or DEFAULT is specified:

- If the graphic-expression is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of graphic-expression. If the length of the graphic-expression is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID for the resulting varying-length graphic string. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535.

In the following rules, S denotes one of the following:

- If the string expression is a host variable containing data in a foreign encoding scheme, S is the result of the expression after converting the data to a CCSID in a native encoding scheme. (See "Character conversion" on page 32 for more information.)
- If the string expression is data in a native encoding scheme, S is that string expression.

If the third argument is not specified, then the CCSID of the result is the same as the CCSID of the first argument.

Integer to DBCLOB

integer-expression

An expression that returns a value that is a built-in integer data type (either SMALLINT, INTEGER, or BIGINT).

The result is a varying-length graphic string of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. The result is left justified.

- If the argument is a small integer, the length attribute of the result is 6.
- If the argument is a large integer, the length attribute of the result is 11.
- If the argument is a big integer, the length attribute of the result is 20.

The actual length of the result is the smallest number of characters that can be used to represent the value of the argument. Leading zeroes are not included. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal to DBCLOB

decimal-expression

An expression that returns a value that is a built-in decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the *decimal-expression* with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length attribute of the result is 2+p where p is the precision of the *decimal-expression*. The actual length of the result is the smallest number of characters that can be used to represent the result, except that trailing characters are included. Leading zeros are not included. If the argument is negative, the result begins with a minus sign. Otherwise, the result begins with a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal floating-point to DBCLOB

decimal floating-point expression

An expression that returns a value that is a built-in decimal floating-point data type.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma.

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DBCLOB

If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument in the form of a decimal floating-point constant.

The length attribute of the result is 42. The actual length of the result is the smallest number of characters that represents the value of the argument, including the sign, digits, and *decimal-character*. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0.

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

The CCSID of the result is 1200 (UTF-16).

Floating-point to DBCLOB

floating-point expression

An expression that returns a value that is a built-in floating-point data type (DOUBLE or REAL).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 24. The actual length of the result is the smallest number of characters that can represent the value of the argument such that the mantissa consists of a single digit other than zero followed by the *decimal-character* and a sequence of digits. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0E0.

The CCSID of the result is 1200 (UTF-16).

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length attribute is specified. For more information, see "CAST specification" on page 170.

Example

 Using the EMPLOYEE table, set the host variable VAR_DESC (VARGRAPHIC(24)) to the DBCLOB equivalent of the first name (FIRSTNME) for employee number (EMPNO) '000050'.

```
SELECT DBCLOB(VARGRAPHIC(FIRSTNME))
INTO :VAR_DESC
FROM EMPLOYEE
WHERE EMPNO = '000050'
```

DBPARTITIONNAME

The DBPARTITIONNAME function returns the relational database name (database partition name) of where a row is located. If the argument identifies a non-distributed table, an empty string is returned.

```
▶▶—DBPARTITIONNAME—(—table-designator—)————
```

For more information about partitions, see the DB2 Multisystem topic collection.

table-designator

A table designator of the subselect. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the relational database name of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the partition name of the first table in the outer subselect of the view, common table expression, or nested table expression.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The DBPARTITIONNAME function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is VARCHAR(18). The result can be null.

The CCSID of the result is the default CCSID of the current server.

Note

Syntax alternatives: NODENAME is a synonym for DBPARTITIONNAME.

Example

 Join the EMPLOYEE and DEPARTMENT tables, select the employee number (EMPNO) and determine the node from which each row involved in the join originated.

```
SELECT EMPNO, DBPARTITIONNAME(X), DBPARTITIONNAME(Y)
FROM EMPLOYEE X, DEPARTMENT Y
WHERE X.DEPTNO=Y.DEPTNO
```

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DBPARTITIONNUM

The DBPARTITIONNUM function returns the node number (database partition number) of a row.

▶►—DBPARTITIONNUM—(—table-designator—)—

If the argument identifies a non-distributed table, the value 0 is returned.⁵⁰ For more information about nodes and node numbers, see the DB2 Multisystem book.

table-designator

A table designator of the subselect. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the node number of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the node number of the first table in the outer subselect of the view, common table expression, or nested table expression.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The DBPARTITIONNUM function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is a large integer. The result can be null.

Note

Syntax alternatives: NODENUMBER is a synonym for DBPARTITIONNUM.

Example

• Determine the node number and employee name for each row in the EMPLOYEE table. If this is a distributed table, the number of the node where the row exists is returned.

SELECT DBPARTITIONNUM(EMPLOYEE), LASTNAME FROM EMPLOYEE

^{50.} If the argument identifies a DDS created logical file that is based on more than one physical file member, DBPARTITIONNUM will not return 0, but instead will return the underlying physical file member number.

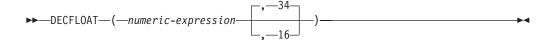
DECFLOAT

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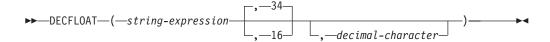
I

The DECFLOAT function returns a decimal floating-point representation of a number or a string representation of a number.

Numeric to DECFLOAT



String to DECFLOAT



The DECFLOAT function returns a decimal floating-point representation of:

- A number
- A character or graphic string representation of a decimal number
- A character or graphic string representation of an integer
- A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to DECFLOAT

numeric-expression

An expression that returns a value of any built-in numeric data type.

34 **or** 16

Specifies the number of digits of precision for the result. If this argument is omitted, the default is 34.

The result is the same number that would occur if the first argument were assigned to a decimal floating-point column or variable.

String to DECFLOAT

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number. Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant.

34 **or** 16

Specifies the number of digits of precision for the result. If this argument is omitted, the default is 34.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in *string-expression* from the whole part of the number. The character must be a period or comma. If *decimal-character* is not specified, the decimal point is the default decimal separator character. For more information, see "Decimal point" on page 116.

DECFLOAT

The result is the same number that would result from CAST(string-expression AS DECFLOAT(34)) or CAST(string-expression AS DECFLOAT(16)). The result of the function is a DECFLOAT number with the specified (either implicitly or explicitly) number of digits of precision. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value. If necessary, the source is rounded to the precision of the target. See "CURRENT DECFLOAT ROUNDING MODE" on page 122 for more information. **Note** Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170. **Example** • Use the DECFLOAT function in order to force a DECFLOAT data type to be returned in a select-list for the EDLEVEL column (data type = SMALLINT) in the EMPLOYEE table. The EMPNO column should also appear in the select list. SELECT EMPNO, DECFLOAT (EDLEVEL, 16) FROM EMPLOYEE

DECFLOAT_SORTKEY

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The DECFLOAT_SORTKEY function returns a binary value that may be used to sort DECFLOAT values.

```
▶ DECFLOAT_SORTKEY—(—expression—)—
```

The DECFLOAT_SORTKEY function returns a binary value that may be used to sort decimal floating-point values in a manner that is consistent with the IEEE 754R specification on total ordering.

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type.

If the data type of the argument is SMALLINT, INTEGER, REAL, DOUBLE, DECIMAL(p,s) where p <=16, or NUMERIC(p,s) where p <=16, then the argument is converted to DECFLOAT(16) for processing. Otherwise, the argument is converted to DECFLOAT(34) for processing.

The result of the function is BINARY(9) if the argument is DECFLOAT(16) or BINARY(17) if the argument is DECFLOAT(34).

If the argument can be null, the result can be null. If the argument is null, the result is the null value.

Example

Note that this result set is arbitrary. The ORDER BY has no effect on ordering these values.

SELECT D1 FROM T1 ORDER BY DECFLOAT SORTKEY(D1);

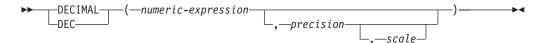
```
D1
2.1000
2.100
2.10
2.10
2.1
```

Note that this result set is ordered according to the IEEE 745R ordering specification.

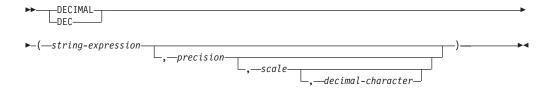
DECIMAL or DEC

The DECIMAL function returns a decimal representation.

Numeric to Decimal



String to Decimal



The DECIMAL function returns a decimal representation of:

- A number
- · A character or graphic string representation of a decimal number
- · A character or graphic string representation of an integer
- · A character or graphic string representation of a decimal floating-point number
- · A character or graphic string representation of a floating-point number

Numeric to Decimal

numeric-expression

An expression that returns a value of any built-in numeric data type.

precision

An integer constant with a value greater than or equal to 1 and less than or equal to 63.

The default for *precision* depends on the data type of the *numeric-expression*:

- 15 for floating point, decimal, numeric, or nonzero scale binary
- 19 for big integer
- 11 for large integer
- 5 for small integer

scale

An integer constant that is greater than or equal to 0 and less than or equal to *precision*. If not specified, the default is 0.

The result is the same number that would occur if the first argument were assigned to a decimal column or variable with a precision of *precision* and a scale of *scale*. An error is returned if the number of significant decimal digits required to represent the whole part of the number is greater than *precision-scale*. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

String to Decimal

string-expression

An expression that returns a character-string or graphic-string representation of

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a number. Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant.

precision

An integer constant that is greater than or equal to 1 and less than or equal to 63. If not specified, the default is 15.

scale

An integer constant that is greater than or equal to 0 and less than or equal to *precision*. If not specified, the default is 0.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in *string-expression* from the whole part of the number. The character must be a period or comma. If *decimal-character* is not specified, the decimal point is the default decimal separator character. For more information, see "Decimal point" on page 116.

The result is the same number that would result from CAST(string-expression AS DECIMAL(precision,scale)). Digits are truncated from the end of the decimal number if the number of digits to the right of the decimal separator character is greater than scale. An error is returned if the number of significant digits to the left of the decimal character (the whole part of the number) in string-expression is greater than precision-scale. The default decimal character is not valid in the substring if the decimal-character argument is specified.

The result of the function is a decimal number with precision of *precision* and scale of *scale*. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when precision is specified. For more information, see "CAST specification" on page 170.

Examples

• Use the DECIMAL function in order to force a DECIMAL data type (with a precision of 5 and a scale of 2) to be returned in a select-list for the EDLEVEL column (data type = SMALLINT) in the EMPLOYEE table. The EMPNO column should also appear in the select list.

```
SELECT EMPNO, DECIMAL (EDLEVEL, 5, 2) FROM EMPLOYEE
```

• Using the PROJECT table, select all of the starting dates (PRSTDATE) that have been incremented by a duration that is specified in a host variable. Assume the host variable PERIOD is of type INTEGER. Then, in order to use its value as a date duration it must be "cast" as DECIMAL(8,0).

```
SELECT PRSTDATE + DECIMAL(:PERIOD,8)
  FROM PROJECT
```

• Assume that updates to the SALARY column are input through a window as a character string using comma as a decimal character (for example, the user inputs 21400,50). Once validated by the application, it is assigned to the host variable newsalary which is defined as CHAR(10).

```
UPDATE STAFF
SET SALARY = DECIMAL(:newsalary, 9, 2, ',')
WHERE ID = :empid
```

DECIMAL or DEC

The value of SALARY becomes 21400.50.

The DECRYPT_BIT, DECRYPT_BINARY, DECRYPT_CHAR, and DECRYPT_DB functions return a value that is the result of decrypting encrypted data. The password used for decryption is either the *password-string* value or the ENCRYPTION PASSWORD value assigned by the SET ENCRYPTION PASSWORD statement.



The decryption functions can only decrypt values that are encrypted using the ENCRYPT_AES, ENCRYPT_RC2, or ENCRYPT_TDES function.

encrypted-data

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An expression that must be a string expression that returns a complete, encrypted data value of a CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, VARBINARY, or BLOB built-in data type. The data string must have been encrypted using the ENCRYPT_AES, ENCRYPT_RC2, or ENCRYPT_TDES function.

password-string

An expression that returns a character string value with at least 6 bytes and no more than 127 bytes. The expression must not be a CLOB. This expression must be the same password used to encrypt the data or an error is returned. If the value of the password argument is null or not provided, the data will be decrypted using the ENCRYPTION PASSWORD value, which must have been set using the SET ENCRYPTION PASSWORD statement.

DEFAULT

The data will be decrypted using the ENCRYPTION PASSWORD value, which must have been set using the SET ENCRYPTION PASSWORD statement.

integer

An integer constant that specifies the CCSID of the result. If DECRYPT_BIT or DECRYPT_BINARY is specified, the third argument must not be specified.

If DECRYPT_CHAR is specified, *integer* must be a valid SBCS CCSID or mixed data CCSID. It cannot be 65535 (bit data). If the third argument is an SBCS CCSID, then the result is SBCS data. If the third argument is a mixed CCSID, then the result is mixed data. If the third argument is not specified then the CCSID of the result is the default CCSID of the current server.

If DECRYPT_DB is specified, *integer* must be a valid DBCS CCSID. If the third argument is not specified then the CCSID of the result is the DBCS CCSID associated with the default CCSID of the current server.

The data type of the result is determined by the function specified and the data type of the first argument as shown in the following table. If a cast from the actual type of the encrypted data to the function's result is not supported a warning or error is returned.

DECRYPT

DECRYPT_BIT CHAR FOR BIT DATA, BINARY, or VARBINARY, ARCHAR FOR BIT DATA, BINARY, or VARBINARY, and VARGHAR FOR BIT DATA, BINARY, or VARBINARY, and VARGHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BIT CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BIT BLOB Any string Error Any string Error Any string CHAR FOR BIT DATA, BINARY CHAR FOR BIT DATA, BINARY DECRYPT_BINARY BLOB Any string Any string CHAR FOR BIT DATA, BINARY DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY AND CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY STRING CHAR FOR BIT DATA, BINARY STRING CHAR FOR BIT DATA, BINARY STRING CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY DECRYPT_D	Function	Data Type of First Argument	Actual Data Type of Encrypted Data	Result
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BIT CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BINARY CHAR FOR BIT DATA, BINARY, or VARBINARY CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BINARY CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY, or	DECRYPT_BIT	VARCHAR FOR BIT DATA,	Character string	VARCHAR FOR BIT DATA
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BINARY CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BINARY BLOB Any string Any string WARBINARY VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB DECRYPT_CHAR DECRY	DECRYPT_BIT	VARCHAR FOR BIT DATA,	Graphic string	Error or Warning **
DECRYPT_BINARY CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_BINARY BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY DECRYPT_DB CHAR FOR BIT DATA, BIN	DECRYPT_BIT	VARCHAR FOR BIT DATA,	Binary string	Error or Warning **
VARCHAR FOR BIT DATA, BINARY, or VARBINARY BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB Character string CLOB DECRYPT_CHAR BLOB Character string CLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character Error or Warning ** DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string Error or Warning ** VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB CHAR FOR BIT DATA, VARCHAR DECRYPT_DB CHAR FOR BIT DATA, VARCHAR DECRYPT_DB CHAR FOR B	DECRYPT_BIT	BLOB	Any string	Error
CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY	DECRYPT_BINARY	VARCHAR FOR BIT DATA,	Any string	VARBINARY
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB Character string CLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, OR VARBINARY DECRYPT_DB CHAR FO	DECRYPT_BINARY	BLOB	Any string	BLOB
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB Character string CLOB Unicode graphic string CLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB Non-Unicode graphic string DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_CHAR BLOB DECRYPT_DB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DECLOB BLOB Non-UTF-8 character Error or Warning ** DECLOB Error or Warning ** VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB Non-UTF-8 character Error or Warning ** Error or	DECRYPT_CHAR	VARCHAR FOR BIT DATA,	Character string	VARCHAR
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB Character string CLOB DECRYPT_CHAR BLOB Unicode graphic string DECRYPT_CHAR BLOB Non-Unicode graphic string DECRYPT_CHAR BLOB Non-Unicode graphic string Error or Warning ** DECRYPT_CHAR BLOB Binary string Error or Warning ** UTF-8 character string or graphic string DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string Error or Warning ** DECRYPT_DB BLOB Non-UTF-8 character string or graphic string Error or Warning ** Error or Warning ** Error or Warning ** DECRYPT_DB BLOB Non-UTF-8 character string or graphic string Error or Warning **	DECRYPT_CHAR	VARCHAR FOR BIT DATA,	Unicode graphic string	VARCHAR
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_CHAR BLOB Unicode graphic string CLOB DECRYPT_CHAR BLOB Non-Unicode graphic string DECRYPT_CHAR BLOB Non-Unicode graphic string Error or Warning ** DECRYPT_CHAR BLOB Binary string Error or Warning ** UTF-8 character string or graphic string Error or Warning ** VARGRAPHIC VARGRAPHIC DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DBCLOB Error or Warning ** Error or Warning ** Error or Warning ** Error or Warning ** DBCLOB Error or Warning ** Error or Warning ** DBCLOB Error or Warning ** DBCLOB Error or Warning **	DECRYPT_CHAR	VARCHAR FOR BIT DATA,		Error or Warning **
DECRYPT_CHAR BLOB Unicode graphic string Non-Unicode graphic string Error or Warning ** DECRYPT_CHAR BLOB Binary string CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DBCLOB DBCLOB DBCLOB Ron-UTF-8 character Error or Warning ** DBCLOB STRIPPICAL STRING DBCLOB DBCLOB STRIPPICAL STRING DBCLOB STRIPPICAL STRIPPICAL STRING DBCLOB STRIPPICAL STR	DECRYPT_CHAR	VARCHAR FOR BIT DATA,	Binary string	Error or Warning **
DECRYPT_CHAR BLOB Non-Unicode graphic string Error or Warning ** DECRYPT_CHAR BLOB Binary string Error or Warning ** UTF-8 character string or graphic string DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DECLOB DECRYPT_DB BLOB Non-UTF-8 character Error or Warning ** DECRYPT_DB BLOB Non-UTF-8 character Error or Warning **	DECRYPT_CHAR	BLOB	Character string	CLOB
DECRYPT_CHAR BLOB Binary string CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DBCLOB DBCLOB DBCLOB Non-UTF-8 character string Error or Warning ** Error or Warning **	DECRYPT_CHAR	BLOB	Unicode graphic string	CLOB
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VARCHAR FOR BIT DATA, BINARY, or VARBINARY CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DECRYPT_DB BLOB Non-UTF-8 character string Error or Warning ** DBCLOB Error or Warning **	DECRYPT_DB	VARCHAR FOR BIT DATA,		VARGRAPHIC
VARCHAR FOR BIT DATA, BINARY, or VARBINARY DECRYPT_DB BLOB UTF-8 character string or graphic string DECRYPT_DB BLOB Non-UTF-8 character string Error or Warning **	DECRYPT_DB	VARCHAR FOR BIT DATA,		Error or Warning **
graphic string DECRYPT_DB BLOB Non-UTF-8 character string Error or Warning **	DECRYPT_DB	VARCHAR FOR BIT DATA,	Binary string	Error or Warning **
string	DECRYPT_DB	BLOB		DBCLOB
DECRYPT_DB BLOB Binary string Error or Warning **	DECRYPT_DB	BLOB		Error or Warning **
	DECRYPT_DB	BLOB	Binary string	Error or Warning **

	Data Type of First	Actual Data Type of	
Function A	Argument	Encrypted Data	Result

Note:

If the *encrypted-data* included a hint, the hint is not returned by the function. The length attribute of the result is the length attribute of the data type of *encrypted-data* minus 8 bytes. The actual length of the result is the length of the original string that was encrypted. If the *encrypted-data* includes bytes beyond the encrypted string, these bytes are not returned by the function.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

If the data is decrypted using a different CCSID than the originally encrypted value, expansion may occur when converting the decrypted value to this CCSID. In such situations, the *encrypted-data* should be cast to a varying-length string with a larger number of bytes.

Note

Password protection: To prevent inadvertent access to the encryption password, do not specify *password-string* as a string constant in the source for a program, procedure, or function. Instead, use the ENCRYPTION PASSWORD special register or a host variable.

When connected to a remote relational database, the specified password itself is sent "in the clear". That is, the password itself is not encrypted. To protect the password in these cases, consider using a communications encryption mechanism such as IPSEC (or SSL if connecting between System i products).

Syntax alternatives: For compatibility with previous versions of DB2, DECRYPT_BIN can be specified in place of DECRYPT_BIT.

Examples

• Assume that table EMP1 has a social security column called SSN. This example uses the ENCRYPTION PASSWORD value to hold the encryption password.

```
SET ENCRYPTION PASSWORD = :pw
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_RC2( '289-46-8832' )
SELECT DECRYPT_CHAR( SSN)
FROM EMP1
```

The DECRYPT_CHAR function returns the original value '289-46-8832'.

• This example explicitly passes the encryption password which has been set in variable pw.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_TDES( '289-46-8832', :pw)
SELECT DECRYPT_CHAR( SSN, :pw)
FROM EMP1
```

The DECRYPT_CHAR function returns the original value '289-46-8832'.

^{**} If the decryption function is in the select list of an outer subselect, a data mapping warning is returned. Otherwise an error is returned. For more information about data mapping warnings, see "Assignments and comparisons" on page 89.

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

If the data type of the argument is DECFLOAT(*n*), the result is DECFLOAT(*n*). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

 Assume the host variable RAD is a DECIMAL(4,3) host variable with a value of 3.142.

SELECT DEGREES(:RAD)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 180.0.

DIFFERENCE

1

The DIFFERENCE function returns a value from 0 to 4 representing the difference between the sounds of two strings based on applying the SOUNDEX function to the strings. A value of 4 is the best possible sound match.

```
▶► DIFFERENCE — (—expression-1—,—expression-2—)—
```

expression-1

An expression that returns a built-in numeric, character-string, or graphic-string data types, but not CLOBs or DBCLOBs. The arguments cannot be binary strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

expression-2

An expression that returns a built-in numeric, character-string, or graphic-string data types, but not CLOBs or DBCLOBs. The arguments cannot be binary strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The data type of the result is INTEGER. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Examples

• Assume the following statement:

Returns 4, C523, and C523. Since the two strings return the same SOUNDEX value, the difference is 4 (the highest value possible).

• Assume the following statement:

Returns 2, C523, and C536. In this case, the two strings return different SOUNDEX values, and hence, a lower difference value.

DIGITS

The DIGITS function returns a character-string representation of the absolute value of a number.

▶►—DIGITS—(—expression—)—

expression

An expression that returns a value of a built-in SMALLINT, INTEGER, BIGINT, DECIMAL, NUMERIC, character-string, or graphic-string data type. A string argument is cast to DECIMAL(63,31) before evaluating the function. For more information about converting strings to decimal, see "DECIMAL or DEC" on page 290.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result of the function is a fixed-length character string representing the absolute value of the argument without regard to its scale. The result does not include a sign or a decimal point. Instead, it consists exclusively of digits, including, if necessary, leading zeros to fill out the string. The length of the string is:

- 5 if the argument is a small integer with a scale of zero
- 10 if the argument is a large integer with a scale of zero
- 19 if the argument is a big integer
- *p* if the argument is a decimal (or an integer with a scale greater than zero) with a precision of *p*

The CCSID of the character string is the default SBCS CCSID at the current server.

Examples

 Assume that a table called TABLEX contains an INTEGER column called INTCOL containing 10-digit numbers. List all combinations of the first four digits contained in column INTCOL.

```
SELECT DISTINCT SUBSTR(DIGITS(INTCOL),1,4)
FROM TABLEX
```

• Assume that COLUMNX has the DECIMAL(6,2) data type, and that one of its values is -6.28.

```
SELECT DIGITS (COLUMNX)
FROM TABLEX
```

Returns the value '000628'.

The result is a string of length six (the precision of the column) with leading zeros padding the string out to this length. Neither sign nor decimal point appear in the result.

'

DLCOMMENT

The DLCOMMENT function returns the comment value, if it exists, from a DataLink value.

```
▶►—DLCOMMENT—(—DataLink-expression—)—
```

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

The result of the function is VARCHAR(254). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the character string is the same as that of *DataLink-expression*.

Examples

 Prepare a statement to select the date, the description and the comment from the link to the ARTICLES column from the HOCKEY_GOALS table. The rows to be selected are those for goals scored by either of the Richard brothers (Maurice or Henri).

```
stmtvar = "SELECT DATE_OF_GOAL, DESCRIPTION, DLCOMMENT(ARTICLES)
FROM HOCKEY_GOALS
WHERE BY_PLAYER = 'Maurice Richard'
OR BY_PLAYER = 'Henri Richard' ";
EXEC SQL PREPARE HOCKEY STMT FROM :stmtvar;
```

• Given a DataLink value that was inserted into column COLA of a row in table TBLA using the scalar function:

```
INSERT INTO TBLA
VALUES (DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment'))
```

then the following function operating on that value:

```
SELECT DLCOMMENT (COLA)
FROM TBLA
```

Returns the value 'A comment'.

DLLINKTYPE

The DLLINKTYPE function returns the link type value from a DataLink value.

▶►—DLLINKTYPE—(—DataLink-expression—)—

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

The result of the function is VARCHAR(4). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the character string is the same as that of DataLink-expression.

Examples

• Given a DataLink value that was inserted into column COLA of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

then the following function operating on that value:

SELECT DLLINKTYPE(COLA) FROM TBLA

Returns the value 'URL'.

DLURLCOMPLETE

The DLURLCOMPLETE function returns the complete URL value from a DataLink value with a link type of URL. The value is the same as what would be returned by the concatenation of DLURLSCHEME with '://', then DLURLSERVER, and then DLURLPATH. If the DataLink has an attribute of FILE LINK CONTROL and READ PERMISSION DB, the value includes a file access token.

```
▶▶—DLURLCOMPLETE—(—DataLink-expression—)—
```

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result of the function is a varying-length string. The length attribute depends on the attributes of the DataLink:

- If the DataLink has an attribute of FILE LINK CONTROL and READ PERMISSION DB, the length attribute of the result is the length attribute of the argument plus 19.
- Otherwise, the length attribute of the result is the length attribute of the argument.

If the DataLink value only includes the comment, the result returned is a zero length string.

The CCSID of the character string is the same as that of DataLink-expression.

Examples

• Given a DataLink value that was inserted into column COLA (with the attributes of FILE LINK CONTROL and READ PERMISSION DB) of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
  VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

then the following function operating on that value:

```
SELECT DLURLCOMPLETE (COLA) FROM TBLA
```

DLURLPATH

The DLURLPATH function returns the path and file name necessary to access a file within a given server from a DataLink value with a linktype of URL. When appropriate, the value includes a file access token.

```
▶► DLURLPATH—(—DataLink-expression—)—
```

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result of the function is a varying-length string. The length attribute depends on the attributes of the DataLink:

- · If the DataLink has an attribute of FILE LINK CONTROL and READ PERMISSION DB, the length attribute of the result is the length attribute of the argument plus 19.
- · Otherwise, the length attribute of the result is the length attribute of the argument.

If the DataLink value only includes the comment, the result returned is a zero length string.

The CCSID of the character string is the same as that of *DataLink-expression*.

Examples

 Given a DataLink value that was inserted into column COLA (with the attributes of FILE LINK CONTROL and READ PERMISSION DB) of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
 VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

then the following function operating on that value:

```
SELECT DLURLPATH (COLA)
  FROM TBLA
```

access token.

DLURLPATHONLY

The DLURLPATHONLY function returns the path and file name necessary to access a file within a given server from a DataLink value with a linktype of URL. The value returned NEVER includes a file access token.

▶►—DLURLPATHONLY—(—DataLink-expression—)—

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result of the function is a varying-length string with a length attribute of that is equal to the length attribute of the argument.

If the DataLink value only includes the comment, the result returned is a zero length string.

The CCSID of the character string is the same as that of DataLink-expression.

Examples

• Given a DataLink value that was inserted into column COLA of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
  VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

then the following function operating on that value:

SELECT DLURLPATHONLY(COLA) FROM TBLA

Returns the value '/x/y/a.b'.

DLURLSCHEME

The DLURLSCHEME function returns the scheme from a DataLink value with a linktype of URL. The value will always be in upper case.

```
▶▶—DLURLSCHEME—(—DataLink-expression—)—
```

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

The result of the function is VARCHAR(20). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

If the DataLink value only includes the comment, the result returned is a zero length string.

The CCSID of the character string is the same as that of *DataLink-expression*.

Examples

· Given a DataLink value that was inserted into column COLA of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
  VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

then the following function operating on that value:

```
SELECT DLURLSCHEME (COLA)
  FROM TBLA
```

Returns the value 'HTTP'.

DLURLSERVER

The DLURLSERVER function returns the file server from a DataLink value with a linktype of URL. The value will always be in upper case.

▶►—DLURLSERVER—(—DataLink-expression—)—

DataLink-expression

An expression that results in a value with a built-in DataLink data type.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result of the function is a varying-length string with a length attribute of that is equal to the length attribute of the argument.

If the DataLink value only includes the comment, the result returned is a zero length string.

The CCSID of the character string is the same as that of DataLink-expression.

Examples

• Given a DataLink value that was inserted into column COLA of a row in table TBLA using the scalar function:

```
INSERT INTO TABLA
VALUES( DLVALUE('http://dlfs.almaden.ibm.com/x/y/a.b','URL','A comment') )
```

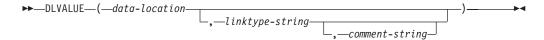
then the following function operating on that value:

SELECT DLURLSERVER (COLA) FROM TBLA

Returns the value 'DLFS.ALMADEN.IBM.COM'.

DLVALUE

The DLVALUE function returns a DataLink value. When the function is on the right hand side of a SET clause in an UPDATE statement or is in a VALUES clause in an INSERT statement, it usually also creates a link to a file. However, if only a comment is specified (in which case the *data-location* is a zero-length string), the DataLink value is created with empty linkage attributes so there is no file link.



data-location

If the link type is URL, then this is a character string expression that contains a complete URL value. If the expression is not an empty string, it must include the URL scheme and URL server. The actual length of the character string expression must be less than or equal to 32718 characters.

linktype-string

An optional character string expression that specifies the link type of the DataLink value. The only valid value is 'URL'.

comment-string

An optional character string expression that provides a comment or additional location information. The actual length of the character string expression must be less than or equal to 254 characters.

The *comment-string* cannot be the null value. If a *comment-string* is not specified, the *comment-string* is the empty string.

If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

The result of the function is a DataLink value.

The CCSID of the DataLink is the same as that of *data-location* except in the following cases:

- If the *comment string* is mixed data and *data-location* is not mixed data, the CCSID of the result will be the CCSID of the *comment string*.⁵¹
- If the *data-location* has a CCSID of bit data (65535), UTF-16 graphic data (1200), UCS-2 graphic data (13488), Turkish data (905 or 1026), or Japanese data (290, 930, or 5026); the CCSID of the result is described in the following table:

CCSID of data-location	CCSID of comment-string	Result CCSID
65535	65535	Job Default CCSID
65535	non-65535	comment-string CCSID (unless the CCSID is 290, 930, 5026, 905, 1026, or 13488 where the CCSID will then be further modified as described in the following rows.)
290	any	4396
930 or 5026	any	939
905 or 1026	any	500

^{51.} If the CCSID of comment string is 5026 or 930, the CCSID of the results will be 939.

CCSID of data-location	CCSID of comment-string	Result CCSID
1200	any	500
13488	any	500

When defining a DataLink value using this function, consider the maximum length of the target of the value. For example, if a column is defined as DataLink(200), then the maximum length of the *data-location* plus the comment is 200 bytes.

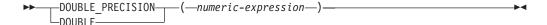
Examples

Insert a row into the table. The URL values for the first two links are contained
in the variables named url_article and url_snapshot. The variable named
url_snapshot_comment contains a comment to accompany the snapshot link.
There is, as yet, no link for the movie, only a comment in the variable named
url movie comment.

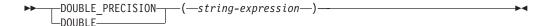
DOUBLE_PRECISION or DOUBLE

The DOUBLE_PRECISION and DOUBLE functions return a floating-point representation.

Numeric to Double



String to Double



The DOUBLE_PRECISION and DOUBLE functions return a floating-point representation of:

- A number
- · A character or graphic string representation of a decimal number
- · A character or graphic string representation of an integer
- · A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to Double

numeric-expression

An expression that returns a value of any built-in numeric data type.

The result is the same number that would occur if the expression were assigned to a double-precision floating-point column or variable.

String to Double

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number.

If the argument is a *string-expression*, the result is the same number that would result from CAST(*string-expression* AS DOUBLE PRECISION). Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant.

The single-byte character constant that must be used to delimit the decimal digits in *string-expression* from the whole part of the number is the default decimal point. For more information, see "Decimal point" on page 116.

The result of the function is a double-precision floating-point number. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: FLOAT is a synonym for DOUBLE_PRECISION and DOUBLE.

The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

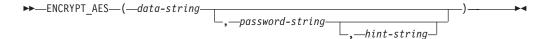
|

 Using the EMPLOYEE table, find the ratio of salary to commission for employees whose commission is not zero. The columns involved (SALARY and COMM) have DECIMAL data types. To eliminate the possibility of out-of-range results, DOUBLE_PRECISION is applied to SALARY so that the division is carried out in floating point:

SELECT EMPNO, DOUBLE_PRECISION(SALARY)/COMM FROM EMPLOYEE WHERE COMM > 0

ENCRYPT_AES

The ENCRYPT_AES function returns a value that is the result of encrypting *data-string* using the AES encryption algorithm. The password used for decryption is either the *password-string* value or the encryption password value (assigned by the SET ENCRYPTION PASSWORD statement).



data-string

An expression that returns the string value to be encrypted. The string expression must be a built-in string data type.

The length attribute for the data type of *data-string* is limited to 24 bytes (or 32 bytes) less than the maximum length of the result data type without a *hint-string* argument and 56 bytes (or 64 bytes) less than the maximum length of the result data type when the *hint-string* argument is specified.

password-string

An expression that returns a character string value with at least 6 bytes and no more than 127 bytes. The expression must not be a CLOB and the CCSID of the expression must not be 65535. The value represents the password used to encrypt the *data-string*. If the value of the password argument is null or not provided, the data will be encrypted using the ENCRYPTION PASSWORD value, which must have been set using the SET ENCRYPTION PASSWORD statement.

hint-string

An expression that returns a character string value with up to 32 bytes that will help data owners remember passwords (For example, 'Ocean' is a hint to remember 'Pacific'). The expression must not be a CLOB and the CCSID of the expression must not be 65535. If a hint value is specified, the hint is embedded into the result and can be retrieved using the GETHINT function. If the password-string is specified and this argument is the null value or not provided, no hint will be embedded in the result. If the password-string is not specified, the hint may be specified using the SET ENCRYPTION PASSWORD statement.

The data type of the result is determined by the first argument as shown in the following table:

Data Type of the First Argument	Data Type of the Result
BINARY or VARBINARY	VARBINARY
CHAR, VARCHAR, GRAPHIC, or VARGRAPHIC	VARCHAR FOR BIT DATA
BLOB, CLOB, or DBCLOB	BLOB

The length attribute of the result depends on the arguments that are specified:

- When a *password-string* is specified but a *hint-string* is not specified, the length attribute of *data-string* plus 24 plus the number of bytes to a 16 byte boundary.
- Otherwise, the length attribute of *data-string* plus 64 plus the number of bytes to a 16 byte boundary.

The actual length of the result is the sum of :

1	• The actual length of <i>data-string</i> plus a numboundary.	ber of bytes to get to a 16 byte
1	• The actual length of the hint.	
I I	The actual length of the hint is zero if <i>hint</i> -argument or on the SET ENCRYPTION PA	
 	• <i>n</i> , where <i>n</i> (the amount of overhead necess (or 32 bytes if <i>data-string</i> is a LOB or differ <i>data-string</i> , the password, or the hint).	
 	If the first argument can be null, the result can the result is the null value.	n be null; if the first argument is null,
 	Note that the encrypted result is longer than assigning encrypted values, ensure that the tacontain the entire encrypted value.	-
I	Notes	
 	Password protection: To prevent inadvertent not specify <i>password-string</i> as a string constant procedure, or function. Instead, use the SET I or a host variable.	t in the source for a program,
 	When connected to a remote relational databasent "in the clear". That is, the password itsel password in these cases, consider using a consuch as IPSEC (or SSL if connecting between	f is not encrypted. To protect the nmunications encryption mechanism
 	Encryption algorithm: The internal encryption Toolkit from IBM Research, The encryption ke using a SHA1 message digest.	
	Encryption passwords and data: It is the use management. Once the data is encrypted only be used to decrypt it. Be careful when using values as they may be padded with blanks. In null terminator and other non-printable characteristics.	y the password used to encrypt it can CHAR variables to set password The encrypted result may contain a
I	Table column definition: When defining coluencrypted data:	umns and distinct types to contain
I I	 The column must be defined with a data ty VARCHAR FOR BIT DATA, BINARY, VAR 	
1	• The length attribute of the column must in is the overhead necessary to encrypt the da	
	Any assignment or cast to a column without length shorter than the suggested data length if the assignment is successful, a failure and I subsequently decrypted. Blanks are valid enc truncated when stored in a column that is too	may result in an assignment error or, ost data when the data is rypted data values that may be
1	Some sample column length calculations:	
	Maximum length of non-encrypted data Number of bytes to the next 16 byte boundary Overhead	6 bytes 10 bytes 24 bytes (or 32 bytes)

ENCRYPT AES

Encrypted data column length 40 bytes (or 48 bytes) Maximum length of non-encrypted data 32 bytes Number of bytes to a 16 byte boundary 0 bytes 24 bytes (or 32 bytes) Overhead Encrypted data column length 56 bytes Administration of encrypted data: Encrypted data can only be decrypted on

servers that support the decryption functions that correspond to the ENCRYPT_AES function. Hence, replication of columns with encrypted data should only be done to servers that support the decryption functions.

Example

• Assume that table EMP1 has a social security column called SSN. This example uses the ENCRYPTION PASSWORD value to hold the encryption password.

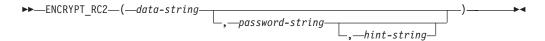
```
SET ENCRYPTION PASSWORD = 'Ben123'
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_AES( '289-46-8832')
```

- This example explicitly passes the encryption password. INSERT INTO EMP1 (SSN) VALUES ENCRYPT_AES('289-46-8832', 'Ben123')
- The hint 'Ocean' is stored to help the user remember the encryption password 'Pacific'.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_AES( '289-46-8832', 'Pacific', 'Ocean' )
```

ENCRYPT_RC2

The ENCRYPT_RC2 function returns a value that is the result of encrypting *data-string* using the RC2 encryption algorithm. The password used for decryption is either the *password-string* value or the encryption password value (assigned by the SET ENCRYPTION PASSWORD statement).



data-string

An expression that returns the string value to be encrypted. The string expression must be a built-in string data type.

The length attribute for the data type of *data-string* must be less than m - MOD(m,8) - n - 1, where m is the maximum length of the result data type and n is the amount of overhead necessary to encrypt the value.

password-string

An expression that returns a character string value with at least 6 bytes and no more than 127 bytes. The expression must not be a CLOB. The value represents the password used to encrypt the *data-string*. If the value of the password argument is null or not provided, the data will be encrypted using the ENCRYPTION PASSWORD value, which must have been set using the SET ENCRYPTION PASSWORD statement.

hint-string

An expression that returns a character string value with up to 32 bytes that will help data owners remember passwords (For example, 'Ocean' is a hint to remember 'Pacific'). The expression must not be a CLOB. If a hint value is specified, the hint is embedded into the result and can be retrieved using the GETHINT function. If the *password-string* is specified and this argument is the null value or not provided, no hint will be embedded in the result. If the *password-string* is not specified, the hint may be specified using the SET ENCRYPTION PASSWORD statement.

The data type of the result is determined by the first argument as shown in the following table:

Data Type of the First Argument	Data Type of the Result
BINARY or VARBINARY	VARBINARY
CHAR, VARCHAR, GRAPHIC, or VARGRAPHIC	VARCHAR FOR BIT DATA
BLOB, CLOB, or DBCLOB	BLOB

The length attribute of the result depends on the arguments that are specified:

- When a *password-string* is specified but a *hint-string* is not specified, the length attribute of *data-string* plus 16 plus the number of bytes to the next 8 byte boundary (even if the *data-string* is already a mul.
- Otherwise, the length attribute of *data-string* plus 48 plus the number of bytes to the next 8 byte boundary.

The actual length of the result is the sum of:

ENCRYPT RC2

- The actual length of *data-string* plus a number of bytes to get to the next 8 byte boundary.
- The actual length of the hint. The actual length of the hint is zero if *hint-string* is not specified as a function

data-string, the password, or the hint).

argument or on the SET ENCRYPTION PASSWORD statement. n, where n (the amount of overhead necessary to encrypt the value) is 8 bytes (or 16 bytes if data-string is a LOB or different CCSID values are used for the

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note that the encrypted result is longer than the *data-string* value. Therefore, when assigning encrypted values, ensure that the target is declared with sufficient size to contain the entire encrypted value.

Notes

Password protection: To prevent inadvertent access to the encryption password, do not specify password-string as a string constant in the source for a program, procedure, or function. Instead, use the SET ENCRYPTION PASSWORD statement or a host variable.

When connected to a remote relational database, the specified password itself is sent "in the clear". That is, the password itself is not encrypted. To protect the password in these cases, consider using a communications encryption mechanism such as IPSEC (or SSL if connecting between System i products).

Encryption algorithm: The internal encryption algorithm used is RC2 block cipher with padding, the 128 bit secret key is derived from the password using a MD5 message digest.

Encryption passwords and data: It is the user's responsibility to perform password management. Once the data is encrypted only the password used to encrypt it can be used to decrypt it. Be careful when using CHAR variables to set password values as they may be padded with blanks. The encrypted result may contain a null terminator and other non-printable characters.

Table column definition: When defining columns and distinct types to contain encrypted data:

- The column must be defined with a data type of CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, VARBINARY, or BLOB.
- The length attribute of the column must include an additional n bytes, where nis the overhead necessary to encrypt the data as described above.

Any assignment or cast to a column without one of these data types or with a length shorter than the suggested data length may result in an assignment error or, if the assignment is successful, a failure and lost data when the data is subsequently decrypted. Blanks are valid encrypted data values that may be truncated when stored in a column that is too short.

^{52.} Unlike ENCRYPT_TDES and ENCRYPT_AES, 8 bytes are added even if the length of data-string is already on an 8 byte boundary.

Some sample column length calculations:

```
Maximum length of non-encrypted data 6 bytes
Number of bytes to the next 8 byte boundary
Overhead 2 bytes

Encrypted data column length 16 bytes (or 32 bytes)

Maximum length of non-encrypted data 32 bytes
Number of bytes to the next 8 byte boundary
Overhead 8 bytes

Encrypted data column length 48 bytes (or 56 bytes)
```

Administration of encrypted data: Encrypted data can only be decrypted on servers that support the decryption functions that correspond to the ENCRYPT_RC2 function. Hence, replication of columns with encrypted data should only be done to servers that support the decryption functions.

Syntax alternatives: For compatibility with previous versions of DB2, ENCRYPT can be specified in place of ENCRYPT_RC2.

Example

• Assume that table EMP1 has a social security column called SSN. This example uses the ENCRYPTION PASSWORD value to hold the encryption password.

```
SET ENCRYPTION PASSWORD = 'Ben123'
```

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_RC2( '289-46-8832' )
```

• This example explicitly passes the encryption password.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT RC2( '289-46-8832', 'Ben123')
```

• The hint 'Ocean' is stored to help the user remember the encryption password 'Pacific'.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_RC2( '289-46-8832', 'Pacific', 'Ocean')
```

ENCRYPT_TDES

The ENCRYPT_TDES function returns a value that is the result of encrypting *data-string* using the Triple DES encryption algorithm. The password used for decryption is either the *password-string* value or the encryption password value (assigned by the SET ENCRYPTION PASSWORD statement).



data-string

An expression that returns the string value to be encrypted. The string expression must be a built-in string data type.

The length attribute for the data type of *data-string* must be less than m - MOD(m,8) - n - 1, where m is the maximum length of the result data type and n is the amount of overhead necessary to encrypt the value.

password-string

An expression that returns a character string value with at least 6 bytes and no more than 127 bytes. The expression must not be a CLOB and the CCSID of the expression must not be 65535. The value represents the password used to encrypt the *data-string*. If the value of the password argument is null or not provided, the data will be encrypted using the ENCRYPTION PASSWORD value, which must have been set using the SET ENCRYPTION PASSWORD statement.

hint-string

An expression that returns a character string value with up to 32 bytes that will help data owners remember passwords (For example, 'Ocean' is a hint to remember 'Pacific'). The expression must not be a CLOB and the CCSID of the expression must not be 65535. If a hint value is specified, the hint is embedded into the result and can be retrieved using the GETHINT function. If the password-string is specified and this argument is the null value or not provided, no hint will be embedded in the result. If the password-string is not specified, the hint may be specified using the SET ENCRYPTION PASSWORD statement.

The data type of the result is determined by the first argument as shown in the following table:

Data Type of the First Argument	Data Type of the Result
BINARY or VARBINARY	VARBINARY
CHAR, VARCHAR, GRAPHIC, or VARGRAPHIC	VARCHAR FOR BIT DATA
BLOB, CLOB, or DBCLOB	BLOB

The length attribute of the result depends on the arguments that are specified:

- When a *password-string* is specified but a *hint-string* is not specified, the length attribute of *data-string* plus 24 plus the number of bytes to an 8 byte boundary.
- Otherwise, the length attribute of *data-string* plus 56 plus the number of bytes to an 8 byte boundary.

The actual length of the result is the sum of:

 The actual length of data-string plus a number of bytes to get to the an 8 byte boundary.

- The actual length of the hint.
 - The actual length of the hint is zero if *hint-string* is not specified as a function argument or on the SET ENCRYPTION PASSWORD statement.
- *n*, where *n* (the amount of overhead necessary to encrypt the value) is 16 bytes (or 24 bytes if *data-string* is a LOB or different CCSID values are used for the *data-string*, the password, or the hint).

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note that the encrypted result is longer than the *data-string* value. Therefore, when assigning encrypted values, ensure that the target is declared with sufficient size to contain the entire encrypted value.

Notes

Password protection: To prevent inadvertent access to the encryption password, do not specify *password-string* as a string constant in the source for a program, procedure, or function. Instead, use the SET ENCRYPTION PASSWORD statement or a host variable.

When connected to a remote relational database, the specified password itself is sent "in the clear". That is, the password itself is not encrypted. To protect the password in these cases, consider using a communications encryption mechanism such as IPSEC (or SSL if connecting between System i products).

Encryption algorithm: The internal encryption algorithm used is Triple DES block cipher with padding, the 128 bit secret key is derived from the password using a SHA1 message digest.

Encryption passwords and data: It is the user's responsibility to perform password management. Once the data is encrypted only the password used to encrypt it can be used to decrypt it. Be careful when using CHAR variables to set password values as they may be padded with blanks. The encrypted result may contain a null terminator and other non-printable characters.

Table column definition: When defining columns and distinct types to contain encrypted data:

- The column must be defined with a data type of CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, VARBINARY, or BLOB.
- The length attribute of the column must include an additional *n* bytes, where *n* is the overhead necessary to encrypt the data as described above.

Any assignment or cast to a column without one of these data types or with a length shorter than the suggested data length may result in an assignment error or, if the assignment is successful, a failure and lost data when the data is subsequently decrypted. Blanks are valid encrypted data values that may be truncated when stored in a column that is too short.

Some sample column length calculations:

ENCRYPT TDES

```
Maximum length of non-encrypted data
                                              32 bytes
Number of bytes to an 8 byte boundary
                                              0 bytes
                                             16 bytes (or 24 bytes)
Overhead
Encrypted data column length
                                              48 bytes (or 56 bytes)
```

Administration of encrypted data: Encrypted data can only be decrypted on servers that support the decryption functions that correspond to the ENCRYPT_TDES function. Hence, replication of columns with encrypted data should only be done to servers that support the decryption functions.

Example

• Assume that table EMP1 has a social security column called SSN. This example uses the ENCRYPTION PASSWORD value to hold the encryption password.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_TDES( '289-46-8832')
```

SET ENCRYPTION PASSWORD = 'Ben123'

- This example explicitly passes the encryption password. INSERT INTO EMP1 (SSN) VALUES ENCRYPT_TDES('289-46-8832', 'Ben123')
- The hint 'Ocean' is stored to help the user remember the encryption password 'Pacific'.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_TDES( '289-46-8832', 'Pacific', 'Ocean' )
```

EXP

The EXP function returns a value that is the base of the natural logarithm (e) raised to a power specified by the argument. The EXP and LN functions are inverse operations.

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values the special values are treated as follows:

- EXP(NaN) returns NaN.
- EXP(-NaN) returns -NaN.
- EXP(Infinity) returns Infinity.
- EXP(-Infinity) returns 0.
- EXP(sNaN) and EXP(-sNaN) return a warning or error.

If the data type of the argument is DECFLOAT(*n*), the result is DECFLOAT(*n*). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable E is a DECIMAL(10,9) host variable with a value of 3.453789832.

SELECT EXP(:E)
FROM SYSIBM.SYSDUMMY1

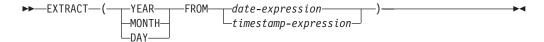
Returns the approximate value 31.62.

^{53.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option, NaN and -NaN are returned respectively with a warning.

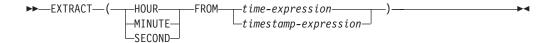
EXTRACT

The EXTRACT function returns a specified portion of a datetime value.

Extract Date Values



Extract Time Values



Extract Date Values

YEAR

Specifies that the year portion of the date or timestamp expression is returned. The result is identical to the YEAR scalar function. For more information, see "YEAR" on page 465.

MONTH

Specifies that the month portion of the date or timestamp expression is returned. The result is identical to the MONTH scalar function. For more information, see "MONTH" on page 368.

DAY

Specifies that the day portion of the date or timestamp expression is returned. The result is identical to the DAY scalar function. For more information, see "DAY" on page 273.

date-expression

An expression that returns the value of either a built-in date or built-in character string data type.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid character-string or graphic-string representation of a date. For the valid formats of string representations of dates, see "String representations of datetime values" on page 77.

timestamp-expression

An expression that returns the value of either a built-in timestamp or built-in character string data type.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid character-string or graphic-string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.

Extract Time Values

HOUR

Specifies that the hour portion of the time or timestamp expression is returned. The result is identical to the HOUR scalar function. For more information, see "HOUR" on page 335.

MINUTE

Specifies that the minute portion of the time or timestamp expression is returned. The result is identical to the MINUTE scalar function. For more information, see "MINUTE" on page 365.

SECOND

I

Specifies that the second portion of the date or timestamp expression is returned. The result is identical to the following:

DECIMAL((SECOND(expression) + DECIMAL(MICROSECOND(expression), 12,6)/1000000), 8,6)

For more information, see "SECOND" on page 411 and "MICROSECOND" on page 362.

time-expression

An expression that returns the value of either a built-in time or built-in character string data type.

If *expression* is a character string, it must not be a CLOB and its value must be a valid character-string representation of a time. For the valid formats of string representations of times, see "String representations of datetime values" on page 77.

timestamp-expression

An expression that returns the value of either a built-in timestamp or built-in character string data type.

If *expression* is a character string, it must not be a CLOB and its value must be a valid character-string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.

The data type of the result of the function depends on the part of the datetime value that is specified:

- If YEAR, MONTH, DAY, HOUR, or MINUTE is specified, the data type of the result is INTEGER.
- If SECOND is specified, the data type of the result is DECIMAL(8,6). The fractional digits contains microseconds.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

Assume the column PRSTDATE has an internal value equivalent to 1988-12-25.
 SELECT EXTRACT (MONTH FROM PRSTDATE)
 FROM PROJECT

Results in the value 12.

FLOAT

The FLOAT function returns a floating point representation of a number or string.

Numeric to Float

►►—FLOAT—(—numeric-expression—)—

String to Float

►►—FLOAT—(—string-expression—)—

FLOAT is a synonym for the DOUBLE_PRECISION and DOUBLE functions. For more information, see "DOUBLE_PRECISION or DOUBLE" on page 308.

FLOOR

| | The FLOOR function returns the largest integer value less than or equal to *expression*.

```
▶▶—FL00R—(—expression—)—
```

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values, the special values are treated as follows:

- FLOOR(NaN) returns NaN.
- FLOOR(-NaN) returns -NaN.
- FLOOR(Infinity) returns Infinity.
- FLOOR(-Infinity) returns -Infinity.
- FLOOR(sNaN) and FLOOR(-sNaN) returns a warning or error.⁵⁴

The result of the function has the same data type and length attribute as the argument except that the scale is 0 if the argument is a decimal number. For example, an argument with a data type of DECIMAL(5,5) will result in DECIMAL(5,0).

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

Use the FLOOR function to truncate any digits to the right of the decimal point.

```
SELECT FLOOR(SALARY)
FROM EMPLOYEE
```

• Use FLOOR on both positive and negative numbers.

This example returns:

```
3. 3. -4. -4.
```

respectively.

^{54.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option, NaN and -NaN are returned respectively with a warning.

GENERATE_UNIQUE

The GENERATE_UNIQUE function returns a bit data character string 13 bytes long (CHAR(13) FOR BIT DATA) that is unique compared to any other execution of the same function. The function is defined as not-deterministic

```
►►—GENERATE UNIQUE—(—)-
```

The result of the function is a unique value that includes the internal form of the Universal Time, Coordinated (UTC) and the system serial number. The result cannot be null.

The result of this function can be used to provide unique values in a table. Each successive value will be greater than the previous value, providing a sequence that can be used within a table. The sequence is based on the time when the function was executed.

This function differs from using the special register CURRENT TIMESTAMP in that a unique value is generated for each instance of the function in an SQL statement and each row of a multiple row insert statement or an insert statement with a fullselect.

The timestamp value that is part of the result of this function can be determined using the TIMESTAMP function with the result of GENERATE_UNIQUE as an argument.

Examples

• Create a table that includes a column that is unique for each row. Populate this column using the GENERATE UNIQUE function. Notice that the UNIQUE ID column is defined as FOR BIT DATA to identify the column as a bit data character string.

```
CREATE TABLE EMP UPDATE
  (UNIQUE ID CHAR(13) FOR BIT DATA,
  EMPNO CHAR(6),
   TEXT VARCHAR (1000))
INSERT INTO EMP UPDATE VALUES (GENERATE_UNIQUE(), '000020', 'Update entry 1...')
INSERT INTO EMP UPDATE VALUES (GENERATE UNIQUE(), '000050', 'Update entry 2...')
```

This table will have a unique identifier for each row provided that the UNIQUE_ID column is always set using GENERATE_UNIQUE. This can be done by introducing a trigger on the table.

```
CREATE TRIGGER EMP UPDATE UNIQUE
 NO CASCADE BEFORE INSERT ON EMP UPDATE
 REFERENCING NEW AS NEW UPD
 FOR EACH ROW MODE DB2SQL
 SET NEW UPD.UNIQUE ID = GENERATE UNIQUE()
```

With this trigger, the previous INSERT statements that were used to populate the table can be issued without specifying a value for the UNIQUE_ID column:

```
INSERT INTO (EMPNO, TEXT) EMP UPDATE VALUES ('000020', 'Update entry 1...')
INSERT INTO (EMPNO, TEXT) EMP UPDATE VALUES ('000050', 'Update entry 2...')
```

The timestamp (in UTC) for when a row was added to EMP_UPDATE can be returned using:

```
SELECT TIMESTAMP (UNIQUE_ID), EMPNO, TEXT FROM EMP_UPDATE
```

Therefore, the table does not need a timestamp column to record when a row is inserted.

GETHINT

The GETHINT function will return the password hint if one is found in the *encrypted-data*. A password hint is a phrase that will help data owners remember passwords (For example, 'Ocean' as a hint to remember 'Pacific').

```
▶►—GETHINT—(—encrypted-data—)—
```

encrypted-data

An expression that must be a string expression that returns a complete, encrypted data value of a CHAR FOR BIT DATA, VARCHAR FOR BIT DATA, BINARY, VARBINARY, or BLOB built-in data type. The data string must have been encrypted using the ENCRYPT_RC2 or ENCRYPT_TDES function.

The data type of the result is VARCHAR(32). The actual length of the result is the actual length of the hint that was provided when the data was encrypted.

The result can be null. If the argument is null or if a hint was not added to the *encrypted-data* by the ENCRYPT_RC2 or ENCRYPT_TDES function, the result is the null value.

The CCSID of the result is the default CCSID of the current server.

Example

 The hint 'Ocean' is stored to help the user remember the encryption password 'Pacific'.

```
INSERT INTO EMP1 (SSN) VALUES ENCRYPT_RC2( '289-46-8832', 'Pacific', 'Ocean' )
SELECT GETHINT( SSN )
FROM EMP1
```

The GETHINT function returns the original hint value 'Ocean'.

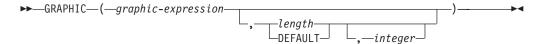
GRAPHIC

The GRAPHIC function returns a fixed-length graphic-string representation of a string expression.

Character to Graphic



Graphic to Graphic



Integer to Graphic



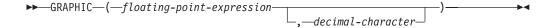
Decimal to GRAPHIC



Decimal floating-point to GRAPHIC



Floating-point to GRAPHIC



The GRAPHIC function returns a graphic-string representation of:

- · An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT
- · A decimal number if the first argument is a packed or zoned decimal number
- · A decimal floating-point number if the first argument is a DECFLOAT
- A double-precision floating-point number if the first argument is a DOUBLE or REAL
- A character string if the first argument is any type of character string
- · A graphic string if the first argument is any type of graphic string

The result of the function is a fixed-length graphic string (GRAPHIC).

If the first argument can be null, the result can be null. If the first argument is null, the result is the null value.

Character to Graphic

character-expression

An expression that returns a value that is a built-in character-string data type. It cannot be a CHAR or VARCHAR bit data. If the expression is an empty string or the EBCDIC string X'0E0F', the result is a single double-byte blank.

length

An integer constant that specifies the length attribute of the result and must be an integer constant between 1 and 16383 if the first argument is not nullable or between 1 and 16382 if the first argument is nullable. If the length of *character-expression* is less than the length specified, the result is padded with double-byte blanks to the length of the result.

If *length* is not specified, or if DEFAULT is specified, the length attribute of the result is the same as the length attribute of the first argument.

Each character of the argument determines a character of the result. If the length attribute of the resulting fixed-length string is less than the actual length of the first argument, truncation is performed and no warning is returned.

integer

An integer constant that specifies the CCSID of the result. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535. If the CCSID represents Unicode graphic data, each character of the argument determines a character of the result. The nth character of the result is the UTF-16 or UCS-2 equivalent of the nth character of the argument.

If *integer* is not specified then the CCSID of the result is determined by a mixed CCSID. Let M denote that mixed CCSID.

In the following rules, S denotes one of the following:

- If the string expression is a host variable containing data in a foreign encoding scheme, S is the result of the expression after converting the data to a CCSID in a native encoding scheme. (See "Character conversion" on page 32 for more information.)
- If the string expression is data in a native encoding scheme, S is that string expression.

M is determined as follows:

- If the CCSID of S is a mixed CCSID, M is that CCSID.
- If the CCSID of S is an SBCS CCSID:
 - If the CCSID of S has an associated mixed CCSID, M is that CCSID.
 - Otherwise the operation is not allowed.

The following table summarizes the result CCSID based on M.

M	Result CCSID	Description	DBCS Substitution Character
930	300	Japanese EBCDIC	X'FEFE'
933	834	Korean EBCDIC	X'FEFE'
935	837	S-Chinese EBCDIC	X'FEFE'
937	835	T-Chinese EBCDIC	X'FEFE'
939	300	Japanese EBCDIC	X'FEFE'
5026	4396	Japanese EBCDIC	X'FEFE'
5035	4396	Japanese EBCDIC	X'FEFE'

The equivalence of SBCS and DBCS characters depends on M. Regardless of the CCSID, every double-byte code point in the argument is considered a DBCS character, and every single-byte code point in the argument is considered an SBCS character with the exception of the EBCDIC mixed data shift codes X'0E' and X'0F'.

- If the nth character of the argument is a DBCS character, the nth character of the result is that DBCS character.
- If the nth character of the argument is an SBCS character that has an equivalent DBCS character, the nth character of the result is that equivalent DBCS character.
- If the nth character of the argument is an SBCS character that does not have an equivalent DBCS character, the nth character of the result is the DBCS substitution character.

Graphic to Graphic

graphic-expression

An expression that returns a value of a built-in graphic-string data type.

length

An integer constant that specifies the length attribute of the result and must be an integer constant between 1 and 16383 if the first argument is not nullable or between 1 and 16382 if the first argument is nullable. If the length of *graphic-expression* is less than the length specified, the result is padded with double-byte blanks to the length of the result.

If the second argument is not specified, or if DEFAULT is specified, the length attribute of the result is the same as the length attribute of the first argument.

If the length of the *graphic-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535.

If *integer* is not specified then the CCSID of the result is the CCSID of the first argument.

Integer to Graphic

integer-expression

An expression that returns a value that is an integer data type (either SMALLINT, INTEGER, or BIGINT).

The result is a fixed-length graphic string of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. It is left justified.

- If the argument is a small integer, the length attribute of the result is 6.
- If the argument is a large integer, the length attribute of the result is 11.
- If the argument is a big integer, the length attribute of the result is 20.

The result is the smallest number of characters that can be used to represent the value of the argument. Leading zeroes are not included. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal to Graphic

decimal-expression

An expression that returns a value that is a packed or zoned decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length graphic string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the *decimal-expression* with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length attribute of the result is 2+p where p is the precision of the *decimal-expression*. The result is the smallest number of characters that can be used to represent the result. Leading zeros are not included. If the argument is negative, the result begins with a minus sign. Otherwise, the result begins with a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal floating-point to Graphic

decimal-floating-point expression

An expression that returns a value that is a built-in decimal floating-point data type.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length graphic string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 42. The actual length of the result is the smallest number of characters that represents the value of the argument, including the sign, digits, and *decimal-character*. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0.

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

The CCSID of the result is 1200 (UTF-16).

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Floating-point to Graphic

floating-point expression

An expression that returns a value that is a floating-point data type (DOUBLE or REAL).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a fixed-length graphic string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 24. The result is the smallest number of characters that can represent the value of the argument such that the mantissa consists of a single digit other than zero followed by the *decimal-character* and a sequence of digits. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0E0.

The CCSID of the result is 1200 (UTF-16).

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length attribute is specified. For more information, see "CAST specification" on page 170.

Example

• Using the EMPLOYEE table, set the host variable DESC (GRAPHIC(24)) to the GRAPHIC equivalent of the first name (FIRSTNME) for employee number (EMPNO) '000050'.

```
SELECT GRAPHIC( VARGRAPHIC(FIRSTNME))
INTO :DESC
FROM EMPLOYEE
WHERE EMPNO = '000050'
```

330

HASH

1

The HASH function returns the partition number of a set of values.



Also see the PARTITION function. For more information about partition numbers, see the DB2 Multisystem topic collection.

expression

An expression that returns a value of any built-in data type except date, time, timestamp, floating-point, or DataLink values.

The result of the function is a large integer with a value between 0 and 1023.

If any of the arguments are null, the result is zero. The result cannot be null.

Example

· Use the HASH function to determine what the partitions would be if the partitioning key was composed of EMPNO and LASTNAME. This query returns the partition number for every row in EMPLOYEE.

SELECT HASH (EMPNO, LASTNAME) FROM EMPLOYEE

HASHED_VALUE

The HASHED_VALUE function returns the partition map index number of a row obtained by applying the hashing function on the partitioning key value of the row.

Also see the "HASH" on page 331 function. If the argument identifies a non-distributed table, the value 0 is returned. For more information about partition maps and partitioning keys, see the DB2 Multisystem topic collection.

table-designator

A table designator of the subselect. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the partition map index number of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the partition map index number of the first table in the outer subselect of the view, common table expression, or nested table expression.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The HASHED_VALUE function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is a large integer with a value between 0 and 1023. The result can be null.

Note

Syntax alternatives: PARTITION is a synonym for HASHED_VALUE.

Example

 Select the employee number (EMPNO) from the EMPLOYEE table for all rows where the partition map index number is equal to 100.

```
SELECT EMPNO
FROM EMPLOYEE
WHERE HASHED_VALUE(EMPLOYEE) = 100
```

HEX

The HEX function returns a hexadecimal representation of a value.



expression

An expression that returns a value of any built-in data type other than a character or binary string with a length attribute greater than 16 336 or a graphic string with a length attribute greater than 8168.

The result of the function is a character string. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is a string of hexadecimal digits, the first two digits represent the first byte of the argument, the next two digits represent the second byte of the argument, and so forth. If the argument is a datetime value, the result is the hexadecimal representation of the internal form of the argument.⁵⁵

If the argument is not a graphic string, the actual length of the result is twice the length of the argument. If the argument is a graphic string, the actual length of the result is four times the length of the argument. The length of the argument is the value that would be returned if the argument were passed to the LENGTH scalar function. For more information, see "LENGTH" on page 351.

The data type and length attribute of the result depends on the attributes of the argument:

- If the argument is not a string, the result is CHAR with a length attribute that is twice the length of the argument.
- If the argument is a fixed-length character string with a length attribute that is less than one half the maximum length attribute of CHAR, the result is CHAR with a length attribute that is twice the length attribute of the argument. If the argument is a fixed-length graphic string with a length attribute that is less than one fourth the maximum length attribute of GRAPHIC, the result is GRAPHIC with a length attribute that is four times the length attribute of the argument. For more information about the product-specific maximum length, see Table 85 on page 1208.
- Otherwise, the result is VARCHAR whose length attribute depends on the following:
 - If the argument is a character or binary string, the length attribute of the result is twice the length attribute of the argument.
 - If the argument is a graphic string, the length attribute of the result is four times the length attribute of the argument.

The length attribute of the result cannot be greater than the product-specific length attribute of CHAR or VARCHAR. See Table 85 on page 1208 for more information.

The CCSID of the string is the default SBCS CCSID at the current server.

^{55.} This hexadecimal representation for DATE, TIMESTAMP, and NUMERIC data types is different from other database products because the internal form for these data types is different.

HEX

Example

• Use the HEX function to return a hexadecimal representation of the education level for each employee.

SELECT FIRSTNME, MIDINIT, LASTNAME, **HEX**(EDLEVEL) FROM EMPLOYEE

1

HOUR

The HOUR function returns the hour part of a value.



expression

An expression that returns a value of one of the following built-in data types: a time, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a time or timestamp. For the valid formats of string representations of times and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a time duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a time, timestamp, or valid character-string representation of a time or timestamp:
 - The result is the hour part of the value, which is an integer between 0 and 24.
- If the argument is a time duration or timestamp duration:
 The result is the hour part of the value, which is an integer between -99 and 99.
 A nonzero result has the same sign as the argument.

Example

• Using the CL_SCHED sample table, select all the classes that start in the afternoon.

```
SELECT *
FROM CL_SCHED
WHERE HOUR(STARTING) BETWEEN 12 AND 17
```

IDENTITY_VAL_LOCAL

IDENTITY_VAL_LOCAL is a non-deterministic function that returns the most recently assigned value for an identity column.

▶►—IDENTITY VAL LOCAL—(—)—

The function has no input parameters. The result is a DECIMAL(31,0) regardless of the actual data type of the identity column that the result value corresponds to.

The value returned is the value that was assigned to the identity column of the table identified in the most recent INSERT statement for a table containing an identity column. The INSERT statement has to be issued at the same level; that is, the value has to be available locally within the level at which it was assigned until replaced by the next assigned value. A new level is initiated when a trigger, function, or stored procedure is invoked. A trigger condition is at the same level as the associated triggered action.

The assigned value can be a value supplied by the user (if the identity column is defined as GENERATED BY DEFAULT) or an identity value that was generated by the database manager.

It is recommended that a SELECT FROM data change statement be used to obtain the assigned value for an identity column. See "table-reference" on page 475 for more information.

The result can be null. The result is null if an INSERT statement has not been issued for a table containing an identity column at the current processing level. This includes invoking the function in a before or after insert trigger.

The result of the IDENTITY_VAL_LOCAL function is not affected by the following statements:

- · An INSERT statement for a table which does not contain an identity column
- · An UPDATE statement
- A COMMIT statement
- · A ROLLBACK statement

Notes

The following notes explain the behavior of the function when it is invoked in various situations:

Invoking the function within the VALUES clause of an INSERT statement

Expressions in an INSERT statement are evaluated before values are assigned to the target columns of the INSERT statement. Thus, when you invoke IDENTITY_VAL_LOCAL in an INSERT statement, the value that is used is the most recently assigned value for an identity column from a previous INSERT statement. The function returns the null value if no such INSERT statement had been executed within the same level as the invocation of the IDENTITY_VAL_LOCAL function.

Invoking the function following a failed INSERT statement

The function returns an unpredictable result when it is invoked after the unsuccessful execution of an INSERT statement for a table with an identity column. The value might be the value that would have been returned from

the function had it been invoked before the failed INSERT or the value that would have been assigned had the INSERT succeeded. The actual value returned depends on the point of failure and is therefore unpredictable.

Invoking the function within the SELECT statement of a cursor

Because the results of the IDENTITY_VAL_LOCAL function are not deterministic, the result of an invocation of the IDENTITY_VAL_LOCAL function from within the SELECT statement of a cursor can vary for each FETCH statement.

Invoking the function within the trigger condition of an insert trigger

The result of invoking the IDENTITY_VAL_LOCAL function from within the condition of an insert trigger is the null value.

Invoking the function within a triggered action of an insert trigger

Multiple before or after insert triggers can exist for a table. In such cases, each trigger is processed separately, and identity values generated by SQL statements issued within a triggered action are not available to other triggered actions using the IDENTITY_VAL_LOCAL function. This is the case even though the multiple triggered actions are conceptually defined at the same level.

Do not use the IDENTITY_VAL_LOCAL function in the triggered action of a before insert trigger. The result of invoking the IDENTITY_VAL_LOCAL function from within the triggered action of a before insert trigger is the null value. The value for the identity column of the table for which the trigger is defined cannot be obtained by invoking the IDENTITY_VAL_LOCAL function within the triggered action of a before insert trigger. However, the value for the identity column can be obtained in the triggered action by referencing the trigger transition variable for the identity column.

The result of invoking the IDENTITY_VAL_LOCAL function in the triggered action of an after insert trigger is the value assigned to an identity column of the table identified in the most recent INSERT statement invoked in the same triggered action for a table containing an identity column. If an INSERT statement for a table containing an identity column was not executed within the same triggered action before invoking the IDENTITY_VAL_LOCAL function, then the function returns a null value.

Invoking the function following an INSERT with triggered actions

The result of invoking the function after an INSERT that activates triggers is the value actually assigned to the identity column (that is, the value that would be returned on a subsequent SELECT statement). This value is not necessarily the value provided in the INSERT statement or a value generated by the database manager. The assigned value could be a value that was specified in a SET transition variable statement within the triggered action of a before insert trigger for a trigger transition variable associated with the identity column.

Scope of IDENTITY_VAL_LOCAL

If an client application or middleware product manages a pool of connections and routes individual transactions to an arbitrary connection in the pool, the application should only rely on the value returned from IDENTITY_VAL_LOCAL until the end of the transaction.

Examples

• Set the variable IVAR to the value assigned to the identity column in the EMPLOYEE table. The value returned from the function in the VALUES statement should be 1.

```
CREATE TABLE EMPLOYEE

(EMPNO INTEGER GENERATED ALWAYS AS IDENTITY,
NAME CHAR(30),
SALARY DECIMAL(5,2),
DEPT SMALLINT)

INSERT INTO EMPLOYEE

(NAME, SALARY, DEPTNO)
VALUES('Rupert', 989.99, 50)

VALUES IDENTITY VAL LOCAL() INTO :IVAR
```

• Assume two tables, T1 and T2, have an identity column named C1. The database manager generates values 1, 2, 3,...for the C1 column in table T1, and values 10, 11, 12,...for the C1 column in table T2.

```
CREATE TABLE T1
(C1 SMALLINT GENERATED ALWAYS AS IDENTITY,
C2 SMALLINT)

CREATE TABLE T2
(C1 DECIMAL(15,0) GENERATED BY DEFAULT AS IDENTITY ( START WITH 10 ) ,
C2 SMALLINT)

INSERT INTO T1 ( C2 ) VALUES(5)

INSERT INTO T1 ( C2 ) VALUES(5)

SELECT * FROM T1
```

C1	C2
1	5
2	5

```
VALUES IDENTITY_VAL_LOCAL() INTO :IVAR
```

At this point, the IDENTITY_VAL_LOCAL function would return a value of 2 in IVAR. The following INSERT statement inserts a single row into T2 where column C2 gets a value of 2 from the IDENTITY_VAL_LOCAL function.

```
INSERT INTO T2 ( C2 ) VALUES( IDENTITY_VAL_LOCAL() )
SELECT * FROM T2
WHERE C1 = DECIMAL( IDENTITY_VAL_LOCAL(), 15, 0)
```

C1	C2
10	2

Invoking the IDENTITY_VAL_LOCAL function after this INSERT would result in a value of 10, which is the value generated by the database manager for column C1 of T2. Assume another single row is inserted into T2. For the following INSERT statement, the database manager assigns a value of 13 to identity column C1 and gives C2 a value of 10 from IDENTITY_VAL_LOCAL. Thus, C2 is given the last identity value that was inserted into T2.

```
INSERT INTO T2 ( C2, C1 ) VALUES( IDENTITY_VAL_LOCAL(), 13 )
SELECT * FROM T2
WHERE C1 = DECIMAL( IDENTITY_VAL_LOCAL(), 15, 0)
```

C1	C2
13	10

 The IDENTITY_VAL_LOCAL function can also be invoked in an INSERT statement that both invokes the IDENTITY_VAL_LOCAL function and causes a new value for an identity column to be assigned. The next value to be returned is thus established when the IDENTITY_VAL_LOCAL function is invoked after the INSERT statement completes. For example, consider the following table definition:

CREATE TABLE T3

- (C1 SMALLINT GENERATED BY DEFAULT AS IDENTITY,
- C2 SMALLINT)

For the following INSERT statement, specify a value of 25 for the C2 column, and the database manager generates a value of 1 for C1, the identity column. This establishes 1 as the value that will be returned on the next invocation of the IDENTITY_VAL_LOCAL function.

INSERT INTO T3 (C2) VALUES(25)

In the following INSERT statement, the IDENTITY_VAL_LOCAL function is invoked to provide a value for the C2 column. A value of 1 (the identity value assigned to the C1 column of the first row) is assigned to the C2 column, and the database manager generates a value of 2 for C1, the identity column. This establishes 2 as the value that will be returned on the next invocation of the IDENTITY VAL LOCAL function.

INSERT INTO T3 (C2) VALUES(IDENTITY_VAL_LOCAL())

In the following INSERT statement, the IDENTITY_VAL_LOCAL function is again invoked to provide a value for the C2 column, and the user provides a value of 11 for C1, the identity column. A value of 2 (the identity value assigned to the C1 column of the second row) is assigned to the C2 column. The assignment of 11 to C1 establishes 11 as the value that will be returned on the next invocation of the IDENTITY_VAL_LOCAL function.

INSERT INTO T3 (C2, C1) VALUES (IDENTITY_VAL_LOCAL(), 11)

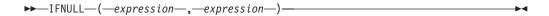
After the 3 INSERT statements have been processed, table T3 contains the following:

C1	C2
1	25
2	1
11	2

The contents of T3 illustrate that the expressions in the VALUES clause are evaluated before the assignments for the columns of the INSERT statement. Thus, an invocation of an IDENTITY_VAL_LOCAL function invoked from a VALUES clause of an INSERT statement uses the most recently assigned value for an identity column in a previous INSERT statement.

IFNULL

The IFNULL function returns the value of the first non-null expression.



The IFNULL function is identical to the COALESCE scalar function with two arguments. For more information, see "COALESCE" on page 256.

Example

• When selecting the employee number (EMPNO) and salary (SALARY) from all the rows in the EMPLOYEE table, if the salary is missing (that is, null), then return a value of zero.

SELECT EMPNO, IFNULL(SALARY,0)
FROM EMPLOYEE

INSERT

Returns a string where *length* characters have been deleted from *source-string* beginning at *start* and where *insert-string* has been inserted into *source-string* beginning at *start*.

source-string

An expression that specifies the source string. The *source-string* may be any built-in numeric or string expression. It must be compatible with the *insert-string*. For more information about data type compatibility, see "Assignments and comparisons" on page 89. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. The actual length of the string must be greater than zero.

start

An expression that returns a built-in BIGINT, INTEGER, or SMALLINT data type. The integer specifies the starting character within *source-string* where the deletion of characters and the insertion of another string is to begin. The value of the integer must be in the range of 1 to the length of *source-string* plus one.

length

An expression that returns a built-in BIGINT, INTEGER, or SMALLINT data type. The integer specifies the number of characters that are to be deleted from *source-string*, starting at the character position identified by *start*. The value of the integer must be in the range of 0 to the length of *source-string*.

insert-string

An expression that specifies the string to be inserted into *source-string*, starting at the position identified by *start*. The *insert-string* may be any built-in numeric or string expression. It must be compatible with the *source-string*. For more information about data type compatibility, see "Assignments and comparisons" on page 89. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. The actual length of the string must be greater than zero.

The data type of the result of the function depends on the data type of the first and fourth arguments. The result data type is the same as if the two arguments were concatenated except that the result is always a varying-length string. For more information see "Conversion rules for operations that combine strings" on page 110.

The length attribute of the result depends on the arguments:

• If *start* and *length* are constants, the length attribute of the result is:

```
L1 - MIN((L1-V2 + 1), V3) + L4
```

where:

```
L1 is the length attribute of source-string
V2 depends on the encoding schema of source-string:
- If the source-string is UTF-8, the value MIN(L1+1,start*3)
- If the source-string is mixed data, the value MIN(L1+1,(start-1)*2.5+4)
- Otherwise, the value of start
V3 is the value of length
L4 is the length attribute of insert-string
```

• Otherwise, the length attribute of the result is the length attribute of *source-string* plus the length attribute of *insert-string*.

If the length attribute of the result exceeds the maximum for the result data type, an error is returned.

The actual length of the result is:

```
A1 - MIN((A1 - V2 + 1), V3) + A4
```

where:

```
A1 is the actual length of source-string
V2 is the value of start
V3 is the value of length
A4 is the actual length of insert-string
```

If the actual length of the result string exceeds the maximum for the result data type, an error is returned.

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is determined by the CCSID of *source-string* and *insert-string*. The resulting CCSID is the same as if the two arguments were concatenated. For more information, see "Conversion rules for operations that combine strings" on page 110.

Examples

• The following example shows how the string 'INSERTING' can be changed into other strings. The use of the CHAR function limits the length of the resulting string to 10 characters.

```
SELECT INSERT('INSERTING', 4, 2, 'IS'),
INSERT('INSERTING', 4, 0, 'IS'),
INSERT('INSERTING', 4, 2, '')
FROM SYSIBM.SYSDUMMY1
```

This example returns 'INSISTING', 'INSISERTIN', and 'INSTING'.

• The previous example demonstrated how to insert text into the middle of some text. This example shows how to insert text before some text by using 1 as the starting point (*start*).

This example returns 'XXINSERTIN', 'XXNSERTING', 'XXSERTING', and 'XXERTING'.

• The following example shows how to insert text after some text. Add 'XX' at the end of string 'ABCABC'. Because the source string is 6 characters long, set the starting position to 7 (one plus the length of the source string).

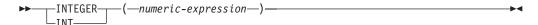
```
SELECT INSERT ('ABCABC', 7, 0, 'XX')
FROM SYSIBM. SYSDUMMY1
```

This example returns 'ABCABCXX'.

INTEGER or INT

The INTEGER function returns an integer representation.

Numeric to Integer



String to Integer



The INTEGER function returns an integer representation of:

- A number
- A character or graphic string representation of a decimal number
- · A character or graphic string representation of an integer
- A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to Integer

numeric-expression

An expression that returns a numeric value of any built-in numeric data type.

If the argument is a *numeric-expression*, the result is the same number that would occur if the argument were assigned to a large integer column or variable. If the whole part of the argument is not within the range of integers, an error is returned. The fractional part of the argument is truncated.

String to Integer

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number.

If the argument is a *string-expression*, the result is the same number that would result from CAST(*string-expression* AS INTEGER). Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant. If the whole part of the argument is not within the range of integers, an error is returned. Any fractional part of the argument is truncated.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

INTEGER or INT

Example

• Using the EMPLOYEE table, select a list containing salary (SALARY) divided by education level (EDLEVEL). Truncate any decimal in the calculation. The list should also contain the values used in the calculation and the employee number (EMPNO).

SELECT INTEGER (SALARY / EDLEVEL), SALARY, EDLEVEL, EMPNO FROM EMPLOYEE

JULIAN DAY

The JULIAN_DAY function returns an integer value representing a number of days from January 1, 4713 B.C. (the start of the Julian date calendar) to the date specified in the argument.

```
▶►—JULIAN DAY—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string. If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Using sample table EMPLOYEE, set the integer host variable JDAY to the Julian day of the day that Christine Haas (EMPNO = '000010') was employed (HIREDATE = '1965-01-01').

```
SELECT JULIAN_DAY(HIREDATE)
INTO :JDAY
FROM EMPLOYEE
WHERE EMPNO = '000010'
```

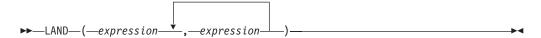
The result is that JDAY is set to 2438762.

Set integer host variable JDAY to the Julian day for January 1, 1998.

```
SELECT JULIAN_DAY('1998-01-01')
INTO :JDAY
FROM SYSIBM.SYSDUMMY1
```

The result is that JDAY is set to 2450815.

The LAND function returns a string that is the logical 'AND' of the argument strings. This function takes the first argument string, does an AND operation with the next string, and then continues to do AND operations with each successive argument using the previous result. If a character-string argument is shorter than the previous result, it is padded with blanks. If a binary-string argument is shorter than the previous result, it is padded with hexadecimal zeros.



The arguments must be compatible.

expression

An expression that returns a value of any built-in numeric or string data type, but cannot be LOBs. The arguments cannot be mixed data character strings, UTF-8 character strings, or graphic strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The arguments are converted, if necessary, to the attributes of the result. The attributes of the result are determined as follows:

- If all the arguments are fixed-length strings, the result is a fixed-length string of length n, where n is the length of the longest argument.
- If any argument is a varying-length string, the result is a varying-length string with length attribute n, where n is the length attribute of the argument with greatest length attribute. The actual length of the result is m, where m is the actual length of the longest argument.

If an argument can be null, the result can be null; if an argument is null, the result is the null value.

The CCSID of the result is 65535.

Example

• Assume the host variable L1 is a CHARACTER(2) host variable with a value of X'A1B1', host variable L2 is a CHARACTER(3) host variable with a value of X'F0F040', and host variable L3 is a CHARACTER(4) host variable with a value of X'A1B10040'.

```
SELECT LAND(:L1,:L2,:L3)
FROM SYSIBM.SYSDUMMY1
```

Returns the value X'A0B00040'.

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LAST_DAY

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The LAST_DAY scalar function returns a date or timestamp that represents the last day of the month indicated by *expression*.

```
►►—LAST_DAY—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a timestamp if *expression* is a timestamp. Otherwise, the result of the function is a date. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Example

Set the host variable END_OF_MONTH with the last day of the current month.
 SET :END OF MONTH = LAST DAY(CURRENT DATE)

The host variable END_OF_MONTH is set with the value representing the end of the current month. If the current day is 2000-02-10, then END_OF_MONTH is set to 2000-02-29.

• Set the host variable END_OF_MONTH with the last day of the month in EUR format for the given date.

```
SET : END_OF_MONTH = CHAR(LAST_DAY('1965-07-07'), EUR)
```

The host variable END_OF_MONTH is set with the value '31.07.1965'.

Assuming that the default date format is ISO,

```
SELECT LAST_DAY('2000-04-24')
FROM SYSIBM.SYSDUMMY1
```

Returns '2000-04-30' which is the last day of April in 2000.

LCASE

The LCASE function returns a string in which all the characters have been converted to lowercase characters, based on the CCSID of the argument.



The LCASE function is identical to the LOWER function. For more information, see "LOWER" on page 359.

If expression is a character string, the result is a character string. If expression is a graphic string, the result is a graphic string. If expression is a binary string, the result is a binary string.

expression

An expression that specifies the string from which the result is derived. The arguments must be expressions that return a value of any built-in numeric, character string, graphic string, or a binary string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

A substring of expression is zero or more contiguous characters of expression. If expression is a character string or graphic string, a single character is either an SBCS, DBCS, or multiple-byte character. If expression is a binary string, the result is the number of bytes in the argument.

integer

An expression that returns a built-in integer data type. The integer specifies the length of the result. The value of *integer* must be greater than or equal to 0 and less than or equal to n, where n is the length attribute of *expression*.

The expression is effectively padded on the right with the necessary number of blank characters (or hexadecimal zeroes for binary strings) so that the specified substring of expression always exists.

The result of the function is a varying-length string with a length attribute that is the same as the length attribute of expression and a data type that depends on the data type of expression:

Data type of expression	Data type of the Result
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The actual length of the result is *integer*.

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is the same as that of *expression*.

Example

• Assume the host variable NAME (VARCHAR(50)) has a value of 'KATIE AUSTIN' and the host variable FIRSTNAME LEN (int) has a value of 5.

LEFT

```
SELECT LEFT(:NAME, :FIRSTNAME_LEN)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'KATIE'

• Assume that NAME is a VARCHAR(128) column, encoded in Unicode UTF-8, that contains the value 'Jürgen'.

```
SELECT LEFT(NAME, 2), SUBSTR(NAME, 1, 2)
FROM T1
WHERE NAME = 'Jürgen'
```

Returns the value 'Jü' for LEFT and 'JÊ' for SUBSTR(NAME, 1, 2).

LENGTH

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The LENGTH function returns the length of a value.



See "CHARACTER_LENGTH" on page 249, "OCTET_LENGTH" on page 378, and "BIT_LENGTH" on page 239 for similar functions.

expression

An expression that returns a value of any built-in data type.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is the length of the argument. The length of strings includes blanks. The length of a varying-length string is the actual length, not the length attribute.

The length of a graphic string is the number of double-byte characters (the number of bytes divided by 2). The length of all other values is the number of bytes used to represent the value:

- 2 for small integer
- 4 for large integer
- · 8 for big integer
- 8 for DECFLOAT(16)
- 16 for DECFLOAT(34)
- The integral part of (p/2)+1 for packed decimal numbers with precision p
- p for zoned decimal numbers with precision p
- 4 for single-precision float
- · 8 for double-precision float
- · The length of the string for strings
- 3 for time
- · 4 for date
- 10 for timestamp
- The actual number of bytes used to store the DataLink value (plus 19 if the DataLink is FILE LINK CONTROL and READ PERMISSION DB) for datalinks
- 26 for row ID

Examples

 Assume the host variable ADDRESS is a varying-length character string with a value of '895 Don Mills Road'.

```
FROM SYSIBM.SYSDUMMY1
```

Returns the value 18.

· Assume that PRSTDATE is a column of type DATE.

```
SELECT LENGTH (PRSTDATE)
FROM PROJECT
```

Returns the value 4.

• Assume that PRSTDATE is a column of type DATE.

LENGTH

SELECT LENGTH(CHAR(PRSTDATE, EUR)) FROM PROJECT

Returns the value 10.

LN

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The LN function returns the natural logarithm of a number. The LN and EXP functions are inverse operations.



expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. The value of the argument must be greater than zero.

For decimal floating-point values the special values are treated as follows:

- LN(NaN) returns NaN. 56
- LN(-NaN) returns NaN. 56
- LN(Infinity) returns Infinity.
- LN(-Infinity) returns NaN. 56.
- LN(sNaN) and LN(-sNaN) return a warning or error.
- LN(0) returns -Infinity.
- LN with a negative argument, including -Infinity, returns NaN. 56

If the data type of the argument is DECFLOAT(*n*), the result is DECFLOAT(*n*). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

 Assume the host variable NATLOG is a DECIMAL(4,2) host variable with a value of 31.62.

```
SELECT LN(:NATLOG)
FROM SYSIBM.SYSDUMMY1
```

Returns the approximate value 3.45.

^{56.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option a warning is returned.

expression

An expression that returns a value of any built-in numeric or string data type, but cannot be LOBs. The arguments cannot be mixed data character strings, UTF-8 character strings, or graphic strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The data type and length attribute of the result is the same as the data type and length attribute of the argument value. If the argument is a varying-length string, the actual length of the result is the same as the actual length of the argument value. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the result is 65535.

Example

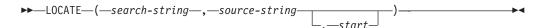
Assume the host variable L1 is a CHARACTER(2) host variable with a value of X'F0F0'.

SELECT LNOT(:L1) FROM SYSIBM.SYSDUMMY1

Returns the value X'0F0F'.

LOCATE

The LOCATE function returns the starting position of the first occurrence of one string (called the *search-string*) within another string (called the *source-string*). If the *search-string* is not found and neither argument is null, the result is zero. If the *search-string* is found, the result is a number from 1 to the actual length of the *source-string*. If the optional *start* is specified, it indicates the character position in the *source-string* at which the search is to begin.



search-string

An expression that specifies the string that is to be searched for. *search-string* may be any built-in numeric or string expression. It must be compatible with the *source-string*. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

source-string

An expression that specifies the source string in which the search is to take place. *source-string* may be any built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

start

An expression that specifies the position within *source-string* at which the search is to start. It must be an integer.

If *start* is specified, the function is similar to:

```
POSITION( SUBSTRING(source-string, start) , search-string ) + start - 1
```

If *start* is not specified, the function is equivalent to:

```
POSITION( source-string , search-string )
```

For more information, see "POSITION" on page 380.

The result of the function is a large integer. If any of the arguments can be null, the result can be null; if any of the arguments is null, the result is the null value.

The POSITION function operates on a character basis. Because POSITION operates on a character-string basis, any shift-in and shift-out characters are not required to be in exactly the same position and their only significance is to indicate which characters are SBCS and which characters are DBCS.

If the CCSID of the *search-string* is different than the CCSID of the *source-string*, it is converted to the CCSID of the *source-string*.

If a collating sequence other than *HEX is in effect when the statement that contains the LOCATE function is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence. An ICU collating sequence table may not be specified with the LOCATE function.

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Example

 Select RECEIVED and SUBJECT columns as well as the starting position of the words 'GOOD' within the NOTE_TEXT column for all entries in the IN_TRAY table that contain these words.

```
SELECT RECEIVED, SUBJECT, LOCATE('GOOD', NOTE_TEXT)
FROM IN_TRAY
WHERE LOCATE('GOOD', NOTE_TEXT) <> 0
```

• Assume that NOTE is a VARCHAR(128) column, encoded in Unicode UTF-8, that contains the value 'Jürgen lives on Hegelstraße'. Find the character position of the character 'ß' in the string.

```
SELECT LOCATE( 'B', NOTE ), POSSTR( NOTE_TEXT, 'B') FROM T1
```

Returns the value 26 for LOCATE and 27 for POSSTR.

LOG₁₀

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The LOG10 function returns the common logarithm (base 10) of a number. The LOG10 and ANTILOG functions are inverse operations.

▶ L0G10 (-expression-)-

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

For decimal floating-point values the special values are treated as follows:

- LOG10(NaN) returns NaN. 57
- LOG10(-NaN) returns NaN. 57
- LOG10(Infinity) returns Infinity.
- LOG10(-Infinity) returns NaN. 57
- LOG10(sNaN) and LOG10(-sNaN) return a warning or error.
- LOG10(0) returns -Infinity.
- LOG10 with a negative argument, including -Infinity, returns NaN. 57

If the data type of the argument is DECFLOAT(*n*), the result is DECFLOAT(*n*). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: LOG is a synonym for LOG10. It is supported only for compatibility with previous DB2 releases. LOG10 should be used instead of LOG because some database managers and applications implement LOG as the natural logarithm of a number instead of the common logarithm of a number.

Example

 Assume the host variable L is a DECIMAL(4,2) host variable with a value of 31.62

```
SELECT LOG10(:L)
FROM SYSIBM.SYSDUMMY1
```

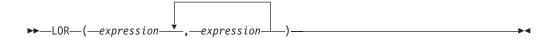
Returns the approximate value 1.49.

^{57.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option a warning is returned.

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LOR

The LOR function returns a string that is the logical OR of the argument strings. This function takes the first argument string, does an OR operation with the next string, and then continues to do OR operations for each successive argument using the previous result. If a character-string argument is shorter than the previous result, it is padded with blanks. If a binary-string argument is shorter than the previous result, it is padded with hexadecimal zeros.



The arguments must be compatible.

expression

An expression that returns a value of any built-in numeric or string data type, but cannot be LOBs. The arguments cannot be mixed data character strings, UTF-8 character strings, or graphic strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The arguments are converted, if necessary, to the attributes of the result. The attributes of the result are determined as follows:

- If all the arguments are fixed-length strings, the result is a fixed-length string of length n, where n is the length of the longest argument.
- If any argument is a varying-length string, the result is a varying-length string with length attribute n, where n is the length attribute of the argument with greatest length attribute. The actual length of the result is m, where m is the actual length of the longest argument.

If an argument can be null, the result can be null; if an argument is null, the result is the null value.

The CCSID of the result is 65535.

Example

 Assume the host variable L1 is a CHARACTER(2) host variable with a value of X'0101', host variable L2 is a CHARACTER(3) host variable with a value of X'F0F000', and host variable L3 is a CHARACTER(4) host variable with a value of X'0000000F'.

```
SELECT LOR(:L1,:L2,:L3)
FROM SYSIBM.SYSDUMMY1
```

Returns the value X'F1F1404F'.

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LOWER

The LOWER function returns a string in which all the characters have been converted to lowercase characters, based on the CCSID of the argument. Only SBCS, Unicode graphic characters are converted. The characters A-Z are converted to a-z, and characters with diacritical marks are converted to their lowercase equivalent, if any.



Refer to the UCS-2 level 1 mapping tables topic in the Globalization topic collection for a description of the monocasing tables that are used for this translation.

expression

An expression that specifies the string to be converted. *expression* must be any built-in numeric, character, Unicode graphic string. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function has the same data type, length attribute, actual length, and CCSID as the argument. If the argument can be null, the result can be null. If the argument is null, the result is the null value.

Note

Syntax alternatives: LCASE is a synonym for LOWER.

Examples

• Ensure that the characters in the value of host variable NAME are lowercase. NAME has a data type of VARCHAR(30) and a value of 'Christine Smith'.

```
SELECT LOWER(:NAME)
    FROM SYSIBM.SYSDUMMY1
```

The result is the value 'christine smith'.

LTRIM

The LTRIM function removes blanks or hexadecimal zeros from the beginning of an expression.



expression

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function.⁵⁸ For more information about converting numeric to a character string, see "VARCHAR" on page 449.

- If the argument is a binary string, the leading hexadecimal zeros (X'00') are removed.
- If the argument is a DBCS graphic string, the leading DBCS blanks are removed.
- If the first argument is a Unicode graphic string, the leading UTF-16 or UCS-2 blanks are removed.
- If the first argument is a UTF-8 character string, the leading UTF-8 blanks are removed.
- Otherwise, leading SBCS blanks are removed.

The data type of the result depends on the data type of *expression*:

Data type of expression	Data type of the Result
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The length attribute of the result is the same as the length attribute of *expression*. The actual length of the result is the length of *expression* minus the number of bytes removed. If all characters are removed, the result is an empty string.

If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

The CCSID of the result is the same as that of the string.

Example

Assume the host variable HELLO of type CHAR(9) has a value of 'Hello'.

SELECT LTRIM(:HELLO)
FROM SYSIBM.SYSDUMMY1

Results in: 'Hello'.

^{58.} The LTRIM function returns the same results as: STRIP(expression, LEADING)

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The MAX scalar function returns the maximum value in a set of values.



The arguments must be compatible. Character-string arguments are compatible with datetime values. The arguments cannot be DataLink values.

expression

An expression that returns the value of any built-in numeric or string data type. If one of the arguments is numeric, then character and graphic string arguments are cast to numeric before evaluating the function.

The result of the function is a large integer. The result can be null if at least one argument can be null; the result is the null value if one of the arguments is null.

The selected argument is converted, if necessary, to the attributes of the result. The attributes of the result are determined by all the operands as explained in "Rules for result data types" on page 105.

If a collating sequence other than *HEX is in effect when the statement is executed and the arguments are SBCS data, mixed data, or Unicode data, the weighted values of the strings are compared instead of the actual values. The weighted values are based on the collating sequence.

Examples

• Assume the host variable M1 is a DECIMAL(2,1) host variable with a value of 5.5, host variable M2 is a DECIMAL(3,1) host variable with a value of 4.5, and host variable M3 is a DECIMAL(3,2) host variable with a value of 6.25.

```
SELECT MAX(:M1,:M2,:M3)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 6.25.

 Assume the host variable M1 is a CHARACTER(2) host variable with a value of 'AA', host variable M2 is a CHARACTER(3) host variable with a value of 'AA', and host variable M3 is a CHARACTER(4) host variable with a value of 'AA A'.

```
SELECT MAX(:M1,:M2,:M3)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'AA A'.

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MICROSECOND

The MICROSECOND function returns the microsecond part of a value.

▶►—MICROSECOND—(—expression—)-

expression

An expression that returns a value of one of the following built-in data types: a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.
- If expression is a number, it must be a timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

 If the argument is a timestamp or a valid character-string representation of a timestamp:

The result is the microsecond part of the value, which is an integer between 0 and 999999.

• If the argument is a duration:

The result is the microsecond part of the value, which is an integer between -999999 and 999999. A nonzero result has the same sign as the argument.

Example

 Assume a table TABLEA contains two columns, TS1 and TS2, of type TIMESTAMP. Select all rows in which the microseconds portion of TS1 is not zero and the seconds portion of TS1 and TS2 are identical.

```
SELECT *
  FROM TABLEA
  WHERE MICROSECOND(TS1) \Leftrightarrow 0 AND SECOND(TS1) = SECOND(TS2)
```

MIDNIGHT SECONDS

The MIDNIGHT_SECONDS function returns an integer value that is greater than or equal to 0 and less than or equal to 86 400 representing the number of seconds between midnight and the time value specified in the argument.

```
▶►—MIDNIGHT_SECONDS—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a time, a timestamp, a character string, or a graphic string. It must not be a CLOB or DBCLOB, and its value must be a valid string representation of a time or timestamp. For the valid formats of string representations of times and timestamps, see "String representations of datetime values" on page 77.

The result of the function is large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Find the number of seconds between midnight and 00:01:00, and midnight and 13:10:10. Assume that host variable XTIME1 has a value of '00:01:00', and that XTIME2 has a value of '13:10:10'.

```
SELECT MIDNIGHT_SECONDS(:XTIME1), MIDNIGHT_SECONDS(:XTIME2)
FROM SYSIBM.SYSDUMMY1
```

This example returns 60 and 47410. Because there are 60 seconds in a minute and 3600 seconds in an hour, 00:01:00 is 60 seconds after midnight ((60 * 1) + 0), and 13:10:10 is 47410 seconds ((3600 * 13) + (60 * 10) + 10).

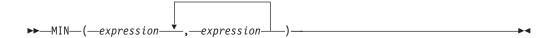
• Find the number of seconds between midnight and 24:00:00, and midnight and 00:00:00.

```
SELECT MIDNIGHT_SECONDS('24:00:00'), MIDNIGHT_SECONDS('00:00:00') FROM SYSIBM.SYSDUMMY1
```

This example returns 86400 and 0. Although these two values represent the same point in time, different values are returned.

MIN

The MIN scalar function returns the minimum value in a set of values.



The arguments must be compatible. Character-string arguments are compatible with datetime values. The arguments cannot be DataLink values.

expression

An expression that returns a value of any built-in numeric or string data type. If one of the arguments is numeric, then character and graphic string arguments are cast to numeric before evaluating the function.

The result of the function is a large integer. The result can be null if at least one argument can be null; the result is the null value if one of the arguments is null.

The selected argument is converted, if necessary, to the attributes of the result. The attributes of the result are determined by all the operands as explained in "Rules for result data types" on page 105.

If a collating sequence other than *HEX is in effect when the statement is executed and the arguments are SBCS data, mixed data, or Unicode data, the weighted values of the strings are compared instead of the actual values. The weighted values are based on the collating sequence.

Examples

 Assume the host variable M1 is a DECIMAL(2,1) host variable with a value of 5.5, host variable M2 is a DECIMAL(3,1) host variable with a value of 4.5, and host variable M3 is a DECIMAL(3,2) host variable with a value of 6.25.

```
SELECT MIN(:M1,:M2,:M3)
 FROM SYSIBM.SYSDUMMY1
```

Returns the value 4.50.

• Assume the host variable M1 is a CHARACTER(2) host variable with a value of 'AA', host variable M2 is a CHARACTER(3) host variable with a value of 'AAA', and host variable M3 is a CHARACTER(4) host variable with a value of 'AAAA'.

```
SELECT MIN(:M1,:M2,:M3)
  FROM SYSIBM.SYSDUMMY1
```

Returns the value 'AA'.

MINUTE

The MINUTE function returns the minute part of a value.

```
▶► MINUTE—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a time, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a time or timestamp. For the valid formats of string representations of times and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a time duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

99. A nonzero result has the same sign as the argument.

- If the argument is a time, a timestamp, or a valid character-string representation of a time or timestamp:
 - The result is the minute part of the value, which is an integer between 0 and 59.
- If the argument is a time duration or timestamp duration:

 The result is the minute part of the value, which is an integer between -99 and

Example

Using the CL_SCHED sample table, select all classes with a duration less than 50 minutes.

```
SELECT *
FROM CL_SCHED
WHERE HOUR(ENDING - STARTING) = 0 AND
MINUTE(ENDING - STARTING) < 50</pre>
```

MOD

The MOD function divides the first argument by the second argument and returns the remainder.

The formula used to calculate the remainder is:

$$MOD(x,y) = x - (x/y) * y$$

where x/y is the truncated integer result of the division. The result is negative only if first argument is negative.

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

expression-2

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. *expression-2* cannot be zero.

If an argument can be null, the result can be null; if an argument is null, the result is the null value.

The attributes of the result are determined as follows:

- If both arguments are large or small integers with zero scale, the data type of the result is large integer.
- If both arguments are integers with zero scale and at least one of the arguments is a big integer, the data type of the result is big integer.
- If one argument is an integer with zero scale and the other is decimal, the result is decimal with the same precision and scale as the decimal argument.
- If both arguments are decimal or integer with scale numbers, the result is decimal. The precision of the result is min (p-s,p'-s') + max (s,s'), and the scale of the result is max (s,s'), where the symbols p and s denote the precision and scale of the first operand, and the symbols p' and s' denote the precision and scale of the second operand.
- If either argument is decimal floating-point, the data type of the result is DECFLOAT(34). If the argument is a special decimal floating-point value, the general rules for arithmetic operations apply. See "General arithmetic operation rules for DECFLOAT" on page 156 for more information.
- If either argument is floating point, the data type of the result is double-precision floating point.

The operation is performed in floating point; the operands having been first converted to double-precision floating-point numbers, if necessary.

An operation involving a floating-point number and an integer is performed with a temporary copy of the integer that has been converted to double-precision floating point. An operation involving a floating-point number and a decimal number is performed with a temporary copy of the decimal

| | | |

number that has been converted to double-precision floating point. The result of a floating-point operation must be within the range of floating-point numbers.

If either argument is decimal floating-point and the second operand evaluates to 0, the result is NaN and the invalid operation warning (SQLSTATE 0168D) is issued. MOD(1, -Infinity) returns the value 1.

Examples

• Assume the host variable M1 is an integer host variable with a value of 5, and host variable M2 is an integer host variable with a value of 2.

```
SELECT MOD(:M1,:M2)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 1.

• Assume the host variable M1 is an integer host variable with a value of 5, and host variable M2 is a DECIMAL(3,2) host variable with a value of 2.20.

```
SELECT MOD(:M1,:M2)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 0.60.

• Assume the host variable M1 is a DECIMAL(4,2) host variable with a value of 5.50, and host variable M2 is a DECIMAL(4,1) host variable with a value of 2.0.

```
SELECT MOD(:M1,:M2)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 1.50.

MONTH

The MONTH function returns the month part of a value.

▶►—MONTH—(—expression—)—

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a date duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

• If the argument is a date, a timestamp, or a valid character-string representation of a date or timestamp:

The result is the month part of the value, which is an integer between 1 and 12.

• If the argument is a date duration or timestamp duration:

The result is the month part of the value, which is an integer between -99 and 99. A nonzero result has the same sign as the argument.

Example

 Select all rows from the EMPLOYEE table for people who were born (BIRTHDATE) in DECEMBER.

```
SELECT *
FROM EMPLOYEE
WHERE MONTH(BIRTHDATE) = 12
```

ı

MONTHNAME

Returns a mixed case character string containing the name of the month (for example, January) for the month portion of the argument.



expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is VARCHAR(100). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the result is the default CCSID of the current server.

Note

National language considerations: The name of the month that is returned is based on the language used for messages in the job. This name of the month is retrieved from message CPX3BC0 in message file QCPFMSG in library *LIBL.

Examples

Assume that the language used is US English.

```
SELECT MONTHNAME ( '2003-01-02' )
FROM SYSIBM.SYSDUMMY1
```

Results in 'January'.

MONTHS BETWEEN

The MONTHS_BETWEEN function returns an estimate of the number of months between *expression1* and *expression2*.

▶►─MONTHS_BETWEEN—(—expression1—,—expression2—)—

expression1

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character-string, or a graphic-string.

If *expression1* is a character or graphic string, it must not be a CLOB or DBCLOB and its values must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77

expression2

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character-string, or a graphic-string.

If *expression*2 is a character or graphic string, it must not be a CLOB or DBCLOB and its values must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77

If *expression1* represents a date that is later than *expression2*, then the result is positive. If *expression2* represents a date that is later than *expression1*, then the result is negative. If *expression1* and *expression2* represent dates with the same day of the month or the last day of the month, then the result is a whole number. Otherwise, the result is calculated based on a 31 day month and the result represents the difference between *expression1* and *expression2* as a fractional number.

The result of the function is a DECIMAL(31,15). If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Examples

• Calculate the months between two dates:

```
SELECT MONTHS_BETWEEN('2005-01-17', '2005-02-17')
   FROM SYSIBM.SYSDUMMY1

Returns the value -1.000000000000000
SELECT MONTHS_BETWEEN('2005-02-20', '2005-01-17')
   FROM SYSIBM.SYSDUMMY1
```

Returns the value 1.096774193548387

MULTIPLY_ALT

The MULTIPLY_ALT scalar function returns the product of the two arguments as a decimal value. It is provided as an alternative to the multiplication operator, especially when the sum of the precisions of the arguments exceeds 63.

▶► MULTIPLY ALT—(—expression-1—,—expression-2—)—

expression-1

An expression that returns a value of any built-in numeric data type (other than floating-point or decimal floating-point), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

expression-2

An expression that returns a value of any built-in numeric data type (other than floating-point or decimal floating-point), character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. *expression-2* cannot be zero.

The result of the function is a DECIMAL. The precision and scale of the result are determined as follows, using the symbols p and s to denote the precision and scale of the first argument, and the symbols p' and s' to denote the precision and scale of the second argument.

- The precision is MIN(*mp*, p+p')
- The scale is:
 - 0 if the scale of both arguments is 0
 - MIN(ms, s+s') if p+p' is less than or equal to mp
 - MIN(ms, MAX(MIN(3, s+s'), mp-(p-s+p'-s'))) if p+p' is greater than mp.

For information about the values of p, s, ms, and mp, see "Decimal arithmetic in SQL" on page 154.

If either argument can be null, the result can be null; if either argument is null, the result is the null value.

The MULTIPLY_ALT function is a better choice than the multiplication operator when performing decimal arithmetic where a scale of at least 3 is wanted and the sum of the precisions exceeds 63. In these cases, the internal computation is performed so that overflows are avoided and then assigned to the result type value using truncation for any loss of scale in the final result. Note that the possibility of overflow of the final result is still possible when the scale is 3.

The following table compares the result types using MULTIPLY_ALT and the multiplication operator when the maximum precision is 31 and the maximum scale is 31:

Type of Argument 1		I .	Result using multiplication operator
DECIMAL(31,3)	DECIMAL(15,8)	DECIMAL(31,3)	DECIMAL(31,11)

1

Type of Argument 1	Type of Argument 2	Result using MULTIPLY_ALT	Result using multiplication operator
DECIMAL(26,23)	DECIMAL(10,1)	DECIMAL(31,19)	DECIMAL(31,24)
DECIMAL(18,17)	DECIMAL(20,19)	DECIMAL(31,29)	DECIMAL(31,31)
DECIMAL(16,3)	DECIMAL(17,8)	DECIMAL(31,9)	DECIMAL(31,11)
DECIMAL(26,5)	DECIMAL(11,0)	DECIMAL(31,3)	DECIMAL(31,5)
DECIMAL(21,1)	DECIMAL(15,1)	DECIMAL(31,2)	DECIMAL(31,2)

Examples

• Multiply two values where the data type of the first argument is DECIMAL(26,3) and the data type of the second argument is DECIMAL(9,8). The data type of the result is DECIMAL(31,7).

SELECT MULTIPLY_ALT(98765432109876543210987.654,5.43210987) FROM SYSIBM.SYSDUMMY1

Returns the value 536504678578875294857887.5277415.

Note that the complete product of these two numbers is 536504678578875294857887.52774154498, but the last 4 digits are truncated to match the scale of the result data type. Using the multiplication operator with the same values will cause an arithmetic overflow, since the result data type is DECIMAL(31,11) and the result value has 24 digits left of the decimal, but the result data type only supports 20 digits.

NEXT_DAY

The NEXT_DAY function returns a timestamp that represents the first weekday, named by *string-expression*, that is later than the date *expression*. If *expression* is a timestamp or valid string representation of a timestamp, the timestamp value has the same hours, minutes, seconds, and microseconds as *expression*. If *expression* is a date, or a valid string representation of a date, then the hours, minutes, seconds, and microseconds value of the result is 0.

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

string-expression

An expression that returns a built-in character string data type or graphic string data type. The value must compare equal to the full name of a day of the week or compare equal to the abbreviation of a day of the week. For example, in the English language:

Day of Week	Abbreviation
MONDAY	MON
TUESDAY	TUE
WEDNESDAY	WED
THURSDAY	THU
FRIDAY	FRI
SATURDAY	SAT
SUNDAY	SUN

The minimum length of the input value is the length of the abbreviation. Leading and trailing blanks are trimmed from *string-expression*. The resulting value is then folded to uppercase, so the characters in the value may be in any case.

The result of the function is a timestamp. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Note

National language considerations: The values of the days of the week (or abbreviations) in *string-expression* may either be the US English values listed in the table above or the values based on the language used for messages in the job. The non-abbreviated name of the day is retrieved from message CPX9034 in message file QCPFMSG in library *LIBL. The abbreviated name of the day is retrieved from message CPX9039 in message file QCPFMSG in library *LIBL.

Applications that need to run in many different language environments may want to consider using US English values since they will always be accepted in the NEXT_DAY function.

Example

 Assuming that the default language for the job is US English, set the host variable NEXTDAY with the date of the Tuesday following April 24, 2000.

```
SET :NEXTDAY = NEXT_DAY(CURRENT_DATE, 'TUESDAY')
```

The host variable NEXTDAY is set with the value of '2000–04–25–00.00.00.000000', assuming that the value of the CURRENT_DATE special register is '2000–04–24'.

 Assuming that the default language for the job is US English, set the host variable NEXTDAY with the date of the first Monday in May, 2000. Assume the host variable DAYHV = 'MON'.

```
SET : NEXTDAY = NEXT_DAY(LAST_DAY(CURRENT_TIMESTAMP), : DAYHV)
```

The host variable NEXTDAY is set with the value of '2000-05-01-12.01.01.123456', assuming that the value of the CURRENT_TIMESTAMP special register is '2000-04-24-12.01.01.123456'.

· Assuming that the default language for the job is US English,

SELECT NEXT_DAY('2000-04-24', 'TUESDAY')
FROM SYSIBM.SYSDUMMY1

Returns '2000-04-25-00.00.00.000000', which is the Tuesday following '2000-04-24'.

NORMALIZE_DECFLOAT

The NORMALIZE_DECFLOAT function returns a DECFLOAT value equal to the input argument set to its simplest form.

```
►►—NORMALIZE_DECFLOAT—(—expression—)—
```

The NORMALIZE_DECFLOAT function returns a decimal floating-point value equal to the input argument set to its simplest form; that is, a non-zero number with trailing zeros in the coefficient has those zeros removed. This may require representing the number in normalized form by dividing the coefficient by the appropriate power of ten and adjusting the exponent accordingly. A zero value has its exponent set to 0.

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the data type of the argument is SMALLINT, INTEGER, REAL, DOUBLE, DECIMAL(p,s) where p <=16, or NUMERIC(p,s) where p <=16, then the argument is converted to DECFLOAT(16) for processing. Otherwise, the argument is converted to DECFLOAT(34) for processing.

If the argument is a special value then the general rules for arithmetic operations apply. See "General arithmetic operation rules for DECFLOAT" on page 156 for more information.

The result of the function is a DECFLOAT(16) value if the data type of *expression* after conversion to decimal floating-point is DECFLOAT(16). Otherwise, the result of the function is a DECFLOAT(34) value. If the argument can be null, the result can be null; if the argument is null, the result is the null value

Examples

The following examples show the result of using the NORMALIZE_DECFLOAT function on various DECFLOAT values:

```
NORMALIZE_DECFLOAT (DECFLOAT(2.1)) = 2.1
NORMALIZE_DECFLOAT (DECFLOAT(-2.0)) = -2
NORMALIZE_DECFLOAT (DECFLOAT(1.200)) = 1.2
NORMALIZE_DECFLOAT (DECFLOAT(-120)) = -1.2E+2
NORMALIZE_DECFLOAT (DECFLOAT(120.00)) = 1.2E+2
NORMALIZE_DECFLOAT (DECFLOAT(0.00)) = 0
NORMALIZE_DECFLOAT(-NAN) = -NAN
NORMALIZE_DECFLOAT(-INFINITY) = -INFINITY
```

NOW

The NOW function returns a timestamp based on a reading of the time-of-day clock when the SQL statement is executed at the current server. The value returned by the NOW function is the same as the value returned by the CURRENT_TIMESTAMP special register. If this function is used more than once within a single SQL statement, or used with the CURDATE or CURTIME scalar functions or the CURRENT_DATE, CURRENT_TIME, or CURRENT_TIMESTAMP special registers within a single statement, all values are based on a single clock reading.



The data type of the result is a timestamp. The result cannot be null.

Note

Syntax alternatives: The CURRENT_TIMESTAMP special register should be used for maximal portability. For more information, see "Special registers" on page 119.

Example

• Return the current timestamp based on the time-of-day clock.

```
SELECT NOW()
FROM SYSIBM.SYSDUMMY1
```

NULLIF

The NULLIF function returns a null value if the arguments compare equal, otherwise it returns the value of the first argument.

```
►►—NULLIF—(—expression-1—,—expression-2—)—
```

The arguments must be compatible and comparable data types.

expression-1

An expression that returns a value of any built-in data type other than a DATALINK or any distinct data type other than a distinct type that is based on a DATALINK.

expression-2

An expression that returns a value of any built-in data type other than a DATALINK or any distinct data type other than a distinct type that is based on a DATALINK.

The attributes of the result are the attributes of the first argument. The result can be null. The result is null if the first argument is null or if both arguments are equal.

The result of using NULLIF(e1,e2) is the same as using the expression CASE WHEN e1=e2 THEN NULL ELSE e1 END

Note that when e1=e2 evaluates to unknown (because one or both arguments is NULL), CASE expressions consider this not true. Therefore, in this situation, NULLIF returns the value of the first operand, e1.

Example

· Assume host variables PROFIT, CASH, and LOSSES have DECIMAL data types with the values 4500.00, 500.00, and 5000.00 respectively:

```
SELECT NULLIF (:PROFIT + :CASH, :LOSSES )
  FROM SYSIBM.SYSDUMMY1
```

Returns the null value.

OCTET_LENGTH

The OCTET_LENGTH function returns the length of a string expression in octets (bytes).

▶►—OCTET LENGTH—(—expression—)—

See "LENGTH" on page 351 and "CHARACTER_LENGTH" on page 249 for similar functions.

expression

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is DECIMAL(31). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The result is the number of octets (bytes) in the argument. The length of a string includes trailing blanks. The length of a varying-length string is the actual length in octets (bytes), not the maximum length.

Example

• Assume table T1 has a GRAPHIC(10) column called C1.

```
SELECT OCTET_LENGTH( C1 ) FROM T1
```

Returns the value 20.

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Returns the value of π 3.141592653589793. There are no arguments.



The result of the function is double-precision floating-point. The result cannot be null.

Example

• The following returns the circumference of a circle with diameter 10:

```
SELECT PI()*10
FROM SYSIBM.SYSDUMMY1
```

POSITION

The POSITION function returns the starting position of the first occurrence of one string (called the *search-string*) within another string (called the *source-string*). If the *search-string* is not found and neither argument is null, the result is zero. If the *search-string* is found, the result is a number from 1 to the actual length of the *source-string*.

See the related functions "LOCATE" on page 355 and "POSSTR" on page 382.

search-string

An expression that specifies the string that is to be searched for. *search-string* can be any built-in numeric or string expression. It must be compatible with the *source-string*. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

source-string

An expression that specifies the source string in which the search is to take place. *source-string* can be any built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is a large integer. If either of the arguments can be null, the result can be null. If either of the arguments is null, the result is the null value.

The POSITION function operates on a character basis. Because POSITION operates on a character-string basis, any shift-in and shift-out characters are not required to be in exactly the same position, and their only significance is to indicate which characters are SBCS and which characters are DBCS.

If the CCSID of the *search-string* is different from the CCSID of the *source-string*, it is converted to the CCSID of the *source-string*. If the CCSID of the *source-string* is mixed data or UTF-8, CCSID conversion to UTF-16 will occur.

If a collating sequence other than *HEX is in effect when the statement that contains the POSITION function is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence. An ICU collating sequence table cannot be specified with the POSITION function.

If the *search-string* has a length of zero, the result returned by the function is 1. Otherwise:

- if the *source-string* has a length of zero, the result returned by the function is 0.
- · Otherwise,
 - If the value of *search-string* is equal to an identical length of substring of contiguous positions within the value of *source-string*, then the result returned by the function is the starting position of the first such substring within the *source-string* value.

- Otherwise, the result returned by the function is 0.⁵⁹

Example

• Select RECEIVED and SUBJECT columns as well as the starting position of the words 'GOOD' within the NOTE_TEXT column for all entries in the IN_TRAY table that contain these words.

```
SELECT RECEIVED, SUBJECT, POSITION('GOOD', NOTE_TEXT)
FROM IN_TRAY
WHERE POSITION('GOOD', NOTE_TEXT) <> 0
```

• Assume that NOTE is a VARCHAR(128) column, encoded in Unicode UTF-8, that contains the value 'Jürgen lives on Hegelstraße'. Find the character position of the character 'ß' in the string.

```
SELECT POSITION( 'B', NOTE ), POSSTR( NOTE_TEXT, 'B') FROM T1
```

Returns the value 26 for POSITION and 27 for POSSTR.

^{59.} This includes the case where the search-string is longer than the source-string.

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POSSTR

The POSSTR function returns the starting position of the first occurrence of one string (called the search-string) within another string (called the source-string). If the search-string is not found and neither argument is null, the result is zero. If the search-string is found, the result is a number from 1 to the actual length of the source-string.

See the related functions, "LOCATE" on page 355 and "POSITION" on page 380.

source-string

An expression that specifies the source string in which the search is to take place. source-string may be any built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

search-string

An expression that specifies the string that is to be searched for. search-string may be any built-in numeric or string expression. It must be compatible with the source-string. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function is a large integer. If either of the arguments can be null, the result can be null. If either of the arguments is null, the result is the null value.

The POSSTR function accepts mixed data strings. However, POSSTR operates on a strict byte-count basis without regard to single-byte or double-byte characters. 60 It is recommended that if either the search-string or source-string contains mixed data, POSITION should be used instead of POSSTR. The POSITION function operates on a character basis. In an EBCDIC encoding scheme, any shift-in and shift-out characters are not required to be in exactly the same position, and their only significance is to indicate which characters are SBCS and which characters are DBCS.

If the CCSID of the search-string is different than the CCSID of the source-string, it is converted to the CCSID of the source-string. If the CCSID of the source-string is mixed data or UTF-8, CCSID conversion to UTF-16 will occur.

If a collating sequence other than *HEX is in effect when the statement that contains the POSSTR function is executed and the arguments are SBCS data, mixed data, or Unicode data, then the result is obtained by comparing weighted values for each value in the set. The weighted values are based on the collating sequence. An ICU collating sequence table cannot be specified with the POSSTR function.

If the search-string has a length of zero, the result returned by the function is 1. Otherwise:

- if the *source-string* has a length of zero, the result returned by the function is 0.
- Otherwise,

^{60.} For example, in an EBCDIC encoding scheme, if the source-string contains mixed data, the search-string will only be found if any shift-in and shift-out characters are also found in the source-string in exactly the same positions.

- If the value of *search-string* is equal to an identical length of substring of contiguous positions within the value of *source-string*, then the result returned by the function is the starting position of the first such substring within the *source-string* value.
- Otherwise, the result returned by the function is $0.^{61}$

Example

• Select RECEIVED and SUBJECT columns as well as the starting position of the words 'GOOD' within the NOTE_TEXT column for all entries in the IN_TRAY table that contain these words.

```
SELECT RECEIVED, SUBJECT, POSSTR(NOTE_TEXT, 'GOOD')
FROM IN_TRAY
WHERE POSSTR(NOTE_TEXT, 'GOOD') <> 0
```

^{61.} This includes the case where the search-string is longer than the source-string.

POWER

The POWER function returns the result of raising the first argument to the power of the second argument.

▶ POWER—(—expression-1—,—expression-2—)—

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. ⁶² A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

expression-2

An expression that returns a value of any built-in numeric data type. If the value of *expression-1* is equal to zero, then *expression-2* must be greater than or equal to zero. If the value of *expression-1* is less than zero, then *expression-2* must be an integer value.

If either argument is decimal floating-point, both arguments are converted to DECFLOAT(34). For decimal floating-point values the special values are treated as follows:

- If either argument is NaN or -NaN, NaN is returned.
- If the first argument is Infinity or -Infinity, Infinity is returned.
- POWER(0,Infinity) returns 0.
- POWER(1,Infinity) returns 1.
- POWER(any number greater than 1,Infinity) returns Infinity.
- POWER(any number greater than 0 and less than 1,Infinity) returns 0.
- POWER(any number less than 0,Infinity) returns NaN. ⁶³
- If either argument is sNaN or -sNaN, a warning or error is returned.

If the data type of the argument is decimal floating-point, the data type of the result is DECFLOAT(34). Otherwise, the result of the function is a double-precision floating-point number. If both arguments are 0, the result is 1. If an argument can be null, the result can be null; if an argument is null, the result is the null value.

Example

Assume the host variable HPOWER is an integer with value 3.

SELECT POWER(2,:HPOWER)
FROM SYSIBM.SYSDUMMY1

Returns the value 8.

^{62.} The result of the POWER function is exactly the same as the result of exponentiation: *expression-1* ** *expression-2*. 63. If *YES is specified for the SQL_DECFLOAT_WARNINGS query option NaN is returned with a warning

QUANTIZE

1

The QUANTIZE function returns a DECFLOAT value that is equal in value and sign to the first argument.

▶▶—QUANTIZE—(—expression1—,—expression2—)—

The QUANTIZE function returns a decimal floating-point value that is equal in value (except for any rounding) and sign to *expression1* and which has an exponent set equal to the exponent in *expression2*.

expression1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the data type of the argument is not a DECFLOAT value, it is converted to DECFLOAT(34) for processing.

expression2

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the data type of the argument is not a DECFLOAT value, it is converted to DECFLOAT(34) for processing.

If one argument (after conversion) is DECFLOAT(16) and the other is DECFLOAT(34), the DECFLOAT(16) argument is converted to DECFLOAT(34) before the function is processed.

The coefficient of the result is derived from that of *expression1*. It is rounded if necessary (if the exponent is being increased), multiplied by a power of ten (if the exponent is being decreased), or remains unchanged (if the exponent is already equal to that of *expression2*).

If necessary, the rounding mode is used by the QUANTIZE function. See "CURRENT DECFLOAT ROUNDING MODE" on page 122 for more information.

Unlike other arithmetic operations on the DECFLOAT data type, if the length of the coefficient after the quantize operation would be greater than the precision of the resulting DECFLOAT number, an error occurs. This guarantees that unless there is an error, the exponent of the result of a QUANTIZE function is always equal to that of *expression2*. Furthermore:

- If either argument is NaN, then NaN is returned.
- If either argument is sNaN, then an exception occurs.
- If both arguments are Infinity (positive or negative), then Infinity (positive or negative) is returned.
- If one argument is Infinity (positive or negative) and the other argument is not Infinity (positive or negative), then NaN is returned.

The result of the function is a DECFLOAT(16) value if both arguments are DECFLOAT(16). Otherwise, the result of the function is a DECFLOAT(34) value. If either argument can be null, the result can be null; if either argument is null, the result is the null value

^{64.} If *YES is specified for the SQL_DECFLOAT_WARNINGS query option, a warning is returned.

QUANTIZE

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1	The following

ing examples illustrate the value that is returned for the QUANTIZE function given the input DECFLOAT values:

```
QUANTIZE(2.17, 0.001)
                                 ==> 2.170
QUANTIZE(2.17, 0.01)
                                ==> 2.17
                                 ==> 2.2
QUANTIZE (2.17, 0.1)
QUANTIZE(2.17, 1e+0)
                                 ==> 2
QUANTIZE(2.17, 1e+1)
                                 ==> 0E+1
QUANTIZE(2, Infinity)
                                 ==> NaN (exception)
QUANTIZE(0, 1e+5)
                                 ==> 0E+5
QUANTIZE(217, 1e-1)
QUANTIZE(217, 1e+0)
                                 ==> 217.0
                                 ==> 217
QUANTIZE(217, 1e+1)
                                 ==> 2.2E+2
QUANTIZE(217, 1e+2)
                                 ==> 2E+2
```

In the following example, the value -0 is returned for the QUANTIZE function. The CHAR function is used to avoid the potential removal of the minus sign by a client program.

```
CHAR(QUANTIZE(-0.1, 1))
                                ==> -0
```

```
▶►—QUARTER—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Using the PROJECT table, set the host variable QUART (INTEGER) to the quarter in which project 'PL2100' ended (PRENDATE).

```
SELECT QUARTER(PRENDATE)
INTO :QUART
FROM PROJECT
WHERE PROJNO = 'PL2100'
```

Results in QUART being set to 3.

| | | | |



expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is cast to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

If the data type of the argument is DECFLOAT(*n*), the result is DECFLOAT(*n*). Otherwise, the data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume that host variable HDEG is an INTEGER with a value of 180. The following statement:

```
SELECT RADIANS(:HDEG)
FROM SYSIBM.SYSDUMMY1
```

Returns a double precision floating-point number with an approximate value of 3.1415926536.

RAISE ERROR

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The RAISE_ERROR function causes the statement that invokes the function to return an error with the specified SQLSTATE (along with SQLCODE -438) and diagnostic string.

```
\blacktriangleright—RAISE_ERROR—(—sqlstate—,—diagnostic-string—)—
```

sqlstate

An expression that returns a value of a built-in CHAR or VARCHAR data type with exactly 5 characters. The *sqlstate* value must follow the rules for application-defined SQLSTATEs:

- Each character must be from the set of digits ('0' through '9') or nonaccented uppercase letters ('A' through 'Z').
- The SQLSTATE class (first two characters) cannot be '00', '01', or '02' because these are not error classes.

If the SQLSTATE does not conform to these rules, an error is returned.

diagnostic-string

An expression that returns a value of a built-in CHAR or VARCHAR data type and a length up to 1000 bytes that describes the error condition. If the string is longer than 1000 bytes, it is truncated.

If an SQLCA is used, the following actions occur:

- The string is returned in the SQLERRMC field of the SQLCA.
- If the actual length of the string is longer than 70 bytes, it is truncated without a warning.

Since the data type of the result of RAISE_ERROR is undefined, it may only be used where parameter markers are allowed. To use this function in a context where parameter markers are not allowed (such as alone in a select list), you must use a cast specification to give a data type to the null value that is returned.

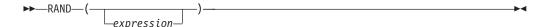
The RAISE_ERROR function always returns NULL with an undefined data type.

Example

• List employee numbers and education levels as Post Graduate, Graduate and Diploma. If an education level is greater than 20, raise an error.

RAND

The RAND function returns a floating point value greater than or equal to 0 and less than or equal to 1.



expression

If an expression is specified, it is used as the seed value. The argument must be an expression that returns a value of a built-in small integer, large integer, character-string, or graphic-string data type. A string argument is cast to integer before evaluating the function. For more information on converting strings to integer, see "INTEGER or INT" on page 343.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

A specific seed value will produce the same sequence of random numbers for a specific instance of a RAND function in a query each time the query is executed. If a seed value is not specified, a different sequence of random numbers is produced each time the query is executed.

RAND is a non-deterministic function.

Example

• Assume that host variable HRAND is an INTEGER with a value of 100. The following statement:

```
SELECT RAND(:HRAND)
FROM SYSIBM.SYSDUMMY1
```

Returns a random floating-point number between 0 and 1, such as the approximate value .0121398.

• To generate values in a numeric interval other than 0 to 1, multiply the RAND function by the size of the wanted interval. For example, to get a random number between 0 and 10, such as the approximate value 5.8731398, multiply the function by 10:

```
SELECT RAND(:HRAND) * 10
FROM SYSIBM.SYSDUMMY1
```

Numeric to Real



String to Real



The REAL function returns a single-precision floating-point representation of:

- A number
- · A character or graphic string representation of a decimal number
- A character or graphic string representation of an integer
- A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to Real

numeric-expression

The argument is an expression that returns a value of any built-in numeric data type.

The result is the same number that would occur if the argument were assigned to a single-precision floating-point column or variable. If the numeric value of the argument is not within the range of single-precision floating-point, an error is returned.

String to Real

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number.

If the argument is a *string-expression*, the result is the same number that would result from CAST(*string-expression* AS REAL). Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant. If the numeric value of the argument is not within the range of single-precision floating-point, an error is returned.

The single-byte character constant that must be used to delimit the decimal digits in *string-expression* from the whole part of the number is the default decimal point. For more information, see "Decimal point" on page 116.

The result of the function is a single-precision floating-point number. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

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Example

• Using the EMPLOYEE table, find the ratio of salary to commission for employees whose commission is not zero. The columns involved (SALARY and COMM) have DECIMAL data types. To eliminate the possibility of out-of-range results, REAL is applied to SALARY so that the division is carried out in floating point:

SELECT EMPNO, REAL(SALARY)/COMM FROM EMPLOYEE WHERE COMM > 0

REPEAT

The REPEAT function returns a string composed of *expression* repeated *integer* times.

expression

An expression that specifies the string to be repeated. The string must be a built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information on converting numeric to a character string, see "VARCHAR" on page 449.

integer

An expression that returns a built-in BIGINT, INTEGER, or SMALLINT data type whose value is a positive integer or zero. The integer specifies the number of times to repeat the string.

The data type of the result of the function depends on the data type of the first argument:

Data type of string-expression	Data type of the Result
CHAR or VARCHAR or any numeric type	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

If *integer* is a constant, the length attribute of the result is the length attribute of *string-expression* times *integer*. Otherwise, the length attribute depends on the data type of the result:

- 1,048,576 for BLOB, CLOB, or DBCLOB
- 4000 for VARCHAR or VARBINARY
- 2000 for VARGRAPHIC

If the length attribute of the result exceeds the maximum for the result data type, an error is returned.

The actual length of the result is the actual length of *string-expression* times *integer*. If the actual length of the result string exceeds the maximum for the return type, an error is returned.

If either argument can be null, the result can be null; if either argument is null, the result is the null value.

The CCSID of the result is the CCSID of string-expression.⁶⁵

^{65.} If the value of *string-expression* is mixed data that is not a properly formed mixed data string, the result will not be a properly formed mixed data string.

Examples

• Repeat 'abc' two times to create 'abcabc'.

```
SELECT REPEAT ('abc', 2)
  FROM SYSIBM.SYSDUMMY1
```

· List the phrase 'REPEAT THIS' five times. Use the CHAR function to limit the output to 60 bytes.

```
SELECT CHAR( REPEAT ('REPEAT THIS', 5), 60)
  FROM SYSIBM.SYSDUMMY1
```

This example results in 'REPEAT THISREPEAT THISREPEAT THISREPEAT THISREPEAT THIS

For the following query, the LENGTH function returns a value of 0 because the result of repeating a string zero times is an empty string, which is a zero-length string.

```
SELECT LENGTH ( REPEAT ('REPEAT THIS', 0) )
  FROM SYSIBM.SYSDUMMY1
```

• For the following query, the LENGTH function returns a value of 0 because the result of repeating an empty string any number of times is an empty string, which is a zero-length string.

```
SELECT LENGTH( REPEAT('', 5) )
  FROM SYSIBM.SYSDUMMY1
```

REPLACE

The REPLACE function replaces all occurrences of *search-string* in *source-string* with *replace-string*. If *search-string* is not found in *source-string*, *source-string* is returned unchanged.

source-string

An expression that specifies the source string. The *source-string* must be a built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

search-string

An expression that specifies the string to be removed from the source string. The *search-string* must be a built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

replace-string

An expression that specifies the replacement string. The *replace-string* must be a built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

source-string, search-string, and replace-string must be compatible. For more information about data type compatibility, see "Assignments and comparisons" on page 89.

The data type of the result of the function depends on the data type of the arguments. The result data type is the same as if the three arguments were concatenated except that the result is always a varying-length string. For more information see "Conversion rules for operations that combine strings" on page 110

The length attribute of the result depends on the arguments:

- If search-string is variable length, the length attribute of the result is: (L3 * L1)
- If the length attribute of *replace-string* is less than or equal to the length attribute of *search-string*, the length attribute of the result is the length attribute of *source-string*
- Otherwise, the length attribute of the result is:

```
(L3 * (L1/L2)) + MOD(L1,L2)
```

where:

```
L1 is the length attribute of source-string
L2 is the length attribute of search-string
L3 is the length attribute of replace-string
```

If the length attribute of the result exceeds the maximum for the result data type, an error is returned.

The actual length of the result is the actual length of *source-string* plus the number of occurrences of *search-string* that exist in *source-string* multiplied by the actual

length of *replace-string* minus the actual length of *search-string*. If the actual length of the result string exceeds the maximum for the result data type, an error is returned.

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is determined by the CCSID of *source-string*, *search-string*, and *replace-string*. The resulting CCSID is the same as if the three arguments were concatenated. For more information, see "Conversion rules for operations that combine strings" on page 110.

Examples

• Replace all occurrences of the character 'N' in the string 'DINING' with 'VID'. Use the CHAR function to limit the output to 10 bytes.

```
SELECT CHAR(REPLACE( 'DINING', 'N', 'VID' ), 10),
FROM SYSIBM.SYSDUMMY1
```

The result is the string 'DIVIDIVIDG'.

• Replace string 'ABC' in the string 'ABCXYZ' with nothing, which is the same as removing 'ABC' from the string.

```
SELECT REPLACE( 'ABCXYZ', 'ABC', '' )
FROM SYSIBM.SYSDUMMY1
```

The result is the string 'XYZ'.

• Replace string 'ABC' in the string 'ABCCABCC' with 'AB'. This example illustrates that the result can still contain the string that is to be replaced (in this case, 'ABC') because all occurrences of the string to be replaced are identified prior to any replacement.

```
SELECT REPLACE( 'ABCCABCC', 'ABC', 'AB') )
FROM SYSIBM.SYSDUMMY1
```

The result is the string 'ABCABC'.

RID

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The RID function returns the relative record number of a row as a BIGINT.

 \blacktriangleright -RID--(-table-designator-)------

table-designator

A table designator that can be used to qualify a column in the same relative location in the SQL statement as the RID function. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the relative record number of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the relative record number of the first table in the outer subselect of the view, common table expression, or nested table expression.

If the argument identifies a distributed table, the function returns the relative record number of the row on the node where the row is located. If the argument identifies a partitioned table, the function returns the relative record number of the row in the partition where the row is located. This means that RID will not be unique for each row of a partitioned or distributed table.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The RID function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is a big integer. The result can be null.

Example

• Return the relative record number and employee name from table EMPLOYEE for those employees in department 20.

```
SELECT RID(EMPLOYEE), LASTNAME
FROM EMPLOYEE
WHERE DEPTNO = 20
```

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If *expression* is a character string, the result is a character string. If *expression* is a graphic string, the result is a graphic string. If *expression* is a binary string, the result is a binary string.

expression

An expression that specifies the string from which the result is derived. The string must be a built-in numeric or string expression. A numeric argument is cast to a character string before evaluating the function. For more information on converting numeric to a character string, see "VARCHAR" on page 449.

A substring of *expression* is zero or more contiguous characters of *expression*. If *expression* is a character string or graphic string, a single character is either an SBCS, DBCS, or multiple-byte character. If *expression* is a binary string, the result is the number of bytes in the argument.

integer

An expression that returns a built-in integer data type. The integer specifies the length of the result. *integer* must be greater than or equal to 0 and less than or equal to *n*, where *n* is the length attribute of *expression*.

The *expression* is effectively padded on the right with the necessary number of blank characters (or hexadecimal zeroes for binary strings) so that the specified substring of *expression* always exists.

The result of the function is a varying-length string with a length attribute that is the same as the length attribute of *expression* and a data type that depends on the data type of *expression*:

Data type of expression	Data type of the Result
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The actual length of the result is *integer*.

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is the same as that of *expression*.

Example

 Assume that host variable ALPHA has a value of 'ABCDEF'. The following statement:

SELECT RIGHT (: ALPHA, 3) **FROM** SYSIBM.SYSDUMMY1

Returns the value 'DEF', which are the three rightmost characters in ALPHA.

• The following statement returns a zero length string.

```
SELECT RIGHT( 'ABCABC', 0)
FROM SYSIBM.SYSDUMMY1
```

• Assume that NAME is a VARCHAR(128) column, encoded in Unicode UTF-8, that contains the value 'Jürgen'.

```
SELECT RIGHT(NAME, 5), SUBSTR(NAME, 3, 5)
FROM T1
WHERE NAME = 'Jürgen'
```

Returns the value 'ürgen' for RIGHT and an unprintable string (X'BC7267656E') for SUBSTR(NAME, 3, 5).

ROUND

The ROUND function returns *expression–1* rounded to some number of places to the right or left of the decimal point.

```
\blacktriangleright ROUND - (-expression - 1 - , -expression - 2 - ) -
```

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

If *expression-1* is a decimal floating-point data type, the DECFLOAT ROUNDING MODE will not be used. The rounding behavior of ROUND corresponds to a value of ROUND_HALF_UP. If a different rounding behavior is wanted, use the QUANTIZE function.

expression-2

An expression that returns a value of a built-in BIGINT, INTEGER, or SMALLINT data type.

If *expression*–2 is positive, *expression*–1 is rounded to the *expression*–2 number of places to the right of the decimal point.

If *expression*–2 is negative, *expression*–1 is rounded to 1 + (the absolute value of *expression*–2) number of places to the left of the decimal point. If the absolute value of *expression*–2 is greater than the number of digits to the left of the decimal point, the result is 0. (For example, ROUND(748.58,-4) returns 0.)

If *expression*–1 is positive, a digit value of 5 is rounded to the next higher positive number. If *expression*–1 is negative, a digit value of 5 is rounded to the next lower negative number.

The data type and length attribute of the result are the same as the data type and length attribute of the first argument, except that precision is increased by one if *expression*–1 is DECIMAL or NUMERIC and the precision is less than the maximum precision (*mp*). For example, an argument with a data type of DECIMAL(5,2) will result in DECIMAL(6,2). An argument with a data type of DECIMAL(63,2) will result in DECIMAL(63,2).

If either argument can be null, the result can be null. If either argument is null, the result is the null value.

Examples

• Calculate the number 873.726 rounded to 2, 1, 0, -1, -2, -3, and -4 decimal places respectively.

```
SELECT ROUND(873.726, 2),
ROUND(873.726, 1),
ROUND(873.726, 0),
ROUND(873.726, -1),
ROUND(873.726, -2),
ROUND(873.726, -3),
ROUND(873.726, -4)
FROM SYSIBM.SYSDUMMY1
```

Returns the following values, respectively:

0873.730 0873.700 0874.000 0870.000 0900.000 1000.000 0000.000

• Calculate both positive and negative numbers.

```
SELECT ROUND(3.5, 0),
ROUND(3.1, 0),
ROUND(-3.1, 0),
ROUND(-3.5, 0)
FROM SYSIBM.SYSDUMMY1

Returns the following examples, respectively:
04.0 03.0 -03.0 -04.0
```

ROUND_TIMESTAMP

The ROUND_TIMESTAMP function returns a timestamp that is the expression rounded to the unit specified by the format-string. If format-string is not specified, expression is rounded to the nearest day, as if 'DD' was specified for format-string.

expression

An expression that returns a value of one of the following built-in data types: a timestamp, a character-string, or a graphic-string.

If expression is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.

format-string

An expression that returns a built-in character string data type or graphic string data type. format-string contains a template of how the timestamp represented by expression should be rounded. For example, if format-string is 'DD', the timestamp that is represented by *expression* is rounded to the nearest day. Leading and trailing blanks are removed from the string, and the resulting substring must be a valid template for a timestamp. The resulting value is then folded to uppercase, so the characters in the value may be in any case. Allowable values for *format-string* are listed in Table 39.

The result of the function is a TIMESTAMP. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Table 39. ROUND_TIMESTAMP and TRUNC_TIMESTAMP format models

Format model	Rounding or truncating unit	ROUND_TIMESTAMP example	TRUNC_TIMESTAMP example
CC	One greater than the first two digits of a four digit	Input value: 1897-12-04-12.22.22.000000	Input value: 1897-12-04-12.22.22.000000
SCC	your. (Rounds up on the 50th year of the century)	Result: 1900-01-01-00.00.00.0000000	Result: 1800-01-01-00.00.00.000000
YYYY	Year (Rounds up on July 1)	Input value: 1897-12-04-12.22.22.000000	Input value: 1897-12-04-12.22.22.000000
YEAR		Result: 1898-01-01-00.00.00.0000000	Result: 1897-01-01-00.00.00.000000
SYEAR YYY			
YY			
Y			

Table 39. ROUND_TIMESTAMP and TRUNC_TIMESTAMP format models (continued)

Format model	Rounding or truncating unit	ROUND_TIMESTAMP example	TRUNC_TIMESTAMP example
IYYY	ISO year (Rounds up on July 1)	Input value: 1897-12-04-12.22.22.000000	Input value: 1897-12-04-12.22.22.000000
IYY IY		Result: 1898-01-01-00.00.00.000000	Result: 1897-01-01-00.00.00.000000
Q	Quarter (Rounds up on the sixteenth day of the second month of the quarter)	Input value: 1999-06-04-12.12.30.000000 Result: 1999-07-01-00.00.00.000000	Input value: 1999-06-04-12.12.30.000000 Result: 1999-04-01-00.00.00.000000
MONTH MON MM	Month (Rounds up on the sixteenth day of the month)	Input value: 1999-06-18-12.12.30.000000 Result: 1999-07-01-00.00.00.000000	Input value: 1999-06-18-12.12.30.000000 Result: 1999-06-01-00.00.00.000000
RM			
WW	Same day of the week as the first day of the year (Rounds up on the 12th hour of the 4th day of the week, with respect to the first day of the year)	Input value: 2000-05-05-12.12.30.000000 Result: 2000-05-06-00.00.00.000000	Input value: 2000-05-05-12.12.30.000000 Result: 2000-04-29-00.00.00.000000
IW	Same day of the week as the first day of the ISO year (Rounds up on the 12th hour of the 4th day of the week, with respect to the first day of the ISO year)	Input value: 2000-05-05-12.12.30.000000 Result: 2000-05-08-00.00.00.000000	Input value: 2000-05-05-12.12.30.000000 Result: 2000-05-01-00.00.00.000000
W	Same day of the week as the first day of the month (Rounds up on the 12th hour of the 4th day of the week, with respect to the first day of the month)	Input value: 2000-05-17-12.12.30.000000 Result: 2000-05-15-00.00.00.000000	Input value: 2000-05-17-12.12.30.000000 Result: 2000-05-15-00.00.00.000000
DDD DD J	Day (Rounds up on the 12th hour of the day)	Input value: 2000-05-17-12.59.59.000000 Result: 2000-05-18-00.00.00.000000	Input value: 2000-05-17-12.59.59.000000 Result: 2000-05-17-00.00.00.0000000
DAY DY D	Starting day of the week (Rounds up with respect to the 12th hour of the 4th day of the week. The first day of the week is always Sunday)	Input value: 2000-05-17-12.59.59.000000 Result: 2000-05-21-00.00.00.000000	Input value: 2000-05-17-12.59.59.000000 Result: 2000-05-14-00.00.00.000000

ROUND_TIMESTAMP

Table 39. ROUND_TIMESTAMP and TRUNC_TIMESTAMP format models (continued)

l I	Format model	Rounding or truncating unit	ROUND_TIMESTAMP example	TRUNC_TIMESTAMP example
 	НН	Hour (Rounds up at 30 minutes)	Input value: 2000-05-17-23.59.59.000000	Input value: 2000-05-17-23.59.59.000000
 	HH12		Result: 2000-05-18-00.00.00.000000	Result: 2000-05-17-23.00.00.000000
	HH24	NO (D. 1		
1	MI	Minute (Rounds up at 30 seconds)	Input value: 2000-05-17-23.58.45.000000	Input value: 2000-05-17-23.58.45.000000
 			Result: 2000-05-17-23.59.00.000000	Result: 2000-05-17-23.58.00.000000
 	SS	Second (Rounds up at 500000 microseconds)	Input value: 2000-05-17-23.58.45.500000	Input value: 2000-05-17-23.58.45.500000
 			Result: 2000-05-17-23.58.46.000000	Result: 2000-05-17-23.58.45.000000

Example

• Set the host variable RND_TMSTMP with the current year rounded to the nearest month value.

```
SET :RND_TMSTMP = ROUND_TIMESTAMP('2000-03-18-17.30.00', 'MONTH');
```

Host variable RND_TMSTMP is set with the value 2000-04-01-00.00.00.000000.

string-expression

An expression that returns a character string value. Although the string can contain any value, it is recommended that it contain a ROWID value that was previously generated by DB2 for z/OS or DB2 for i to ensure a valid ROWID value is returned. For example, the function can be used to convert a ROWID value that was cast to a CHAR value back to a ROWID value.

If the actual length of *string-expression* is less than 40, the result is not padded. If the actual length of *string-expression* is greater than 40, the result is truncated. If non-blank characters are truncated, a warning is returned.

The length attribute of the result is 40. The actual length of the result is the length of *string-expression*.

The result of the function is a row ID. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

 Assume that table EMPLOYEE contains a ROWID column EMP_ROWID. Also assume that the table contains a row that is identified by a row ID value that is equivalent to X'F0DFD230E3C0D80D81C201AA0A2801000000000000203'. Using direct row access, select the employee number for that row.

```
SELECT EMPNO
   FROM EMPLOYEE
   WHERE EMP ROWID = ROWID(X'FODFD230E3C0D80D81C201AA0A28010000000000000203')
```

The RRN function returns the relative record number of a row.



table-designator

A table designator that could be used to qualify a column in the same relative location in the SQL statement as the RRN function. For more information about table designators, see "Table designators" on page 132.

In SQL naming, the table name may be qualified. In system naming, the table name cannot be qualified.

If the argument identifies a view, common table expression, or nested table expression, the function returns the relative record number of its base table. If the argument identifies a view, common table expression, or nested table expression derived from more than one base table, the function returns the relative record number of the first table in the outer subselect of the view, common table expression, or nested table expression.

If the argument identifies a distributed table, the function returns the relative record number of the row on the node where the row is located. If the argument identifies a partitioned table, the function returns the relative record number of the row in the partition where the row is located. This means that RRN will not be unique for each row of a partitioned or distributed table.

The argument must not identify a view, common table expression, or nested table expression whose outer fullselect subselect includes an aggregate function, a GROUP BY clause, a HAVING clause, a UNION clause, an INTERSECT clause, DISTINCT clause, or VALUES clause. The RRN function cannot be specified in a SELECT clause if the fullselect contains an aggregate function, a GROUP BY clause, a HAVING clause, or a VALUES clause. If the argument is a correlation name, the correlation name must not identify a correlated reference.

The data type of the result is a decimal with precision 15 and scale 0. The result can be null.

Example

• Return the relative record number and employee name from table EMPLOYEE for those employees in department 20.

```
SELECT RRN(EMPLOYEE), LASTNAME
FROM EMPLOYEE
WHERE DEPTNO = 20
```

RTRIM

The RTRIM function removes blanks or hexadecimal zeroes from the end of a string expression.



expression

An expression that returns a value of any built-in numeric or string data type. ⁶⁶ A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

- If the argument is a binary string, then the trailing hexadecimal zeros (X'00') are removed.
- If the argument is a DBCS graphic string, then the trailing DBCS blanks are removed.
- If the first argument is a Unicode graphic string, then the trailing UTF-16 or UCS-2 blanks are removed.
- If the first argument is a UTF-8 character string, then the trailing UTF-8 blanks are removed.
- Otherwise, trailing SBCS blanks are removed.

The data type of the result depends on the data type of *string-expression*:

Data type of string-expression	Data type of the Result
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The length attribute of the result is the same as the length attribute of *string-expression*. The actual length of the result is the length of the expression minus the number of bytes removed. If all characters are removed, the result is an empty string.

If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

The CCSID of the result is the same as that of the string.

Example

Assume the host variable HELLO of type CHAR(9) has a value of 'Hello'.
 SELECT RTRIM(:HELLO)
 FROM SYSIBM.SYSDUMMY1

Results in: 'Hello'.

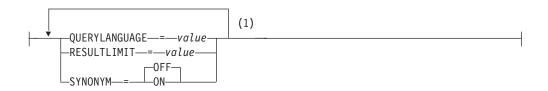
^{66.} The RTRIM function returns the same results as: STRIP(expression,TRAILING)

SCORE

The SCORE function searches a text search index using criteria that are specified in a search argument and returns a relevance score that measures how well a document matches the query.

```
►►—SCORE—(—column-name—,—search-argument————search-argument-options——)
```

search-argument-options-string:



Notes:

1 The same clause must not be specified more than once.

column-name

Specifies a qualified or unqualified name of a column that has a text search index that is to be searched. The column must exist in the table or view that is identified in the FROM clause in the statement and the column of the table, or the column of the underlying base table of the view must have an associated text search index. The underlying expression of the column of a view must be a simple column reference to the column of an underlying table, either directly or through another nested view.

search-argument

An expression that returns a character-string data type or graphic-string data type that contains the terms to be searched for. It must not be the empty string or contain all blanks. The actual length of the string must not exceed 32 740 and must not exceed the text search limitations or terms as specified in the search argument syntax. For information on *search-argument* syntax, see Appendix G, "Text search argument syntax," on page 1473.

search-argument-options

A character string or graphic string value that specifies the search argument options to use for the search. It must be a constant or a variable.

The options that can be specified as part of the search-argument-options are:

QUERYLANGUAGE = value

Specifies the language value. The value can be any of the supported language codes. If QUERYLANGUAGE is not specified, the default is the language value of the text search index that is used when the function is invoked. If the language value of the text search index is AUTO, the default value for QUERYLANGUAGE is en_US. For more information on the query language option, see "Text search language options" on page 1483.

RESULTLIMIT = value

Specifies the maximum number of results that are to be returned from the underlying search engine. The *value* must be an integer from 1 to 2 147 483 647. If RESULTLIMIT is not specified, no result limit is in effect for the query.

SCORE may or may not be called for each row of the result table, depending on the plan that the optimizer chooses. If SCORE is called once 1 for the query to the underlying search engine, a result set of all of the ROWIDs or primary keys that match are returned from the search engine. This result set is then joined to the table containing the column to identify the result rows. In this case, the RESULTLIMIT value acts like a FETCH FIRST *n* ROWS ONLY from the underlying text search engine and can be used as an optimization. If SCORE is called for each row of the result because the optimizer determines that is the best plan, then the RESULTLIMIT option has no effect. SYNONYM = OFF or SYNONYM = ONSpecifies whether to use a synonym dictionary associated with the text search index. The default is OFF. **OFF** Do not use a synonym dictionary. ON Use the synonym dictionary associated with the text search index. If search-argument-options is the empty string or the null value, the function is I evaluated as if search-argument-options were not specified. The result of the function is a double-precision floating-point number. If ı search-argument can be null, the result can be null; if search-argument is null, the result is the null value. The result of SCORE is a value between 0 and 1. The more frequent the column contains a match for the search criteria specified by search-argument, the larger the result value. If a match is not found, the result is 0. If the column value is null or ı search-argument contains only blanks or is the empty string, the result is 0. SCORE is a non-deterministic function. Note Rules: If a view, nested table expression, or common table expression provides a

text search column for a CONTAINS or SCORE scalar function and the applicable view, nested table expression, or common table expression has a DISTINCT clause on the outermost SELECT, the SELECT list must contain all the corresponding key fields of the text search index.

If a view, nested table expression, or common table expression provides a text search column for a CONTAINS or SCORE scalar function, the applicable view, nested table expression, or common table expression cannot have a UNION, EXCEPT, or INTERSECT at the outermost SELECT.

If a common table expression provides a text search column for a CONTAINS or SCORE scalar function, the common table expression cannot be subsequently referenced again in the entire query unless that reference does not provide a text search column for a CONTAINS or SCORE scalar function.

CONTAINS and SCORE scalar functions are not allowed if the query specifies:

a distributed table,

ı

I

ı

ı

· a table with a read trigger,

SCORE

- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

Example

• The following statement generates a list of employees in the order of how well their resumes match the query "programmer AND (java OR cobol)", along with a relevance value that is normalized between 0 (zero) and 100.

```
SELECT EMPNO, INTEGER(SCORE(RESUME, 'programmer AND
  (java OR cobol)') * 100) AS RELEVANCE
FROM EMP_RESUME
WHERE RESUME FORMAT = 'ascii'
AND CONTAINS(RESUME, 'programmer AND (java OR cobol)') = 1
ORDER BY RELEVANCE DESC
```

The database manager first evaluates the CONTAINS predicate in the WHERE clause, and therefore, does not evaluate the SCORE function in the SELECT list for every row of the table. In this case, the arguments for SCORE and CONTAINS must be identical.

SECOND

The SECOND function returns the seconds part of a value.

▶►—SECOND—(—expression—)—

expression

An expression that returns a value of one of the following built-in data types: a time, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a time or timestamp. For the valid formats of string representations of times and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a time duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a time, a timestamp, or a valid character-string representation of a time or timestamp:
 - The result is the seconds part of the value, which is an integer between 0 and 59.
- If the argument is a time duration or timestamp duration:

The result is the seconds part of the value, which is an integer between -99 and 99. A nonzero result has the same sign as the argument.

Examples

Assume that the host variable TIME_DUR (DECIMAL(6,0)) has the value 153045.

```
SELECT SECOND(:TIME_DUR)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 45.

• Assume that the column RECEIVED (TIMESTAMP) has an internal value equivalent to 1988-12-25-17.12.30.000000.

```
SELECT SECOND (RECEIVED)
FROM IN TRAY
```

Returns the value 30.

1

SIGN

The SIGN function returns an indicator of the sign of expression.

```
►►—SIGN—(—expression—)—
```

The returned value is:

- -1 if the argument is less than zero
- -0 if the argument is DECFLOAT negative zero
- 0 if the argument is zero
- 1 if the argument is greater than zero

expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The result has the same data type and length attribute as the argument, except that precision is increased by one if the argument is DECIMAL or NUMERIC and the scale of the argument is equal to its precision. For example, an argument with a data type of DECIMAL(5,5) will result in DECIMAL(6,5). If the precision is already the maximum precision (mp), the scale will be decreased by one. For example, DECIMAL(63,63) will result in DECIMAL(63,62).

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

Assume that host variable PROFIT is a large integer with a value of 50000.

```
SELECT SIGN(:PROFIT)
  FROM EMPLOYEE
```

Returns the value 1.

The SIN function returns the sine of the argument, where the argument is an angle expressed in radians. The SIN and ASIN functions are inverse operations.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable SINE is a decimal (2,1) host variable with a value of 1.5.

```
SELECT SIN(:SINE)
FROM SYSIBM.SYSDUMMY1
```

Returns the approximate value 0.99.

SINH

The SINH function returns the hyperbolic sine of the argument, where the argument is an angle expressed in radians.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable HSINE is a decimal (2,1) host variable with a value of 1.5.

```
SELECT SINH(:HSINE)
FROM SYSIBM.SYSDUMMY1
```

Returns the approximate value 2.12.

4.4

SMALLINT

The SMALLINT function returns a small integer representation.

Numeric to Smallint



String to Smallint



The SMALLINT function returns a small integer representation of

- A number
- · A character or graphic string representation of a decimal number
- A character or graphic string representation of an integer
- · A character or graphic string representation of a decimal floating-point number
- A character or graphic string representation of a floating-point number

Numeric to Smallint

numeric-expression

An expression that returns a numeric value of any built-in numeric data type.

The result is the same number that would occur if the argument were assigned to a small integer column or variable. If the whole part of the argument is not within the range of small integers, an error is returned. The fractional part of the argument is truncated.

String to Smallint

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number.

If the argument is a *string-expression*, the result is the same number that would result from CAST(*string-expression* AS SMALLINT). Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant. If the whole part of the argument is not within the range of small integers, an error is returned. Any fractional part of the argument is truncated.

The result of the function is a small integer. If the argument can be null, the result can be null. If the argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

• Using the EMPLOYEE table, select a list containing salary (SALARY) divided by education level (EDLEVEL). Truncate any decimal in the calculation. The list should also contain the values used in the calculation and the employee number (EMPNO).

SELECT SMALLINT(SALARY / EDLEVEL), SALARY, EDLEVEL, EMPNO FROM EMPLOYEE

```
►►—SOUNDEX—(—expression—)—
```

expression

An expression that returns a value of any built-in numeric or string data type, that is not a CLOB or DBCLOB. The argument cannot be a binary string. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The data type of the result is CHAR(4). If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID of the result is the default CCSID of the current server.

The SOUNDEX function is useful for finding strings for which the sound is known but the precise spelling is not. It makes assumptions about the way that letters and combinations of letters sound that can help to search out words with similar sounds. The comparison can be done directly or by passing the strings as arguments to the DIFFERENCE function. For more information, see "DIFFERENCE" on page 297.

Example

 Using the EMPLOYEE table, find the EMPNO and LASTNAME of the employee with a surname that sounds like 'Loucesy'.

```
SELECT EMPNO, LASTNAME
       FROM EMPLOYEE
       WHERE SOUNDEX(LASTNAME) = SOUNDEX('Loucesy')
```

Returns the row:

000110 LUCCHESSI

SPACE

The SPACE function returns a character string that consists of the number of SBCS blanks that the argument specifies.



expression

An expression that returns a value of any built-in SMALLINT, INTEGER, BIGINT, character-string, or graphic-string data type. A string argument is converted to integer before evaluating the function. For more information about converting strings to integer, see "INTEGER or INT" on page 343.

The *expression* specifies the number of SBCS blanks for the result, and it must be between 0 and 32740. If *expression* is a constant, it must not be the constant 0

The result of the function is a varying-length character string (VARCHAR) that contains SBCS data.

If *expression* is a constant, the length attribute of the result is the constant. Otherwise, the length attribute of the result is 4000. The actual length of the result is the value of *expression*. The actual length of the result must not be greater than the length attribute of the result.

If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The CCSID is the default CCSID for SBCS data of the job.

Example

• The following statement returns a character string that consists of 5 blanks.

SELECT SPACE(5)
FROM SYSIBM.SYSDUMMY1

SQRT

The SQRT function returns the square root of a number.



expression

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308. The value of *expression* must be greater than or equal to zero.

If the argument is DECFLOAT(n), the result is DECFLOAT(n). Otherwise, the result of the function is a double precision floating-point number. If the argument is a special decimal floating point value, the general rules for arithmetic operations apply. See "General arithmetic operation rules for DECFLOAT" on page 156 for more information. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

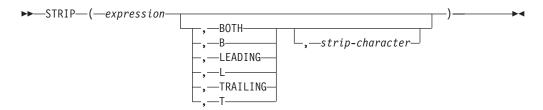
• Assume the host variable SQUARE is a DECIMAL(2,1) host variable with a value of 9.0.

SELECT SQRT(:SQUARE)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 3.00.

STRIP

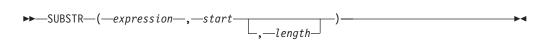
The STRIP function removes blanks or another specified character from the end, the beginning, or both ends of a string expression.



The STRIP function is identical to the TRIM scalar function. For more information, see "TRIM" on page 440.

SUBSTR

The SUBSTR function returns a substring of a string.



expression

An expression that specifies the string from which the result is derived.

Expression must be any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. If *expression* is a character string, the result of the function is a character string. If it is a graphic string, the result of the function is a graphic string. If it is a binary string, the result of the function is a binary string.

A substring of *expression* is zero or more contiguous characters of *expression*. If *expression* is a graphic string, a character is a DBCS or Unicode graphic character. If *expression* is a character string, a character is a byte.⁶⁷ If *expression* is a binary string, a character is a byte.

start

An expression that specifies the position within *expression* of the first character (or byte) of the result. The expression must return a value that is a built-in BIGINT, INTEGER, or SMALLINT data type. *start* may be negative or zero. It may also be greater than the length attribute of *expression*. (The length attribute of a varying-length string is its maximum length.)

length

An expression that specifies the length of the result. If specified, *length* must be an expression that returns a value that is a built-in BIGINT, INTEGER, or SMALLINT data type. The value must be greater than or equal to 0.

If *length* is explicitly specified, *expression* is effectively padded on the right with the necessary number of blank characters so that the specified substring of *expression* always exists. Hexadecimal zeroes are used as the padding character when *expression* is a binary string.

If *expression* is a fixed-length string, omission of *length* is an implicit specification of LENGTH(expression) - start + 1, which is the number of characters (or bytes) from the start character (or byte) to the last character (or byte) of expression. If expression is a varying-length string, omission of length is an implicit specification of zero or LENGTH(expression) - start + 1, whichever is greater. If the resulting length is zero, the result is the empty string.

^{67.} The SUBSTR function accepts mixed data strings. However, because SUBSTR operates on a strict byte-count basis, the result will not necessarily be a properly formed mixed data string.

The data type of the result depends on the data type of *expression*:

Data type of expression	Data Type of the Result for SUBSTR	
CHAR or VARCHAR	CHAR, if:	
	• <i>length</i> is explicitly specified by an integer constant that is greater than zero.	
	• <i>length</i> is not explicitly specified, but <i>expression</i> is a fixed-length string and <i>start</i> is an integer constant.	
	VARCHAR, in all other cases	
CLOB	CLOB	
GRAPHIC or VARGRAPHIC	GRAPHIC, if:	
	• <i>length</i> is explicitly specified by an integer constant that is greater than zero.	
	• <i>length</i> is not explicitly specified, but <i>expression</i> is a fixed-length string and <i>start</i> is an integer constant.	
	VARGRAPHIC, in all other cases.	
DBCLOB	DBCLOB	
BINARY or VARBINARY	BINARY, if:	
	• <i>length</i> is explicitly specified by an integer constant that is greater than zero.	
	• <i>length</i> is not explicitly specified, but <i>expression</i> is a fixed-length string and <i>start</i> is an integer constant.	
	VARBINARY, in all other cases.	
BLOB	BLOB	

If expression is not a LOB, the length attribute of the result depends on length, start, and the attributes of expression.

- If length is explicitly specified by an integer constant that is greater than zero, the length attribute of the result is *length*.
- If length is not explicitly specified, but expression is a fixed-length string and start is an integer constant, the length attribute of the result is LENGTH(expression) start + 1.

In all other cases, the length attribute of the result is the same as the length attribute of expression. (Remember that if the actual length of expression is less than the value for *start*, the actual length of the substring is zero.)

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is the same as that of *expression*.

Examples

 Assume the host variable NAME (VARCHAR(50)) has a value of 'KATIE AUSTIN' and the host variable SURNAME_POS (INTEGER) has a value of 7.

```
SELECT SUBSTR(:NAME, :SURNAME POS)
  FROM SYSIBM.SYSDUMMY1
```

Returns the value 'AUSTIN'.

· Likewise,

```
SELECT SUBSTR(:NAME, :SURNAME_POS, 1)
  FROM SYSIBM.SYSDUMMY1
```

Returns the value 'A'.

• Select all rows from the PROJECT table for which the project name (PROJNAME) starts with the word 'OPERATION'.

```
SELECT *
  FROM PROJECT
  WHERE SUBSTR(PROJNAME,1,10) = 'OPERATION '
```

The space at the end of the constant is necessary to preclude initial words such as 'OPERATIONS'.

expression

An expression that specifies the string from which the result is derived.

Expression must be any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. If expression is a character string, the result of the function is a character string. If it is a graphic string, the result of the function is a graphic string. If it is a binary string, the result of the function is a binary string.

A substring of *expression* is zero or more contiguous characters of *expression*. If *expression* is a graphic string, a character is a DBCS or Unicode graphic character. If *expression* is a character string, a character is a character that may consist of one or more bytes. If *expression* is a binary string, a character is a byte.

start

An expression that specifies the position within *expression* of the first character (or byte) of the result. The expression must return a value that is a built-in BIGINT, INTEGER, or SMALLINT data type. *start* may be negative or zero. It may also be greater than the length attribute of *expression*. (The length attribute of a varying-length string is its maximum length.)

length

An expression that specifies the maximum actual length of the resulting substring. If specified, *length* must be an expression that returns a value that is a built-in BIGINT, INTEGER, or SMALLINT data type. The value must be greater than or equal to 0.

If *length* is explicitly specified, padding is not performed.

If *expression* is a fixed-length string, omission of *length* is an implicit specification of LENGTH(*expression*) - *start* + 1, which is the number of characters (or bytes) from the *start* character (or byte) to the last character (or byte) of *expression*. If *expression* is a varying-length string, omission of *length* is an implicit specification of zero or LENGTH(*expression*) - *start* + 1, whichever is greater. If the resulting length is zero, the result is the empty string.

The data type of the result depends on the data type of *expression*:

Data type of expression	Data Type of the Result for SUBSTRING
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The length attribute of the result is the same as the length attribute of *expression*. (Remember that if the actual length of *expression* is less than the value for *start*, the actual length of the substring is zero.)

If any argument can be null, the result can be null; if any argument is null, the result is the null value.

The CCSID of the result is the same as that of *expression*.

Examples

• Select all rows from the PROJECT table for which the project name (PROJNAME) starts with the word 'OPERATION'.

```
SELECT *
  FROM PROJECT
  WHERE SUBSTRING(PROJNAME,1,10) = 'OPERATION'
```

The space at the end of the constant is necessary to preclude initial words such as 'OPERATIONS'.

• Assume that FIRSTNAME is a VARCHAR(12) column, encoded in Unicode UTF-8, in T1. One of its values is the 6-character string 'Jürgen'. When FIRSTNAME has this value:

```
SELECT SUBSTRING(FIRSTNAME, 1,2), SUBSTR(FIRSTNAME, 1,2) FROM T1
```

Returns the values 'Jü' (x'4AC3BC') and 'Jô' (x'4AC3').

I

The TAN function returns the tangent of the argument, where the argument is an angle expressed in radians. The TAN and ATAN functions are inverse operations.



expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable TANGENT is a DECIMAL(2,1) host variable with a value of 1.5.

SELECT TAN(:TANGENT)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 14.10.

The TANH function returns the hyperbolic tangent of the argument, where the argument is an angle expressed in radians. The TANH and ATANH functions are inverse operations.

►►—TANH—(—expression—)—

expression

An expression that returns a value of any built-in numeric data type (except for DECFLOAT), character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

The data type of the result is double-precision floating point. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Assume the host variable HTANGENT is a DECIMAL(2,1) host variable with a value of 1.5.

SELECT TANH(:HTANGENT)
FROM SYSIBM.SYSDUMMY1

Returns the approximate value 0.90.

expression

An expression that returns a value of one of the following built-in data types: a time, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a time or timestamp. For the valid formats of string representations of times and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a time. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a time:
 - The result is that time.
- If the argument is a timestamp:
 The result is the time part of the timestamp.
- If the argument is a character string:

The result is the time or time part of the timestamp represented by the character string. When a string representation of a time is SBCS with a CCSID that is not the same as the default CCSID for SBCS data, that value is converted to adhere to the default CCSID for SBCS data before it is interpreted and converted to a time value.

When a string representation of a time is mixed data with a CCSID that is not the same as the default CCSID for mixed data, that value is converted to adhere to the default CCSID for mixed data before it is interpreted and converted to a time value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

• Select all notes from the IN_TRAY sample table that were received at least one hour later in the day (any day) than the current time.

```
SELECT *
FROM IN_TRAY
WHERE TIME(RECEIVED) >= CURRENT TIME + 1 HOUR
```

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expression-1

If only one argument is specified, the argument must be an expression that returns a value of one of the following built-in data types: a timestamp, a character string, or a graphic string. If *expression-1* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be one of the following:

- A valid string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.
- A string with an actual length of 7 that represents a valid date in the form yyyynnn, where yyyy are digits denoting a year, and nnn are digits between 001 and 366 denoting a day of that year.
- A character string with an actual length of 13 that is assumed to be a result from a GENERATE_UNIQUE function. For information on GENERATE_UNIQUE, see "GENERATE_UNIQUE" on page 324.

If both arguments are specified, the first argument must be an expression that returns a value of one of the following built-in data types: a date, a character string, or a graphic string. If *expression-1* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a date.

expression-2

An expression that returns a value of one of the following built-in data types: a time, a character string, or a graphic string.

If *expression-2* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a time. For the valid formats of string representations of times, see "String representations of datetime values" on page 77.

The result of the function is a timestamp. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

The other rules depend on whether the second argument is specified:

- If both arguments are specified:
 - The result is a timestamp with the date specified by the first argument and the time specified by the second argument. The microsecond part of the timestamp is zero.
- If only one argument is specified and it is a timestamp: The result is that timestamp.
- If only one argument is specified and it is a character string:

The result is the timestamp represented by that character string. If the argument is a character string of length 14, the timestamp has a microsecond part of zero.

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TIMESTAMP

When a string representation of a date, time, or timestamp is SBCS data with a CCSID that is not the same as the default CCSID for SBCS data, that value is converted to adhere to the default CCSID for SBCS data before it is interpreted and converted to a timestamp value.

When a string representation of a date, time, or timestamp is mixed data with a CCSID that is not the same as the default CCSID for mixed data, that value is converted to adhere to the default CCSID for mixed data before it is interpreted and converted to a timestamp value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when only one argument is specified. For more information, see "CAST specification" on page 170.

Example

Assume the following date and time values:

```
SELECT TIMESTAMP( DATE('1988-12-25'), TIME('17.12.30') ) FROM SYSIBM.SYSDUMMY1
```

Returns the value '1988-12-25-17.12.30.000000'.

TIMESTAMP_FORMAT

The TIMESTAMP_FORMAT function returns a timestamp.

 $\blacktriangleright \blacksquare \texttt{TIMESTAMP_FORMAT} - (-string-expression-, -format-string-) - \blacksquare$

string-expression

An expression that returns a value of any built-in character string data type or graphic string data type.

The resulting substring is interpreted as a timestamp using the format specified by *format-string*.

format-string

An expression that returns a built-in character string data type or graphic string data type. *format-string* contains a template of how *string-expression* is to be interpreted as a timestamp value. The resulting value is then folded to uppercase, so the characters in the value may be in any case. The resulting substring must:

- Contain at least one format element and must not contain multiple specifications for any component of a timestamp.
- Each portion of the format must be separated by a valid separator. Valid separators are
 - dash (-)
 - period (.)
 - slash (/)
 - comma (,)
 - apostrophe (')
 - semicolon (;)
 - colon (:)
 - blank ().

Format	Unit
DD	Day
HH24	Hour
MI	Minute
MM	Month
NNNNN	Microsecond
RR	Last 2 digits of the adjusted year (00-99).
SS	Seconds
YY	Last 2 digits of the year (00-99).
YYYY	Year

The RR format element can be used to alter how a specification for a year is to be interpreted by adjusting the value to produce a 4-digit value depending on the last 2 digits of the current year according to the following table:

	Two digits of year in string-expression	First 2 digits of the year component of timestamp
0-50	0-49	First 2 digits of current year

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Last two digits of current year	Two digits of year in string-expression	First 2 digits of the year component of timestamp
51-99	0-49	First 2 digits of current year + 1
0-50	50-99	First 2 digits of current year - 1
51-99	50-99	First 2 digits of current year

The following defaults will be used when a format string does not include a format element for one of the components of a timestamp:

year	current year
month	current month
day	01
hour	00
minute	00
second	00
microsecond	00

Leading zeroes can be specified for any component of the timestamp value (for example., month, day, hour, minutes, seconds) that does not have the maximum number of significant digits for the corresponding format element in the format string.

A substring of the string-expression representing a component of a timestamp (such as year, month, day, hour, minutes, seconds) can include less than the maximum number of digits for that component of the timestamp. Any missing digits default to zero. For example, with a format-string of 'YYYY-MM-DD HH24:MI:SS', an input value of '999-3-9 5:7:2' would produce the same result as '0999-03-09 05:07:02'.

Examples of valid format strings are:

```
'YYYY-MM-DD'
'YYYY-MM-DD-HH24-MI-SS'
'YYYY-MM-DD-HH24-MI-SS-NNNNNN'
```

The result is timestamp. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Note

Determinism: TIMESTAMP_FORMAT is a non-deterministic function.

Syntax alternatives: TO_DATE is a synonym for TIMESTAMP_FORMAT.

Example

• Set the character variable TVAR to the value of ROUTINE_CREATED from QSYS2.SYSPROCS if it is equal to one second before the beginning of the year 2000 ('1999-12-31 23:59:59'). The character string should be interpreted according to the format string provided.

```
SELECT VARCHAR FORMAT (ROUTINE CREATED, 'YYYY-MM-DD HH24:MI:SS')
     INTO :TVAR
     FROM QSYS2.SYSPROCS
     WHERE ROUTINE CREATED =
                TIMESTAMP FORMAT('1999-12-31 23:59:59, 'YYYY-MM-DD HH24:MI:SS')
```

TIMESTAMP_ISO

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Returns a timestamp value based on a date, time, or timestamp argument. If the argument is a date, it inserts zero for the time and microseconds part of the timestamp. If the argument is a time, it inserts the value of CURRENT DATE for the date part of the timestamp and zero for the microseconds part of the timestamp.

```
►►—TIMESTAMP_ISO—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a timestamp, a date, a time, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a timestamp. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

If *expression* is a time, the function is not deterministic.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications. For more information, see "CAST specification" on page 170.

Example

Assume the following date value:

```
SELECT TIMESTAMP_ISO( DATE( '1988-12-25' ) )
FROM SYSIBM.SYSDUMMY1
```

Returns the value '1988-12-25-00.00.00.000000'.

TIMESTAMPDIFF

The TIMESTAMPDIFF function returns an estimated number of intervals of the type defined by the first argument, based on the difference between two timestamps.

▶ TIMESTAMPDIFF—(—numeric-expression—,—string-expression—)—

numeric-expression

The first argument must be a built-in data type of either INTEGER or SMALLINT. The value specifies the interval that is used to determine the difference between two timestamps. Valid values of the interval follow.

Table 40. Valid values for numeric-expression and equivalent intervals that are used to determine the difference between two timestamps

Valid values for numeric-expression	Equivalent intervals
1	Microseconds
2	Seconds
4	Minutes
8	Hours
16	Days
32	Weeks
64	Months
128	Quarters
256	Years

string-expression

string-expression is the result of subtracting two timestamps and converting the result to a string of length 22. The argument must be an expression that returns a value of a built-in character string or a graphic string. If string-expression is a character or graphic string, it must not be a CLOB or DBCLOB.

If a positive or negative sign is present, it is the first character of the string. The following table describes the elements of the character string duration:

Table 41. TIMESTAMPDIFF String Elements

String elements	Valid values	Character position from the decimal point (negative is left)
		<u>, </u>
Years	1-9998 or blank	-14 to -11
Months	0-11 or blank	-10 to -9
Days	0-30 or blank	-8 to -7
Hours	0-24 or blank	-6 to -5
Minutes	0-59 or blank	-4 to -3
Seconds	0-59	-2 to -1
Decimal separator	period	0
Microseconds	000000-999999	1 to 6

The result of the function is an integer with the same sign as *string-expression*. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

The returned value is determined for each interval as indicated by the following table:

Table 42. TIMESTAMPDIFF Computations

Result interval	Computation using duration elements
Years	years
Quarters	integer value of (months+(years*12))/3
Months	months + (years*12)
Weeks	integer value of ((days+(months*30))/7)+(years*52)
Days	days + (months*30)+(years*365)
Hours	hours + ((days+(months*30)+(years*365))*24)
Minutes (the absolute value of the duration must not exceed 40850913020759.999999)	minutes + (hours+((days+(months*30)+(years*365))*24))*60
Seconds (the absolute value of the duration must be less than 680105031408.000000)	seconds + (minutes+(hours+((days+(months*30)+(years*365))*24))*60)*60
Microseconds (the absolute value of the duration must be less than 3547.483648)	microseconds + (seconds+(minutes*60))*1000000

The following assumptions are used when converting the element values to the requested interval type:

- One year has 365 days.
- One year has 52 weeks.
- One year has 12 months.
- One quarter has 3 months.
- One month has 30 days.
- One week has 7 days.
- One day has 24 hours.
- One hour has 60 minutes.
- One minute has 60 seconds.
- One second has 1000000 microseconds.

The use of these assumptions imply that some result values are an estimate of the interval. Consider the following examples:

Difference of 1 month where the month has less than 30 days.

TIMESTAMPDIFF(16, CHAR(TIMESTAMP('1997-03-01-00.00.00') - TIMESTAMP('1997-02-01-00.00.00')))

The result of the timestamp arithmetic is a duration of 0000010000000.000000, or 1 month. When the TIMESTAMPDIFF function is invoked with 16 for the interval argument (days), the assumption of 30 days in a month is applied and the result is 30.

TIMESTAMPDIFF

• Difference of 1 day less than 1 month where the month has less than 30 days. TIMESTAMPDIFF(16, CHAR(TIMESTAMP('1997-03-01-00.00.00') - TIMESTAMP('1997-02-02-00.00.00'))) The result of the timestamp arithmetic is a duration of 00000027000000.000000, or 27 days. When the TIMESTAMPDIFF function is invoked with 16 for the interval argument (days), the result is 27. • Difference of 1 day less than 1 month where the month has 31 days. TIMESTAMPDIFF(64, CHAR(TIMESTAMP('1997-09-01-00.00.00') - TIMESTAMP('1997-08-02-00.00.00'))) The result of the timestamp arithmetic is a duration of 0000030000000.000000, or 30 days. When the TIMESTAMPDIFF function is invoked with 64 for the interval argument (months), the result is 0. The days portion of the duration is 30, but it is ignored because the interval specified months. **Example** • The following statement estimates the age of employees in months and returns that value as AGE_IN_MONTHS: **SELECT** TIMESTAMPDIFF (64, CAST (CURRENT TIMESTAMP-CAST (BIRTHDATE AS TIMESTAMP) AS CHAR(22))) AS AGE IN MONTHS FROM EMPLOYEE

TOTALORDER

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The TOTALORDER function returns an ordering for DECFLOAT values.

```
▶▶—TOTALORDER—(—expression-1—,—expression-2—)—
```

The TOTALORDER function returns a small integer value that indicates how *expression-1* compares with *expression-2*.

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the argument is not DECFLOAT(34), it is logically converted to DECFLOAT(34) for processing.

expression-2

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. If the argument is not DECFLOAT(34), it is logically converted to DECFLOAT(34) for processing.

Numeric comparison is exact, and the result is determined for finite operands as if range and precision were unlimited. Overflow or underflow cannot occur.

TOTALORDER determines ordering based on the total order predicate rules of IEEE 754R, with the following result:

```
-1 if the first operand is lower in order compared to the second.
```

0 if both operands have the same order.

1 if the first operand is higher in order compared to the second.

The ordering of the special values and finite numbers is as follows:

```
-NAN<-SNAN<-INFINITY<-0.10<-0.100<-0<00<0.100<0.10<INFINITY<SNAN<NAN
```

The result of the function is SMALLINT. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

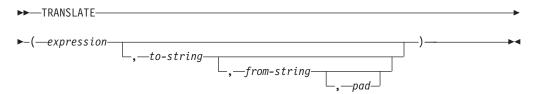
Examples

The following examples show the use of the TOTALORDER function to compare decimal floating-point values:

```
TOTALORDER(-INFINITY, -INFINITY)
                                                        0
TOTALORDER(DECFLOAT(-1.0), DECFLOAT(-1.0))
TOTALORDER(DECFLOAT(-1.0), DECFLOAT(-1.00))
TOTALORDER(DECFLOAT(-1.0), DECFLOAT(-0.5))
                                                       -1
TOTALORDER(DECFLOAT(-1.0), DECFLOAT(0.5))
                                                       -1
TOTALORDER(DECFLOAT(-1.0), INFINITY)
                                                       -1
TOTALORDER(DECFLOAT(-1.0), SNAN)
                                                       -1
TOTALORDER (DECFLOAT (-1.0), NAN)
                                                       -1
TOTALORDER(NAN, DECFLOAT(-1.0))
                                                        1
TOTALORDER(-NAN, -NAN)
                                                        0
TOTALORDER (-SNAN, -SNAN)
                                                        0
TOTALORDER (NAN, NAN)
TOTALORDER (SNAN, SNAN)
```

TRANSLATE

The TRANSLATE function returns a value in which one or more characters in *expression* may have been converted into other characters.



expression

An expression that specifies the string to be converted *expression* must be any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

to-string

A string that specifies the characters to which certain characters in *expression* are to be converted. This string is sometimes called the *output translation table*. The string must be any built-in numeric or string constant. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. A character string argument must have an actual length that is not greater than 256.

If the length attribute of the *to-string* is less than the length attribute of the *from-string*, then the *to-string* is padded to the longer length using either the *pad* character if it is specified or a blank if a *pad* character is not specified. If the length attribute of the *to-string* is greater than the length attribute of the *from-string*, the extra characters in *to-string* are ignored without warning.

from-string

A string that specifies the characters that if found in *expression* are to be converted. This string is sometimes called the *input translation table*. When a character in *from-string* is found, the character in *expression* is converted to the character in *to-string* that is in the corresponding position of the character in *from-string*

The string must be any built-in numeric or string constant. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449. A character string argument must have an actual length that is not greater than 256.

If there are duplicate characters in *from-string*, the first one scanning from the left is used and no warning is issued. The default value for *from-string* is a string starting with the character X'00' and ending with the character X'FF' (decimal 255).

pad

A string that specifies the character with which to pad *to-string* if its length is less than *from-string*. The string must be a character string constant with a length of 1. The default is an SBCS blank.

If the first argument is a Unicode graphic or UTF-8 string, no other arguments may be specified.

If only the first argument is specified, the SBCS characters of the argument are converted to uppercase, based on the CCSID of the argument. Only SBCS characters are converted. The characters a-z are converted to A-Z, and characters with diacritical marks are converted to their uppercase equivalent, if any. If the first argument is UTF-16, UCS-2, or UTF-8, the alphabetic UTF-16, UCS-2, or UTF-8 characters are converted to uppercase. Refer to the UCS-2 level 1 mapping tables topic of the Globalization topic collection for a description of the monocasing tables that are used for this conversion.

If more than one argument is specified, the result string is built character by character from *expression*, converting characters in *from-string* to the corresponding character in *to-string*. For each character in *expression*, the same character is searched for in *from-string*. If the character is found to be the *n*th character in *from-string*, the resulting string will contain the *n*th character from *to-string*. If *to-string* is less than *n* characters long, the resulting string will contain the pad character. If the character is not found in *from-string*, it is moved to the result string unconverted.

Conversion is done on a byte basis and, if used improperly, may result in an invalid mixed string. The SRTSEQ attribute does not apply to the TRANSLATE function.

The result of the function has the same data type, length attribute, actual length, and CCSID as the argument. If the first argument can be null, the result can be null. If the argument is null, the result is the null value.

Examples

Monocase the string 'abcdef'.

```
SELECT TRANSLATE('abcdef')
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'ABCDEF'.

Monocase the mixed character string.

```
SELECT TRANSLATE ('ab Soc Sidef')
FROM SYSIBM. SYSDUMMY1
```

Returns the value 'AB 5 C 1 DEF'

• Given that the host variable SITE is a varying-length character string with a value of 'Pivabiska Lake Place'.

```
SELECT TRANSLATE(:SITE, '$', 'L')
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'Pivabiska \$ake Place'.

```
SELECT TRANSLATE(:SITE, '$$', 'L1')
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'Pivabiska \$ake P\$ace'.

```
SELECT TRANSLATE(:SITE, 'pLA', 'Place', '.')
FROM SYSIBM.SYSDUMMY1
```

Returns the value 'pivAbiskA LAk. pLA..'.

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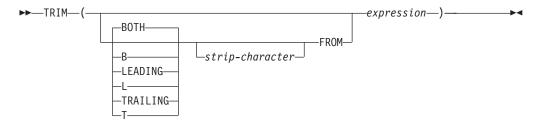
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TRIM

The TRIM function removes blanks or another specified character from the end, from the beginning, or from both of a string expression.



The first argument, if specified, indicates whether characters are removed from the end or beginning of the string. If the first argument is not specified, then the characters are removed from both the end and the beginning of the string.

strip-character

The second argument, if specified, is a single-character constant that indicates the binary, SBCS, or DBCS character that is to be removed. If *expression* is a binary string, the second argument must be a binary string constant. If *expression* is a DBCS graphic or DBCS-only string, the second argument must be a graphic constant consisting of a single DBCS character. If the second argument is not specified then:

- If *expression* is a binary string, then the default strip character is a hexadecimal zero (X'00').
- If *expression* is a DBCS graphic string, then the default strip character is a DBCS blank.
- If *expression* is a Unicode graphic string, then the default strip character is a UTF-16 or UCS-2 blank.
- If *expression* is a UTF-8 character string, then the default strip character is a UTF-8 blank.
- Otherwise, the default strip character is an SBCS blank.

expression

An expression that returns a value of any built-in numeric or string data type. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The data type of the result depends on the data type of *expression*:

Data type of expression	Data type of the Result
CHAR or VARCHAR	VARCHAR
CLOB	CLOB
GRAPHIC or VARGRAPHIC	VARGRAPHIC
DBCLOB	DBCLOB
BINARY or VARBINARY	VARBINARY
BLOB	BLOB

The length attribute of the result is the same as the length attribute of *expression*. The actual length of the result is the length of the expression minus the number of bytes removed. If all characters are removed, the result is an empty string.

If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

The CCSID of the result is the same as that of the string.

The SRTSEQ attribute does not apply to the TRIM function.

Examples

Assume the host variable HELLO of type CHAR(9) has a value of 'Hello '.
 SELECT TRIM(:HELLO), TRIM(TRAILING FROM :HELLO)
 FROM SYSIBM.SYSDUMMY1

Results in 'Hello' and 'Hello' respectively.

 Assume the host variable BALANCE of type CHAR(9) has a value of '000345.50'.

```
SELECT TRIM( L '0' FROM :BALANCE )
FROM SYSIBM.SYSDUMMY1
```

Results in: '345.50'

• Assume the string to be stripped contains mixed data.

```
SELECT TRIM( BOTH ^{\circ} \circ ^{\circ} _{I}^{\circ} FROM ^{\circ} \circ \circ AB \subset ^{\circ} _{I}^{\circ} ) FROM SYSIBM.SYSDUMMY1
```

Results in: 'SAB CSI'

TRUNCATE or TRUNC

The TRUNCATE function returns *expression–1* truncated to some number of places to the right or left of the decimal point.

expression-1

An expression that returns a value of any built-in numeric, character-string, or graphic-string data type. A string argument is converted to double-precision floating point before evaluating the function. For more information about converting strings to double-precision floating point, see "DOUBLE_PRECISION or DOUBLE" on page 308.

If *expression-1* is a decimal floating-point data type, the DECFLOAT ROUNDING MODE will not be used. The rounding behavior of TRUNCATE corresponds to a value of ROUND_DOWN. If a different rounding behavior is wanted, use the QUANTIZE function.

expression-2

An expression that returns a value of a built-in small integer, large integer, or big integer data type. The absolute value of integer specifies the number of places to the right of the decimal point for the result if *expression*–2 is not negative, or to the left of the decimal point if *expression*–2 is negative.

If *expression*–2 is not negative, *expression*–1 is truncated to the *expression*–2 number of places to the right of the decimal point.

If *expression*–2 is negative, *expression*–1 is truncated to the absolute value of (*expression*–2+1) number of places to the left of the decimal point.

If the absolute value of *expression*–2 is larger than the number of digits to the left of the decimal point, the result is 0. For example, TRUNCATE(748.58,-4) = 0.

The data type and length attribute of the result are the same as the data type and length attribute of the first argument.

If either argument can be null, the result can be null. If either argument is null, the result is the null value.

Examples

• Calculate the average monthly salary for the highest paid employee. Truncate the result to two places to the right of the decimal point.

```
SELECT TRUNCATE(MAX(SALARY/12, 2)
FROM EMPLOYEE
```

Because the highest paid employee in the sample employee table earns \$52750.00 per year, the example returns the value 4395.83.

• Calculate the number 873.726 truncated to 2, 1, 0, -1, -2, and -3 decimal places respectively.

| | | |

TRUNCATE or TRUNC

TRUNC_TIMESTAMP

The TRUNC_TIMESTAMP function returns a timestamp that is the *expression* truncated to the unit specified by the *format-string*. If *format-string* is not specified, *expression* is truncated to the nearest day, as if 'DD' was specified for *format-string*.

expression

An expression that returns a value of one of the following built-in data types: a timestamp, a character-string, or a graphic-string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB and its value must be a valid string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.

format-string

An expression that returns a built-in character string data type or graphic string data type. *format-string* contains a template of how the timestamp represented by *expression* should be truncated. For example, if *format-string* is 'DD', the timestamp that is represented by *expression* is truncated to the nearest day. Leading and trailing blanks are removed from the string, and the resulting substring must be a valid template for a timestamp. The resulting value is then folded to uppercase, so the characters in the value may be in any case. Allowable values for *format-string* are listed in Table 39 on page 402.

The result of the function is a TIMESTAMP. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

Example

• Set the host variable TRN_TMSTMP with the current year rounded to the nearest year value.

```
SET :TRN TMSTMP = TRUNC TIMESTAMP('2000-03-14-17.30.00', 'YEAR');
```

Host variable TRN TMSTMP is set with the value 2000-01-01-00.00.00.000000.

UCASE

The UCASE function returns a string in which all the characters have been converted to uppercase characters, based on the CCSID of the argument.



The UCASE function is identical to the UPPER function. For more information, see "UPPER" on page 446.

UPPER

The UPPER function returns a string in which all the characters have been converted to uppercase characters, based on the CCSID of the argument. Only SBCS and Unicode graphic characters are converted. The characters a-z are converted to A-Z, and characters with diacritical marks are converted to their uppercase equivalent, if any.

```
▶ UPPER—(—expression—)—
```

Refer to the UCS-2 level 1 mapping tables topic of the Globalization topic collection for a description of the monocasing tables that are used for this translation.

expression

An expression that specifies the string to be converted. *expression* must be any built-in numeric, character, Unicode graphic string. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The result of the function has the same data type, length attribute, actual length, and CCSID as the argument. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Note

Syntax alternatives: UCASE is a synonym for UPPER.

Examples

• Uppercase the string 'abcdef' using the UPPER scalar function.

```
SELECT UPPER('abcdef')
   FROM SYSIBM.SYSDUMMY1
```

Returns the value 'ABCDEF'.

• Uppercase the mixed character string using the UPPER scalar function.

```
FROM SYSIBM.SYSDUMMY1

Returns the value: 'AB SOC SIDEF'
```

VALUE

The VALUE function returns the value of the first non-null expression.



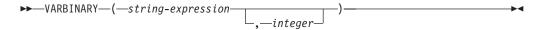
The VALUE function is identical to the COALESCE scalar function. For more information, see "COALESCE" on page 256.

Note

Syntax alternatives: COALESCE should be used for conformance to the SQL 2003

VARBINARY

The VARBINARY function returns a VARBINARY representation of a string of any type.



The result of the function is VARBINARY. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

string-expression

A *string-expression* whose value can be a character string, graphic string, binary string, or row ID.

integer

An integer constant that specifies the length attribute for the resulting binary string. The value must be between 1 and 32740 (32739 if nullable).

If integer is not specified:

- If the *string-expression* is the empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument, unless the argument is a graphic string. In this case, the length attribute of the result is twice the length attribute of the argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of the expression (or twice the length of the expression when the input is graphic data). If the length of the *string-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the first input argument is a character string and all the truncated characters are blanks, or the first input argument is a graphic string and all the truncated characters are double-byte blanks, or the first input argument is a binary string and all the truncated bytes are hexadecimal zeroes.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the length is specified. For more information, see "CAST specification" on page 170.

Example

 The following function returns a VARBINARY for the string 'This is a VARBINARY'.

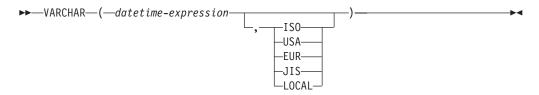
```
SELECT VARBINARY('This is a VARBINARY')
FROM SYSIBM.SYSDUMMY1
```

|

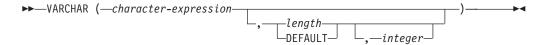
VARCHAR

The VARCHAR function returns a character-string representation.

Datetime to Varchar



Character to Varchar



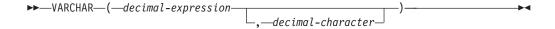
Graphic to Varchar



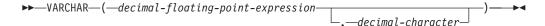
Integer to Varchar



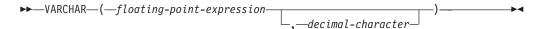
Decimal to Varchar



Decimal floating-point to Varchar



Floating-point to Varchar



The VARCHAR function returns a character-string representation of:

- An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT.
- A decimal number if the first argument is a packed or zoned decimal number.
- A decimal floating-point number if the first argument is DECFLOAT.

- A double-precision floating-point number if the first argument is a DOUBLE or REAL.
- A character string if the first argument is any type of character string.
- A graphic string if the first argument is any graphic string.
- A date value if the first argument is a DATE.
- A time value if the first argument is a TIME.
- A timestamp value if the first argument is a TIMESTAMP.

The result of the function is a varying-length string. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Datetime to Character

datetime-expression

An expression that is one of the following three built-in data types

date The result is the character-string representation of the date in the format specified by the second argument. If the second argument is not specified, the format used is the default date format. If the format is ISO, USA, EUR, or JIS, the length attribute and actual length of the result is 10. Otherwise the length attribute and actual length of the result is the length of the default date format. For more information see "String representations of datetime values" on page 77.

time The result is the character-string representation of the time in the format specified by the second argument. If the second argument is not specified, the format used is the default time format. The length attribute and actual length of the result is 8. For more information see "String representations of datetime values" on page 77.

timestamp

The second argument is not applicable and must not be specified.

The result is the character-string representation of the timestamp. The length attribute and actual length of the result is 26.

The CCSID of the string is the default SBCS CCSID at the current server.

ISO, EUR, USA, or JIS

Specifies the date or time format of the resulting character string. For more information, see "String representations of datetime values" on page 77.

LOCAL

Specifies that the date or time format of the resulting character string should come from the DATFMT, DATSEP, TIMFMT, and TIMSEP attributes of the job at the current server.

Character to Varchar

character-expression

An expression that returns a value that is a built-in CHAR, VARCHAR, or CLOB data type.⁶⁸

length

An integer constant that specifies the length attribute for the resulting varying

^{68.} A binary string is also allowed if a CCSID of 65535 is explicitly specified.

length character string. The value must be between 1 and 32740 (32739 if nullable). If the first argument is mixed data, the second argument cannot be less than 4.

If the second argument is not specified or DEFAULT is specified:

- If the *character-expression* is an empty string constant, the length attribute of the result is 1.
- Otherwise, the length attribute of the result is the same as the length attribute of the first argument.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *character-expression*. If the length of the *character-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a valid SBCS CCSID, mixed data CCSID, or 65535 (bit data). If the third argument is an SBCS CCSID, then the result is SBCS data. If the third argument is a mixed CCSID, then the result is mixed data. If the third argument is 65535, then the result is bit data. If the third argument is a SBCS CCSID, then the first argument cannot be a DBCS-either or DBCS-only string.

If the third argument is not specified then:

- If the first argument is SBCS data, then the result is SBCS data. The CCSID of the result is the same as the CCSID of the first argument.
- If the first argument is mixed data (DBCS-open, DBCS-only, or DBCS-either), then the result is mixed data. The CCSID of the result is the same as the CCSID of the first argument.

Graphic to Varchar

graphic-expression

An expression that returns a value that is a GRAPHIC, VARGRAPHIC, and DBCLOB data type. It must not be DBCS-graphic data.

length

An integer constant that specifies the length attribute for the resulting varying length character string. The value must be between 1 and 32740 (32739 if nullable). If the first argument contains DBCS data, the second argument cannot be less than 4.

If the second argument is not specified or DEFAULT is specified, the length attribute of the result is determined as follows (where n is the length attribute of the first argument):

- If the *graphic-expression* is the empty graphic string constant, the length attribute of the result is 1.
- If the result is SBCS data, the result length is *n*.
- If the result is mixed data, the result length is (2.5*(n-1)) + 4.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *graphic-expression*. If the length of the *character-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a valid

SBCS CCSID or mixed data CCSID. If the third argument is an SBCS CCSID, then the result is SBCS data. If the third argument is a mixed CCSID, then the result is mixed data. The third argument cannot be 65535.

If the third argument is not specified, the CCSID of the result is the default CCSID at the current server. If the default CCSID is mixed data, then the result is mixed data. If the default CCSID is SBCS data, then the result is SBCS data.

Integer to Varchar

integer-expression

An expression that returns a value that is an integer data type (either SMALLINT, INTEGER, or BIGINT).

The result is a varying-length character string of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. It is left justified.

- If the argument is a small integer, the length attribute of the result is 6.
- If the argument is a large integer, the length attribute of the result is 11.
- If the argument is a big integer, the length attribute of the result is 20.

The actual length of the result is the smallest number of characters that can be used to represent the value of the argument. Leading zeroes are not included. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the decimal-character.

The CCSID of the result is the default SBCS CCSID at the current server.

Decimal to Varchar

decimal-expression

An expression that returns a value that is a packed or zoned decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the decimal-expression with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length attribute of the result is 2+p where p is the precision of the decimal-expression. The actual length of the result is the smallest number of characters that can be used to represent the result, except that trailing characters are included. Leading zeros are not included. If the argument is negative, the result begins with a minus sign. Otherwise, the result begins with a digit or the decimal-character.

The CCSID of the result is the default SBCS CCSID at the current server.

Decimal floating-point to Varchar

decimal-floating-point expression

An expression that returns a value that is a decimal floating-point data type.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument in the form of a decimal floating-point constant.

The length attribute of the result is 42. The actual length of the result is the smallest number of characters that represents the value of the argument, including the sign, digits, and *decimal-character*. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0.

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

The CCSID of the result is the default SBCS CCSID at the current server.

Floating-point to Varchar

floating-point expression

An expression that returns a value that is a floating-point data type (DOUBLE or REAL).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length character string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 24. The actual length of the result is the smallest number of characters that can represent the value of the argument such that the mantissa consists of a single digit other than zero followed by the *decimal-character* and a sequence of digits. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0E0.

The CCSID of the result is the default SBCS CCSID at the current server.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length argument is specified. For more information, see "CAST specification" on page 170.

VARCHAR

Example

• Make EMPNO varying-length with a length of 10.

SELECT VARCHAR(EMPNO,10) INTO :VARHV FROM EMPLOYEE

VARCHAR_FORMAT

The VARCHAR_FORMAT function returns a character representation of a timestamp in the format indicated by *format-string*.

►► VARCHAR FORMAT—(—expression—,—format-string—)—

expression

An expression that returns a value of one of the following built-in data types: a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, the value of *expression* must be a valid string representation of a timestamp. For the valid formats of string representations of timestamps, see "String representations of datetime values" on page 77.

format-string

An expression that returns a built-in character string data type or graphic string data type. *format-string* contains a template of how *expression* is to be formatted. The resulting value is then folded to uppercase, so the characters in the value may be in any case. A valid format is any combination of the formats listed below optionally separated by valid separators (- . / : and blank)

Format	Unit
CC	Century (00-99). If the last two digits of the four digit year are zero, the result is the first two digits of the year. Otherwise, the result is the first two digits of the year plus one.
D	Day of week (1-7).
DD	Day of month (01-31).
DDD	Day of year (001-366).
FF[n]	Fractional seconds (000000-999999). The number n is used to specify the number of digits to include in the value returned. Valid values for n are 1-6.
HH24	Hour of the day (00-24).
ID	ISO day of week (1-7), where 1 is Monday and 7 is Sunday
IW	ISO week of year (1-53). The week starts on Monday and includes 7 days. Week 1 is the first week of the year to contain a Thursday, which is equivalent to the first week of the year to contain January 4
IYYY	ISO year (0000-9999). The year based on the ISO week that is returned.
J	Julian date (0000000-9999999).
MI	Minute (00-59).
MM	Month (01-12).
NNNNN	Microseconds (000000-999999).
Q	Quarter (1-4).
SS	Seconds (00-59).
SSSS	Seconds since previous midnight (0-86400).
W	Week of month (1-5).
YYYY	Year (0000-9999).

Examples of valid format strings are:

VARCHAR FORMAT

```
'HH24-MI-SS'
'HH24-MI-SS-NNNNNN'
'YYYY-MM-DD'
'YYYY-MM-DD-HH24-MI-SS'
'YYYY-MM-DD-HH24-MI-SS-NNNNNN'
'FF3.J/Q-YYYY'
```

The data type of the result is same as the data type of the *format-string*. The length attribute of the result is the maximum of 100 and the length attribute of the *format-string*. *format-string* also determines the actual length of the result. If either argument can be null, the result can be null; if either argument is null, the result is the null value.

The CCSID of the result is same as the CCSID of the format-string.

Note

Syntax alternatives: TO_CHAR is a synonym for VARCHAR_FORMAT.

Example

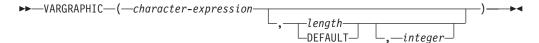
 Set the character variable TVAR to the timestamp value of RECEIVED from CORPDATA.IN_TRAY, using the character string format supported by the function to specify the format of the value for TVAR.

```
SELECT VARCHAR_FORMAT(RECEIVED, 'YYYY-MM-DD HH24:MI:SS')
   INTO :TVAR
   FROM CORPDATA.IN TRAY
```

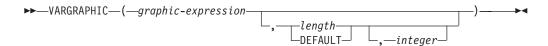
VARGRAPHIC

The VARGRAPHIC function returns a graphic-string representation.

Character to Vargraphic



Graphic to Vargraphic



Integer to Vargraphic

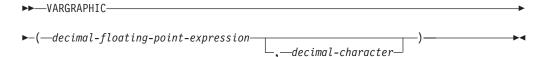


Decimal to Vargraphic

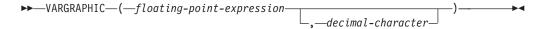
I



Decimal floating-point to Vargraphic



Floating-point to Vargraphic



The VARGRAPHIC function returns a graphic-string representation of

- An integer number if the first argument is a SMALLINT, INTEGER, or BIGINT.
- A decimal number if the first argument is a packed or zoned decimal number.
- A decimal floating-point number if the first argument is DECFLOAT.
- A double-precision floating-point number if the first argument is a DOUBLE or REAL.
- A character string if the first argument is any type of character string.
- A graphic string if the first argument is a Unicode graphic string.

The result of the function is a varying-length graphic string (VARGRAPHIC).

If the first argument can be null, the result can be null. If the first argument is null, the result is the null value. If the first argument is an empty string or the EBCDIC string X'0E0F', the result is an empty string.

Character to Graphic

character-expression

Specifies a character string expression. It cannot be a CHAR or VARCHAR bit data.

length

An integer constant that specifies the length attribute of the result and must be an integer constant between 1 and 16370 if the first argument is not nullable or between 1 and 16369 if the first argument is nullable.

If the second argument is not specified, or if DEFAULT is specified, the length attribute of the result is the same as the length attribute of the first argument, except if the expression is an empty string or the EBCDIC string X'0E0F', the length attribute of the result is 1.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *character-expression*. Each character of the argument determines a character of the result. If the length (in characters) of the *character-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535. If the CCSID represents Unicode graphic data, each character of the argument determines a character of the result. The nth character of the result is the UTF-16 or UCS-2 equivalent of the nth character of the argument.

If *integer* is not specified then the CCSID of the result is determined by a mixed CCSID. Let M denote that mixed CCSID.

In the following rules, S denotes one of the following:

- If the string expression is a host variable containing data in a foreign encoding scheme, S is the result of the expression after converting the data to a CCSID in a native encoding scheme. (See "Character conversion" on page 32 for more information.)
- If the string expression is data in a native encoding scheme, S is that string expression.

M is determined as follows:

- If the CCSID of S is 1208 (UTF-8), M is 1200 (UTF-16).
- If the CCSID of S is a mixed CCSID, M is that CCSID.
- If the CCSID of S is an SBCS CCSID:
 - If the CCSID of S has an associated mixed CCSID, M is that CCSID.
 - Otherwise the operation is not allowed.

The following table summarizes the result CCSID based on M.

M	Result CCSID	Description	DBCS Substitution Character
930	300	Japanese EBCDIC	X'FEFE'
933	834	Korean EBCDIC	X'FEFE'
935	837	S-Chinese EBCDIC	X'FEFE'

M	Result CCSID	Description	DBCS Substitution Character
937	835	T-Chinese EBCDIC	X'FEFE'
939	300	Japanese EBCDIC	X'FEFE'
5026	4396	Japanese EBCDIC	X'FEFE'
5035	4396	Japanese EBCDIC	X'FEFE'

The equivalence of SBCS and DBCS characters depends on M. Regardless of the CCSID, every double-byte code point in the argument is considered a DBCS character, and every single-byte code point in the argument is considered an SBCS character with the exception of the EBCDIC mixed data shift codes X'0E' and X'0F'.

- If the nth character of the argument is a DBCS character, the nth character of the result is that DBCS character.
- If the nth character of the argument is an SBCS character that has an equivalent DBCS character, the nth character of the result is that equivalent DBCS character.
- If the nth character of the argument is an SBCS character that does not have an equivalent DBCS character, the nth character of the result is the DBCS substitution character.

Graphic to Vargraphic

graphic-expression

An expression that returns a value that is a graphic string.

length

An integer constant that specifies the length attribute of the result and must be an integer constant between 1 and 16370 if the first argument is not nullable or between 1 and 16369 if the first argument is nullable.

If the second argument is not specified, or if DEFAULT is specified, the length attribute of the result is the same as the length attribute of the first argument, except if the expression is an empty string, the length attribute of the result is 1.

The actual length of the result is the minimum of the length attribute of the result and the actual length of *graphic-expression*. Each character of the argument determines a character of the result. If the length (in characters) of the *graphic-expression* is greater than the length attribute of the result, truncation is performed. A warning (SQLSTATE 01004) is returned unless the truncated characters were all blanks.

integer

An integer constant that specifies the CCSID of the result. It must be a DBCS, UTF-16, or UCS-2 CCSID. The CCSID cannot be 65535.

If *integer* is not specified then the CCSID of the result is the CCSID of the first argument.

Integer to Vargraphic

integer-expression

An expression that returns a value that is an integer data type (either SMALLINT, INTEGER, or BIGINT).

VARGRAPHIC

The result is a varying-length graphic string of the argument in the form of an SQL integer constant. The result consists of n characters that are the significant digits that represent the value of the argument with a preceding minus sign if the argument is negative. It is left justified.

- If the argument is a small integer, the length attribute of the result is 6.
- If the argument is a large integer, the length attribute of the result is 11.
- If the argument is a big integer, the length attribute of the result is 20.

The actual length of the result is the smallest number of characters that can be used to represent the value of the argument. Leading zeroes are not included. If the argument is negative, the first character of the result is a minus sign. Otherwise, the first character is a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal to Vargraphic

decimal-expression

An expression that returns a value that is a packed or zoned decimal data type (either DECIMAL or NUMERIC). If a different precision and scale is wanted, the DECIMAL scalar function can be used to make the change.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument. The result includes a decimal character and up to p digits, where p is the precision of the *decimal-expression* with a preceding minus sign if the argument is negative. Leading zeros are not returned. Trailing zeros are returned.

The length attribute of the result is 2+p where p is the precision of the *decimal-expression*. The actual length of the result is the smallest number of characters that can be used to represent the result, except that trailing characters are included. Leading zeros are not included. If the argument is negative, the result begins with a minus sign. Otherwise, the result begins with a digit or the *decimal-character*.

The CCSID of the result is 1200 (UTF-16).

Decimal floating-point to Vargraphic

decimal-floating-point expression

An expression that returns a value that is a decimal floating-point data type.

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument in the form of a decimal floating-point constant.

ı 1 I

١ 1 smallest number of characters that represents the value of the argument, including the sign, digits, and decimal-character. Trailing zeros are significant. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the *decimal-character*. If the argument is zero, the result is 0.

The length attribute of the result is 42. The actual length of the result is the

If the DECFLOAT value is Infinity, sNaN, or NaN, the strings 'INFINITY', 'SNAN', and 'NAN', respectively, are returned. If the special value is negative, a minus sign will be the first character in the string. The DECFLOAT special value sNaN does not result in an exception when converted to a string.

The CCSID of the result is 1200 (UTF-16).

Floating-point to Vargraphic

floating-point expression

An expression that returns a value that is a floating-point data type (DOUBLE or REAL).

decimal-character

Specifies the single-byte character constant that is used to delimit the decimal digits in the result character string. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal point. For more information, see "Decimal point" on page 116.

The result is a varying-length graphic string representation of the argument in the form of a floating-point constant.

The length attribute of the result is 24. The actual length of the result is the smallest number of characters that can represent the value of the argument such that the mantissa consists of a single digit other than zero followed by the decimal-character and a sequence of digits. If the argument is negative, the first character of the result is a minus sign; otherwise, the first character is a digit or the decimal-character. If the argument is zero, the result is 0E0.

The CCSID of the result is 1200 (UTF-16).

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the first argument is a string and the length attribute is specified. For more information, see "CAST specification" on page 170.

Example

 Using the EMPLOYEE table, set the host variable VAR_DESC (VARGRAPHIC(24)) to the VARGRAPHIC equivalent of the first name (FIRSTNME) for employee number (EMPNO) '000050'.

```
SELECT VARGRAPHIC(FIRSTNME)
 INTO : VAR DESC
 FROM EMPLOYEE
 WHERE EMPNO = '000050'
```

The WEEK function returns an integer between 1 and 54 that represents the week of the year. The week starts with Sunday, and January 1 is always in the first week.

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Example

• Using the PROJECT table, set the host variable WEEK (INTEGER) to the week that project ('PL2100') ended.

```
SELECT WEEK(PRENDATE)
INTO :WEEK
FROM PROJECT
WHERE PROJNO = 'PL2100'
```

Results in WEEK being set to 38.

• Assume that table X has a DATE column called DATE_1 with various dates from the list below.

```
SELECT DATE_1, WEEK(DATE_1)
FROM X
```

Results in the following list shows what is returned by the WEEK function for various dates.

```
1997-12-28 53

1997-12-31 53

1998-01-01 1

1999-01-01 2

1999-12-31 53

2000-01-01 1

2000-01-03 2
```

The WEEK_ISO function returns an integer between 1 and 53 that represents the week of the year. The week starts with Monday. Week 1 is the first week of the year to contain a Thursday, which is equivalent to the first week containing January 4. Thus, it is possible to have up to 3 days at the beginning of the year appear as the last week of the previous year or to have up to 3 days at the end of a year appear as the first week of the next year.

```
▶►-WEEK_ISO-(-expression-)--
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, or a graphic string.

If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

Examples

• Using the PROJECT table, set the host variable WEEK (INTEGER) to the week that project ('AD2100') ended.

```
SELECT WEEK_ISO(PRENDATE)
INTO :WEEK
FROM PROJECT
WHERE PROJNO = 'AD3100'
```

Results in WEEK being set to 5.

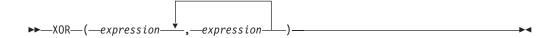
• Assume that table X has a DATE column called DATE_1 with various dates from the list below.

```
SELECT DATE_1, WEEK_ISO(DATE_1)
FROM X
```

Results in the following:

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The XOR function returns a string that is the logical XOR of the argument strings. This function takes the first argument string, does an XOR operation with the next string, and then continues to do XOR operations for each successive argument using the previous result. If a character-string argument is shorter than the previous result, it is padded with blanks. If a binary-string argument is shorter than the previous result, it is padded with hexadecimal zeros.



The arguments must be compatible.

expression

An expression that returns a value of any built-in numeric or string data type, but cannot be LOBs. The arguments cannot be mixed data character strings, UTF-8 character strings, or graphic strings. A numeric argument is cast to a character string before evaluating the function. For more information about converting numeric to a character string, see "VARCHAR" on page 449.

The arguments are converted, if necessary, to the attributes of the result. The attributes of the result are determined as follows:

- · If all the arguments are fixed-length strings, the result is a fixed-length string of length n, where n is the length of the longest argument.
- If any argument is a varying-length string, the result is a varying-length string with length attribute n, where n is the length attribute of the argument with greatest length attribute. The actual length of the result is m, where m is the actual length of the longest argument.

If an argument can be null, the result can be null; if an argument is null, the result is the null value.

The CCSID of the result is 65535.

Example

 Assume the host variable L1 is a CHARACTER(2) host variable with a value of X'E1E1', host variable L2 is a CHARACTER(3) host variable with a value of X'F0F000', and host variable L3 is a CHARACTER(4) host variable with a value of X'0000000F'.

```
SELECT XOR(:L1,:L2,:L3)
 FROM SYSIBM.SYSDUMMY1
```

Returns the value X'1111404F'.

YEAR

The YEAR function returns the year part of a value.

```
▶▶—YEAR—(—expression—)—
```

expression

An expression that returns a value of one of the following built-in data types: a date, a timestamp, a character string, a graphic string, or a numeric data type.

- If *expression* is a character or graphic string, it must not be a CLOB or DBCLOB, and its value must be a valid string representation of a date or timestamp. For the valid formats of string representations of dates and timestamps, see "String representations of datetime values" on page 77.
- If *expression* is a number, it must be a date duration or timestamp duration. For the valid formats of datetime durations, see "Datetime operands and durations" on page 160.

The result of the function is a large integer. If the argument can be null, the result can be null; if the argument is null, the result is the null value.

The other rules depend on the data type of the argument:

- If the argument is a date or a timestamp or a valid character-string representation of a date or timestamp:
 - The result is the year part of the value, which is an integer between 1 and 9999.
- If the argument is a date duration or timestamp duration: The result is the year part of the value, which is an integer between -9999 and 9999. A nonzero result has the same sign as the argument.

Examples

• Select all the projects in the PROJECT table that are scheduled to start (PRSTDATE) and end (PRENDATE) in the same calendar year.

```
SELECT *
  FROM PROJECT
  WHERE YEAR(PRSTDATE) = YEAR(PRENDATE)
```

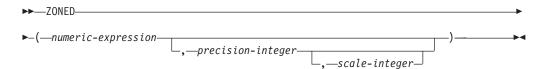
• Select all the projects in the PROJECT table that are scheduled to take less than one year to complete.

```
SELECT *
FROM PROJECT
WHERE YEAR(PRENDATE - PRSTDATE) < 1</pre>
```

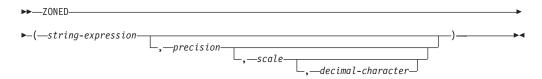
ZONED

The ZONED function returns a zoned decimal representation.

Numeric to Zoned Decimal



String to Zoned Decimal



The ZONED function returns a zoned decimal representation of:

- · A number
- · A character or graphic string representation of a decimal number
- · A character or graphic string representation of an integer
- A character or graphic string representation of a decimal floating-point number
- · A character or graphic string representation of a floating-point number

Numeric to Zoned Decimal

numeric-expression

An expression that returns a value of any built-in numeric data type.

precision

An integer constant with a value greater than or equal to 1 and less than or equal to 63.

The default for *precision* depends on the data type of the *numeric-expression*:

- 15 for floating point, decimal, numeric, or nonzero scale binary
- 19 for big integer
- 11 for large integer
- 5 for small integer

scale

An integer constant that is greater than or equal to 0 and less than or equal to *precision*. If not specified, the default is 0.

The result is the same number that would occur if the first argument were assigned to a decimal column or variable with a precision of *precision* and a scale of *scale*. An error is returned if the number of significant decimal digits required to represent the whole part of the number is greater than *precision-scale*. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

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String to Zoned Decimal

string-expression

An expression that returns a value that is a character-string or graphic-string representation of a number. Leading and trailing blanks are eliminated and the resulting string must conform to the rules for forming a floating-point, decimal floating-point, integer, or decimal constant.

precision

An integer constant that is greater than or equal to 1 and less than or equal to 63. If not specified, the default is 15.

scale

An integer constant that is greater than or equal to 0 and less than or equal to *precision*. If not specified, the default is 0.

decimal-character

Specifies the single-byte character constant that was used to delimit the decimal digits in *string-expression* from the whole part of the number. The character must be a period or comma. If the second argument is not specified, the decimal point is the default decimal separator character. For more information, see "Decimal point" on page 116.

The result is the same number that would result from CAST(string-expression AS NUMERIC(precision,scale)). Digits are truncated from the end if the number of digits to the right of the decimal-character is greater than the scale s. An error is returned if the number of significant digits to the left of the decimal-character (the whole part of the number) in string-expression is greater than precision-scale. The default decimal separator character is not valid in the substring if the decimal-character argument is specified.

The result of the function is a zoned decimal number with precision of *precision* and scale of *scale*. If the first argument can be null, the result can be null; if the first argument is null, the result is the null value.

Note

Syntax alternatives: The CAST specification should be used to increase the portability of applications when the precision is specified. For more information, see "CAST specification" on page 170.

Examples

Assume the host variable Z1 is a decimal host variable with a value of 1.123.

```
SELECT ZONED(:Z1,15,14)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 1.12300000000000.

• Assume the host variable Z1 is a decimal host variable with a value of 1123.

```
SELECT ZONED(:Z1,11,2)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 1123.00.

· Likewise,

```
SELECT ZONED(:Z1,4)
FROM SYSIBM.SYSDUMMY1
```

Returns the value 1123.

ZONED

Chapter 4. Queries

A *query* specifies a result table or an intermediate result table. A query is a component of certain SQL statements.

The three forms of a query are the *subselect*, the *fullselect*, and the *select-statement*. There is another SQL statement that can be used to retrieve at most a single row described under "SELECT INTO" on page 1065.

Authorization

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For any form of a query, the privileges held by the authorization ID of the statement must include at least one of the following:

- · For each table or view identified in the statement,
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

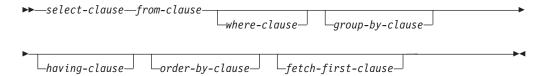
If a query includes a user-defined function, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each user-defined function identified in the statement:
 - The EXECUTE privilege on the function
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View or Corresponding System Authorities When Checking Privileges to a Function or Procedure.

subselect

The *subselect* is a component of the fullselect.

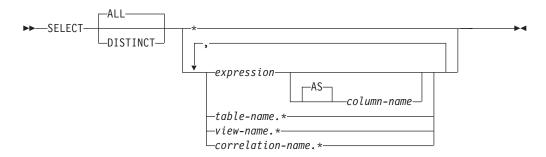


A subselect specifies a result table derived from the tables or views identified in the FROM clause. The derivation can be described as a sequence of operations in which the result of each operation is input for the next. (This is only a way of describing the subselect. The method used to perform the derivation may be quite different from this description. If portions of the subselect do not actually need to be executed for the correct result to be obtained, they may or may not be executed.)

A *scalar-subselect* is a subselect, enclosed in parentheses, that returns a single result row and a single result column. If the result of the subselect is no rows, then the null value is returned. An error is returned if there is more than one row in the result.

The sequence of the (hypothetical) operations is:

- 1. FROM clause
- 2. WHERE clause
- 3. GROUP BY clause
- 4. HAVING clause
- 5. SELECT clause
- 6. ORDER BY clause
- 7. FETCH FIRST clause



The column values are produced by the application of the *select list* to R. The select list is the names or expressions specified in the SELECT clause, and R is the result of the previous operation of the subselect. For example, if the only clauses specified are SELECT, FROM, and WHERE, R is the result of that WHERE clause.

ALL

Selects all rows of the final result table and does not eliminate duplicates. This is the default.

DISTINCT

Eliminates all but one of each set of duplicate rows of the final result table. Two rows are duplicates of one another only if each value in the first row is equal to the corresponding value in the second row. (For determining duplicate rows, two null values are considered equal.) The collating sequence is also used for determining distinct values.

DISTINCT is not allowed if the select-list contains a DATALINK column.

Select list notation

* Represents a list of columns of table R in the order the columns are produced by the FROM clause. Any columns defined with the hidden attribute will not be included. The list of names is established when the statement containing the SELECT clause is prepared. Therefore, * does not identify any columns that have been added to a table after the statement has been prepared.

expression

Specifies the values of a result column. Each *column-name* in the *expression* must unambiguously identify a column of R.

column-name or AS column-name

Names or renames the result column. The name must not be qualified and does not have to be unique.

name.*

Represents a list of columns of *name*. Any columns defined with the hidden attribute are not included. The *name* can be a table name, view name, or correlation name, and must designate an exposed table, view, or correlation name in the FROM clause immediately following the SELECT clause. The first name in the list identifies the first column of the table or view, the second name in the list identifies the second column of the table or view, and so on.

The list of names is established when the statement containing the SELECT clause is prepared. Therefore, * does not identify any columns that have been added to a table after the statement has been prepared.

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- · When an SQL program or SQL package is saved and then restored on a System i product that is not the same release as the system from which it was saved.
- When SQL naming is specified for an SQL program or package and the owner of the program has changed since the SQL program or package was created.
- When an SQL statement is executed for the first time after the install of a more recent release of the IBM i operating system.
- When the SELECT * occurs in the fullselect of an INSERT statement or in a fullselect within a predicate, and a table or view referenced in the fullselect has been deleted and recreated with additional columns.

The number of columns in the result of SELECT is the same as the number of expressions in the operational form of the select list (that is, the list established at prepare time), and cannot exceed 8000. The result of a subquery must be a single expression, unless the subquery is used in the EXISTS predicate.

Applying the select list

The results of applying the select list to R depend on whether GROUP BY or HAVING is used:

If GROUP BY or HAVING is used

- Each column-name in the select list must identify a grouping expression, or be specified within an aggregate function, or be a correlated reference:
 - If the grouping expression is a column name, the select list may apply additional operators to the column name. For example, if the grouping expression is column C1, the select list may contain C1+1.
 - If the grouping expression is not a column name, the select list may not apply additional operators to the expression. For example, if the grouping expression is C1+1, the select list may contain C1+1, but not (C1+1)/8.
- The select list is applied to each group of R, and the result contains as many rows as there are groups in R. When the select list is applied to a group of R, that group is the source of the arguments of the aggregate functions in the select
- The RRN, RID, DATAPARTITIONNAME, DATAPARTITIONNUM, DBPARTITIONNAME, DBPARTITIONNUM, and HASHED_VALUE functions cannot be specified in the select list.

If neither GROUP BY nor HAVING is used

- The select list must not include any aggregate functions, or each column-name must be specified in an aggregate function or be a correlated reference.
- If the select list does not include aggregate functions, it is applied to each row of R and the result contains as many rows as there are rows in R.
- If the select list is a list of aggregate functions, R is the source of the arguments of the functions and the result of applying the select list is one row.

In either case the nth column of the result contains the values specified by applying the *n*th expression in the operational form of the select list.

Result columns allow null values if they are derived from:

- Any aggregate function but COUNT and COUNT_BIG
- Any column that allows null values
- · A scalar function or expression with an operand that allows null values
- A host variable that has an indicator variable, an SQL parameter or variable, or in the case of Java, a variable or expression whose type is able to represent a Java null value
- A result of a UNION or INTERSECT if at least one of the corresponding items in the select list is nullable
- · An arithmetic expression in the outer select list
- A scalar-fullselect
- · A user-defined scalar or table function
- A GROUPING SETS grouping-expression

Names of result columns

- If the AS clause is specified, the name of the result column is the name specified on the AS clause.
- If the AS clause is not specified and a column list is specified in the correlation clause, the name of the result column is the corresponding name in the correlation column list
- If neither an AS clause nor a column list in the correlation clause is specified and the result column is derived only from a single column (without any functions or operators), then the result column name is the unqualified name of that column.
- If neither an AS clause nor a column list in the correlation clause is specified and the result column is derived only from a single variable (without any functions or operators), then the result column name is the unqualified name of that variable.
- · All other result columns are unnamed.

Data types of result columns

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Each column of the result of SELECT acquires a data type from the expression from which it is derived.

When the expression is:	The data type of the result column is:	
the name of any numeric column	the same as the data type of the column, with the same precision and scale for decimal columns.	
an integer constant	INTEGER or BIGINT (if the value of the constant is outside the range of INTEGER, but within the range of BIGINT).	
a decimal or floating-point constant	the same as the data type of the constant, with the same precision and scale for decimal constants.	
the name of a DECFLOAT(7) variable	DECFLOAT(16)	
the name of any numeric variable	the same as the data type of the variable, with the same precision and scale for decimal variables. If the data type of the variable is not identical to an SQL data type (for example, DISPLAY SIGN LEADING SEPARATE in COBOL), the result column is decimal.	

select-clause

When the expression is:	The data type of the result column is:
an expression	the same as the data type of the result, with the same precision and scale for decimal results as described under "Expressions" on page 152.
any function	the data type of the result of the function. For a built-in function, see Chapter 3, "Built-in functions," on page 203 to determine the data type of the result. For a user-defined function, the data type of the result is what was defined in the CREATE FUNCTION statement for the function.
the name of any string column	the same as the data type of the column, with the same length attribute.
the name of any string variable	the same as the data type of the variable, with a length attribute equal to the length of the variable. If the data type of the variable is not identical to an SQL data type (for example, a NUL-terminated string in C), the result column is a varying-length string.
a character-string constant of length n	VARCHAR(n)
a graphic-string constant of length <i>n</i>	VARGRAPHIC(n)
the name of a datetime column, or an ILE RPG compiler or ILE COBOL compiler datetime host variable	the same as the data type of the column or variable.
the name of a distinct type column	the same as the distinct type of the column, with the same length, precision, and scale attributes, if any.
the name of a datalink column	a datalink, with the same length attribute.
the name of a row ID column or a row ID variable	ROWID

from-clause

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The FROM clause specifies an intermediate result table.



If only one table-reference is specified, the intermediate result table is simply the result of that table-reference. If more than one table-reference is specified in the FROM clause, the intermediate result table consists of all possible combinations of the rows of the specified table-references (the Cartesian product). Each row of the result is a row from the first table-reference concatenated with a row from the second table-reference, concatenated in turn with a row from the third, and so on. The number of rows in the result is the product of the number of rows in all the individual table-references.

table-reference

A table-reference specifies an intermediate result table.



single-table:

```
-table-name
                   -correlation-clause\dashv
-view-name-
```

nested-table-expression:

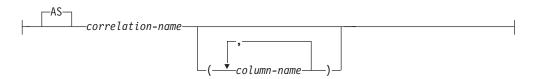
table-function:

```
---TABLE---(---function-invocation---)---correlation-clause---
```

data-change-table-reference:

```
-TABLE—(—INSERT statement—)————correlation-clause-
```

correlation-clause:



- If a single table or view is identified, the intermediate result table is simply that table or view.
- A fullselect in parentheses called a *nested table expression*.⁶⁹ If a nested table expression is specified, the result table is the result of that nested table expression. The columns of the result do not need unique names, but a column with a non-unique name cannot be explicitly referenced.
- If a *function-name* is specified, the intermediate result table is the set of rows returned by the table function.
- If a *data-change-table-reference* is specified, the intermediate result table is the set of rows inserted by the INSERT statement.
- If a *joined-table* is specified, the intermediate result table is the result of one or more join operations. For more information, see "joined-table" on page 481.

If *table-reference* identifies a distributed table, DDS-created logical file, or a table that has a read trigger, the query cannot contain:

- EXCEPT or INTERSECT operations,
- · VALUES in a fullselect,
- · OLAP specifications,
- recursive common table expressions,
- ORDER OF,
- scalar fullselects (scalar subselects are supported),
- · full outer join,
- LOBs in a GROUP BY, or
- grouping sets or super groups.

The list of names in the FROM clause must conform to these rules:

- Each *table-name* and *view-name* must name an existing table or view at the current server or the *table-identifier* of a common table expression defined preceding the subselect containing the *table-reference*.
- The exposed names must be unique. An exposed name is a *correlation-name*, a *table-name* that is not followed by a *correlation-name*, or a *view-name* that is not followed by a *correlation-name*.
- Each *function-name*, together with the types of its arguments, must resolve to a table function that exists at the current server. An algorithm called function resolution, which is described on "Function resolution" on page 147, uses the function name and the arguments to determine the exact function to use. Unless given column names in the *correlation-clause*, the column names for a table function are those specified on the RETURNS clause of the CREATE FUNCTION statement. This is analogous to the column names of a table, which are defined in the CREATE TABLE statement.

^{69.} A nested table expression is also called a derived table.

The exposed names of all table references should be unique. An exposed name is:

- A correlation-name
- A table-name or view-name that is not followed by a correlation-name
- The *table-name* or *view-name* that is the target of the *data-change-table-reference* when the *data-change-table-reference* is not followed by a *correlation-name*

Any qualified reference to a column for a table, view, nested table expression, table function, or *data-change-table-reference* must use the exposed name. If the same table name or view name is specified twice, at least one specification should be followed by a *correlation-name*. The *correlation-name* is used to qualify references to the columns of the table or view. When a *correlation-name* is specified, column-names can also be specified to give names to the columns of the *table-name*, *view-name*, *nested-table-expression*, *table-function*, or *data-change-table-reference*. If a column list is specified, there must be a name in the column list for each column in the table or view and for each result column in the *nested-table-expression*, *table-function*, or *data-change-table-reference*. For more information, see "Correlation names" on page 129.

In general, *nested-table-expressions* and *table-functions* can be specified in any FROM clause. Columns from the nested table expressions and table functions can be referenced in the select list and in the rest of the subselect using the correlation name which must be specified. The scope of this correlation name is the same as correlation names for other table or view names in the FROM clause. A nested table expression can be used:

- in place of a view to avoid creating the view (when general use of the view is not required)
- when the wanted result table is based on variables.

Correlated references in table-references

Correlated references can be used in *nested-table-expressions*. The basic rule that applies is that the correlated reference must be from a *table-reference* at a higher level in the hierarchy of subqueries. This hierarchy includes the *table-references* that have already been resolved in the left-to-right processing of the FROM clause. For nested table expressions, the TABLE or LATERAL keyword must appear before the fullselect. For more information see "References to SQL parameters and SQL variables" on page 1145

A table function can contain one or more correlated references to other tables in the same FROM clause if the referenced tables precede the reference in the left-to-right order of the tables in the FROM clause. The same capability exists for nested table expressions if the optional keyword TABLE or LATERAL is specified. Otherwise, only references to higher levels in the hierarchy of subqueries is allowed.

A nested table expression or table function that contains correlated references to other tables in the same FROM clause:

- Cannot participate in a RIGHT OUTER JOIN, FULL OUTER JOIN, or RIGHT EXCEPTION JOIN
- Can participate in LEFT OUTER JOIN or an INNER JOIN if the referenced tables precede the reference in the left-to-right order of the tables in the FROM clause

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from-clause

If *table-reference* identifies a distributed table, DDS-created logical file, or a table that has a read trigger; a nested table expression cannot contain a correlated reference to other tables in the same FROM clause when:

- The nested table expression contains a UNION, EXCEPT, or INTERSECT.
- The nested table expression uses the DISTINCT keyword in the select list.
- The nested table expression contains an ORDER BY and FETCH FIRST clause.
- The nested table expression is in the FROM clause of another nested table expression that contains one of these restrictions.

Data change table references

A *data-change-table-reference* specifies an intermediate result table that is based on the rows that are directly changed by the INSERT statement included in the clause. A *data-change-table-reference* must be the only *table-reference* in the FROM clause of the outer fullselect that is used in a select-statement, a SELECT INTO statement, a SET *variable* statement, or as the only fullselect in an assignment statement.

The intermediate result table for a *data-change-table-reference* includes all rows that were inserted. All columns of the inserted table may be referenced in the subselect, along with any INCLUDE columns defined on the INSERT statement. A *data-change-table-reference* has the following restrictions:

- It can appear only in the outer level fullselect.
- The target table or view of the INSERT statement is considered a table or view referenced in the query. Therefore, the authorization ID of the query must be authorized to the table or view as well as having the necessary privileges required by the INSERT.
- A fullselect in the INSERT statement cannot contain correlated references to columns outside the fullselect of the INSERT statement.
- A data-change-table-reference in a select-statement makes the cursor READ ONLY.
 This means that UPDATE WHERE CURRENT OF and DELETE WHERE
 CURRENT OF cannot be used.
- If the INSERT references a view, the view must be defined using WITH CASCADED CHECK OPTION or could have been defined using WITH CHECK OPTION. In addition, the view cannot have a WHERE clause that contains:
 - a function that modifies SQL data
 - a function that is not deterministic or has external action
- A *data-change-table-reference* clause cannot be specified in a view definition or a materialized query table definition.
- If the target of the SQL data change statement is a view that is defined with an INSTEAD OF INSERT trigger, an error is returned.

FINAL TABLE

Specifies that the rows of the intermediate result table represent the set of rows that are inserted by the SQL data change statement as they appear at the completion of the data change statement. If there are AFTER INSERT triggers or referential constraints that result in further changes to the inserted rows of the table that is the target of the data change statement, an error is returned.

NEW TABLE

Specifies that the rows of the intermediate result table represent the set of rows that are changed by the SQL data change statement prior to the application of referential constraints and AFTER triggers. Data in the target table at the

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completion of the statement might not match the data in the intermediate result table because of additional processing for referential constraints and AFTER triggers.

Syntax Alternatives: TABLE can be specified in place of LATERAL.

Example 1

The following example is valid:

```
SELECT D.DEPTNO, D.DEPTNAME, EMPINFO.AVGSAL, EMPINFO.EMPCOUNT
FROM DEPARTMENT D,
  (SELECT AVG(E.SALARY) AS AVGSAL, COUNT (*) AS EMPCOUNT
    FROM EMPLOYEE E
    WHERE E.WORKDEPT =
       (SELECT X.DEPTNO
          FROM DEPARTMENT X
          WHERE X.DEPTNO = E.WORKDEPT ) ) AS EMPINFO
```

The following example is not valid because the reference to D.DEPTNO in the WHERE clause of the *nested-table-expression* attempts to reference a table that is outside the hierarchy of subqueries:

```
SELECT D.DEPTNO, D.DEPTNAME,
EMPINFO.AVGSAL, EMPINFO.EMPCOUNT
FROM DEPARTMENT D,
(SELECT AVG(E.SALARY) AS AVGSAL, COUNT (*) AS EMPCOUNT
FROM EMPLOYEE E
WHERE E.WORKDEPT = D.DEPTNO ) AS EMPINFO
```

The following example is valid because the reference to D.DEPTNO in the WHERE clause of the *nested-table-expression* references DEPT, which precedes the *nested-table-expression* and the LATERAL keyword was specified:

```
SELECT D.DEPTNO, D.DEPTNAME,
EMPINFO.AVGSAL, EMPINFO.EMPCOUNT
FROM DEPARTMENT D,
LATERAL (SELECT AVG(E.SALARY) AS AVGSAL, COUNT (*) AS EMPCOUNT
FROM EMPLOYEE E
WHERE E.WORKDEPT = D.DEPTNO ) AS EMPINFO
```

Example 2

The following example of a table function is valid:

```
SELECT t.c1, z.c5
FROM t, TABLE(tf3 (t.c2 ) ) AS z
WHERE t.c3 = z.c4
```

The following example is not valid because the reference to t.c2 is for a table that is to the right of the table function in the FROM clause:

```
SELECT t.c1, z.c5
FROM TABLE(tf6 (t.c2 ) ) AS z, t
WHERE t.c3 = z.c4
***INCORRECT***
```

Example 3

The following example of a table function is valid:

```
SELECT t.c1, z.c5
  FROM t, TABLE(tf4 (2 * t.c2 ) ) AS z
  WHERE t.c3 = z.c4
```

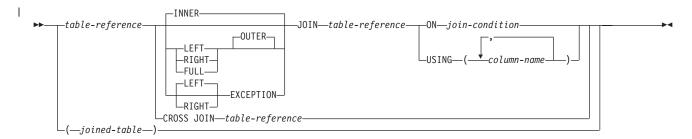
from-clause

The following example is not valid because the reference to b.c2 is for the table function that is to the right of the table function containing the reference to b.c2 in the FROM clause:

```
SELECT a.c1, b.c5
  FROM TABLE(tf7a (b.c2 ) ) AS z,
TABLE(tf7b (a.c6 ) ) AS b
                                                                  ***INCORRECT***
  WHERE a.c3 = b.c4
```

joined-table

A *joined-table* specifies an intermediate result table that is the result of either an inner, outer, cross, or exception join. The table is derived by applying one of the join operators: INNER, LEFT OUTER, RIGHT OUTER, FULL OUTER, LEFT EXCEPTION, RIGHT EXCEPTION, or CROSS to its operands.



If a join operator is not specified, INNER is implicit. The order in which multiple joins are performed can affect the result. Joins can be nested within other joins. The order of processing for joins is generally from left to right, but based on the position of the required *join-condition* or USING clause. Parentheses are recommended to make the order of nested joins more readable. For example:

```
TB1 LEFT JOIN TB2 ON TB1.C1=TB2.C1
LEFT JOIN TB3 LEFT JOIN TB4 ON TB3.C1=TB4.C1
ON TB1.C1=TB3.C1
```

is the same as

```
(TB1 LEFT JOIN TB2 ON TB1.C1=TB2.C1)
LEFT JOIN (TB3 LEFT JOIN TB4 ON TB3.C1=TB4.C1)
ON TB1.C1=TB3.C1
```

An inner join combines each row of the left table with every row of the right table keeping only the rows where the *join-condition* (or USING clause) is true. Thus, the result table may be missing rows of from either or both of the joined tables. Outer joins include the rows produced by the inner join as well as the missing rows, depending on the type of outer join. Exception joins include only the missing rows, depending on the type of exception join as follows:

- A left outer join includes the rows from the left table that were missing from the inner join.
- A right outer join includes the rows from the right table that were missing from the inner join.
- A full outer join includes the rows from both tables that were missing from the inner join.
- A left exception join includes only the rows from the left table that were missing from the inner join.
- A right exception join includes only the rows from the right table that were missing from the inner join.

A joined table can be used in any context in which any form of the SELECT statement is used. A view or a cursor is read-only if its SELECT statement includes a joined table.

Join condition

The *join-condition* is a *search-condition* that must conform to these rules:

- It cannot contain a quantified subquery, IN predicate with a subselect, or EXISTS subquery. It can contain basic predicate subqueries and scalar-fullselects.
- Any column referenced in an expression of the join-condition must be a column
 of one of the operand tables of the associated join (in the scope of the same
 joined-table clause).
- Each column name must unambiguously identify a column in one of the tables in the *from-clause*.
- Aggregate functions cannot be used in the *expression*.

For any type of join, column references in an expression of the *join-condition* are resolved using the rules for resolution of column name qualifiers specified in "Column names" on page 129 before any rules about which tables the columns must belong to are applied.

Join USING

The USING clause specifies a shorthand way of defining the join condition. This form is known as a *named-columns-join*.

column-name

Must unambiguously identify a column that exists in both *table-references* of the joined table. The column must not be a DATALINK column.

The result table of the join only contains the column from the first table of the join.

The USING clause is equivalent to a *join-condition* in which each column from the left *table-reference* is compared equal to a column of the same name in the right *table-reference*. For example, assume that TB1 and TB2 have columns C1, C2, ... Cn, D1, D2 *named-columns-join* of the form:

```
TB1 INNER JOIN TB2
USING (C1, C2, ... Cn)
```

defines a result table that is equivalent to:

```
SELECT TB1.*, TB2.D1, TB2.D2
FROM TB1 INNER JOIN TB2
ON TB1.C1 = TB2.C1 AND
TB1.C2 = TB2.C2 AND
...
TB1.Cn = TB2.Cn
```

Join operations

A *join-condition* (or USING clause) specifies pairings of T1 and T2, where T1 and T2 are the left and right operand tables of the JOIN operator of the *join-condition* (or USING clause). For all possible combinations of rows of T1 and T2, a row of T1 is paired with a row of T2 if the *join-condition* (or USING clause) is true. When a row of T1 is joined with a row of T2, a row in the result consists of the values of that row of T1 concatenated with the values of that row of T2. In the case of OUTER joins, the execution might involve the generation of a null row. The null row of a table consists of a null value for each column of the table, regardless of whether the columns allow null values.

INNER JOIN or JOIN

The result of T1 INNER JOIN T2 consists of their paired rows.

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Using the INNER JOIN syntax with a *join-condition* (or USING clause) will produce the same result as specifying the join by listing two tables in the FROM clause separated by commas and using the *where-clause* to provide the join condition.

LEFT JOIN or LEFT OUTER JOIN

The result of T1 LEFT OUTER JOIN T2 consists of their paired rows and, for each unpaired row of T1, the concatenation of that row with the null row of T2. All columns derived from T2 allow null values.

RIGHT JOIN or RIGHT OUTER JOIN

The result of T1 RIGHT OUTER JOIN T2 consists of their paired rows and, for each unpaired row of T2, the concatenation of that row with the null row of T1. All columns derived from T1 allow null values.

FULL JOIN or FULL OUTER JOIN

The result of T1 FULL OUTER JOIN T2 consists of their paired rows and, for each unpaired row of T2, the concatenation of that row with the null row of T1 and, for each unpaired row of T1, the concatenation of that row with the null row of T2. All columns derived from T1 and T2 allow null values.

FULL OUTER JOIN is not allowed if the query specifies:

- a distributed table,
- a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

LEFT EXCEPTION JOIN and EXCEPTION JOIN

The result of T1 LEFT EXCEPTION JOIN T2 consists only of each unpaired row of T1, the concatenation of that row with the null row of T2. All columns derived from T2 allow null values.

RIGHT EXCEPTION JOIN

The result of T1 RIGHT EXCEPTION JOIN T2 consists only of each unpaired row of T2, the concatenation of that row with the null row of T1. All columns derived from T1 allow null values.

CROSS JOIN

The result of T1 CROSS JOIN T2 consists of each row of T1 paired with each row of T2. CROSS JOIN is also known as cartesian product.

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where-clause

The WHERE clause specifies an intermediate result table that consists of those rows of R for which the *search-condition* is true. R is the result of the FROM clause of the statement.



The search-condition must conform to the following rules:

- Each *column-name* must unambiguously identify a column of R or be a correlated reference. A *column-name* is a correlated reference if it identifies a column of a table, view, *common-table-expression*, or *nested-table-expression* identified in an outer fullselect.
- An aggregate function must not be specified unless the WHERE clause is specified in a subquery of a HAVING clause and the argument of the function is a correlated reference to a group.

Any subquery in the *search-condition* is effectively executed for each row of R and the results are used in the application of the *search-condition* to the given row of R. A subquery is executed for each row of R if it includes a correlated reference to a column of R. A subquery with no correlated reference is typically executed just once.

If a collating sequence other than *HEX is in effect when the statement that contains the WHERE clause is executed and if the *search-condition* contains operands that are SBCS data, mixed data, or Unicode data, then the comparison for those predicates is done using weighted values. The weighted values are derived by applying the collating sequence to the operands of the predicate.

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group-by-clause

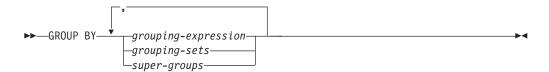
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The GROUP BY clause specifies an intermediate result table that consists of a grouping of the rows of R. R is the result of the previous clause of the subselect.



In its simplest form, a GROUP BY clause contains a *grouping-expression*. A *grouping-expression* is an expression that defines the grouping of R. The following restrictions apply to *grouping-expression*.

- Each column name included in *grouping-expression* must unambiguously identify a column of R.
- The result of *grouping-expression* cannot be a DataLink data type or a distinct type that is based on a DataLink.
- grouping-expression cannot include any of the following items:
 - A correlated column
 - A variable
 - An aggregate function
 - Any function that is non-deterministic

More complex forms of the GROUP BY clause include *grouping-sets* and *super-groups*. For a description of these forms, see "grouping-sets" on page 486 and "super-groups" on page 487, respectively.

The result of the GROUP BY clause is a set of groups of rows. In each group of more than one row, all values of each *grouping-expression* are equal, and all rows with the same set of values of the *grouping-expressions* are in the same group. For grouping, all null values for a *grouping-expression* are considered equal.

Because every row of a group contains the same value of any *grouping-expression*, *grouping-expressions* can be used in a search condition in a HAVING clause, in the SELECT clause, or in a *sort-key-expression* of an ORDER BY clause (see "order-by-clause" on page 500 for details). In each case, the reference specifies only one value for each group. The *grouping-expression* specified in these clauses must exactly match the *grouping-expression* in the GROUP BY clause, except that blanks are not significant. For example, a *grouping-expression* of SALARY*.10

will match the expression in a *having-clause* of **HAVING** SALARY*.10

but will not match

HAVING .10 *SALARY

or

HAVING (SALARY*.10)+100

If the *grouping-expression* contains varying-length strings with trailing blanks, the values in the group can differ in the number of trailing blanks and may not all have the same length. In that case, a reference to the *grouping-expression* still

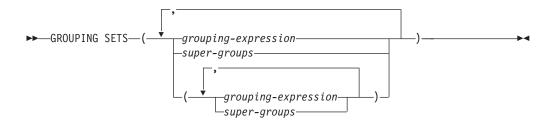
group-by-clause

specifies only one value for each group, but the value for a group is chosen arbitrarily from the available set of values. Thus, the actual length of the result value is unpredictable.

The sum of the length attributes of *grouping-expressions* must not exceed 32766-*n* bytes, where *n* is the number of *grouping-expressions* specified that allow nulls.

If a collating sequence other than *HEX is in effect when the statement that contains the GROUP BY clause is executed, and the *grouping-expressions* are SBCS data, mixed data, or Unicode data, then the rows are placed into groups using the weighted values. The weighted values are derived by applying the collating sequence to the *grouping-expressions*. In that case, a reference to the *grouping-expression* still specifies only one value for each group, but the value for a group is chosen arbitrarily from the available set of values. Thus, the actual value of the result is unpredictable.

grouping-sets



A *grouping-sets* specification allows multiple grouping clauses to be specified in a single statement. This can be thought of as the union of two or more groups of rows into a single result set. It is logically equivalent to the union of multiple subselects with the group by clause in each subselect corresponding to one grouping set. A grouping set can be a single element or can be a list of elements delimited by parentheses, where an element is either a *grouping-expression* or a *super-group*. Using grouping sets allows the groups to be computed with a single pass over the base table.

The *grouping-sets* specification allows either a simple *grouping-expression* to be used, or the more complex forms of *super-groups*. For a description of *super-groups*, see "super-groups" on page 487.

Note that grouping sets are the fundamental building blocks for GROUP BY operations. A simple GROUP BY with a single column can be considered a grouping set with one element. For example:

```
is the same as

GROUP BY GROUPING SETS( (a) )

and

GROUP BY a, b, c

is the same as

GROUP BY GROUPING SETS( (a,b,c) )
```

GROUP BY a

Non-aggregation columns from the select list of the subselect that are excluded from a grouping set will return a null for such columns for each row generated for that grouping set. This reflects the fact that aggregation was done without considering the values for those columns.

If a table-reference in the previous clauses of the query identifies a distributed table, DDS-created logical file, or a table that has a read trigger; a grouping-sets specification is not allowed.

Example C2 through Example C7 illustrate the use of grouping sets.

super-groups

```
-ROLLUP—(-grouping-expression-list-)-
-CUBE—(—grouping-expression-list—)—
⊣ grand-total ├──
```

Notes:

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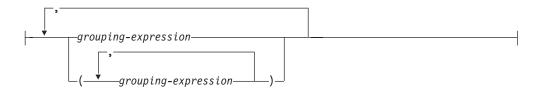
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- Alternate specification when used alone in *group-by-clause* is: grouping-expression-list WITH ROLLUP.
- 2 Alternate specification when used alone in *group-by-clause* is: grouping-expression-list WITH CUBE.

grouping-expression-list::



grand-total::



ROLLUP (grouping-expression-list)

A ROLLUP grouping is an extension to the GROUP BY clause that produces a result set containing *sub-total* rows in addition to the "regular" grouped rows. Sub-total rows are "super-aggregate" rows that contain further aggregates whose values are derived by applying the same column functions that were used to obtain the grouped rows. These rows are called sub-total rows because that is their most common use; however, any aggregate function can be used for the aggregation. For instance, MAX and AVG are used in example C8.

A ROLLUP grouping is a series of *grouping-sets*. The general specification of a ROLLUP with n elements

GROUP BY ROLLUP(
$$C_1, C_2, \ldots, C_{n-1}, C_n$$
)

is equivalent to

```
group-by-clause
                                 GROUP BY GROUPING SETS( (C_1, C_2, \ldots, C_{n-1}, C_n),
                                                           (C_1,C_2,\ldots,C_{n-1}),
                                                           (C_1, C_2),
                                                           (C_1),
                            Note that the n elements of the ROLLUP translate to n+1 grouping sets. Note
                            also that the order in which the grouping-expressions are specified is significant
                            for ROLLUP. For example:
                                 GROUP BY ROLLUP (a,b)
                            is equivalent to
                                 GROUP BY GROUPING SETS ( (a,b),
                                                            (a),
                                                            () )
                            while
                                 GROUP BY ROLLUP (b,a)
                            is equivalent to
                                 GROUP BY GROUPING SETS ( (b,a),
                                                            (b),
                        CUBE (grouping-expression-list)
```

The ORDER BY clause is the only way to guarantee the order of the rows in the result set. Example C3 illustrates the use of ROLLUP.

A CUBE grouping is an extension to the GROUP BY clause that produces a result set that contains all the rows of a ROLLUP aggregation and, in addition, contains "cross-tabulation" rows. Cross-tabulation rows are additional "super-aggregate" rows that are not part of an aggregation with sub-totals.

Like a ROLLUP, a CUBE grouping can also be thought of as a series of grouping-sets. In the case of a CUBE, all permutations of the cubed grouping-expression-list are computed along with the grand total. Therefore, the n elements of a CUBE translate to 2 ** n (2 to the power n) grouping-sets. For instance, a specification of

```
GROUP BY CUBE (a,b,c)
```

is equivalent to

```
GROUP BY GROUPING SETS ( (a,b,c),
                           (a,b),
                           (a,c),
                           (b,c),
                           (a),
                           (b),
                           (c),
                           () )
```

Notice that the 3 elements of the CUBE translate to 8 grouping sets.

The order of specification of elements does not matter for CUBE. 'CUBE(DayOfYear, Sales_Person)' and 'CUBE(Sales_Person, DayOfYear) yield the same result sets. The use of the word 'same' applies to content of the result set, not to its order. The ORDER BY clause is the only way to guarantee the order of the rows in the result set. Example C4 illustrates the use of CUBE.

grouping-expression-list
A grouping-expression

A *grouping-expression-list* is used within a CUBE or ROLLUP grouping to define the number of elements in the CUBE or ROLLUP operation. This is controlled by using parentheses to delimit elements with multiple *grouping-expressions*.

The rules for a *grouping-expression* are described in "group-by-clause" on page 485. For example, suppose that a query is to return the total expenses for the ROLLUP of City within a Province but not within a County. However, the clause

```
GROUP BY ROLLUP (Province, County, City)
```

results in unwanted sub-total rows for the County. In the clause

```
GROUP BY ROLLUP (Province, (County, City))
```

the composite (County, City) forms one element in the ROLLUP and, therefore, a query that uses this clause will yield the wanted result. In other words, the two element ROLLUP

```
GROUP BY ROLLUP (Province, (County, City))
```

generates

```
GROUP BY GROUPING SETS ( (Province, County, City) (Province) () )
```

while the three element ROLLUP generates

Example C2 also uses composite column values.

grand-total

Both CUBE and ROLLUP return a row which is the overall (grand total) aggregation. This may be separately specified with empty parentheses within the GROUPING SETS clause. It may also be specified directly in the GROUP BY clause, although there is no effect on the result of the query. Example C4 uses the grand-total syntax.

Combining grouping sets

This can be used to combine any of the types of GROUP BY clauses. When simple *grouping-expressions* are combined with other groups, they are "appended" to the beginning of the resulting *grouping sets*. When ROLLUP and CUBE expressions are combined, they operate like "multipliers" on the remaining expression, forming additional grouping set entries according to the definition of either ROLLUP or CUBE.

For instance, combining grouping-expression elements acts as follows

Or similarly

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group-by-clause

```
GROUP BY a,b, ROLLUP (c,d)
is equivalent to
     GROUP BY GROUPING SETS( (a,b,c,d),
                             (a,b,c),
                             (a,b))
Combining of ROLLUP elements acts as follows:
     GROUP BY ROLLUP(a), ROLLUP (b,c)
is equivalent to
     GROUP BY GROUPING SETS( (a,b,c),
                             (a,b),
                             (a),
                             (b,c),
                             (b),
                             ())
Similarly,
     GROUP BY ROLLUP(a), CUBE (b,c)
is equivalent to
     GROUP BY GROUPING SETS( (a,b,c),
                             (a,b),
                             (a,c),
                             (a),
                             (b,c),
                             (b),
                             (c),
                             ())
Combining of CUBE and ROLLUP elements acts as follows:
     GROUP BY CUBE(a,b), ROLLUP (c,d)
is equivalent to
     GROUP BY GROUPING SETS( (a,b,c,d),
                             (a,b,c),
                             (a,b),
                             (a,c,d),
                             (a,c),
                             (a),
                             (b,c,d),
                             (b,c),
                             (b),
                             (c,d),
                             (c),
                             ())
Like a simple grouping-expression, combining grouping sets also eliminates
duplicates within each grouping set. For instance,
     GROUP BY a, ROLLUP (a,b)
is equivalent to
     GROUP BY GROUPING SETS( (a,b),
                             (a) )
A more complete example of combining grouping sets is to construct a result set
that eliminates certain rows that would be returned for a full CUBE aggregation.
```

For example, consider the following GROUP BY clause:

The column listed immediately to the right of GROUP BY is grouped, those within the parentheses following ROLLUP are rolled up, and those within the parentheses following CUBE are cubed. Thus, the above clause results in a cube of MONTH within YEAR which is then rolled up within WEEK within Sales_Person within the Region aggregation. It does not result in any grand total row or any cross-tabulation rows on Region, Sales_Person, or WEEK(Sales_Date) so produces fewer rows than the clause:

Examples of grouping sets, cube, and rollup

The queries in Example C1 through C4 use a subset of the rows in the SALES table based on the predicate 'WEEK(SALES_DATE) = 13'.

```
SELECT WEEK(SALES_DATE) AS WEEK,
DAYOFWEEK(SALES_DATE) AS DAY_WEEK,
SALES_PERSON,
SALES AS UNITS_SOLD
FROM SALES
WHERE WEEK(SALES DATE) = 13
```

which results in:

|

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WEEK	DAY_WEEK		SALES_PERSON	UNITS_SOLD	
13	6		LUCCHESSI		3
13	6	,	LUCCHESSI		1
13	6	,	LEE		2
13	6	,	LEE		2
13	6)	LEE		3
13	6)	LEE		5
13	6)	GOUNOT		3
13	6)	GOUNOT		1
13	6)	GOUNOT		7
13	7		LUCCHESSI		1
13	7		LUCCHESSI		2
13	7		LUCCHESSI		1
13	7		LEE		7
13	7		LEE		3
13	7		LEE		7
13	7		LEE		4
13	7		GOUNOT		2
13	7		GOUNOT	:	18
13	7		GOUNOT		1

Example C1:

Here is a query with a basic GROUP BY over 3 columns:

```
SELECT WEEK(SALES_DATE) AS WEEK,

DAYOFWEEK(SALES_DATE) AS DAY_WEEK,

SALES_PERSON,

SUM(SALES) AS UNITS_SOLD

FROM SALES

WHERE WEEK(SALES_DATE) = 13

GROUP BY WEEK(SALES_DATE), DAYOFWEEK(SALES_DATE), SALES_PERSON

ORDER BY WEEK, DAY WEEK, SALES PERSON
```

This results in:

WEEK	DAY_WEEK	SALES_PERSON	UNITS_SOLD
13	6	GOUNOT	11
13	6	LEE	12
13	6	LUCCHESSI	4
13	7	GOUNOT	21
13	7	LEE	21
13	7	LUCCHESSI	4

Example C2:

Produce the result based on two different grouping sets of rows from the SALES table.

```
SELECT WEEK(SALES_DATE) AS WEEK,
      DAYOFWEEK(SALES_DATE) AS DAY_WEEK,
      SALES PERSON,
      SUM(SALES) AS UNITS_SOLD
FROM SALES
WHERE WEEK(SALES DATE) = 13
GROUP BY GROUPING SETS( (WEEK(SALES_DATE), SALES PERSON),
                        (DAYOFWEEK(SALES_DATE), SALES_PERSON) )
ORDER BY WEEK, DAY_WEEK, SALES_PERSON
```

This results in:

WEEK	DAY_WEEK	SALES_PERSON	UNITS_SOLD
13	-	GOUNOT	32
13	-	LEE	33
13	-	LUCCHESSI	8
-	6	GOUNOT	11
-	6	LEE	12
-	6	LUCCHESSI	4
-	7	GOUNOT	21
-	7	LEE	21
-	7	LUCCHESSI	4

The rows with WEEK 13 are from the first grouping set and the other rows are from the second grouping set.

Example C3:

If you use 3 distinct columns involved in the grouping sets of Example C2 and perform a ROLLUP, you can see grouping sets for (WEEK, DAY_WEEK, SALES_PERSON), (WEEK, DAY_WEEK), (WEEK), and grand total.

```
SELECT WEEK(SALES_DATE) AS WEEK,
       DAYOFWEEK (SALES_DATE) AS DAY_WEEK,
       SALES_PERSON,
       SUM(SALES) AS UNITS_SOLD
FROM SALES
WHERE WEEK(SALES DATE) = 13
GROUP BY ROLLUP( WEEK (SALES_DATE), DAYOFWEEK (SALES_DATE), SALES_PERSON)
ORDER BY WEEK, DAY_WEEK, SALES_PERSON
```

This results in:

WEEK	DAY_WEEK	SALES_PERSON	UNITS_SOLD
13	6	GOUNOT	11
13	6	LEE	12
13	6	LUCCHESSI	4
13	6	-	27

13	7 GOUNOT	21
13	7 LEE	21
13	7 LUCCHESSI	4
13	7 -	46
13		73
_		73

Example C4:

If you run the same query as Example C3 only replace ROLLUP with CUBE, you can see additional grouping sets for (WEEK, SALES_PERSON), (DAY_WEEK, SALES_PERSON), (DAY_WEEK), and (SALES_PERSON) in the result.

```
SELECT WEEK(SALES_DATE) AS WEEK,

DAYOFWEEK(SALES_DATE) AS DAY_WEEK,

SALES_PERSON,

SUM(SALES) AS UNITS_SOLD

FROM SALES
WHERE WEEK(SALES_DATE) = 13

GROUP BY CUBE( WEEK(SALES_DATE), DAYOFWEEK(SALES_DATE), SALES_PERSON)

ORDER BY WEEK, DAY_WEEK, SALES_PERSON
```

This results in:

WEEK	DAY_WEEK	SALES_PERSON	UNITS_SOLD
13	6	GOUNOT	11
13	6	LEE	12
13	-	LUCCHESSI	4
13	6	-	27
13		GOUNOT	21
13	7	LEE	21
13	7	LUCCHESSI	4
13	7		46
13		GOUNOT	32
13		LEE	33
13	_	LUCCHESSI	8
13	_	-	73
_	6	GOUNOT	11
_	6	LEE	12
_	6	LUCCHESSI	4
_	6	_	27
_	7	GOUNOT	21
-	7	LEE	21
_	7	LUCCHESSI	4
_	7	_	46
-	-	GOUNOT	32
-	-	LEE	33
-	-	LUCCHESSI	8
-	-	-	73

Example C5:

Obtain a result set which includes a grand total of selected rows from the SALES table together with a group of rows aggregated by SALES_PERSON and MONTH.

```
SELECT SALES_PERSON,

MONTH(SALES_DATE) AS MONTH,

SUM(SALES) AS UNITS_SOLD

FROM SALES

GROUP BY GROUPING SETS( (SALES_PERSON, MONTH(SALES_DATE)),

() )

ORDER BY SALES_PERSON, MONTH
```

This results in:

group-by-clause

SALES_PERSON	MONTH	UNITS_SOLD
GOUNOT	3	35
GOUNOT	4	14
GOUNOT	12	1
LEE	3	60
LEE	4	25
LEE	12	6
LUCCHESSI	3	9
LUCCHESSI	4	4
LUCCHESSI	12	1
_	_	155

Example C6:

This example shows two simple ROLLUP queries followed by a query which treats the two ROLLUPs as grouping sets in a single result set and specifies row ordering for each column involved in the grouping sets.

Example C6-1:

```
SELECT WEEK(SALES_DATE) AS WEEK,
      DAYOFWEEK (SALES DATE) AS DAY WEEK,
      SUM(SALES) AS UNITS_SOLD
FROM SALES
GROUP BY ROLLUP( WEEK(SALES_DATE), DAYOFWEEK(SALES_DATE) )
ORDER BY WEEK, DAY_WEEK
```

This results in:

DAY_WEEK	UNITS_SOLD
6	27
7	46
-	73
1	31
2	43
-	74
1	8
-	8
-	155
	6 7 - 1 2

Example C6-2:

```
SELECT MONTH (SALES_DATE) AS MONTH,
      REGION,
      SUM(SALES) AS UNITS SOLD
FROM SALES
GROUP BY ROLLUP( MONTH(SALES_DATE), REGION )
ORDER BY MONTH, REGION
```

This results in:

MONTH	REGION	UNITS_SOLD
3	Manitoba	22
3	Ontario-North	8
3	Ontario-South	34
3	Quebec	40
3	-	104
4	Manitoba	17
4	Ontario-North	1
4	Ontario-South	14
4	Quebec	11
4	_	43
12	Manitoba	2

```
12 Ontario-South
                                    2
      12 Quebec
      12 -
                                    8
                                   155
Example C6-3:
     SELECT WEEK(SALES_DATE) AS WEEK,
            DAYOFWEEK (SALES_DATE) AS DAY_WEEK,
            MONTH (SALES_DATE) AS MONTH,
            REGION,
            SUM(SALES) AS UNITS SOLD
     FROM SALES
     GROUP BY GROUPING SETS (ROLLUP (WEEK (SALES DATE), DAYOFWEEK (SALES DATE)),
                            ROLLUP( MONTH(SALES_DATE), REGION ) )
     ORDER BY WEEK, DAY_WEEK, MONTH, REGION
```

This results in:

WEEK	DAY_WEEK	MONTH	REGION	UNITS_SOLD
13	6		-	27
13	7	_	_	46
13	_	_	_	73
14	1	_	-	31
14	2	-	-	43
14	-	-	-	74
53	1	-	-	8
53	-	-	-	8
-	-	3	Manitoba	22
-	-	3	Ontario-North	8
-	-		Ontario-South	34
-	-		Quebec	40
-	-	3		104
-	-	4		17
-	-		Ontario-North	1
-	-		Ontario-South	14
-	-		Quebec	11
-	-	4	-	43
-	-		Manitoba	2
-	-		Ontario-South	4
-	-		Quebec	2
-	-	12	-	8
-	-	-	-	155
-	-	-	-	155

Using the two ROLLUPs as grouping sets causes the result to include duplicate rows. There are even two grand total rows.

Observe how the use of ORDER BY has affected the results:

- In the first grouped set, week 53 has been repositioned to the end
- In the second grouped set, month 12 has now been positioned to the end and the regions now appear in alphabetic order.
- Null values are sorted high.

Example C7:

In queries that perform multiple ROLLUPs in a single pass (such as Example C6-3) you may want to be able to indicate which grouping set produced each row. The following steps demonstrate how to provide a column (called GROUP) which indicates the origin of each row in the result set. By origin means which one of the two grouping sets produced the row in the result set.

Step 1: Introduce a way of generating new data values using a query which selects from a VALUES clause (which is an alternate form of a fullselect). This query shows how a table called X can be derived that has 2 columns, R1 and R2, and one row of data.

```
SELECT R1, R2
FROM (VALUES ('GROUP 1', 'GROUP 2')) AS X(R1, R2)
```

Results in:

```
R1
        R2
GROUP 1 GROUP 2
```

Step 2: Form the cross product of this table X with the SALES table. This adds columns R1 and R2 to every row.

```
SELECT R1, R2,
      WEEK (SALES DATE) AS WEEK,
      DAYOFWEEK (SALES_DATE) AS DAY_WEEK,
      MONTH(SALES_DATE) AS MONTH,
      REGION.
      SALES AS UNITS SOLD
FROM SALES,
     (VALUES ('GROUP 1', 'GROUP 2')) AS X(R1, R2)
```

Step 3: Now these columns are combined with the grouping sets to include these columns in the rollup analysis.

```
SELECT R1, R2,
      WEEK (SALES DATE) AS WEEK,
      DAYOFWEEK (SALES DATE) AS DAY WEEK,
      MONTH (SALES DATE) AS MONTH,
      REGION,
      SUM(SALES) AS UNITS_SOLD
FROM SALES,
     (VALUES ('GROUP 1', 'GROUP 2')) AS X(R1, R2)
GROUP BY GROUPING SETS((R1, ROLLUP(WEEK(SALES_DATE), DAYOFWEEK(SALES_DATE))),
                       (R2, ROLLUP(MONTH(SALES DATE), REGION)) )
ORDER BY WEEK, DAY_WEEK, MONTH, REGION
```

This results in:

R1	R2	WEEK	DAY_WEEK	MONTH	REGION	UNITS_SOLD
GROUP 1	-	13	6	-	-	27
GROUP 1	-	13	7	-	-	46
GROUP 1	-	13	-	-	-	73
GROUP 1	-	14	1	-	-	31
GROUP 1	-	14	2	-	-	43
GROUP 1	-	14	-	-	-	74
GROUP 1	-	53	1	-	-	8
GROUP 1	-	53	-	-	-	8
_	GROUP 2	-	_	3	Manitoba	22
_	GROUP 2	-	_	3	Ontario-North	8
_	GROUP 2	-	_	3	Ontario-South	34
-	GROUP 2	-	_	3	Quebec	40
_	GROUP 2	-	_	3	_	104
_	GROUP 2	-	_	4	Manitoba	17
_	GROUP 2	-	_	4	Ontario-North	1
-	GROUP 2	-	_	4	Ontario-South	14
_	GROUP 2	_	_	4	Quebec	11
_	GROUP 2	_	_	4	_	43
_	GROUP 2	_	_	12	Manitoba	2
_	GROUP 2	_	_	12	Ontario-South	4
-	GROUP 2	-	-	12	Quebec	2

-	GROUP 2	-	-	12 -	8
-	GROUP 2	-	-		155
GROUP 1	_	_	_		155

Step 4: Notice that because R1 and R2 are used in different grouping sets, whenever R1 is non-null in the result, R2 is null and whenever R2 is non-null in the result, R1 is null. That means you can consolidate these columns into a single column using the COALESCE function. You can also use this column in the ORDER BY clause to keep the results of the two grouping sets together.

```
SELECT COALESCE(R1, R2) AS GROUP,

WEEK(SALES_DATE) AS WEEK,

DAYOFWEEK(SALES_DATE) AS DAY_WEEK,

MONTH(SALES_DATE) AS MONTH,

REGION,

SUM(SALES) AS UNITS_SOLD

FROM SALES,

(VALUES ('GROUP 1', 'GROUP 2')) AS X(R1, R2)

GROUP BY GROUPING SETS((R1, ROLLUP(WEEK(SALES_DATE), DAYOFWEEK(SALES_DATE))),

(R2, ROLLUP(MONTH(SALES_DATE), REGION)))

ORDER BY GROUP, WEEK, DAY_WEEK, MONTH, REGION
```

This results in:

GROUP	WEEK	DAY_WEEK	MONTH	REGION	UNITS_SOLD
GROUP 1	13	6	-	-	27
GROUP 1	13	7	_	_	46
GROUP 1	13	-	-	_	73
GROUP 1	14	1	-	-	31
GROUP 1	14	2	-	-	43
GROUP 1	14	-	-	-	74
GROUP 1	53	1	-	-	8
GROUP 1	53	-	-	-	8
GROUP 1	-	-	-	-	155
GROUP 2	-	-		Manitoba	22
GROUP 2	-	-	3	Ontario-North	8
GROUP 2	-	-	3	Ontario-South	34
GROUP 2	-	-	3	Quebec	40
GROUP 2	-	-	3	-	104
GROUP 2	-	-	4	Manitoba	17
GROUP 2	-	-	4	Ontario-North	1
GROUP 2	-	-	4	Ontario-South	14
GROUP 2	-	-	4	Quebec	11
GROUP 2	-	-	4	-	43
GROUP 2	-	-	12	Manitoba	2
GROUP 2	-	-	12	Ontario-South	4
GROUP 2	-	-	12	Quebec	2
GROUP 2	-	-	12	-	8
GROUP 2	-	-	-	-	155

Example C8

The following example illustrates the use of various aggregate functions when performing a CUBE. The example also makes use of cast functions and rounding to produce a decimal result with reasonable precision and scale.

```
SELECT MONTH(SALES_DATE) AS MONTH,

REGION,
SUM(SALES) AS SALES,
MAX(SALES) AS BEST_SALE,
CAST(ROUND(AVG(DECIMAL(SALES)),2) AS DECIMAL(5,2)) AS AVG_UNITS_SOLD
FROM SALES
GROUP BY CUBE (MONTH(SALES_DATE), REGION)
ORDER BY MONTH, REGION
```

group-by-clause

MONTH	REGION	UNITS_SOLD	BEST_SALE	AVG_UNITS_SOLD
3	Manitoba Ontario-North Ontario-South	22 8 34	7 3 14	3.14 2.67 4.25
3	Quebec -	40 104	18 18	5.00 4.00
4	Manitoba Ontario-North	17 1	9 1	5.67 1.00
	Ontario-South Ouebec	14 11	8	4.67 5.50
4	- Manitoba	43	9	4.78 2.00
12	Ontario-South	4	3	2.00
12		2	1	1.00 1.60
	Manitoba Ontario-North	41 9	9	3.73 2.25
	Ontario-South Quebec	52 53	14 18	4.00 4.42
-	-	155	18	3.87

having-clause

The HAVING clause specifies an intermediate result table that consists of those groups of R for which the *search-condition* is true. R is the result of the previous clause of the subselect. If this clause is not GROUP BY, R is considered a single group with no grouping expressions.

►►—HAVING—search-condition—

Each expression that contains a *column-name* in the search condition must do one of the following:

- Unambiguously identify a grouping expression of R.
- · Be specified within an aggregate function.
- Be a correlated reference. A *column-name* is a correlated reference if it identifies a
 column of a table, view, common table expression, or nested table expression
 identified in an outer subselect.

The RRN, RID, DATAPARTITIONNAME, DATAPARTITIONNUM, DBPARTITIONNAME, DBPARTITIONNUM, and HASHED_VALUE functions cannot be specified in the HAVING clause unless it is within an aggregate function. See "Functions" in Chapter 3 for restrictions that apply to the use of aggregate functions.

A group of R to which the search condition is applied supplies the argument for each aggregate function in the search condition, except for any function whose argument is a correlated reference.

If the search condition contains a subquery, the subquery can be thought of as being executed each time the search condition is applied to a group of R, and the results used in applying the search condition. In actuality, the subquery is executed for each group only if it contains a correlated reference. For an illustration of the difference, see examples 6 and 7 under "Examples of a subselect" on page 504.

A correlated reference to a group of R must either identify a grouping column or be contained within an aggregate function.

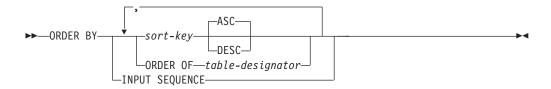
When HAVING is used without GROUP BY, any column name in the select list must appear within an aggregate function.

If a collating sequence other than *HEX is in effect when the statement that contains the HAVING clause is executed and if the *search-condition* contains operands that have SBCS data, mixed data, or Unicode data, the comparison for those predicates is done using weighted values. The weighted values are derived by applying the collating sequence to the operands in the predicate.

| | | |

order-by-clause

The ORDER BY clause specifies an ordering of the rows of the result table.



sort-key:



A subselect that contains an ORDER BY clause cannot be specified in the following objects:

- The outermost fullselect of a view
- The definition of a materialized query table

If the subselect is not enclosed within parentheses and is not the outermost fullselect, the ORDER BY clause cannot be specified.

If a single sort specification (one *sort-key* with associated ascending or descending ordering specification) is identified, the rows are ordered by the values of that specification. If more than one sort specification is identified, the rows are ordered by the values of the first identified sort specification, then by the values of the second identified sort specification, and so on.

If a collating sequence other than *HEX is in effect when the statement that contains the ORDER BY clause is executed and if the ORDER BY clause involves sort specifications that are SBCS data, mixed data, or Unicode data, the comparison for those sort specifications is done using weighted values. The weighted values are derived by applying the collating sequence to the values of the sort specifications.

A named column in the select list may be identified by a *sort-key* that is a *integer* or a *column-name*. An unnamed column in the select list may be identified by a *integer* or, in some cases by a *sort-key-expression* that matches the expression in the select list (see details of *sort-key-expression*). "Names of result columns" on page 473 defines when result columns are unnamed. If the fullselect includes a UNION operator, see "fullselect" on page 506 for the rules on named columns in a fullselect.

Ordering is performed in accordance with the comparison rules described in Chapter 2, "Language elements," on page 47. The null value is higher than all other values. If your ordering specification does not determine a complete ordering, rows with duplicate values of the last identified *sort-key* have an arbitrary order. If the ORDER BY clause is not specified, the rows of the result table have an arbitrary order.

The sum of the length attributes of the *sort-keys* must not exceed 32766-n bytes (where n is the number of *sort-keys* specified that allow nulls).

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column-name

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Must unambiguously identify a column of the result table. The column must not be a DATALINK column. The rules for unambiguous column references are the same as in the other clauses of the fullselect. See "Column name qualifiers to avoid ambiguity" on page 131 for more information.

If the fullselect includes a UNION, UNION ALL, EXCEPT, or INTERSECT, the column name cannot be qualified.

The *column-name* may also identify a column name of a table, view, or *nested-table-expression* identified in the FROM clause. An error occurs if the subselect includes an aggregation in the select list and the *column-name* is not a *grouping-expression*.

integer

Must be greater than 0 and not greater than the number of columns in the result table. The integer n identifies the nth column of the result table. The identified column must not be a DATALINK column.

sort-key-expression

An expression that is not simply a column name or an unsigned integer constant. The query to which ordering is applied must be a subselect to use this form of *sort-key*.

The *sort-key-expression* cannot contain RRN, RID, DATAPARTITIONNAME, DATAPARTITIONNUM, DBPARTITIONNAME, DBPARTITIONNUM, and HASHED_VALUE scalar functions if the *fullselect* includes a UNION, UNION ALL, EXCEPT, or INTERSECT. The result of the *sort-key-expression* must not be a DATALINK.

If the subselect is grouped, the *sort-key-expression* can be an expression in the select list of the subselect or can include an aggregate function, constant, or variable.

ASC

Uses the values of the column in ascending order. This is the default.

DESC

Uses the values of the column in descending order.

ORDER OF table-designator

Specifies that the same ordering used in *table-designator* should be applied to the result table of the subselect. There must be a table reference matching *table-designator* in the FROM clause of the subselect that specifies this clause and the table reference must identify a *nested-table-expression* or *common-table-expression*. The subselect (or fullselect) corresponding to the specified *table-designator* must include an ORDER BY clause. The ordering that is applied is the same as if the columns of the ORDER BY clause in the *nested-table-expression* or *common-table-expression* were included in the outer subselect (or fullselect), and these columns were specified in place of the ORDER OF clause.

ORDER OF is not allowed if the query specifies:

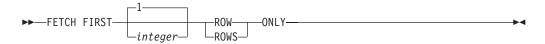
- a distributed table,
- a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

order-by-clause

INPUT SEQUENCE Specifies that the result table reflects the input order of the rows of an INSERT statement. INPUT SEQUENCE ordering can be specified only when an INSERT statement is specified in a from-clause. If INPUT SEQUENCE is specified and the input data is not ordered, the INPUT SEQUENCE clause is ignored. Specification of the ORDER BY clause in a select-statement without an UPDATE clause makes the result table read-only. A read-only result table must not be referred to in an UPDATE or DELETE statement. A sort-key must not be LOB if the query specifies: · a distributed table, • a table with a read trigger, · a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or • a logical file built over multiple physical file members.

fetch-first-clause

The *fetch-first-clause* sets a maximum number of rows that can be retrieved. It lets the database manager know that only *integer* rows should be made available to be retrieved, regardless of how many rows there might be in the result table when this clause is not specified. An attempt to fetch beyond *integer* rows is handled the same way as normal end of data (SQLSTATE 02000). The value of *integer* must be a positive integer (not zero).



Limiting the result table to the first *integer* rows can improve performance. The database manager will cease processing the query once it has determined the first *integer* rows.

If both the *order-by-clause* and *fetch-first-clause* are specified, the FETCH FIRST operation is always performed on the ordered data. Specification of the *fetch-first-clause* in a *select-statement* makes the result table *read-only*. A *read-only* result table must not be referred to in an UPDATE or DELETE statement. The *fetch-first-clause* cannot appear in a statement containing an UPDATE clause.

Examples of a subselect

subselect can be used in many different ways.

Example 1

Select all columns and rows from the EMPLOYEE table.

```
SELECT * FROM EMPLOYEE
```

Example 2

Join the EMPPROJACT and EMPLOYEE tables, select all the columns from the EMPPROJACT table and add the employee's surname (LASTNAME) from the EMPLOYEE table to each row of the result.

```
SELECT EMPPROJACT.*, LASTNAME
  FROM EMPPROJACT, EMPLOYEE
 WHERE EMPPROJACT.EMPNO = EMPLOYEE.EMPNO
```

Example 3

Join the EMPLOYEE and DEPARTMENT tables, select the employee number (EMPNO), employee surname (LASTNAME), department number (WORKDEPT in the EMPLOYEE table and DEPTNO in the DEPARTMENT table) and department name (DEPTNAME) of all employees who were born (BIRTHDATE) earlier than 1930.

```
SELECT EMPNO, LASTNAME, WORKDEPT, DEPTNAME
  FROM EMPLOYEE, DEPARTMENT
  WHERE WORKDEPT = DEPTNO
  AND YEAR (BIRTHDATE) < 1930
```

This subselect could also be written as follows:

```
SELECT EMPNO, LASTNAME, WORKDEPT, DEPTNAME
 FROM EMPLOYEE INNER JOIN DEPARTMENT
 ON WORKDEPT = DEPTNO
 WHERE YEAR(BIRTHDATE) < 1930
```

Example 4

Select the job (JOB) and the minimum and maximum salaries (SALARY) for each group of rows with the same job code in the EMPLOYEE table, but only for groups with more than one row and with a maximum salary greater than or equal to 27000.

```
SELECT JOB, MIN(SALARY), MAX(SALARY)
 FROM EMPLOYEE
  GROUP BY JOB
  HAVING COUNT(*) > 1 AND MAX(SALARY) >= 27000
```

Example 5

Select all the rows of EMPPROJACT table for employees (EMPNO) in department (WORKDEPT) 'E11'. (Employee department numbers are shown in the EMPLOYEE table.)

```
SELECT * FROM EMPPROJACT
  WHERE EMPNO IN (SELECT EMPNO FROM EMPLOYEE
                  WHERE WORKDEPT = 'E11')
```

Example 6

From the EMPLOYEE table, select the department number (WORKDEPT) and maximum departmental salary (SALARY) for all departments whose maximum salary is less than the average salary for all employees.

```
SELECT WORKDEPT, MAX (SALARY)
FROM EMPLOYEE
GROUP BY WORKDEPT
HAVING MAX (SALARY) < (SELECT AVG (SALARY)
FROM EMPLOYEE)
```

The subquery in the HAVING clause would only be executed once in this example.

Example 7

Using the EMPLOYEE table, select the department number (WORKDEPT) and maximum departmental salary (SALARY) for all departments whose maximum salary is less than the average salary in all other departments.

```
SELECT WORKDEPT, MAX(SALARY)
FROM EMPLOYEE EMP_COR
GROUP BY WORKDEPT
HAVING MAX(SALARY) < (SELECT AVG(SALARY)
FROM EMPLOYEE
WHERE NOT WORKDEPT = EMP COR.WORKDEPT)
```

In contrast to example 6, the subquery in the HAVING clause would need to be executed for each group.

Example 8

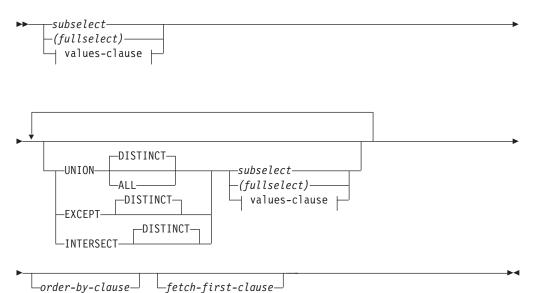
Join the EMPLOYEE and EMPPROJACT tables, select all of the employees and their project numbers. Return even those employees that do not have a project number currently assigned.

```
SELECT EMPLOYEE.EMPNO, PROJNO
FROM EMPLOYEE LEFT OUTER JOIN EMPPROJACT
ON EMPLOYEE.EMPNO = EMPPROJACT.EMPNO
```

Any employee in the EMPLOYEE table that does not have a project number in the EMPPROJACT table will return one row in the result table containing the EMPNO value and the null value in the PROJNO column.

| | | |

The *fullselect* is a component of the *select-statement*, ALTER TABLE statement for the definition of a materialized query table, CREATE TABLE statement, CREATE VIEW statement, DECLARE GLOBAL TEMPORARY TABLE statement, INSERT statement, SET transition-variable statement, SET VARIABLE statement, UPDATE statement, and *assignment-statement*.



values-clause:



values-row:



A fullselect that is enclosed in parenthesis is called a *subquery*. For example, a *subquery* can be used in a search condition.

A *scalar-fullselect* is a fullselect, enclosed in parentheses, that returns a single result row and a single result column. If the result of the fullselect is no rows, then the null value is returned. An error is returned if there is more than one row in the result.

A *fullselect* specifies a result table. If UNION, EXCEPT, or INTERSECT is not used, the result of the fullselect is the result of the specified subselect or *values-clause*.

values-clause

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Derives a result table by specifying the actual values, using expressions, for each column of a row in the result table. Multiple rows may be specified.

NULL can only be used with multiple specifications of *values-row*, and at least one row in the same column must not be NULL.

A values-row is specified by:

- A single expression for a single column result table or,
- *n* expressions (or NULL) separated by commas and enclosed in parentheses, where *n* is the number of columns in the result table.

A multiple row VALUES clause must have the same number of expressions in each *values-row*.

The following are examples of values-clauses and their meanings.

```
VALUES (1), (2), (3)

VALUES 1, 2, 3

VALUES (1, 2, 3)

VALUES (1, 21), (2,22), (3,23)

- 3 rows of 1 column

- 1 row of 3 columns

- 3 rows of 2 columns
```

A *values-clause* that is composed of n specifications of *values-row*, RE₁ to RE_n, where n is greater than 1 is equivalent to:

```
RE<sub>1</sub> UNION ALL RE<sub>2</sub> ... UNION ALL RE<sub>n</sub>
```

This means that the corresponding expressions of each *values-row* must be comparable. All result columns in a *values-row* are unnamed.

UNION, EXCEPT, or INTERSECT

The set operators UNION, EXCEPT, and INTERSECT correspond to the relational operators union, difference, and intersection. A fullselect specifies a result table. If a set operator is not used, the result of the fullselect is the result of the specified subselect. Otherwise, the result table is derived by combining two other result tables (R1 and R2) subject to the specified set operator.

UNION DISTINCT or UNION ALL

If UNION is specified without the ALL option, the result is the set of all rows in either R1 or R2, with duplicate rows eliminated. In either case, however, each row of the UNION table is either a row from R1 or a row from R2.

EXCEPT DISTINCT

The result consists of all rows that are only in R1, with duplicate rows in the result of this operation eliminated. Each row in the result table of the difference is a row from R1 that does not have a matching row in R2.

INTERSECT DISTINCT

The result consists of all rows that are in both R1 and R2, with the duplicate rows eliminated. Each row in the result table of the intersection is a row that exists in both R1 and R2.

Rules for columns:

- R1 and R2 must have the same number of columns, and the data type of the *n*th column of R1 must be compatible with the data type of the *n*th column of R2. Character-string values are compatible with datetime values.
- The *n*th column of the result of UNION, UNION ALL, EXCEPT, or INTERSECT is derived from the *n*th columns of R1 and R2. The attributes of the result columns are determined using the rules for result columns.

- If the *n*th column of R1 and the *n*th column of R2 have the same result column name, then the *n*th column of the result table has the result column name. If the *n*th column of R1 and the *n*th column of R2 do not have the same names, then the result column is unnamed.
- If UNION, INTERSECT, or EXCEPT is specified, no column can be a DATALINK column.

For information on the valid combinations of operand columns and the data type of the result column, see "Rules for result data types" on page 105.

EXCEPT and INTERSECT restrictions: VALUES, INTERSECT, and EXCEPT are not allowed if the query specifies one of the following:

- A distributed table
- A table with a read trigger
- A table referenced directly or indirectly in the fullselect that must not be a DDS-created logical file
- A logical file built over multiple physical file members

Duplicate rows: Two rows are duplicates if each value in the first is equal to the corresponding value of the second. (For determining duplicates, two null values are considered equal.)

Operator precedence: UNION, UNION ALL, and INTERSECT are associative set operations. However, when UNION, UNION ALL, EXCEPT, and INTERSECT are used in the same statement, the result depends on the order in which the operations are performed. Operations within parenthesis are performed first. When the order is not specified by parentheses, operations are performed in left-to-right order with the exception that all INTERSECT operations are performed before UNION or EXCEPT operations.

Results of set operators: In the following example, the values of tables R1 and R2 are shown on the left. The other headings listed show the values as a result of various set operations on R1 and R2.

R1	R2	UNION ALL	UNION	EXCEPT	INTERSECT
1	1	1	1	2	1
1	1	1	2	5	3
1	3	1	3		4
2	3	1	4		
2	3	1	5		
2	3	2			
3	4	2			
4		2			
4		3			
5		3			
		3			
		3			
		3			
		4			
		4			

R1	R2	UNION ALL UNION	EXCEPT INTERSECT
		4	
		5	

Collating sequence: If a collating sequence other than *HEX is in effect when the statement that contains the UNION, EXCEPT, or INTERSECT keyword is executed and if the result tables contain columns that are SBCS data, mixed data, or Unicode data, the comparison for those columns is done using weighted values. The weighted values are derived by applying the collating sequence to each value.

Examples of a fullselect

Example 1

Select all columns and rows from the EMPLOYEE table.

```
SELECT * FROM FMPLOYEE
```

Example 2

List the employee numbers (EMPNO) of all employees in the EMPLOYEE table whose department number (WORKDEPT) either begins with 'E' or who are assigned to projects in the EMPPROJACT table whose project number (PROJNO) equals 'MA2100', 'MA2110', or 'MA2112'.

```
SELECT EMPNO FROM EMPLOYEE
WHERE WORKDEPT LIKE 'E%'
UNION
SELECT EMPNO FROM EMPPROJACT
WHERE PROJNO IN('MA2100', 'MA2110', 'MA2112')
```

Example 3

Make the same query as in example 2, only use UNION ALL so that no duplicate rows are eliminated.

```
SELECT EMPNO FROM EMPLOYEE
WHERE WORKDEPT LIKE 'E%'
UNION ALL
SELECT EMPNO FROM EMPPROJACT
WHERE PROJNO IN('MA2100', 'MA2110', 'MA2112')
```

Example 4

Make the same query as in example 2, and, in addition, "tag" the rows from the EMPLOYEE table with 'emp' and the rows from the EMPPROJACT table with 'empprojact'. Unlike the result from example 2, this query may return the same EMPNO more than once, identifying which table it came from by the associated "tag".

```
SELECT EMPNO, 'emp' FROM EMPLOYEE
WHERE WORKDEPT LIKE 'E%'
UNION
SELECT EMPNO, 'empprojact' FROM EMPPROJACT
WHERE PROJNO IN('MA2100', 'MA2110', 'MA2112')
```

Example 5

Make the same query as in example 3, only include an additional two employees currently not in any table and tag these rows as "new".

```
SELECT EMPNO, 'emp' FROM EMPLOYEE
WHERE WORKDEPT LIKE 'E%'
UNION
SELECT EMPNO, 'empprojact' FROM EMPPROJACT
WHERE PROJNO IN('MA2100', 'MA2110', 'MA2112')
UNION
VALUES ('NEWAAA', 'new'), ('NEWBBB', 'new')
```

Example 6

This example of EXCEPT produces all rows that are in T1 but not in T2, with duplicate rows removed.

```
(SELECT * FROM T1)
EXCEPT DISTINCT
(SELECT * FROM T2)

If no NULL values are involved, this example returns the same results as:
(SELECT DISTINCT *
FROM T1
WHERE NOT EXISTS (SELECT * FROM T2
WHERE T1.C1 = T2.C1 AND T1.C2 = T2.C2 AND...) )
```

where C1, C2, and so on represent the columns of T1 and T2.

Example 7

This example of INTERSECT produces all rows that are in both tables T1 and T2, with duplicate rows removed.

```
(SELECT * FROM T1)
INTERSECT DISTINCT
(SELECT * FROM T2)
```

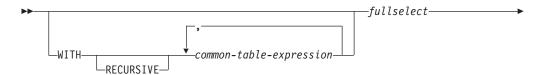
If no NULL values are involved, this example returns the same results as:

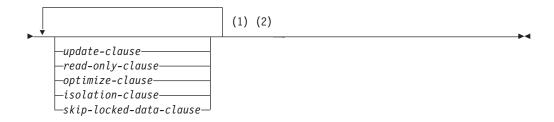
```
(SELECT DISTINCT *
FROM T1
WHERE EXISTS (SELECT * FROM T2
WHERE T1.C1 = T2.C1 AND T1.C2 = T2.C2 AND...) )
```

where C1, C2, and so on represent the columns of T1 and T2.

select-statement

The select-statement is the form of a query that can be directly specified in a DECLARE CURSOR or FOR statement, prepared and then referenced in a DECLARE CURSOR statement, or directly specified in an SQLJ assignment clause. It can also be issued interactively. In any case, the table specified by a select-statement is the result of the fullselect.





Notes:

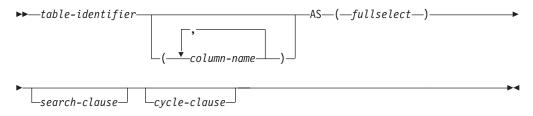
- The update-clause and read-only-clause cannot both be specified in the same 1 select-statement.
- Each clause may be specified only once.

RECURSIVE

Indicates that a *common-table-expression* is potentially recursive.

common-table-expression

A *common-table-expression* permits defining a result table with a *table-identifier* that can be specified as a table name in any FROM clause of the fullselect that follows. Multiple common table expressions can be specified following the single WITH keyword. Each common table expression specified can also be referenced by name in the FROM clause of subsequent common table expressions.

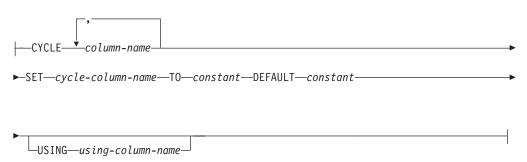


search-clause:

1

```
-SEARCH—DEPTH FIRST—BY—column-name—SET—seq-column-name—
```

cycle-clause:



If a list of columns is specified, it must consist of as many names as there are columns in the result table of the fullselect. Each *column-name* must be unique and unqualified. If these column names are not specified, the names are derived from the select list of the subselect used to define the common table expression.

The *table-identifier* of a common table expression must be different from any other common table expression *table-identifier* in the same statement. A common table expression *table-identifier* can be specified as a table name in any FROM clause throughout the fullselect. A *table-identifier* of a common table expression overrides any existing table, view, or alias (in the catalog) with the same unqualified name or any *table-identifier* specified for a trigger.

If more than one common table expression is defined in the same statement, cyclic references between the common table expressions are not permitted. A *cyclic reference* occurs when two common table expressions *dt1* and *dt2* are created such that *dt1* refers to *dt2* and *dt2* refers to *dt1*.

common-table-expression

The table name of a common table expression can only be referenced in the select-statement, INSERT statement, or CREATE VIEW statement that defines it.

If a select-statement, INSERT statement, or CREATE VIEW statement refers to an unqualified table name, the following rules are applied to determine which table is actually being referenced:

- If the unqualified name corresponds to one or more common table expression names that are specified in the select-statement, the name identifies the common table expression that is in the innermost scope.
- If in a CREATE TRIGGER statement and the unqualified name corresponds to a transition table name, the name identifies that transition table.
- Otherwise, the name identifies a persistent table, a temporary table, or a view that is present in the default schema.

A common-table-expression can be used:

- In place of a view to avoid creating the view (when general use of the view is not required and positioned UPDATE or DELETE is not used)
- To enable grouping by a column that is derived from a scalar-fullselect or function that is not deterministic
- When the required result table is based on variables
- When the same result table needs to be shared in a fullselect
- When the result needs to be derived using recursion

If a fullselect of a common table expression contains a reference to itself in a FROM clause, the common table expression is a recursive table expression. Queries using recursion are useful in supporting applications such as bill of materials (BOM), reservation systems, and network planning.

The following restrictions must be true of a recursive *common-table-expression*:

- Each fullselect that is part of the recursion cycle must start with SELECT or SELECT ALL. Use of SELECT DISTINCT is not allowed.
- The UNION ALL set operator must be specified.
- A list of column-names must be specified following the table-identifier of the common-table-expression.
- The first fullselect of the first union (the initialization fullselect) must not include a reference to the *common-table-expression* itself in any FROM clause.
- Each fullselect that is part of the recursion cycle must not include any aggregate functions, GROUP BY clauses, or HAVING clauses.
- The FROM clauses of these fullselects can include at most one reference to a *common-table-expression* that is part of a recursion cycle.
- The table being defined in the common-table-expression cannot be referenced in a subquery of a *fullselect* that defines the *common-table-expression*.
- LEFT OUTER JOIN and FULL OUTER JOIN are not allowed if the common-table-expression is the right operand. RIGHT OUTER JOIN and FULL OUTER JOIN are not allowed if the *common-table-expression* is the left operand.
- Each fullselect other than the initialization fullselect that is part of the recursion cycle must not include an ORDER BY clause.

If a column name of the *common-table-expression* is referred to in the iterative fullselect, the attributes of the result columns are determined using the rules for result columns. For more information see "Rules for result data types" on page

search-clause

The SEARCH clause in the definition of the recursive *common-table-expression* is used to specify the order in which the result rows are to be returned.

SEARCH DEPTH FIRST

Each parent or containing item appears in the result before the items that it contains.

SEARCH BREADTH FIRST

Sibling items are grouped before subordinate items.

BY column-name,...

Identifies the columns that associate the parent and child relationship of the recursive query. Each column-name must unambiguously identify a column of the parent. The column must not be a DATALINK column. The rules for unambiguous column references are the same as in the other clauses of the fullselect. See "Column name qualifiers to avoid ambiguity" on page 131 for more information.

The column-name must identify a column name of the recursive common-table-expression. The column-name must not be qualified.

SET *seq-column-name*

Specifies the name of a result column that contains an ordinal number of the current row in the recursive query result. The data type of the seq-column-name is BIGINT.

The seq-column-name may only be referenced in the ORDER BY clause of the outer fullselect that references the *common-table-expression*. The seq-column-name cannot be referenced in the fullselect that defines the common-table-expression.

The seq-column-name must not be the same as using-column-name or cycle-column-name.

cycle-clause

The CYCLE clause in the definition of the recursive common-table-expression is used to prevent an infinite loop in the recursive query when the parent and child relationship of the data results in a loop.

CYCLE column-name,...

Specifies the list of columns that represent the parent/child join relationship values for the recursion. Any new row from the query is first checked for a duplicate value (per these column names) in the existing rows that lead to this row in the recursive query results to determine if there is a cycle.

Each column-name must identify a result column of the common table expression. The same column-name must not be specified more than once.

SET *cycle-column-name*

Specifies the name of a result column that is set based on whether a cycle has been detected in the recursive query:

- If a duplicate row is encountered, indicating that a cycle has been detected in the data, the *cycle-column-name* is set to the TO *constant*.
- If a duplicate row is not encountered, indicating that a cycle has not been detected in the data, the cycle-column-name is set to the DEFAULT constant.

The data type of the *cycle-column-name* is CHAR(1).

When cyclic data in the row is encountered, the duplicate row is not returned to the recursive query process for further recursion and that child branch of the query is stopped. By specifying the provided *cycle-column-name* is in the result set of the main fullselect, the existence of cyclic data can actually be determined and even corrected if that is wanted.

The *cycle-column-name* must not be the same as *using-column-name* or *seq-column-name*.

The *cycle-column-name* can be referenced in the fullselect that defines the *common-table-expression*.

TO constant

Specifies a CHAR(1) constant value to assign to the *cycle-column* if a cycle has been detected in the data. The TO *constant* must not be equal to the DEFAULT *constant*.

DEFAULT constant

Specifies a CHAR(1) constant value to assign to the *cycle-column* if a cycle has not been detected in the data. The DEFAULT *constant* must not be equal to the TO *constant*.

USING using-column-name

Identifies the temporary results consisting of the columns from the CYCLE column list. The temporary result is used by the database manager to identify duplicate rows in the query result.

The *using-column-name* must not be the same as *cycle-column-name* or *seq-column-name*.

When developing recursive common table expressions, remember that an infinite recursion cycle (loop) can be created. Ensure that recursion cycles will end. This is especially important if the data involved is cyclic. A recursive common table expression is expected to include a predicate that will prevent an infinite loop. The recursive common table expression is expected to include:

- In the iterative fullselect, an integer column incremented by a constant.
- A predicate in the WHERE clause of the iterative *fullselect* in the form "counter_col < constant" or "counter_col < :hostvar".

A warning is issued if this syntax is not found in the recursive common table expression.

Recursive common table expressions are not allowed if the query specifies:

- · a distributed table,
- a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

Recursion example: bill of materials

Bill of materials (BOM) applications are a common requirement in many business environments. To illustrate the capability of a recursive common table expression for BOM applications, consider a table of parts with associated subparts and the quantity of subparts required by the part.

For this example, create the table as follows:

1

```
CREATE TABLE PARTLIST
  ( PART VARCHAR(8), SUBPART VARCHAR(8),
    QUANTITY INTEGER )
```

To give query results for this example, assume that the PARTLIST table is populated with the following values:

PART	SUBPART	QUANTITY
00	01	5
00	05	3
01	02	2
01	03	3
01	04	4
01	06	3
02	05	7
02	06	6
03	07	6
04	80	10
04	09	11
05	10	10
05	11	10
06	12	10
06	13	10
07	14	8
07	12	8

Example 1: Single level explosion

The first example is called single level explosion. It answers the question, "What parts are needed to build the part identified by '01'?". The list will include the direct subparts, subparts of the subparts and so on. However, if a part is used multiple times, its subparts are only listed once.

```
WITH RPL (PART, SUBPART, QUANTITY) AS
     ( SELECT ROOT.PART, ROOT.SUBPART, ROOT.QUANTITY
           FROM PARTLIST ROOT
          WHERE ROOT.PART = '01'
       UNION ALL
        SELECT CHILD.PART, CHILD.SUBPART, CHILD.QUANTITY
          FROM RPL PARENT, PARTLIST CHILD
          WHERE PARENT.SUBPART = CHILD.PART
SELECT DISTINCT PART, SUBPART, QUANTITY
  FROM RPL
  ORDER BY PART, SUBPART, QUANTITY
```

The above query includes a common table expression, identified by the name RPL, that expresses the recursive part of this query. It illustrates the basic elements of a recursive common table expression.

The first operand (fullselect) of the UNION, referred to as the initialization fullselect, gets the direct children of part '01'. The FROM clause of this fullselect refers to the source table and will never refer to itself (RPL in this case). The result of this first fullselect goes into the common table expression RPL (Recursive PARTLIST). As in this example, the UNION must always be a UNION ALL.

The second operand (fullselect) of the UNION uses RPL to compute subparts of subparts by having the FROM clause refer to the common table expression RPL and the source table with a join of a part from the source table (child) to a subpart

common-table-expression

of the current result contained in RPL (parent). The result goes back to RPL again. The second operand of UNION is then used repeatedly until no more children exist.

The SELECT DISTINCT in the main fullselect of this query ensures the same part/subpart is not listed more than once.

The result of the query is as follows:

SUBPART	QUANTITY
02	2
03	3
04	4
06	3
05	7
06	6
07	6
08	10
09	11
10	10
11	10
12	10
13	10
12	8
14	8
	02 03 04 06 05 06 07 08 09 10 11 12 13

Observe in the result that part '01' goes to '02' which goes to '06' and so on. Further, notice that part '06' is reached twice, once through '01' directly and another time through '02'. In the output, however, its subcomponents are listed only once (this is the result of using a SELECT DISTINCT) as required.

Example 2: Summarized explosion

The second example is a summarized explosion. The question posed here is, what is the total quantity of each part required to build part '01'. The main difference from the single level explosion is the need to aggregate the quantities. The first example indicates the quantity of subparts required for the part whenever it is required. It does not indicate how many of the subparts are needed to build part '01'.

In the above query, the select list of the second operand of the UNION in the recursive common table expression, identified by the name RPL, shows the aggregation of the quantity. To find out how much of a subpart is used, the quantity of the parent is multiplied by the quantity per parent of a child. If a part is used multiple times in different places, it requires another final aggregation. This is done by the grouping over the common table expression RPL and using the SUM aggregate function in the select list of the main fullselect.

	The	result	of	the	auerv	is	as	follows:
--	-----	--------	----	-----	-------	----	----	----------

PART	SUBPART	Total	Qty	Used
01	02		2	
01	03		3	
01	04		4	
01	05		14	
01	06	15		
01	07		18	
01	08	40		
01	09	44		
01	10	14	40	
01	11	14	40	
01	12	29	94	
01	13	1	50	
01	14	14	44	

Looking at the output, consider the line for subpart '06'. The total quantity used value of 15 is derived from a quantity of 3 directly for part '01' and a quantity of 6 for part '02' which is needed 2 times by part '01'.

Example 3: Controlling depth

The question may come to mind, what happens when there are more levels of parts in the table than you are interested in for your query? That is, how is a query written to answer the question, "What are the first two levels of parts needed to build the part identified by '01'?" For the sake of clarity in the example, the level is included in the result.

```
WITH RPL ( LEVEL, PART, SUBPART, QUANTITY)

AS ( SELECT 1, ROOT.PART, ROOT.SUBPART, ROOT.QUANTITY

FROM PARTLIST ROOT

WHERE ROOT.PART = '01'

UNION ALL

SELECT PARENT.LEVEL+1, CHILD.PART, CHILD.SUBPART, CHILD.QUANTITY

FROM RPL PARENT, PARTLIST CHILD

WHERE PARENT.SUBPART = CHILD.PART

AND PARENT.LEVEL < 2

)

SELECT PART, LEVEL, SUBPART, QUANTITY

FROM RPL
```

This query is similar to example 1. The column LEVEL was introduced to count the levels from the original part. In the initialization fullselect, the value for the LEVEL column is initialized to 1. In the subsequent fullselect, the level from the parent is incremented by 1. Then to control the number of levels in the result, the second fullselect includes the condition that the parent level must be less than 2. This ensures that the second fullselect only processes children to the second level.

The result of the query is:

PART	LEVEL	SUBPART	QUANTITY
01	1	02	2
01	1	03	3
01	1	04	4
01	1	06	3
02	2	05	7
02	2	06	6
03	2	07	6
04	2	08	10
04	2	09	11
06	2	12	10
06	2	13	10

update-clause

The UPDATE clause identifies the columns that can appear as targets in an assignment clause in a subsequent positioned UPDATE statement. Each *column-name* must be unqualified and must identify a column of the table or view identified in the first FROM clause of the fullselect. The clause must not be specified if the result table of the fullselect is read-only.



If an UPDATE clause is specified with a *column-name* list, and extended indicator variables are not enabled, then *column-name* must be an updatable column.

If the UPDATE clause is specified without *column-name* list, then the implicit *column-name* list is determined as follows:

- If extended indicator variables are enabled, all the columns of the table or view identified in the first FROM clause of the fullselect.
- Otherwise, all the updatable columns of the table or view identified in the first FROM clause of the fullselect.

If the UPDATE clause is not specified in a *select-statement* and its result table is not *read-only*, then an implicit UPDATE clause will result. The implicit *column-name* list is determined as follows:

- If extended indicator variables are enabled, all the columns of the table or view identified in the first FROM clause of the fullselect are included.
- Otherwise, all the updatable columns of the table or view identified in the first FROM clause of the fullselect are included.

The UPDATE clause must not be specified if the result table of the fullselect is read-only (for more information see "DECLARE CURSOR" on page 845) or if the FOR READ ONLY clause is used.

When the UPDATE clause is used, FETCH operations referencing the cursor acquire an exclusive row lock.

read-only-clause

I

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The READ ONLY clause indicates that the result table is read-only; therefore, the cursor cannot be used for positioned UPDATE and DELETE statements.

►►—FOR READ ONLY—

Some result tables are read-only by nature. (For example, a table based on a read-only view). FOR READ ONLY can still be specified for such tables, but the specification has no effect.

For result tables in which updates and deletes are allowed, specifying FOR READ ONLY can possibly improve the performance of FETCH operations by allowing the database manager to do blocking and avoid exclusive locks. For example, in programs that contain dynamic SQL statements without the FOR READ ONLY or ORDER BY clause, the database manager might open cursors as if the UPDATE clause was specified.

A read-only result table must not be referred to in an UPDATE or DELETE statement, whether it is read-only by nature or specified as FOR READ ONLY.

To guarantee that selected data is not locked by any other job, you can specify the optional syntax of USE AND KEEP EXCLUSIVE LOCKS on the *isolation-clause*. This guarantees that the selected data can later be updated or deleted without incurring a row lock conflict.

Syntax Alternatives: FOR FETCH ONLY can be specified in place of FOR READ ONLY.

optimize-clause

The optimize-clause tells the database manager to assume that the program does not intend to retrieve more than integer rows from the result table. Without this clause, or with the keyword ALL, the database manager assumes that all rows of the result table are to be retrieved. Optimizing for integer rows can improve performance. The database manager will optimize the query based on the specified number of rows.

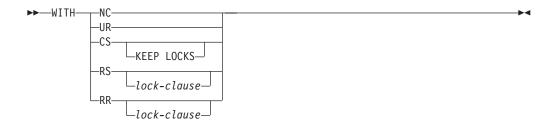


The clause does not change the result table or the order in which the rows are fetched. Any number of rows can be fetched, but performance can possibly degrade after integer fetches.

The value of *integer* must be a positive integer (not zero).

isolation-clause

The *isolation-clause* specifies an isolation level at which the select statement is executed.



lock-clause:

-- USE AND KEEP EXCLUSIVE LOCKS-----

RR Repeatable Read

USE AND KEEP EXCLUSIVE LOCKS

Exclusive row locks are acquired and held until a COMMIT or ROLLBACK statement is executed.

RS Read Stability

USE AND KEEP EXCLUSIVE LOCKS

Exclusive row locks are acquired and held until a COMMIT or ROLLBACK statement is executed. The USE AND KEEP EXCLUSIVE LOCKS clause is only allowed in the *isolation-clause* in the following SOL statements:

- DECLARE CURSOR
- FOR
- select-statement
- SELECT INTO
- PREPARE in the ATTRIBUTES string

It is not allowed on updatable cursors.

CS Cursor Stability

KEEP LOCKS

The KEEP LOCKS clause specifies that any read locks acquired will be held for a longer duration. Normally, read locks are released when the next row is read. If the isolation clause is associated with a cursor, the locks will be held until the cursor is closed or until a COMMIT or ROLLBACK statement is executed. Otherwise, the locks will be held until the completion of the SQL statement.

UR Uncommitted Read

NC No Commit

If *isolation-clause* is not specified, the default isolation is used with the exception of a default isolation level of uncommitted read. See "Isolation level" on page 26 for a description of how the default is determined.

isolation-clause

Exclusive locks: The USE AND KEEP EXCLUSIVE LOCKS clause should be used with caution. If it is specified, the exclusive row locks that are acquired on rows will prevent concurrent access to those rows by other users running COMMIT(*CS), COMMIT(*RS), and COMMIT(*RR) till the end of the unit of work. Concurrent access by users running COMMIT(*NC) or COMMIT(*UR) is not prevented.

Keyword Synonyms: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword NONE can be used as a synonym for NC.
- The keyword CHG can be used as a synonym for UR.
- The keyword ALL can be used as a synonym for RS.

skip-locked-data-clause

The skip-locked-data-clause specifies to skip rows on which incompatible locks are held by other transactions. These rows can belong to any table referenced in the statement.

►►-SKIP LOCKED DATA-

This clause is only used under isolation levels CS and RS. It is ignored when an isolation level of NC, UR, or RR is in effect. It applies to row level locks. If isolation-clause is not specified, the default isolation level is used.

Examples of a select-statement

You can use select-statement in many different ways.

Example 1

Select all columns and rows from the EMPLOYEE table.

```
SELECT * FROM EMPLOYEE
```

Example 2

Select the project name (PROJNAME), start date (PRSTDATE), and end date (PRENDATE) from the PROJECT table. Order the result table by the end date with the most recent dates appearing first.

```
SELECT PROJNAME, PRSTDATE, PRENDATE
FROM PROJECT
ORDER BY PRENDATE DESC
```

Example 3

Select the department number (WORKDEPT) and average departmental salary (SALARY) for all departments in the EMPLOYEE table. Arrange the result table in ascending order by average departmental salary.

```
SELECT WORKDEPT, AVG (SALARY)
FROM EMPLOYEE
GROUP BY WORKDEPT
ORDER BY AVGSAL
```

Example 4

Declare a cursor named UP_CUR, to be used in a C program, that updates the start date (PRSTDATE) and the end date (PRENDATE) columns in the PROJECT table. The program must receive both of these values together with the project number (PROJNO) value for each row. The declaration specifies that the access path for the query be optimized for the retrieval of a maximum of 2 rows. Even so, the program can retrieve more than 2 rows from the result table. However, when more than 2 rows are retrieved, performance could possibly degrade.

```
EXEC SQL DECLARE UP_CUR CURSOR FOR
SELECT PROJNO, PRSTDATE, PRENDATE
FROM PROJECT
FOR UPDATE OF PRSTDATE, PRENDATE
OPTIMIZE FOR 2 ROWS;
```

Example 5

Select items from a table with an isolation level of Read Stability (RS).

```
SELECT NAME, SALARY
FROM PAYROLL
WHERE DEPT = 704
WITH RS
```

Example 6

Find the average charges for each subscriber (SNO) in the state of California during the last Friday of each month in the first quarter of 2000. Group the result according to SNO. Each MONTHnn table has columns for SNO, CHARGES, and DATE. The CUST table has columns for SNO and STATE.

```
SELECT V.SNO, AVG( V.CHARGES)
  FROM CUST, LATERAL (
    SELECT SNO, CHARGES, DATE
    FROM MONTH1
    WHERE DATE BETWEEN '01/01/2000' AND '01/31/2000'
        UNION ALL
    SELECT SNO, CHARGES, DATE
    FROM MONTH2
    WHERE DATE BETWEEN '02/01/2000' AND '02/29/2000'
        UNION ALL
    SELECT SNO, CHARGES, DATE
    FROM MONTH3
    WHERE DATE BETWEEN '03/01/2000' AND '03/31/2000'
    ) AS V (SNO, CHARGES, DATE)
  WHERE CUST.SNO=V.SNO
  AND CUST.STATE='CA'
  AND DATE IN ('01/28/2000', '02/25/2000', '03/31/2000')
  GROUP BY V.SNO
```

Example 7

This example names the expression SAL+BONUS+COMM as TOTAL_PAY:

```
SELECT SALARY+BONUS+COMM AS TOTAL_PAY FROM EMPLOYEE ORDER BY TOTAL PAY
```

Example 8

Determine the employee number and salary of sales representatives along with the average salary and head count of their departments. Also, list the average salary of the department with the highest average salary.

Using a common table expression for this case saves the overhead of creating the DINFO view as a regular view. Because of the context of the rest of the fullselect, only the rows for the department of the sales representatives need to be considered by the view.

```
WITH

DINFO (DEPTNO, AVGSALARY, EMPCOUNT) AS

(SELECT OTHERS.WORKDEPT, AVG(OTHERS.SALARY), COUNT(*)

FROM EMPLOYEE OTHERS

GROUP BY OTHERS.WORKDEPT),

DINFOMAX AS

(SELECT MAX(AVGSALARY) AS AVGMAX

FROM DINFO)

SELECT THIS_EMP.EMPNO, THIS_EMP.SALARY, DINFO.AVGSALARY, DINFO.EMPCOUNT,

DINFOMAX.AVGMAX

FROM EMPLOYEE THIS_EMP, DINFO, DINFOMAX
WHERE THIS_EMP.JOB = 'SALESREP'
AND THIS EMP.WORKDEPT = DINFO.DEPTNO
```

Examples of a select-statement

Chapter 5. Statements

This section contains syntax diagrams, semantic descriptions, rules, and examples of the use of the SQL statements.

The statements are listed in the following table.

Table 43. SQL Schema Statements

SQL Statement	Description	Page
ALTER FUNCTION (External Scalar)	Alters the description of an external scalar function	"ALTER FUNCTION (External Scalar)" on page 543
ALTER FUNCTION (External Table)	Alters the description of an external table function	"ALTER FUNCTION (External Table)" on page 548
ALTER FUNCTION (SQL Scalar)	Alters the description of an SQL scalar function	"ALTER FUNCTION (SQL Scalar)" on page 553
ALTER FUNCTION (SQL Table)	Alters the description of an SQL table function	"ALTER FUNCTION (SQL Table)" on page 560
ALTER PROCEDURE (External)	Alters the description of an external procedure	"ALTER PROCEDURE (External)" on page 567
ALTER PROCEDURE (SQL)	Alters the description of an SQL procedure	"ALTER PROCEDURE (SQL)" on page 572
ALTER SEQUENCE	Alters the description of a sequence	"ALTER SEQUENCE" on page 580
ALTER TABLE	Alters the description of a table	"ALTER TABLE" on page 585
COMMENT	Replaces or adds a comment to the description of an alias, column, constraint, function, index, package, parameter, procedure, sequence, table, trigger, type, or view	"COMMENT" on page 630
CREATE ALIAS	Creates an alias	"CREATE ALIAS" on page 652
CREATE FUNCTION	Creates a user-defined function	"CREATE FUNCTION" on page 655
CREATE FUNCTION (External Scalar)	Creates an external scalar function	"CREATE FUNCTION (External Scalar)" on page 659
CREATE FUNCTION (External Table)	Creates an external table function	"CREATE FUNCTION (External Table)" on page 677
CREATE FUNCTION (Sourced)	Creates a user-defined function based on another existing scalar or column function	"CREATE FUNCTION (Sourced)" on page 693
CREATE FUNCTION (SQL Scalar)	Creates an SQL scalar function	"CREATE FUNCTION (SQL Scalar)" on page 703
CREATE FUNCTION (SQL Table)	Creates an SQL table function	"CREATE FUNCTION (SQL Table)" on page 713

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Table 43. SQL Schema Statements (continued)

SQL Statement	Description	Page
CREATE INDEX	Creates an index on a table	"CREATE INDEX" on page 723
CREATE PROCEDURE	Creates a procedure.	"CREATE PROCEDURE" on page 730
CREATE PROCEDURE (External)	Creates an external procedure.	"CREATE PROCEDURE (External)" on page 731
CREATE PROCEDURE (SQL)	Creates an SQL procedure.	"CREATE PROCEDURE (SQL)" on page 745
CREATE SCHEMA	Creates a schema and a set of objects in that schema	"CREATE SCHEMA" on page 756
CREATE SEQUENCE	Creates a sequence	"CREATE SEQUENCE" on page 761
CREATE TABLE	Creates a table	"CREATE TABLE" on page 768
CREATE TRIGGER	Creates a trigger	"CREATE TRIGGER" on page 813
CREATE TYPE	Creates a type	"CREATE TYPE" on page 827
CREATE VIEW	Creates a view of one or more tables or views	"CREATE VIEW" on page 835
DROP	Drops an alias, function, index, package, procedure, schema, sequence, table, trigger, type, or view	"DROP" on page 907
GRANT (Function or Procedure Privileges)	Grants privileges on a function or procedure	"GRANT (Function or Procedure Privileges)" on page 967
GRANT (Package Privileges)	Grants privileges on a package	"GRANT (Package Privileges)" on page 975
GRANT (Sequence Privileges)	Grants privileges on a sequence	"GRANT (Sequence Privileges)" on page 978
GRANT (Table or View Privileges)	Grants privileges on a table or view	"GRANT (Table or View Privileges)" on page 981
GRANT (Type Privileges)	Grants privileges on a type	"GRANT (Type Privileges)" on page 987
LABEL	Replaces or adds a label on the description of an alias, column, constraint, function, package, procedure, sequence, table, or view	"LABEL" on page 1005
RENAME	Renames a table, view, or index.	"RENAME" on page 1039
REVOKE (Function or Procedure Privileges)	Revokes privileges on a function or procedure	"REVOKE (Function or Procedure Privileges)" on page 1042
REVOKE (Package Privileges)	Revokes the privilege to execute statements in a package	"REVOKE (Package Privileges)" on page 1049
REVOKE (Sequence Privileges)	Revokes privileges on a sequence	"REVOKE (Sequence Privileges)" on page 1051
REVOKE (Table or View Privileges)	Revokes privileges on a table or view	"REVOKE (Table or View Privileges)" on page 1053

Table 43. SQL Schema Statements (continued)

SQL Statement	Description	Page
REVOKE (Type Privileges)	Revokes the privilege to use a type	"REVOKE (Type Privileges)" on page 1056

Table 44. SQL Data Change Statements

SQL Statement	Description	Page
DELETE	Deletes one or more rows from a table	"DELETE" on page 886
INSERT	Inserts one or more rows into a table	"INSERT" on page 994
UPDATE	Updates the values of one or more columns in one or more rows of a table	"UPDATE" on page 1127

Table 45. SQL Data Statements

SQL Statement	Description	Page
	All SQL Data Change statements	Table 44
CLOSE	Closes a cursor	"CLOSE" on page 628
DECLARE CURSOR	Defines an SQL cursor	"DECLARE CURSOR" on page 845
FETCH	Positions a cursor on a row of the result table; can also assign values from one or more rows of the result table to variables	"FETCH" on page 925
FREE LOCATOR	Removes the association between a LOB locator variable and its value	"FREE LOCATOR" on page 932
HOLD LOCATOR	Allows a LOB locator variable to retain its association with a value beyond a unit of work	"HOLD LOCATOR" on page 990
LOCK TABLE	Either prevents concurrent processes from changing a table or prevents concurrent processes from using a table	"LOCK TABLE" on page 1013
OPEN	Opens a cursor	"OPEN" on page 1015
REFRESH TABLE	Refreshes the data in a materialized query table	"REFRESH TABLE" on page 1034
SELECT	Executes a query	"SELECT" on page 1064
SELECT INTO	Assigns values to variables	"SELECT INTO" on page 1065
SET transition-variable	Assigns values to a transition variable	"SET transition-variable" on page 1118
SET variable	Assigns values to a variable	"SET variable" on page 1120
VALUES	Provides a method to invoke a user-defined function from a trigger.	"VALUES" on page 1136
VALUES INTO	Specifies a result table of no more than one row and assigns the values to variables.	"VALUES INTO" on page 1138

Table 46. SQL Transaction Statements

SQL Statement	Description	Page
COMMIT	Ends a unit of work and commits the database changes made by that unit of work	"COMMIT" on page 639
RELEASE SAVEPOINT	Releases a savepoint within a unit of work	"RELEASE SAVEPOINT" on page 1038
ROLLBACK	Ends a unit of work and backs out the database changes made by that unit of work or made since the specified savepoint	"ROLLBACK" on page 1058
SAVEPOINT	Sets a savepoint within a unit of work	"SAVEPOINT" on page 1062
SET TRANSACTION	Changes the isolation level for the current unit of work	"SET TRANSACTION" on page 1115

Table 47. SQL Connection Statements

SQL Statement	Description	Page
CONNECT (Type 1)	Connects to an application server and establishes the rules for remote unit of work	"CONNECT (Type 1)" on page 642
CONNECT (Type 2)	Connects to an application server and establishes the rules for application-directed distributed unit of work	"CONNECT (Type 2)" on page 647
DISCONNECT	Immediately ends one or more connections	"DISCONNECT" on page 905
RELEASE (Connection)	Places one or more connections in the release-pending state	"RELEASE (Connection)" on page 1036
SET CONNECTION	Establishes the application server of the process by identifying one of its existing connections	"SET CONNECTION" on page 1068

Table 48. SQL Dynamic Statements

SQL Statement	Description	Page
ALLOCATE DESCRIPTOR	Allocates an SQL descriptor	"ALLOCATE DESCRIPTOR" on page 541
DEALLOCATE DESCRIPTOR	Deallocates an SQL descriptor	"DEALLOCATE DESCRIPTOR" on page 844
DESCRIBE	Describes the result columns of a prepared statement	"DESCRIBE" on page 892
DESCRIBE INPUT	Describes the input parameter markers of a prepared statement	"DESCRIBE INPUT" on page 897
DESCRIBE TABLE	Describes the columns of a table or view	"DESCRIBE TABLE" on page 901
EXECUTE	Executes a prepared SQL statement	"EXECUTE" on page 919

Table 48. SQL Dynamic Statements (continued)

SQL Statement	Description	Page
EXECUTE IMMEDIATE	Prepares and executes an SQL statement	"EXECUTE IMMEDIATE" on page 923
GET DESCRIPTOR	Gets information from an SQL descriptor	"GET DESCRIPTOR" on page 933
PREPARE	Prepares an SQL statement for execution	"PREPARE" on page 1020
SET DESCRIPTOR	Sets items in an SQL descriptor	"SET DESCRIPTOR" on page 1078

Table 49. SQL Session Statements

SQL Statement	Description	Page
DECLARE GLOBAL TEMPORARY TABLE	Defines a declared temporary table	"DECLARE GLOBAL TEMPORARY TABLE" on page 855
SET CURRENT DEBUG MODE	Assigns a value to the CURRENT DEBUG MODE special register	"SET CURRENT DEBUG MODE" on page 1071
SET CURRENT DECFLOAT ROUNDING MODE	Assigns a value to the CURRENT DECFLOAT ROUNDING MODE special register	"SET CURRENT DECFLOAT ROUNDING MODE" on page 1073
SET CURRENT DEGREE	Assigns a value to the CURRENT DEGREE special register	"SET CURRENT DEGREE" on page 1075
SET ENCRYPTION PASSWORD	Assigns a value to the default encryption password and default encryption password hint	"SET ENCRYPTION PASSWORD" on page 1083
SET PATH	Assigns a value to the CURRENT PATH special register	"SET PATH" on page 1103
SET SCHEMA	Assigns a value to the CURRENT SCHEMA special register	"SET SCHEMA" on page 1109
SET SESSION AUTHORIZATION	Changes the user of the job and the USER special register	"SET SESSION AUTHORIZATION" on page 1112

Table 50. SQL Embedded Host Language Statements

SQL Statement	Description	Page
BEGIN DECLARE SECTION	Marks the beginning of an SQL declare section	"BEGIN DECLARE SECTION" on page 618
CALL	Calls a procedure	"CALL" on page 620
DECLARE PROCEDURE	Defines an external procedure	"DECLARE PROCEDURE" on page 871
DECLARE STATEMENT	Declares the names used to identify prepared SQL statements	"DECLARE STATEMENT" on page 881
DECLARE VARIABLE	Declares a subtype or normalized other than the default for a host variable	"DECLARE VARIABLE" on page 883

Table 50. SQL Embedded Host Language Statements (continued)

SQL Statement	Description	Page
END DECLARE SECTION	Marks the end of an SQL declare section	"END DECLARE SECTION" on page 918
GET DIAGNOSTICS	Obtains information about the previously executed SQL statement	"GET DIAGNOSTICS" on page 943
INCLUDE	Inserts declarations into a source program	"INCLUDE" on page 992
SET OPTION	Establishes the options for processing SQL statements	"SET OPTION" on page 1085
SET RESULT SETS	Identifies the result sets in a procedure	"SET RESULT SETS" on page 1106
SIGNAL	Signals an error or warning condition	"SIGNAL" on page 1123
WHENEVER	Defines actions to be taken on the basis of SQL return codes	"WHENEVER" on page 1141

Table 51. SQL Control Statements

SQL Statement	Description	Page
assignment-statement	Assigns a value to an output parameter or to a local variable	"assignment-statement" on page 1153
CALL	Calls a procedure	"CALL statement" on page 1155
CASE	Selects an execution path based on multiple conditions	"CASE statement" on page 1158
compound-statement	Groups other statements together in an SQL routine	"compound-statement" on page 1160
FOR	Executes a statement for each row of a table	"FOR statement" on page 1170
GET DIAGNOSTICS	Obtains information about the previously executed SQL statement	"GET DIAGNOSTICS statement" on page 1172
GOTO	Branches to a user-defined label within an SQL routine or trigger	"GOTO statement" on page 1180
IF	Provides conditional execution based on the truth value of a condition	"IF statement" on page 1182
ITERATE	Causes the flow of control to return to the beginning of a labelled loop	"ITERATE statement" on page 1184
LEAVE	Continues execution by leaving a block or loop	"LEAVE statement" on page 1186
LOOP	Repeats the execution of a statement	"LOOP statement" on page 1188
REPEAT	Repeats the execution of a statement	"REPEAT statement" on page 1190
RESIGNAL	Resignals an error or warning condition	"RESIGNAL statement" on page 1192
RETURN	Returns from a routine	"RETURN statement" on page 1196
SIGNAL	Signals an error or warning condition	"SIGNAL statement" on page 1199

Table 51. SQL Control Statements (continued)

SQL Statement	Description	Page
WHILE	I	"WHILE statement" on
	while a specified condition is true	page 1203

How SQL statements are invoked

The SQL statements described in this chapter are classified as *executable* or *nonexecutable*. The *Invocation* section in the description of each statement indicates whether the statement is executable.

An executable statement can be invoked in any of the following ways:

- Embedded in an application program
- · Dynamically prepared and executed
- Issued interactively

Note: Statements embedded in REXX or processed using RUNSQLSTM are prepared and executed dynamically.

Depending on the statement, some or all of these methods can be used. The *Invocation* section in the description of each statement tells you which methods can be used.

A nonexecutable statement can only be embedded in an application program.

Embedding a statement in an application program

SQL statements can be included in a source program that will be submitted to the precompiler by using the CRTSQLCBL, CRTSQLCBLI, CRTSQLCI, CRTSQLCPPI, CRTSQLPLI, CRTSQLRPG, or CRTSQLRPGI commands. Such statements are said to be *embedded* in the program.

An embedded statement can be placed anywhere in the program where a host language statement is allowed. Each embedded statement must be preceded by a keyword (or keywords) to indicate that the statement is an SQL statement:

- In C, COBOL, PL/I, and RPG, each embedded statement must be preceded by the keywords EXEC and SQL.
- In Java, each embedded statement must be preceded by the keywords #sql.
- In REXX, each embedded statement must be preceded by the keyword EXECSQL.

Executable statements

An executable statement embedded in an application program is executed every time a statement of the host language would be executed if specified in the same place. This means that a statement within a loop is executed every time the loop is executed, and a statement within a conditional construct is executed only when the condition is satisfied.

An embedded statement can contain references to variables. A variable referenced in this way can be used in two ways:

 As input (the current value of the variable is used in the execution of the statement) |

• As output (the variable is assigned a new value as a result of executing the statement)

In particular, all references to variables in expressions and predicates are effectively replaced by current values of the variables; that is, the variables are used as input. The treatment of other references is described individually for each statement.

Follow all executable statements with a test of the SQL return state or the SQL return code. Alternatively, the WHENEVER statement (which is itself nonexecutable) can be used to change the flow of control immediately after the execution of an embedded statement.

Objects referenced in SQL statements need not exist when the statements are prepared.

Nonexecutable statements

An embedded nonexecutable statement is processed only by the precompiler. The precompiler reports any errors encountered in the statement. The statement is *never* executed, and acts as a no-operation if placed among executable statements of the application program. Therefore, do not follow such statements by a test of an SQL return code.

Dynamic preparation and execution

An application program can dynamically build an SQL statement in the form of a character string placed in a variable. In general, the statement is built from some data available to the program (for example, input from a workstation).

The statement can be prepared for execution using the (embedded) statement PREPARE and executed by the (embedded) statement EXECUTE. Alternatively, the (embedded) statement EXECUTE IMMEDIATE can be used to prepare and execute a statement in one step. In Java, the statement can be prepared for execution by means of the Statement, PreparedStatement, and CallableStatement classes, and executed by means of their respective execute() methods.

A statement that is dynamically prepared must not contain references to host variables. Instead, the statement can contain parameter markers. See "PREPARE" on page 1020 for rules concerning the parameter markers. When the prepared statement is executed, the parameter markers are effectively replaced by the current values of the variables specified in the EXECUTE statement. See "EXECUTE" on page 919 for rules concerning this replacement. After a statement is prepared, it can be executed several times with different values of variables. Parameter markers are not allowed in EXECUTE IMMEDIATE.

In C, COBOL, PL/I, REXX, and RPG, the successful or unsuccessful execution of the statement is indicated by the values returned in the stand-alone SQLCODE or SQLSTATE after the EXECUTE (or EXECUTE IMMEDIATE) statement. The SQL return code should be checked as described above for embedded statements. See the topic "SQL diagnostic information" on page 537 for more information. In Java, the successful or unsuccessful execution of the statement is handled by Java Exceptions.

Static invocation of a select-statement

A *select-statement* can be included as a part of the (nonexecutable) statement DECLARE CURSOR.

Such a statement is executed every time the cursor is opened by means of the (embedded) statement OPEN. After the cursor is open, the result table can be retrieved one row at a time by successive executions of the FETCH statement or multiple rows at a time by using the multiple-row FETCH statement.

Used in this way, the *select-statement* can contain references to variables. These references are effectively replaced by the values that the variables have at the moment of executing OPEN.

Dynamic invocation of a select-statement

An application program can dynamically build a *select-statement* in the form of a character string placed in a variable.

In general, the statement is built from some data available to the program (for example, a query obtained from a workstation). The statement is then executed every time the cursor is opened by means of the (embedded) statement OPEN. After the cursor is open, the result table can be retrieved one row at a time by successive executions of the FETCH statement or multiple rows at a time by using the multiple-row FETCH statement.

Used in this way, the *select-statement* must not contain references to variables. It can instead contain parameter markers. See "PREPARE" on page 1020 for rules concerning the parameter markers. The parameter markers are effectively replaced by the values of the variables specified in the OPEN statement. See "OPEN" on page 1015 for rules concerning this replacement.

Interactive invocation

A capability for entering SQL statements from a workstation is part of the architecture of the database manager. A statement entered in this way is said to be issued interactively.

A statement issued interactively must be an executable statement that does not contain parameter markers or references to variables, because these make sense only in the context of an application program.

The DB2 for i database provides the Start Structured Query Language (STRSQL) command, the Start Query Manager (STRQM) command, and the Run SQL Script support of System i Navigator for this facility. Other products are also available.

SQL diagnostic information

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The database manager uses a diagnostics area to store status information and diagnostic information about the execution of an executable SQL statement. When an SQL statement other than GET DIAGNOSTICS or *compound-statement* is processed, the current diagnostics area is cleared, before processing the SQL statement. As each SQL statement is processed, information about the execution of that SQL statement is recorded in the current diagnostics area as one or more completion conditions or exception conditions.

A completion condition indicates the SQL statement completed successfully, completed with a warning condition, or completed with a not found condition. An exception condition indicates that the statement was not successful. The GET DIAGNOSTICS statement can be used in most languages to return conditions and

SQL diagnostic information

other information about the previously executed SQL statement from the diagnostics area. For more information, see "GET DIAGNOSTICS" on page 943. Additionally, the condition information is provided through language specific mechanisms:

- For SQL procedures, SQL functions, and SQL triggers, see "SQL-procedure-statement" on page 1150.
- For host languages, see "Detecting and processing error and warning conditions in host language applications."

Detecting and processing error and warning conditions in host language applications

Each host language provides a mechanism for handling diagnostic information:

- In C, COBOL, and PL/I, an application program containing executable SQL statements must provide at least one of the following:
 - A structure named SQLCA.
 - A stand-alone CHAR(5) (CHAR(6) in C) variable named SQLSTATE.
 - A stand-alone integer variable named SQLCODE.

A stand-alone SQLSTATE or SQLCODE must not be declared in a host structure. Both a stand-alone SQLSTATE and SQLCODE may be provided.

An SQLCA can be obtained by using the INCLUDE SQLCA statement. If an SQLCA is provided, neither a stand-alone SQLSTATE or SQLCODE can be provided. The SQLCA includes a character-string variable named SQLSTATE and an integer variable named SQLCODE.

A stand-alone SQLSTATE should be used to conform with the SQL 2003 Core standard.

- In Java, for error conditions, the getSQLState method can be used to get the SQLSTATE and the getErrorCode method can be used to get the SQLCODE.
- In REXX and RPG, an SQLCA is provided automatically.

SQLSTATE

The database manager sets SQLSTATE after each SQL statement (other than GET DIAGNOSTICS or a compound statement) is executed. Thus, application programs can check the execution of SQL statements by testing SQLSTATE instead of SQLCODE.

SQLSTATE provides application programs with common codes for common error conditions. Furthermore, SQLSTATE is designed so that application programs can test for specific errors or classes of errors. The scheme is the same for all database managers and is based on the ISO/ANSI SQL 2003 Core standard. A complete list of SQLSTATE classes and SQLSTATEs associated with each SQLCODE is supplied in the SQL Messages and Codes topic collection.

SQLCODE

The database manager sets SQLCODE after each SQL statement (other than GET DIAGNOSTICS or a compound statement) is executed. SQLCODE is set as follows:

If SQLCODE = 0 and SQLWARN0 is blank, execution was successful.

Detecting and processing error and warning conditions in host language applications

- If SQLCODE = 100, no data was found. For example, a FETCH statement returned no data, because the cursor was positioned after the last row of the result table.
- If SQLCODE > 0 and not = 100, execution was successful with a warning.
- If SQLCODE = 0 and SQLWARN0 = 'W', execution was successful with a warning.
- If SQLCODE < 0, execution was not successful.

A complete listing of DB2 for i SQLCODEs and their corresponding SQLSTATEs is provided in the SQL Messages and Codes topic collection.

SQL comments

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In most host languages, static SQL statements can include host language or SQL comments. In Java and REXX, static SQL statements cannot include host language or SQL comments.

Dynamic SQL statements can include SQL comments.

There are two types of SQL comments:

simple comments

Simple comments are introduced by two consecutive hyphens.

bracketed comments

Bracketed comments are introduced by /* and end with */.

These rules apply to the use of simple comments:

- The two hyphens must be on the same line and must not be separated by a space.
- Simple comments can be started wherever a space is valid (except within a delimiter token or between 'EXEC' and 'SQL').
- Simple comments cannot be continued to the next line.
- In COBOL, the hyphens must be preceded by a space.

These rules apply to the use of bracketed comments:

- The /* must be on the same line and not separated by a space.
- The */ must be on the same line and not separated by a space.
- Bracketed comments can be started wherever a space is valid (except within a delimiter token or between 'EXEC' and 'SQL').
- Bracketed comments can be continued to the next line.
- Bracketed comments can be nested within other bracketed comments.

Example 1

This example shows how to include simple comments in a statement:

```
CREATE VIEW PRJ_MAXPER -- PROJECTS WITH MOST SUPPORT PERSONNEL

AS SELECT PROJNO, PROJNAME -- NUMBER AND NAME OF PROJECT
FROM PROJECT
WHERE DEPTNO = 'E21' -- SYSTEMS SUPPORT DEPT CODE
AND PRSTAFF > 1
```

SQL comments

Example 2

This example shows how to include bracketed comments in a statement: CREATE VIEW PRJ_MAXPER /* PROJECTS WITH MOST SUPPORT PERSONNEL AS SELECT PROJNO, PROJNAME /* NUMBER AND NAME OF PROJECT */ FROM PROJECT WHERE DEPTNO = 'E21' /* SYSTEMS SUPPORT DEPT CODE AND PRSTAFF > 1

ALLOCATE DESCRIPTOR

The ALLOCATE DESCRIPTOR statement allocates an SQL descriptor.

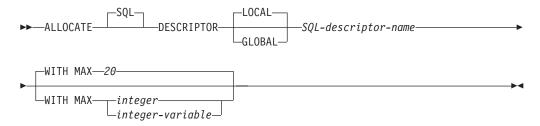
Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It cannot be issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

Authorization

None required.

Syntax



Description

LOCAL

Defines the scope of the name of the descriptor to be local to the program invocation. The descriptor will not be known outside this scope. For example, a program called from another separately compiled program cannot use a descriptor that was allocated by the calling program. The scope of the descriptor is also limited to the thread in which the program that contains the descriptor is running. For example, if the same program is running in two separate threads in the same job, the second thread cannot use a descriptor that was allocated by the first thread.

GLOBAL

Defines the scope of the name of the descriptor to be global to the SQL session. The descriptor will be known to any program that executes using the same database connection.

SQL-descriptor-name

Names the descriptor to allocate. The name must not be the same as a descriptor that already exists with the specified scope.

WITH MAX

The descriptor is allocated to support the specified maximum number of items. If this clause is not specified, the descriptor is allocated with a maximum of 20 items.

integer

Specifies the number of items to allocate. The value of *integer* must be greater than zero and not greater than 8000.

integer-variable

Specifies an integer variable (or decimal or numeric variable with zero

ALLOCATE DESCRIPTOR

scale) that contains the number of items to allocate. The value of integer-variable must be greater than zero and not greater than 8000.

Notes

Descriptor persistence: Local descriptors are implicitly deallocated based on the CLOSQLCSR option:

- For ILE programs, if CLOSQLCSR(*ENDACTGRP) is specified (the default), local descriptors are implicitly deallocated when the activation group ends. If CLOSQLCSR(*ENDMOD) is specified, local descriptors are implicitly deallocated on exit from the module.
- For OPM programs, if CLOSQLCSR(*ENDPGM) is specified (the default), local descriptors are implicitly deallocated when the program ends. If CLOSQLCSR(*ENDSQL) is specified, local descriptors are implicitly deallocated when the first SQL program on the call stack ends. If CLOSQLCSR(*ENDJOB) is specified, local descriptors are implicitly deallocated when the job ends.

Global descriptors are implicitly deallocated when the activation group ends.

Both local and global descriptors can be explicitly deallocated using the DEALLOCATE DESCRIPTOR statement.

Examples

Allocate a descriptor called 'NEWDA' large enough to hold 20 items.

EXEC SQL ALLOCATE DESCRIPTOR 'NEWDA' WITH MAX 20

ALTER FUNCTION (External Scalar)

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The ALTER FUNCTION (External Scalar) statement alters an external scalar function at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

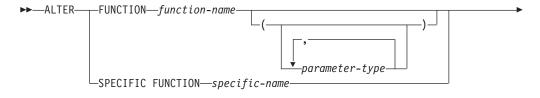
The privileges held by the authorization ID of the statement must include at least one of the following:

- For the function identified in the statement:
 - The ALTER privilege for the function, and
 - The system authority *EXECUTE on the library containing the function.
- Administrative authority

If a different external program is specified, the privileges held by the authorization ID of the statement must also include the same privileges required to create a new external scalar function. For more information, see "CREATE FUNCTION (External Scalar)" on page 659.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax





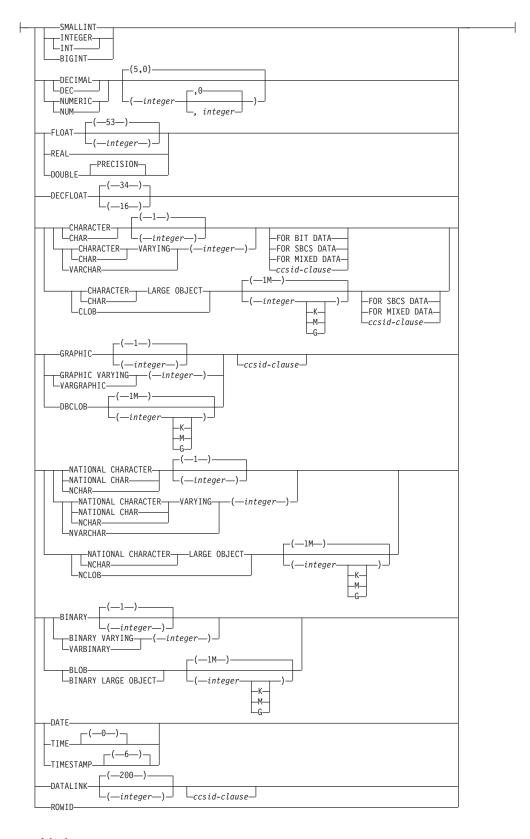
parameter-type:

data-type:

```
-__built-in-type-
distinct-type-name-
```

ALTER FUNCTION (External Scalar)

option-list: -LANGUAGE -PARAMETER STYLE SQL--C++ -PARAMETER STYLE GENERAL--CL--PARAMETER STYLE GENERAL WITH NULLS--PARAMETER STYLE JAVA--COBOL--COBOLLE--PARAMETER STYLE DB2GENERAL--JAVA--PLI--REXX--RPG-∟RPGLE-(1) -NOT DETERMINISTIC--MODIFIES SQL DATA--DETERMINISTIC--READS SQL DATA--CONTAINS SQL-∟NO SQL— └INHERIT SPECIAL REGISTERS -CALLED ON NULL INPUT--RETURNS NULL ON NULL INPUT--STATIC DISPATCH⊸ -NO DBINFO--EXTERNAL ACTION--FENCED-└─DBINFO-└NO EXTERNAL ACTION └NOT FENCED -NO FINAL CALL-–<code>EXTERNAL</code> <code>NAME</code>-<code>external-program-name</code>-<code> $\!$ </code> └-FINAL CALL--ALLOW PARALLEL--NO SCRATCHPAD-LDISALLOW PARALLEL--100-└─SCRATCHPAD--integer-**Notes:** The clauses in the *option-list* can be specified in any order. built-in-type:



ccsid-clause:

I

--CCSID--integer--

ALTER FUNCTION (External Scalar)

Description

FUNCTION or SPECIFIC FUNCTION

Identifies the function to alter. *function-name* must identify an external scalar function that exists at the current server. It cannot identify a built-in function, a sourced function, or an SQL function. An external table function cannot be altered to be an external scalar function.

The specified function is altered. The owner of the function is preserved. If the external program or service program exists at the time the function is altered, all privileges on the function are preserved.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (*parameter-type,...*)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type,...*) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance which is being altered. Synonyms for data types are considered a match.

If *function-name*() is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type,...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its precision value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

I AS LOCATOR or a distinct type based on a LOB. **SPECIFIC FUNCTION** specific-name a specific function that exists at the current server. **ALTER** option-list each option. RESTRICT function, procedure, or materialized query table. **Notes** I while preserving the privileges on the function. be used: NOT DETERMINISTIC and DETERMINISTIC. • The keywords SIMPLE CALL can be used as a synonym for GENERAL. The keyword DB2GENRL may be used as a synonym for DB2GENERAL. The value DB2SQL may be used as a synonym for SQL. optional. DETERMINISTIC. Example I

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB

Identifies the function by its specific name. The specific-name must identify

Indicates that one or more of the options of the function are to be altered. If an option is not specified, the value from the existing function definition is used. See "CREATE FUNCTION (External Scalar)" on page 659 for a description of

Indicates that the function will not be altered if it is referenced by any view,

General considerations for defining or replacing functions: See CREATE FUNCTION (External Scalar) for general information about defining a function. ALTER FUNCTION (External Scalar) allows individual attributes to be altered

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not

- The keywords VARIANT and NOT VARIANT can be used as synonyms for
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.

- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are
- The keywords IS DETERMINISTIC may be used as a synonym for

The function MAIL() has been thoroughly tested. To improve its performance, alter the function to be not fenced.

ALTER FUNCTION MAIL() NOT FENCED

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ALTER FUNCTION (External Table)

The ALTER FUNCTION (External Table) statement alters an external table function at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

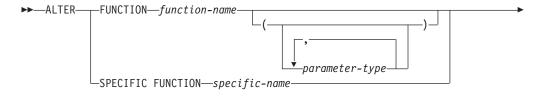
The privileges held by the authorization ID of the statement must include at least one of the following:

- · For the function identified in the statement:
 - The ALTER privilege for the function, and
 - The system authority *EXECUTE on the library containing the function.
- Administrative authority

If a different external program is specified, the privileges held by the authorization ID of the statement must also include the same privileges required to create a new external table function. For more information, see "CREATE FUNCTION (External Table)" on page 677.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax





parameter-type:

```
-data-type-AS LOCATOR-
```

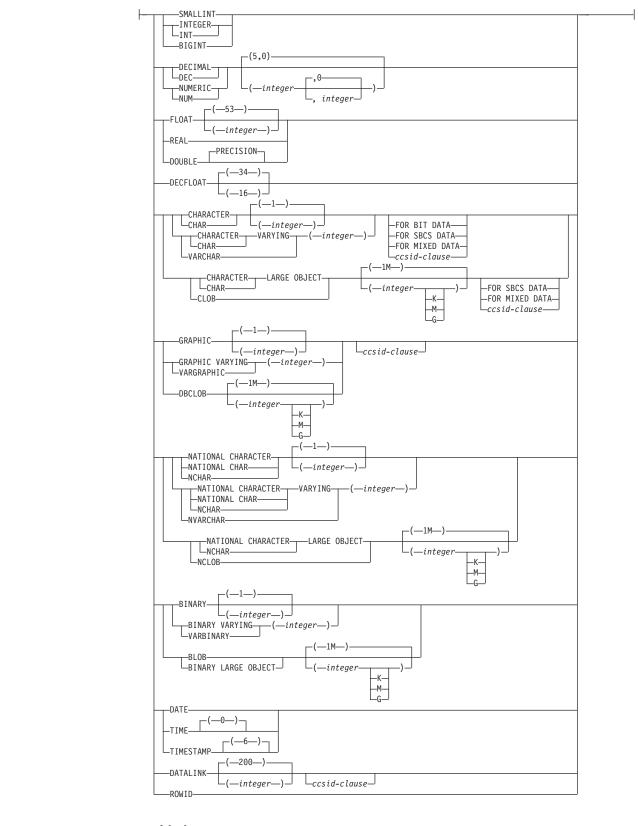
data-type:

option-list: -LANGUAGE -PARAMETER STYLE DB2SQL--C++ PARAMETER STYLE DB2GENERAL--CL--COBOL--COBOLLE--JAVA--PLI--REXX--RPG-RPGLE-(1) -NOT DETERMINISTIC--MODIFIES SQL DATA-└─DETERMINISTIC--READS SQL DATA--CONTAINS SQL--NO SQL--CALLED ON NULL INPUT-└INHERIT SPECIAL REGISTERS dashRETURNS NULL ON NULL INPUT--STATIC DISPATCH--NO DBINFO--EXTERNAL ACTION--FENCED-LDBINFO--NO EXTERNAL ACTION-└NOT FENCED -NO FINAL CALL-—EXTERNAL NAME—external-program-name— └-FINAL CALL--ALLOW PARALLEL -NO SCRATCHPAD- \sqcup CARDINALITY $_$ bigint $_$ LDISALLOW PARALLEL--100-∟SCRATCHPAD--integer-**Notes:** The clauses in the *option-list* can be specified in any order.

built-in-type:

ALTER FUNCTION (External Table)

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ccsid-clause:

---CCSID--integer----

Description

FUNCTION or SPECIFIC FUNCTION

Identifies the function to alter. *function-name* must identify an external table function that exists at the current server. It cannot identify a built-in function, a sourced function, or an SQL function. An external scalar function cannot be altered to be an external table function.

The specified function is altered. The owner of the function is preserved. If the external program or service program exists at the time the function is altered, all privileges on the function are preserved.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type,...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type,...*) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance which is being altered. Synonyms for data types are considered a match.

If *function-name()* is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type,...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its precision value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement.

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ALTER FUNCTION (External Table)

Specifying the FOR DATA clause or CCSID clause is optional.

Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC FUNCTION specific-name

Identifies the function by its specific name. The *specific-name* must identify a specific function that exists at the current server.

ALTER option-list

Indicates that one or more of the options of the function are to be altered. If an option is not specified, the value from the existing function definition is used. See "CREATE FUNCTION (External Table)" on page 677 for a description of each option.

RESTRICT

Indicates that the function will not be altered if it is referenced by any view, function, procedure, or materialized query table.

Notes

General considerations for defining or replacing functions: See CREATE FUNCTION (External Table) for general information about defining a function. ALTER FUNCTION (External Table) allows individual attributes to be altered while preserving the privileges on the function.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The keyword DB2GENRL may be used as a synonym for DB2GENERAL.
- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are optional.
- The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.

Example

Modify the definition for an external table function to set the estimated cardinality to 10,000.

ALTER FUNCTION GET_TABLE
ALTER CARDINALITY 10000

ALTER FUNCTION (SQL Scalar)

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The ALTER FUNCTION (SQL Scalar) statement alters an SQL scalar function at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

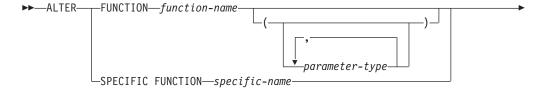
The privileges held by the authorization ID of the statement must include at least one of the following:

- For the function identified in the statement:
 - The ALTER privilege for the function, and
 - The system authority *EXECUTE on the library containing the function.
- Administrative authority

If a different external program is specified, the privileges held by the authorization ID of the statement must also include the same privileges required to create a new external scalar function. For more information, see "CREATE FUNCTION (SQL Scalar)" on page 703.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

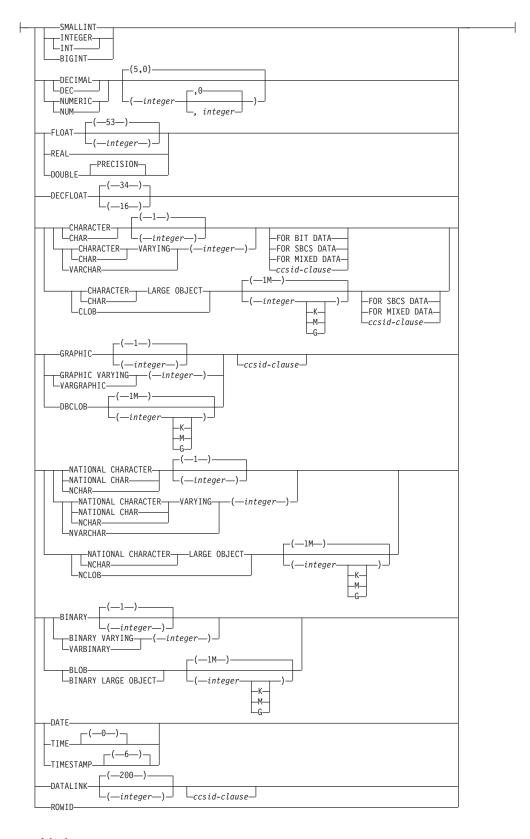




parameter-type:

ALTER FUNCTION (SQL Scalar)

data-type1, data-type2,data-type3: -built-in-type--distinct-type-nameroutine-specification: -)—RETURNS—data-type2-–option-list— -parameter-declaration -SQL-routine-body--SET OPTION-statement parameter-declaration: ---parameter-name--data-type3-**SQL-routine-body:** option-list: -LANGUAGE SQL--NOT DETERMINISTIC--READS SQL DATA-(1) -DETERMINISTIC--MODIFIES SQL DATA-└CONTAINS SQL--CALLED ON NULL INPUT-—INHERIT SPECIAL REGISTERS--RETURNS NULL ON NULL INPUT— -FENCED--STATIC DISPATCH— -EXTERNAL ACTION-└NOT FENCED └NO EXTERNAL ACTION -ALLOW PARALLEL--DISALLOW PARALLEL-**Notes:** The clauses in the *option-list* can be specified in any order. built-in-type:



ccsid-clause:

I

--CCSID-integer--

ALTER FUNCTION (SQL Scalar)

Description

FUNCTION or SPECIFIC FUNCTION

Identifies the function to alter. *function-name* must identify an SQL scalar function that exists at the current server.

The specified function is altered. The owner of the function and all privileges on the function are preserved.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type,...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type,...*) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance which is being altered. Synonyms for data types are considered a match.

If *function-name()* is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type,...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its precision value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either

clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement. AS LOCATOR Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. **SPECIFIC FUNCTION** specific-name Identifies the function by its specific name. The specific-name must identify a specific function that exists at the current server. **ALTER** option-list Indicates that one or more of the options of the function are to be altered. If ALTER FUNCTION ALTER option-list is specified and an option is not specified, the value from the existing function definition is used. See "CREATE FUNCTION (SQL Scalar)" on page 703 for a description of each option. **REPLACE** routine-specification Indicates that the existing function definition, including options and parameters, is to be replaced by those specified in this statement. The values of all options are replaced when a function is replaced. If an option is not specified, the same default is used as when a new SQL scalar function is created, for more information see "CREATE FUNCTION (SQL Scalar)" on page 703. RESTRICT Indicates that the function will not be altered or replaced if it is referenced by any function, materialized query table, procedure, trigger, or view. (parameter-declaration,...) Specifies the number of parameters of the function, the data type of each parameter, and the name of each parameter. The maximum number of parameters allowed in an SQL function is 90. parameter-name Names the parameter. The name is used to refer to the parameter within the body of the function. The name cannot be the same as any other parameter-name in the parameter list. data-type3 Specifies the data type of the input parameter. If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked. **RETURNS** Specifies the output of the function. data-type2 I Specifies the data type and attributes of the output. You can specify any built-in data type (except LONG VARCHAR, or LONG VARGRAPHIC) or a distinct type. If a CCSID is specified and the CCSID of the return data is encoded in a ı different CCSID, the data is converted to the specified CCSID. If a CCSID is not specified the return data is converted to the CCSID of the ı job (or associated graphic CCSID of the job for graphic string return values), if the CCSID of the return data is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider

ALTER FUNCTION (SQL Scalar)

explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data). option-list List of options for the function being altered. These options are the same ones that are listed above under ALTER option-list. If a specific option is not specified, the same default that is used when a new function is created is used. For more information see "CREATE FUNCTION (SQL Scalar)" on page 703. SET OPTION-statement Specifies the options that will be used to create the function. For example, to create a debuggable function, the following statement could be included: SET OPTION DBGVIEW = *SOURCE For more information, see "SET OPTION" on page 1085. The options CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the ALTER FUNCTION statement. *SQL-routine-body* Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL functions. A call to a procedure that issues a CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, and SET TRANSACTION statement is not allowed in a function. The SQL-routine-body must contain at least one RETURN statement and a RETURN statement must be executed when the function is called. ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*. **Notes** General considerations for defining or replacing functions: See CREATE FUNCTION (SQL Scalar) for general information about defining a function. ALTER FUNCTION (SQL Scalar) allows individual attributes to be altered while preserving the privileges on the function. Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used: The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC. The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT. The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC. Example

Modify the definition for an SQL scalar function to indicate that the function is

deterministic.

ALTER FUNCTION (SQL Scalar)

 $\textbf{ALTER} \ \ \textbf{FUNCTION} \ \ \texttt{MY}_\texttt{UDF1}$ DETERMINISTIC

ALTER FUNCTION (SQL Table)

The ALTER FUNCTION (SQL Table) statement alters an SQL table function at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

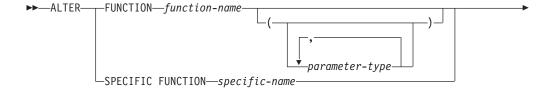
The privileges held by the authorization ID of the statement must include at least one of the following:

- For the function identified in the statement:
 - The ALTER privilege for the function, and
 - The system authority *EXECUTE on the library containing the function.
- Administrative authority

If a different external program is specified, the privileges held by the authorization ID of the statement must also include the same privileges required to create a new external table function. For more information, see "CREATE FUNCTION (SQL Table)" on page 713.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax





parameter-type:

```
-data-type1--AS_LOCATOR-
```

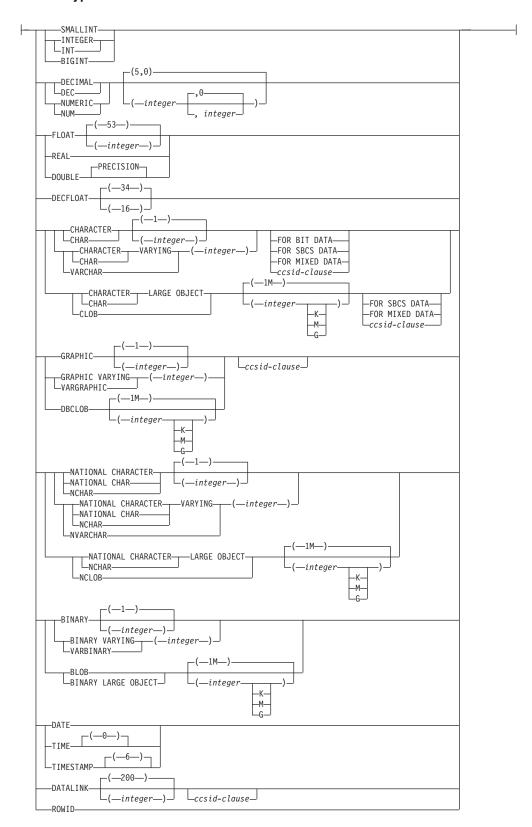
data-type1, data-type2, data-type3: -built-in-type--distinct-type-nameroutine-specification: -parameter-declaration-►—RETURNS TABLE—(--column-name——data-type2 option-list--SQL-routine-body--SET OPTION-statement parameter-declaration: —parameter-name—data-type3— **SQL-routine-body**: ----SQL-control-statementoption-list: -LANGUAGE SQL \neg (1) _NOT DETERMINISTIC--READS SQL DATA--DETERMINISTIC--MODIFIES SQL DATA--CONTAINS SQL--CALLED ON NULL INPUT--INHERIT SPECIAL REGISTERS--RETURNS NULL ON NULL INPUT^{__} STATIC DISPATCH--EXTERNAL ACTION--FENCED--NO EXTERNAL ACTION— ⊓ └NOT FENCED -ALLOW PARALLEL--CARDINALITY—bigint--DISALLOW PARALLEL **Notes:**

The clauses in the *option-list* can be specified in any order.

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ALTER FUNCTION (SQL Table)

built-in-type:



ccsid-clause:

--CCSID--integer-----

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Description

FUNCTION or SPECIFIC FUNCTION

Identifies the function to alter. *function-name* must identify an SQL table function that exists at the current server.

The specified function is altered. The owner of the function and all privileges on the function are preserved.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type,...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type,...*) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance which is being altered. Synonyms for data types are considered a match.

If *function-name*() is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type,...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its precision value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type

ALTER FUNCTION (SQL Table) are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement. AS LOCATOR Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. **SPECIFIC FUNCTION** specific-name Identifies the function by its specific name. The specific-name must identify a specific function that exists at the current server. **ALTER** option-list Indicates that one or more of the options of the function are to be altered. If ALTER FUNCTION ALTER option-list is specified and an option is not specified, the value from the existing function definition is used. See "CREATE FUNCTION (SQL Table)" on page 713 for a description of each option.

REPLACE routine-specification

Indicates that the existing function definition, including options and parameters, is to be replaced by those specified in this statement. The values of all options are replaced when a function is replaced. If an option is not specified, the same default is used as when a new SQL table function is created, for more information see "CREATE FUNCTION (SQL Table)" on page 713.

RESTRICT

Indicates that the function will not be altered or replaced if it is referenced by any function, materialized query table, procedure, trigger, or view.

(parameter-declaration,...)

Specifies the number of parameters of the function, the data type of each parameter, and the name of each parameter.

The maximum number of parameters allowed in an SQL function is 90.

parameter-name

Names the parameter. The name is used to refer to the parameter within the body of the function. The name cannot be the same as any other *parameter-name* in the parameter list.

data-type3

Specifies the data type of the input parameter. If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

RETURNS TABLE

Specifies the output table of the function.

Assume the number of parameters is N. There must be no more than (247-(N*2))/2 columns.

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column-name

Specifies the name of a column of the output table. Do not specify the same name more than once.

data-type2

Specifies the data type and attributes of the output.

You can specify any built-in data type (except LONG VARCHAR, or LONG VARGRAPHIC) or a distinct type.

If a CCSID is specified and the CCSID of the return data is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified the return data is converted to the CCSID of the job (or associated graphic CCSID of the job for graphic string return values), if the CCSID of the return data is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

option-list

List of options for the function being altered. These options are the same ones that are listed above under ALTER *option-list*. If a specific option is not specified, the same default that is used when a new function is created is used. For more information see "CREATE FUNCTION (SQL Table)" on page 713.

SET OPTION-statement

Specifies the options that will be used to create the function. For example, to create a debuggable function, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the ALTER FUNCTION statement.

SQL-routine-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL functions.

A call to a procedure that issues a CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, and SET TRANSACTION statement is not allowed in a function.

The *SQL-routine-body* must contain at least one RETURN statement and a RETURN statement must be executed when the function is called.

ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*.

Notes

General considerations for defining or replacing functions: See CREATE FUNCTION (SQL Table) for general information about defining a function. ALTER FUNCTION (SQL Table) allows individual attributes to be altered while preserving the privileges on the function.

ALTER FUNCTION (SQL Table)

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.

Example

Modify the definition for an SQL table function to set the estimated cardinality to 10,000.

ALTER FUNCTION GET_TABLE
ALTER CARDINALITY 10000

ALTER PROCEDURE (External)

The ALTER PROCEDURE (External) statement alters an external procedure at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

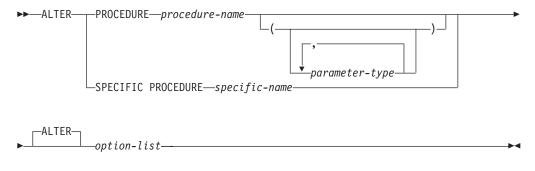
- For the procedure identified in the statement:
 - The ALTER privilege for the procedure, and
 - The system authority *EXECUTE on the library containing the procedure.
- Administrative authority

If a different external program is specified, the privileges held by the authorization ID of the statement must also include the same privileges required to create a new external procedure. For more information, see "CREATE PROCEDURE (External)" on page 731.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

I



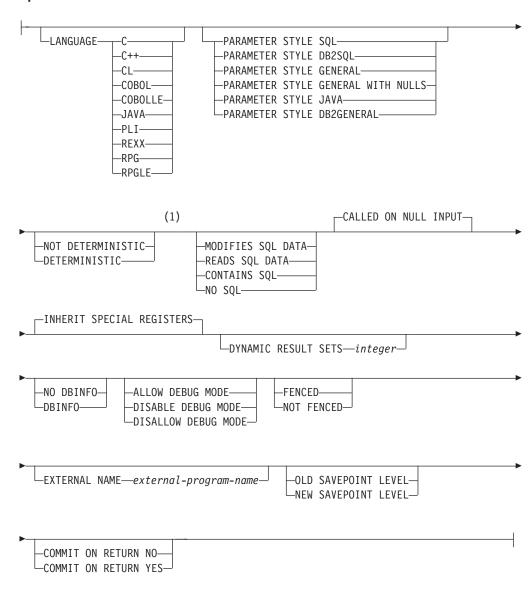
parameter-type:

data-type:

```
___built-in-type______distinct-type-name__
```

ALTER PROCEDURE (External)

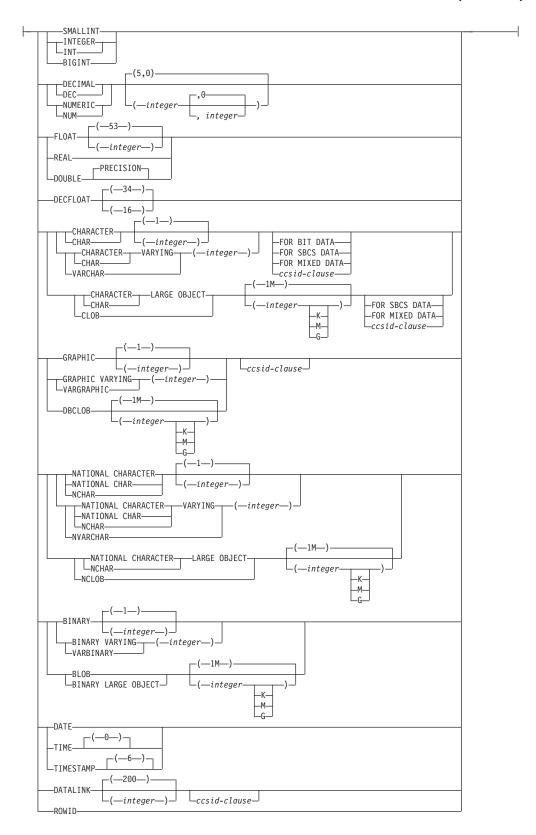
option-list:



Notes:

1 The clauses in the *option-list* can be specified in any order.

built-in-type:



ccsid-clause:

I

I

---CCSID---integer----

ALTER PROCEDURE (External)

Description

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure to alter. *procedure-name* must identify an external procedure that exists at the current server.

The specified procedure is altered. The owner of the procedure is preserved. If the external program or service program exists at the time the procedure is altered, all privileges on the procedure are preserved.

PROCEDURE procedure-name

Identifies the procedure by its name. The *procedure-name* must identify exactly one external procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE *procedure-name* (*parameter-type,...*)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The *procedure-name* (*parameter-type,...*) must identify an external procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types and the logical concatenation of the data types is used to identify the specific procedure instance which is being altered. Synonyms for data types are considered a match.

If *procedure-name()* is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type,...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the
 attribute when determining whether the data types match. For
 example, DEC() will be considered a match for a parameter of a
 procedure defined with a data type of DEC(7,2). However, FLOAT
 cannot be specified with empty parenthesis because its precision
 value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC PROCEDURE specific-name

Identifies the procedure by its specific name. The *specific-name* must identify a specific procedure that exists at the current server.

ALTER option-list

Indicates that one or more of the options of the procedure are to be altered. If an option is not specified, the value from the existing procedure definition is used. See "CREATE PROCEDURE (External)" on page 731 for a description of each option.

Notes

General considerations for defining or changing a procedure: See CREATE PROCEDURE for general information about defining a procedure. ALTER PROCEDURE (External) allows individual attributes to be altered while preserving the privileges on the procedure.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL can be used as synonyms for CALLED ON NULL INPUT.
- DYNAMIC RESULT SET, RESULT SETS, and RESULT SET may be used as synonyms for DYNAMIC RESULT SETS.

Examples

Modify the definition for procedure MYPROC to change the name of the external program that is invoked when the procedure is called. The name of the external program is PROG10A.

ALTER PROCEDURE MYPROC EXTERNAL NAME PROG10A

| | | |

The ALTER PROCEDURE (SQL) statement alters a procedure at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

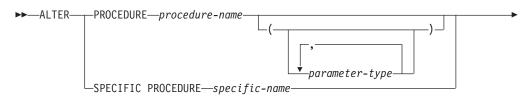
- For the procedure identified in the statement:
 - The ALTER privilege for the procedure, and
 - The system authority *EXECUTE on the library containing the procedure.
- · Administrative authority

If a distinct type is referenced in a parameter-declaration, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

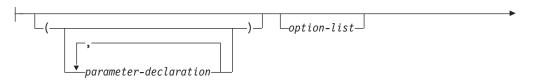
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax





routine-specification:



parameter-declaration:

```
-OUT-INOUT-parameter-name-data-type-
```

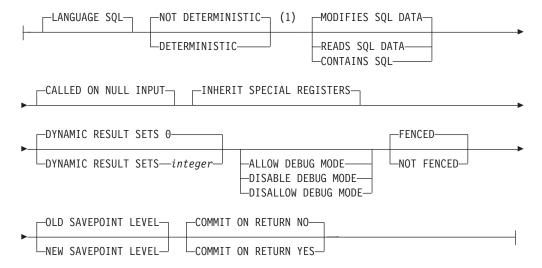
parameter-type:

```
---data-type---
```

data-type:

```
___built-in-type_______
```

option-list:



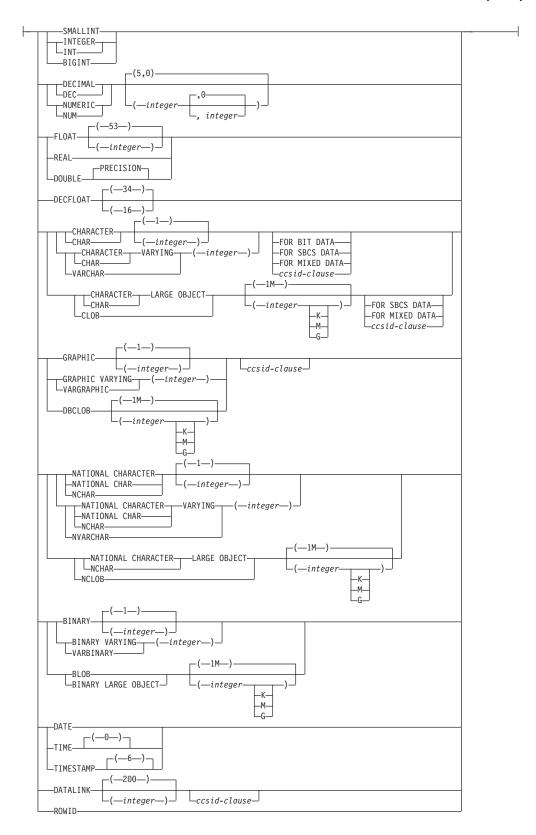
Notes:

1 The clauses in the *option-list* can be specified in any order.

SQL-routine-body:

CO1t1tt
SQL-control-statement
—ALLOCATE DESCRIPTOR-statement
—ALTER FUNCTION-statement—
—ALTER PROCEDURE-statement—
-ALTER SEQUENCE-statement-
—ALTER TABLE-statement—
COMMENT-statement-
-COMMIT-statement
CONNECT-statement
—CREATE ALIAS-statement—
—CREATE FUNCTION (External Scalar)-statement—
—CREATE FUNCTION (External Table)-statement—
—CREATE FUNCTION (Sourced)-statement—
—CREATE INDEX-statement—
—CREATE PROCEDURE (External)-statement—
—CREATE SCHEMA-statement—
-CREATE SEQUENCE-statement-
-CREATE TABLE-statement-
—CREATE TYPE-statement—
-CREATE VIEW-statement-
—DEALLOCATE DESCRIPTOR-statement—
—DECLARE GLOBAL TEMPORARY TABLE-statement—
—DELETE-statement
—DESCRIBE-statement—
—DESCRIBE INPUT-statement—
—DESCRIBE TABLE-statement—
—DISCONNECT-statement—
-DROP-statement
-EXECUTE IMMEDIATE-statement-
GET DESCRIPTOR-statement
-GRANT-statement
-INSERT-statement-
-LABEL-statement
LOCK TABLE-statement
REFRESH TABLE-statement
-RELEASE-statement
-RELEASE SAVEPOINT-statement-
—RENAME-statement—
—REVOKE-statement—
—ROLLBACK-statement—
—SAVEPOINT-statement—
—SELECT INTO-statement—
—SET CONNECTION-statement—
—SET CURRENT DEBUG MODE-statement—
—SET CURRENT DECFLOAT ROUNDING MODE-statement—
—SET CURRENT DEGREE-statement—
—SET DESCRIPTOR-statement—
—SET ENCRYPTION PASSWORD-statement—
—SET PATH-statement—
—SET RESULT SETS-statement—
—SET SCHEMA-statement—
SET TRANSACTION-statement
—UPDATE-statement
VALUES INTO-statement—

built-in-type:



ccsid-clause:

I

١

---CCSID---integer----

Description

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure to alter. *procedure-name* must identify an SQL procedure that exists at the current server.

The specified procedure is altered. The owner of the procedure and all privileges on the procedure are preserved.

PROCEDURE procedure-name

Identifies the procedure by its name. The *procedure-name* must identify exactly one SQL procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE procedure-name (parameter-type,...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The *procedure-name* (*parameter-type,...*) must identify an SQL procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types and the logical concatenation of the data types is used to identify the specific procedure instance which is being altered. Synonyms for data types are considered a match.

If *procedure-name()* is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type,...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parenthesis indicates that the database manager ignores the
 attribute when determining whether the data types match. For
 example, DEC() will be considered a match for a parameter of a
 procedure defined with a data type of DEC(7,2). However, FLOAT
 cannot be specified with empty parenthesis because its precision
 value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either

clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC PROCEDURE specific-name

Identifies the procedure by its specific name. The specific-name must identify a specific procedure that exists at the current server.

ALTER option-list

Indicates that one or more of the options of the procedure are to be altered. If ALTER PROCEDURE ALTER option-list is specified and an option is not specified, the value from the existing procedure definition is used. See "CREATE PROCEDURE (SQL)" on page 745 for a description of each option.

REPLACE routine-specification

Indicates that the existing procedure definition, including options and parameters, is to be replaced by those specified in this statement. The values of all options are replaced when a procedure is replaced. If an option is not specified, the same default is used as when a new SQL procedure is created, for more information see "CREATE PROCEDURE (SQL)" on page 745.

(parameter-declaration,...)

Specifies the number of parameters of the procedure, the data type of each parameter, and the name of each parameter. A parameter for a procedure can be used for input only, for output only, or for both input and output.

The maximum number of parameters allowed in an SQL procedure is 1024.

IN Identifies the parameter as an input parameter to the procedure.

OUT

Identifies the parameter as an output parameter that is returned by the procedure. If the parameter is not set within the procedure, the null value is returned.

INOUT

Identifies the parameter as both an input and output parameter for the procedure. If the parameter is not set within the procedure, its input value is returned.

parameter-name

Names the parameter for use as an SQL variable. The name cannot be the same as any other parameter-name for the procedure.

data-type

Specifies the data type of the parameter. If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the procedure. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the procedure is called.

option-list

List of options for the procedure being altered. These options are the same ones that are listed above under ALTER option-list. If a specific option is not specified, the same default that is used when a new procedure is created is used. For more information see "CREATE PROCEDURE (SQL)" on page 745.

SET OPTION-statement

Specifies the options that will be used to create the procedure. For example, to create a debuggable procedure, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CLOSQLCSR, CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the ALTER PROCEDURE statement.

SQL-routine-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL procedures.

CONNECT, SET CONNECTION, RELEASE, DISCONNECT, and SET TRANSACTION statements are not allowed in a procedure that is running on a remote application server. COMMIT and ROLLBACK statements are not allowed in an ATOMIC SQL procedure or in a procedure that is running on a connection to a remote application server.

ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*.

Notes

General considerations for defining or replacing procedures: See CREATE PROCEDURE for general information about defining a procedure. ALTER PROCEDURE (SQL) allows individual attributes or the routine specification to be altered while preserving the privileges on the procedure.

Alter Procedure Replace considerations: When an SQL procedure definition is replaced, SQL creates a temporary source file that will contain C source code with embedded SQL statements. A program object is then created using the CRTPGM command. The SQL options used to create the program are the options that are in effect at the time the ALTER PROCEDURE (SQL) statement is executed. The program is created with ACTGRP(*CALLER).

When an SQL procedure is altered, a new *PGM object is created and the procedure's attributes are stored in the created program object. If the *PGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

The specific name is used as the name of the member in the source file and the name of the program object, if it is a valid system name. If the procedure name is not a valid system name, a unique name is generated. If a source file member with the same name already exists, the member is overlaid. If a module or a program with the same name already exists, the objects are not overlaid, and a unique name is generated. The unique names are generated according to the rules for generating system table names.

Target release considerations: When an SQL procedure definition is replaced, the target release will be the current release in which the ALTER statement is executed unless the user explicitly specifies a different target release. The target release can be explicitly specified using the TGTRLS keyword in the SET OPTION statement.

If the ALTER is specified in the source for a RUNSQLSTM or CRTSQLxxx command, the TGTRLS keyword can also be specified on the command.

If the procedure definition is not replaced, the target release of the existing procedure will be preserved unless the target release level of the procedure is earlier than the earliest supported release level. In this case, the target release will be changed to the earliest supported release level.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL can be used as synonyms for CALLED ON NULL INPUT.
- DYNAMIC RESULT SET, RESULT SETS, and RESULT SET may be used as synonyms for DYNAMIC RESULT SETS.

Examples

Modify the definition for an SQL procedure so that SQL changes are committed on return from the SQL procedure.

ALTER PROCEDURE UPDATE_SALARY_2
ALTER COMMIT ON RETURN YES

ALTER SEQUENCE

The ALTER SEQUENCE statement can be used to change a sequence.

The ALTER SEQUENCE statement can be used to change a sequence in any of these ways:

- Restarting the sequence
- · Changing the increment between future sequence values
- · Setting or eliminating the minimum or maximum values
- Changing the number of cached sequence numbers
- Changing the attribute that determines whether the sequence can cycle or not
- Changing whether sequence numbers must be generated in order of request

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the sequence identified in the statement:
 - The system authority *EXECUTE on the library containing the sequence
 - The ALTER privilege for the sequence
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE to the Change Data Area (CHGDTAARA) command
 - *USE to the Retrieve Data Area (RTVDTAARA) command
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSSEQOBJECTS catalog table:
 - The UPDATE privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

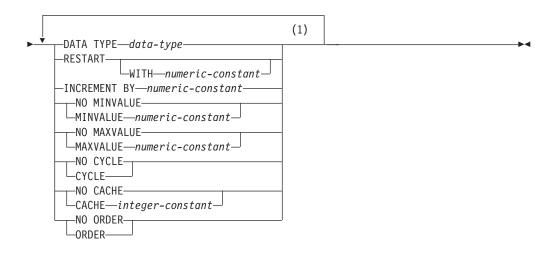
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information on the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Sequence, Corresponding System Authorities When Checking Privileges to a Table or View, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

►►—ALTER SEQUENCE—sequence-name—



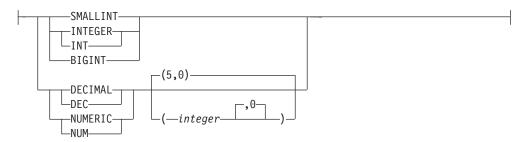
Notes:

1 The same clause must not be specified more than once.

data-type:

```
-__built-in-type-distinct-type-name-
```

built-in-type:



Description

sequence-name

Identifies the sequence to be altered. The name must identify a sequence that already exists at the current server.

DATA TYPE data-type

Specifies the new data type to be used for the sequence value. The data type can be any exact numeric type (SMALLINT, INTEGER, BIGINT, DECIMAL, or

NUMERIC) with a scale of zero, or a user-defined distinct type for which the source type is an exact numeric type with a scale of zero.

Each of the existing START WITH, INCREMENT BY, MINVALUE, and MAXVALUE attributes that are not changed by the ALTER SEQUENCE statement must contain a value that could be assigned to a column of the data type associated with the new data type.

built-in-type

Specifies the new built-in data type used as the basis for the internal representation of the sequence. If the data type is DECIMAL or NUMERIC, the precision must be less than or equal to 63 and the scale must be 0. See "CREATE TABLE" on page 768 for a more complete description of each built-in data type.

For portability of applications across platforms, use DECIMAL instead of a NUMERIC data type.

distinct-type-name

Specifies that the new data type of the sequence is a distinct type (a user-defined data type). If the source type is DECIMAL or NUMERIC, the precision of the sequence is the precision of the source type of the distinct type. The precision of the source type must be less than or equal to 63 and the scale must be 0. If a distinct type name is specified without a schema name, the distinct type name is resolved by searching the schemas on the SQL path.

RESTART

Restarts the sequence. If *numeric-constant* is not specified, the sequence is restarted at the value specified implicitly or explicitly as the starting value on the CREATE SEQUENCE statement that originally created the sequence.

WITH numeric-constant

Restarts the sequence with the specified value. This value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence, without nonzero digits to the right of the decimal point.

INCREMENT BY numeric-constant

Specifies the interval between consecutive values of the sequence. This value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence, and does not exceed the value of a large integer constant, without nonzero digits existing to the right of the decimal point.

If this value is negative, then this is a descending sequence. If this value is 0 or positive, this is an ascending sequence after the ALTER statement.

NO MINVALUE or MINVALUE

Specifies the minimum value at which a descending sequence either cycles or stops generating values, or an ascending sequence cycles to after reaching the maximum value.

NO MINVALUE

For an ascending sequence, the value is the original starting value. For a descending sequence, the value is the minimum value of the data type (and precision, if DECIMAL or NUMERIC) associated with the sequence.

MINVALUE numeric-constant

Specifies the numeric constant that is the minimum value that is generated for this sequence. This value can be any positive or negative value that could be assigned to a column of the data type associated with the

sequence and without non-zero digits to the right of the decimal point. The value must be less than or equal to the maximum value.

NO MAXVALUE or MAXVALUE

Specifies the maximum value at which an ascending sequence either cycles or stops generating values, or a descending sequence cycles to after reaching the minimum value.

NO MAXVALUE

For an ascending sequence, the value is the maximum value of the data type (and precision, if DECIMAL or NUMERIC) associated with the sequence. For a descending sequence, the value is the original starting value.

MAXVALUE numeric-constant

Specifies the numeric constant that is the maximum value that is generated for this sequence. This value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence and without non-zero digits to the right of the decimal point. The value must be greater than or equal to the minimum value.

CYCLE or NO CYCLE

Specifies whether this sequence should continue to generate values after reaching either the maximum or minimum value of the sequence.

NO CYCLE

Specifies that values will not be generated for the sequence once the maximum or minimum value for the sequence has been reached.

CYCLE

Specifies that values continue to be generated for this sequence after the maximum or minimum value has been reached. If this option is used, after an ascending sequence reaches the maximum value of the sequence, it generates its minimum value. After a descending sequence reaches its minimum value of the sequence, it generates its maximum value. The maximum and minimum values for the sequence determine the range that is used for cycling.

When CYCLE is in effect, duplicate values can be generated for a sequence by the database manager.

CACHE or NO CACHE

Specifies whether to keep some preallocated values in memory. Preallocating and storing values in the cache improves the performance of the NEXT VALUE sequence expression.

CACHE *integer-constant*

Specifies the maximum number of sequence values that are preallocated and kept in memory. Preallocating and storing values in the cache reduces synchronous I/O when values are generated for the sequence.

In certain situations, such as system failure, all cached sequence values that have not been used in committed statements are lost, and thus, will never be used. The value specified for the CACHE option is the maximum number of sequence values that could be lost in these situations.

The minimum value is 2.

NO CACHE

Specifies that values of the sequence are not to be preallocated. It ensures that there is not a loss of values in situations, such as system failure. When

this option is specified, the values of the sequence are not stored in the cache. In this case, every request for a new value for the sequence results in synchronous I/O.

NO ORDER or ORDER

Specifies whether the sequence numbers must be generated in order of request.

NO ORDER

Specifies that the sequence numbers do not need to be generated in order of request.

ORDER

Specifies that the sequence numbers are generated in order of request. If ORDER is specified, the performance of the NEXT VALUE sequence expression will be worse than if NO ORDER is specified.

Notes

Altering a sequence:

- Only future sequence numbers are affected by the ALTER SEQUENCE statement.
- All the cached values are lost when a sequence is altered.
- After restarting a sequence or changing it to cycle, it is possible that a generated value will duplicate a value previously generated for that sequence.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases of other DB2 products. These keywords are non-standard and should not be used:

 The keywords NOMINVALUE, NOMAXVALUE, NOCYCLE, NOCACHE, and NOORDER can be used as synonyms for NO MINVALUE, NO MAXVALUE, NO CYCLE, NO CACHE, and NO ORDER.

Examples

A possible reason for specifying RESTART without a numeric value would be to reset the sequence to the START WITH value. In this example, the goal is to generate the numbers from 1 up to the number of rows in a table and then inserting the numbers into a column added to the table using temporary tables.

ALTER SEQUENCE ORG_SEQ RESTART

```
DECLARE GLOBAL TEMPORARY TABLE TEMP_ORG AS
(SELECT NEXT VALUE FOR ORG_SEQ, ORG.*
FROM ORG) WITH DATA

INSERT INTO TEMP_ORG
SELECT NEXT VALUE FOR ORG_SEQ, ORG.*
FROM ORG
```

Another use would be to get results back where all the resulting rows are numbered:

```
ALTER SEQUENCE ORG_SEQ RESTART

SELECT NEXT VALUE FOR ORG_SEQ, ORG.*
FROM ORG
```

1

ALTER TABLE

The ALTER TABLE statement alters the definition of a table.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the table identified in the statement,
 - The ALTER privilege on the table, and
 - The system authority *EXECUTE on the library containing the table
- Administrative authority

To define a foreign key, the privileges held by the authorization ID of the statement must include at least one of the following on the parent table:

- The REFERENCES privilege or object management authority for the table
- The REFERENCES privilege on each column of the specified parent key
- Administrative authority

If a *select-statement* is specified, the privileges held by the authorization ID of the statement must include at least one of the following on the tables or views specified in these clauses:

- · The SELECT privilege for the table or view
- Administrative authority

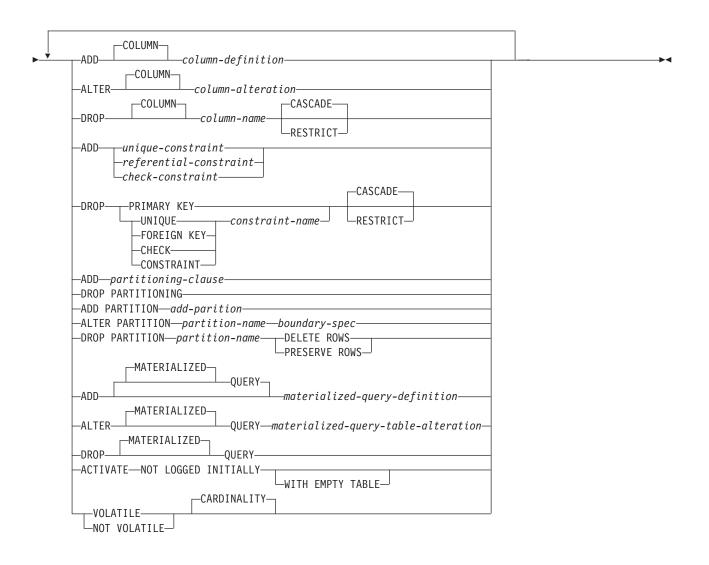
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

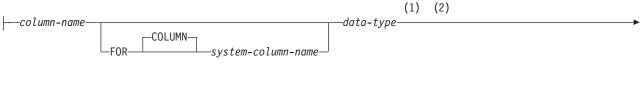
For information on the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

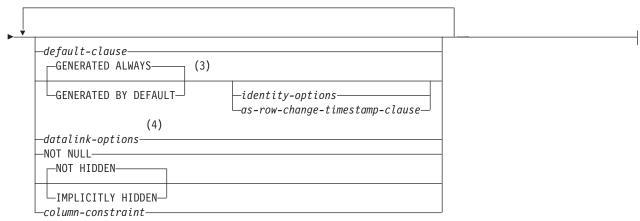
Syntax

►►—ALTER TABLE—table-name—



column-definition:





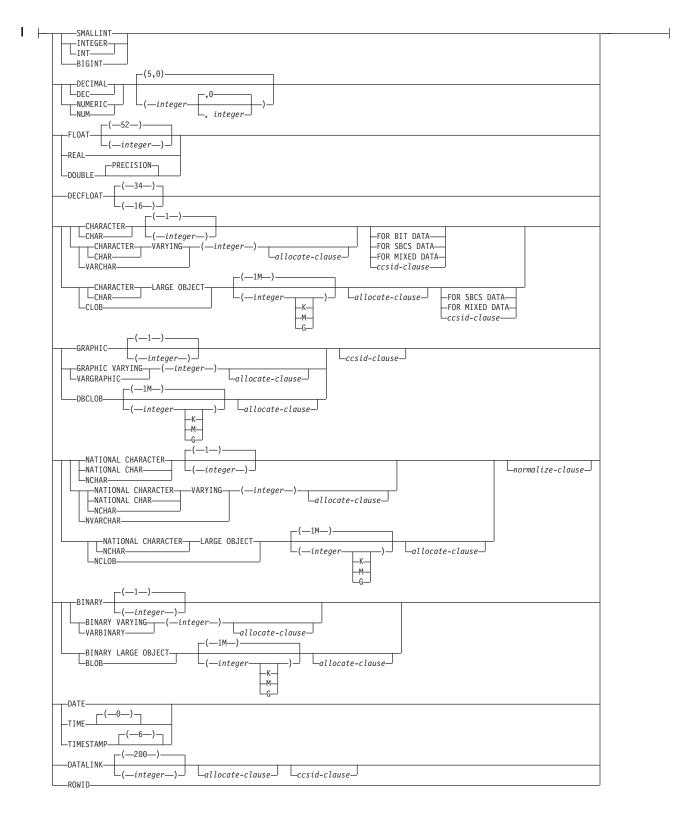
data-type:

Notes:

- 1 data-type is optional for row change timestamp columns
 - 2 The same clause must not be specified more than once.
- GENERATED can be specified only if the column has a ROWID data type (or a distinct type that is based on a ROWID data type), the column is an identity column, or the column is a row change timestamp.
 - 4 The datalink-options can only be specified for DATALINKs and distinct-types sourced on DATALINKs.

built-in-type:

ALTER TABLE



allocate-clause:

```
--ALLOCATE-(integer)---
```

ccsid-clause:

normalize-clause:

default-clause:

```
DEFAULT

-constant

-USER

-NULL

-CURRENT_DATE

-CURRENT_TIME

-CURRENT_TIMESTAMP

-cast-function-name

-CURRENT_DATE

-CURRENT_DATE

-CURRENT_DATE

-CURRENT_DATE

-CURRENT_DATE

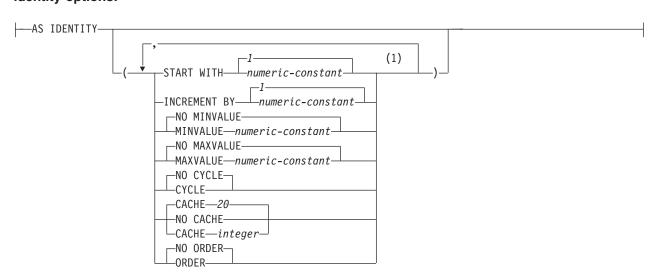
-CURRENT_TIME

-CURRENT_TIME

-CURRENT_TIME

-CURRENT_TIMESTAMP
```

identity-options:



Notes:

1 The same clause must not be specified more than once.

ALTER TABLE

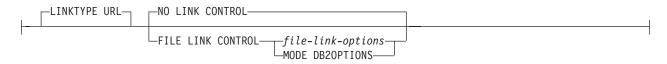
as-row-change-timestamp-clause:

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP-

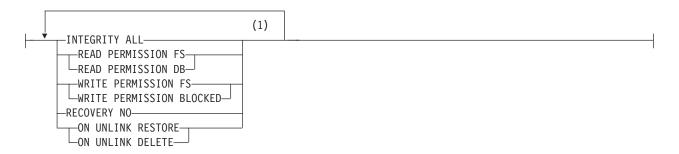
column-constraint:

```
-PRIMARY KEY
ldsymbol{oxedsymbol{oxed}}CONSTRAINT-constraint-name-
                                                            UNIQUE-
                                                          -references-clause-
                                                         \sqsubseteqCHECK\longrightarrow(\longrightarrowcheck-condition\longrightarrow)-
```

datalink-options:



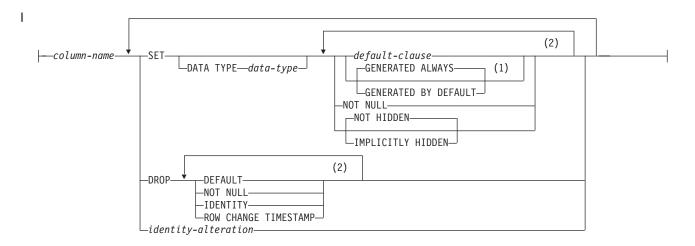
file-link-options:



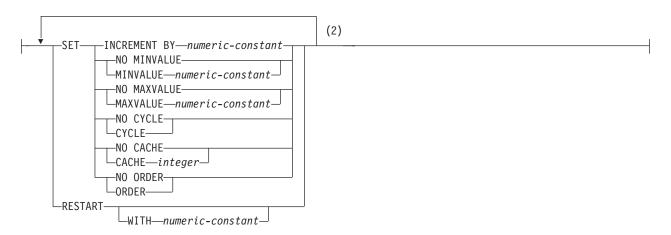
Notes:

All five file-link-options must be specified, but they can be specified in any order.

column-alteration:



identity-alteration:

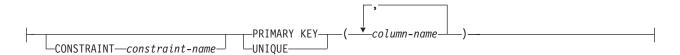


Notes:

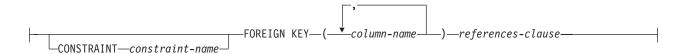
- GENERATED can be specified only if the column has a ROWID data type (or a distinct type that is based on a ROWID data type), the column is an identity column, or the column is a row change timestamp.
 - 2 The same clause must not be specified more than once.

ALTER TABLE

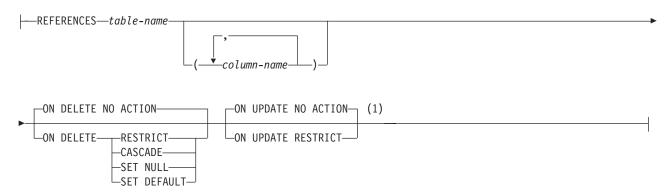
unique-constraint:



referential-constraint:



references-clause:



check-constraint:

```
-CHECK—(—check-condition—)–
-CONSTRAINT—constraint-name-
```

Notes:

The ON DELETE and ON UPDATE clauses may be specified in either order.

partitioning-clause:

```
PARTITION BY range-partition-spec
```

range-partition-spec:

```
partition-expression )—( partition-element )—
```

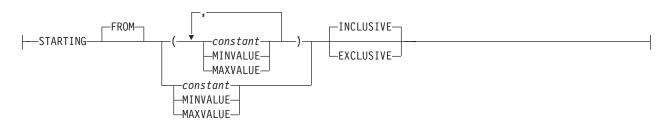
partition-expression:

partition-element:

```
PARTITION—partition-name— (1)
—boundary-spec—EVERY—(—integer-constant——DAY——DAYS——MONTH——MONTHS—
—YEAR——YEARS—
```

boundary-spec:

starting-clause:

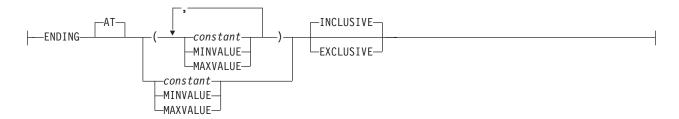


Notes:

This syntax for a *partition-element* is valid if there is only one *partition-expression* with a numeric or datetime data type.

ALTER TABLE

ending-clause:



hash-partition-spec:

```
--(--column-name--)-INTO--integer--PARTITIONS-----
```

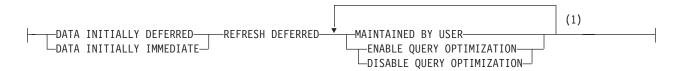
add-partition:



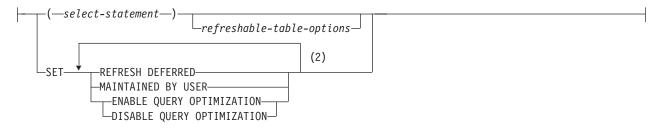
materialized-query-definition:

```
--(-select-statement--)-refreshable-table-options--
```

refreshable-table-options:



materialized-query-table-alteration:



Notes:

- 1 The same clause must not be specified more than once. MAINTAINED BY USER must be specified.
- 2 The same clause must not be specified more than once.

Description

table-name

Identifies the table to be altered. The *table-name* must identify a table that exists at the current server. It must not be a view, a catalog table, or a declared temporary table. If *table-name* identifies a materialized query table, ADD *column-definition*, ALTER *column-alteration*, and DROP COLUMN are not allowed.

ADD COLUMN column-definition

Adds a column to the table. If the table has rows, every value of the column is set to its default value, unless the column is a ROWID column, an identity column (a column that is defined AS IDENTITY), or a row change timestamp. The database manager generates default values for ROWID columns and identity columns. If the table previously had n columns, the ordinality of the new column is n+1. The value of n+1 must not exceed 8000.

A table can have only one ROWID, identity column, or row change timestamp.

A DataLink column with FILE LINK CONTROL cannot be added to a table that is a dependent in a referential constraint with a delete rule of CASCADE.

Adding a new column must not make the sum of the row buffer byte counts of the columns be greater than 32766 or, if a VARCHAR or VARGRAPHIC column is specified, 32740. Additionally, if a LOB is specified, the sum of the byte counts of the columns must not be greater than 3 758 096 383 at the time of insert or update. For information on the byte counts of columns according to data type, see "Maximum row sizes" on page 807.

column-name

Names the column to be added to the table. Do not use the same name for more than one column of the table or for a *system-column-name* of the table. Do not qualify *column-name*.

FOR COLUMN *system-column-name*

Provides an IBM i name for the column. Do not use the same name for more than one *column-name* or *system-column-name* of the table.

If the *system-column-name* is not specified, and the *column-name* is not a valid *system-column-name*, a system column name is generated. For more information about how system column names are generated, see "Rules for Column Name Generation" on page 809.

data-type

Specifies the data type of the column. The data type can be a built-in data type or a distinct type.

built-in-type

Specifies a built-in data type. See "CREATE TABLE" on page 768 for a description of built-in types.

distinct-type-name

Specifies that the data type of a column is a distinct type. The length, precision and scale of the column are respectively the length, precision, and scale of the source type of the distinct type. If a distinct type name is specified without a schema name, the distinct type name is resolved by searching the schemas on the SQL path.

ALTER TABLE

DEFAULT Specifies a default value for the column. This clause cannot be specified more than once in the same column-definition. DEFAULT cannot be specified for a ROWID column, an identity column (a column that is defined AS IDENTITY), or a row change timestamp column. The database manager generates default values for ROWID columns, identity columns, and row change timestamp columns. If a value is not specified following the DEFAULT keyword, then: • if the column is nullable, the default value is the null value. if the column is not nullable, the default depends on the data type of the column: Data type Default value Numeric

Fixed-length character or graphic string

Fixed-length binary string

Blanks

Hexadecimal zeros

Varying-length string

A string length of 0

For existing rows, a date corresponding to 1 January 0001. For added rows, the current date.

For existing rows, a time corresponding to 0 hours, 0 minutes, and 0 seconds. For added rows, the current time.

Timestamp

For existing rows, a date corresponding to 1 January 0001 and a time corresponding to 0 hours, 0 minutes, 0 seconds, and 0 microseconds. For added rows, the current timestamp.

Datalink

A value corresponding to DLVALUE(",'URL',").

Distinct type

The default value of the corresponding source type of the distinct

Omission of NOT NULL and DEFAULT from a column-definition is an implicit specification of DEFAULT NULL.

constant

Specifies the constant as the default for the column. The specified constant must represent a value that could be assigned to the column in accordance with the rules of assignment as described in "Assignments and comparisons" on page 89. A floating-point constant or decimal floating-point constant must not be used for a SMALLINT, INTEGER, BIGINT, DECIMAL, or NUMERIC column. A decimal constant must not contain more digits to the right of the decimal point than the specified scale of the column.

USER

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value for the column. The data type of the column must be CHAR or VARCHAR with a length attribute that is greater than

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or equal to the length attribute of the USER special register. For existing rows, the value is that of the USER special register at the time the ALTER TABLE statement is processed.

NULL

Specifies null as the default for the column. If NOT NULL is specified, DEFAULT NULL must not be specified within the same *column-definition*.

CURRENT_DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the column must be DATE or a distinct type based on a DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the column must be TIME or a distinct type based on a TIME.

CURRENT TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the column must be TIMESTAMP or a distinct type based on a TIMESTAMP.

cast-function-name

This form of a default value can only be used with columns defined as a distinct type, BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME, or TIMESTAMP data types. The following table describes the allowed uses of these *cast-functions*.

Data Type	Cast Function Name
Distinct type N based on a BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
Distinct type N based on a DATE, TIME, or TIMESTAMP	N (the user-defined cast function that was generated when N was created) **
	or
	DATE, TIME, or TIMESTAMP *
Distinct type N based on other data types	N (the user-defined cast function that was generated when N was created) **
BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
DATE, TIME, or TIMESTAMP	DATE, TIME, or TIMESTAMP *
Notes:	

^{*} The name of the function must match the name of the data type (or the source type of the distinct type) with an implicit or explicit schema name of QSYS2.

constant

Specifies a constant as the argument. The constant must conform to the rules of a constant for the source type of the distinct type or for the data type if not a distinct type. For BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME, and TIMESTAMP functions, the constant must be a string constant.

^{**} The name of the function must match the name of the distinct type for the column. If qualified with a schema name, it must be the same as the schema name for the distinct type. If not qualified, the schema name from function resolution must be the same as the schema name for the distinct type.

ALTER TABLE

USER

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value for the column. The data type of the source type of the distinct type of the column must be CHAR or VARCHAR with a length attribute that is greater than or equal to the length attribute of USER. For existing rows, the value is that of the USER special register at the time the ALTER TABLE statement is processed.

CURRENT_DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the source type of the distinct type of the column must be DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the source type of the distinct type of the column must be TIME.

CURRENT_TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the source type of the distinct type of the column must be TIMESTAMP.

If the value specified is not valid, an error is returned.

GENERATED

Specifies that the database manager generates values for the column. GENERATED may be specified if the column is to be considered an identity column (defined with the AS IDENTITY clause) or a row change timestamp column. It may also be specified if the data type of the column is a ROWID (or a distinct type that is based on a ROWID). Otherwise, it must not be specified.

ALWAYS

Specifies that the database manager will always generate a value for the column when a row is inserted into the table. ALWAYS is the recommended value.

BY DEFAULT

Specifies that the database manager will generate a value for the column when a row is inserted only if a value is not specified for the column. If a value is specified, the database manager uses that value.

For a ROWID column, the database manager uses a specified value, but it must be a valid unique row ID value that was previously generated by the database manager or DB2 for i.

For an identity column or row change timestamp column, the database manager inserts a specified value but does not verify that it is a unique value for the column unless the identity column or row change timestamp column has a unique constraint or a unique index that solely specifies the identity column or row change timestamp column.

AS IDENTITY

Specifies that the column is an identity column for the table. A table can have only one identity column. An identity column is not allowed in a partitioned table or distributed table. AS IDENTITY can be specified only if the data type for the column is an exact numeric type with a scale of zero (SMALLINT, INTEGER, BIGINT, DECIMAL or NUMERIC with a scale of zero, or a distinct type based on one of these data types). If a DECIMAL or NUMERIC data type is specified, the precision must not be greater than 31.

An identity column is implicitly NOT NULL. See the AS IDENTITY clause in "CREATE TABLE" on page 768 for the descriptions of the identity attributes.

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP

Specifies that the column is a timestamp and the values will be generated by the database manager. The database manager generates a value for the column for each row as a row is inserted, and for every row in which any column is updated. The value generated for a row change timestamp column is a timestamp corresponding to the time of the insert or update of the row. If multiple rows are inserted with a single SQL statement, the value for the row change timestamp column may be different for each row to reflect when each row was inserted. The generated value is not guaranteed to be unique.

A table can have only one row change timestamp column. If data-type is specified, it must be a TIMESTAMP or a distinct type based on a TIMESTAMP. A row change timestamp column cannot have a DEFAULT clause and must be NOT NULL.

datalink-options

Specifies the options associated with a DATALINK column. See "CREATE TABLE" on page 768 for a description of datalink-options.

NOT NULL

Prevents the column from containing null values. Omission of NOT NULL implies that the column can contain null values. If NOT NULL is specified in the column definition, then DEFAULT must also be specified. NOT NULL is required for a row change timestamp column

NOT HIDDEN

Indicates the column is included in implicit references to the table in SQL statements. This is the default.

IMPLICITLY HIDDEN

Indicates the column is not visible in SQL statements unless it is referred to explicitly by name. For example, SELECT * does not include any hidden columns in the result. A table must contain at least one column that is not IMPLICITLY HIDDEN.

column-constraint

The column-constraint of a column-definition provides a shorthand method of defining a constraint composed of a single column. Thus, if a column-constraint is specified in the definition of column C, the effect is the same as if that constraint were specified as a unique-constraint, referential-constraint or *check-constraint* in which C is the only identified column.

CONSTRAINT constraint-name

A constraint-name must not be the same as a constraint name that was previously specified in the ALTER TABLE statement and must not identify a constraint that already exists at the current server.

If the clause is not specified, a unique constraint name is generated by the database manager.

PRIMARY KEY

Provides a shorthand method of defining a primary key composed of a single column. Thus, if PRIMARY KEY is specified in the definition of column C, the effect is the same as if the PRIMARY KEY(C) clause is specified as a separate clause.

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This clause must not be specified in more than one *column-definition* and must not be specified at all if the UNIQUE clause is specified in the column definition. The column must not be a LOB or DataLink column.

When a primary key is added, a CHECK constraint is implicitly added to enforce the rule that the NULL value is not allowed in the column that makes up the primary key.

UNIQUE

Provides a shorthand method of defining a unique constraint composed of a single column. Thus, if UNIQUE is specified in the definition of column C, the effect is the same as if the UNIQUE (C) clause is specified as a separate clause.

This clause cannot be specified more than once in a column definition and must not be specified if PRIMARY KEY is specified in the *column-definition*. The column must not be a LOB or DataLink column.

references-clause

The *references-clause* of a column-definition provides a shorthand method of defining a foreign key composed of a single column. Thus, if a *references-clause* is specified in the definition of column C, the effect is the same as if that references-clause were specified as part of a FOREIGN KEY clause in which C is the only identified column. A *references-clause* is not allowed if the table is a declared temporary table, a partitioned table, or a distributed table.

CHECK(*check-condition*)

Provides a shorthand method of defining a check constraint whose *check-condition* only references a single column. Thus, if CHECK is specified in the column definition of column C, no columns other than C can be referenced in the *check-condition* of the check constraint. The effect is the same as if the check constraint were specified as a separate clause.

ROWID or DATALINK with FILE LINK CONTROL columns cannot be referenced in a CHECK constraint. For additional restrictions see, "ADD check-constraint" on page 605.

ALTER COLUMN column-alteration

Alters the definition of a column, including the attributes of an existing identity column. Only the attributes specified will be altered. Others will remain unchanged.

column-name

Identifies the column to be altered. The name must not be qualified and must identify an existing column in the table. The name must not identify a column that is being added or dropped in the same ALTER TABLE statement.

SET DATA TYPE data-type

Specifies the new data type of the column to be altered. The new data type must be compatible with the existing data type of the column. For more information about the compatibility of data types see "Assignments and comparisons" on page 89. However, changing a datetime data type to a character-string data type or a numeric data type to a character-string data type or a character-string data type to a numeric data type is not allowed.

The specified length, precision, and scale may be larger, smaller, or the same as the existing length, precision, and scale. However, if the new length, precision, or scale is smaller, truncation or numeric conversion errors may occur. If the specified column has a default value and a new default value is not specified, the existing default value must represent a value that could be assigned to the column in accordance with the rules for assignment as described in "Assignments and comparisons" on page 89.

If the column is specified in a unique, primary, or foreign key, the new sum of the lengths of the columns of the keys must not exceed 32766-n, where n is the number of columns specified that allow nulls.

Changing the attributes will cause any existing values in the column to be converted to the new column attributes according to the rules for assignment to a column, except that string values will be truncated.

SET *default-clause*

Specifies the new default value of the column to be altered. The specified default value must represent a value that could be assigned to the column in accordance with the rules for assignment as described in "Assignments and comparisons" on page 89.

SET NOT NULL

Specifies that the column cannot contain null values. All values for this column in existing rows of the table must be not null. If the specified column has a default value and a new default value is not specified, the existing default value must not be NULL. SET NOT NULL is not allowed if the column is identified in the foreign key of a referential constraint with a DELETE rule of SET NULL and no other nullable columns exist in the foreign key.

SET NOT HIDDEN or IMPLICITLY HIDDEN

Specifies the hidden attribute for the column.

NOT HIDDEN

Indicates the column is included in implicit references to the table in SQL statements.

IMPLICITLY HIDDEN

Indicates the column is not visible in SQL statements unless it is referred to explicitly by name. For example, SELECT * does not include any hidden columns in the result. A table must contain at least one column that is not IMPLICITLY HIDDEN.

SET GENERATED ALWAYS or GENERATED BY DEFAULT

Specifies that the database manager generates values for the column. GENERATED may be specified if the column is to be considered an identity column (defined with the AS IDENTITY clause), row change timestamp column, or the data type of the column is a ROWID (or a distinct type that is based on a ROWID). Otherwise, it must not be specified.

DROP DEFAULT

Drops the current default for the column. The specified column must have a default value and must not have NOT NULL as the null attribute. The new default value is the null value.

DROP NOT NULL

Drops the NOT NULL attribute of the column, allowing the column to have the null value. If a default value is not specified or does not already exist, the new default value is the null value. DROP NOT NULL is not allowed if the column is specified in the primary key of the table or is an identity column, row change timestamp column, or ROWID.

DROP IDENTITY

Drops the identity attributes of the column, making the column a simple numeric data type column. DROP IDENTITY is not allowed if the column is not an identity column.

DROP ROW CHANGE TIMESTAMP

Drops the row change timestamp attribute of the column, making the column a simple timestamp column. DROP ROW CHANGE TIMESTAMP is not allowed if the column is not a row change timestamp column.

identity-alteration

Alters the identity attributes of the column. The column must exist in the specified table and must already be defined with the IDENTITY attribute. For a description of the attributes, see AS IDENTITY.

RESTART

Specifies the next value for an identity column. If WITH numeric-constant is not specified, the sequence is restarted at the value specified implicitly or explicitly as the starting value when the identity column was originally created. RESTART does not change the original START WITH value.

WITH numeric-constant

Specifies that *numeric-constant* will be used as the next value for the column. The numeric-constant must be an exact numeric constant that can be any positive or negative value that could be assigned to this column, without nonzero digits existing to the right of the decimal point.

DROP COLUMN

Drops the identified column from the table.

column-name

Identifies the column to be dropped. The column name must not be qualified. The name must identify a column of the specified table. The name must not identify a column that was already added or altered in this ALTER TABLE statement. The name must not identify the only column of a table. The name must not identify a partition key of a partitioned table or a distributed table.

Specifies that any views, indexes, triggers, or constraints that are dependent on the column being dropped are also dropped. 70

RESTRICT

Specifies that the column cannot be dropped if any views, indexes, triggers, or constraints are dependent on the column. 70

If all the columns referenced in a constraint are dropped in the same ALTER TABLE statement, RESTRICT does not prevent the drop.

ADD unique-constraint

CONSTRAINT constraint-name

Names the constraint. A constraint-name must not be the same as a constraint name that was previously specified in the ALTER TABLE statement and must not identify a constraint that already exists at the current server. The constraint-name must be unique within a schema.

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^{70.} A trigger is dependent on the column if it is referenced in the UPDATE OF column list or anywhere in the triggered action.

If not specified, a unique constraint name is generated by the database manager.

UNIQUE (column-name,...)

| |

Defines a unique constraint composed of the identified columns. Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. The column must not be a LOB or DATALINK column. The number of identified columns must not exceed 120, and the sum of their lengths must not exceed 32766-*n*, where *n* is the number of columns specified that allow nulls.

The set of identified columns cannot be the same as the set of columns specified in another UNIQUE constraint or PRIMARY KEY on the table. For example, UNIQUE (A,B) is not allowed if UNIQUE (B,A) or PRIMARY KEY (A,B) already exists on the table. Any existing nonnull values in the set of columns must be unique. Multiple null values are allowed.

If a unique index already exists on the identified columns, that index is designated as a unique constraint index. Otherwise, a unique index is created to support the uniqueness of the unique key. The unique index is created as part of the system physical file, not as a separate system logical file.

PRIMARY KEY (column-name,...)

Defines a primary key composed of the identified columns. Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. The column must not be a LOB or DATALINK column. The number of identified columns must not exceed 120, and the sum of their lengths must not exceed 32766. The table must not already have a primary key.

The identified columns cannot be the same as the columns specified in another UNIQUE constraint on the table. For example, PRIMARY KEY (A,B) is not allowed if UNIQUE (B,A) already exists on the table. Any existing values in the set of columns must be unique.

When a primary key is added, a CHECK constraint is implicitly added to enforce the rule that the NULL value is not allowed in any of the columns that make up the primary key.

If a unique index already exists on the identified columns, that index is designated as a primary index. Otherwise, a primary index is created to support the uniqueness of the primary key. The unique index is created as part of the system physical file, not a separate system logical file.

ADD referential-constraint

CONSTRAINT constraint-name

Names the constraint. A *constraint-name* must not identify a constraint that already exists at the current server.

If not specified, a unique constraint name is generated by the database manager.

FOREIGN KEY

Defines a referential constraint. FOREIGN KEY is not allowed if the table is a partitioned table.

Let T1 denote the table being altered.

(column-name,...)

The foreign key of the referential constraint is composed of the identified columns. Each *column-name* must be an unqualified name that identifies a

column of T1. The same column must not be identified more than once. The column must not be a LOB or DATALINK column and must not be a row change timestamp column. The number of the identified columns must not exceed 120, and the sum of their lengths must not exceed 32766-n, where n is the number of columns specified that allows nulls.

REFERENCES table-name

The table-name specified in a REFERENCES clause must identify a base table that exists at the current server, but it must not identify a catalog table, a declared temporary table, a partitioned table, or a distributed table. This table is referred to as the parent table in the constraint relationship.

A referential constraint is a *duplicate* if its foreign key, parent key, and parent table are the same as the foreign key, parent key, and parent table of an existing referential constraint on the table. Duplicate referential constraints are allowed, but not recommended.

Let T2 denote the identified parent table.

(column-name,...)

The parent key of the referential constraint is composed of the identified columns. Each column-name must be an unqualified name that identifies a column of T2. The same column must not be identified more than once. The column must not be a LOB or DATALINK column and must not be a row change timestamp column. The number of identified columns must not exceed 120, and the sum of their lengths must not exceed 32766-n, where n is the number of columns specified that allow nulls.

The list of column names must be identical to the list of column names in the primary key of T2 or a UNIQUE constraint that exists on T2. The names may be specified in any order. For example, if (A,B) is specified, a unique constraint defined as UNIQUE (B,A) would satisfy the requirement. If a column name list is not specified then T2 must have a primary key. Omission of the column name list is an implicit specification of the columns of that primary key.

The specified foreign key must have the same number of columns as the parent key of T2. The description of the *n*th column of the foreign key and the nth column of the parent key must have identical data types, lengths, and CCSIDs.

Unless the table is empty, the values of the foreign key must be validated before the table can be used. Values of the foreign key are validated during the execution of the ALTER TABLE statement. Therefore, every nonnull value of the foreign key must match some value of the parent key of T2.

The referential constraint specified by the FOREIGN KEY clause defines a relationship in which T2 is the parent and T1 is the dependent.

ON DELETE

Specifies what action is to take place on the dependent tables when a row of the parent table is deleted. There are five possible actions:

- NO ACTION (default)
- RESTRICT
- CASCADE
- SET NULL
- SET DEFAULT

SET NULL must not be specified unless some column of the foreign key allows null values. SET NULL and SET DEFAULT must not be specified if T1 has an update trigger.

CASCADE must not be specified if T1 has a delete trigger.

CASCADE must not be specified if T1 contains a DataLink column with FILE LINK CONTROL.

The delete rule applies when a row of T2 is the object of a DELETE or propagated delete operation and that row has dependents in T1. Let p denote such a row of T2.

- If RESTRICT or NO ACTION is specified, an error occurs and no rows are deleted.
- If CASCADE is specified, the delete operation is propagated to the dependents of *p* in T1.
- If SET NULL is specified, each nullable column of the foreign key of each dependent of *p* in T1 is set to null.
- If SET DEFAULT is specified, each column of the foreign key of each dependent of *p* in T1 is set to its default value.

ON UPDATE

Specifies what action is to take place on the dependent tables when a row of the parent table is updated.

The update rule applies when a row of T2 is the object of an UPDATE or propagated update operation and that row has dependents in T1. Let p denote such a row of T2.

 If RESTRICT or NO ACTION is specified, an error occurs and no rows are updated.

ADD check-constraint

CONSTRAINT constraint-name

Names the constraint. A *constraint-name* must not identify a constraint that already exists at the current server. The *constraint-name* must be unique within a schema.

If not specified, a unique constraint name is generated by the database manager.

CHECK(*check-condition*)

Defines a check constraint. The *check-condition* must be true or unknown for every row of the table.

The *check-condition* is a *search-condition*, except:

- It can only refer to columns of the table and the column names must not be qualified.
- It cannot reference ROWID or DATALINK with FILE LINK CONTROL columns.
- It must not contain any of the following:
 - Subqueries
 - Aggregate functions
 - Variables

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- Parameter markers
- Sequence-references
- Complex expressions that contain LOBs (such as concatenation)

ALTER TABLE

l	_	OLAP s
l	-	ROW C
l	_	Special
l	-	Any fur
		User-de with the
I	_	The foll
İ	ATAN2	
	CURDATE	

-	OLAP	specifications	

- CHANGE expressions
- registers
- nction that is not deterministic
- efined functions other than functions that were implicitly generated e creation of a distinct type
- lowing built-in scalar functions:

ATAN2	DECRYPT_DB	ENCRYPT_TDES	RAND
CURDATE	DIFFERENCE	GENERATE_UNIQUE	REPEAT
CURTIME	DLURLCOMPLETE 1	GETHINT	REPLACE
DATAPARTITIONNAME	DLURLPATH	IDENTITY_VAL_LOCAL	ROUND_TIMESTAMP
DATAPARTITIONNUM	DLURLPATHONLY	INSERT	SOUNDEX
DAYNAME	DLURLSCHEME	MONTHNAME	TIMESTAMP_FORMAT
DBPARTITIONNAME	DLURLSERVER	MONTHS_BETWEEN	TIMESTAMPDIFF
DECRYPT_BINARY	DLVALUE	NEXT_DAY	TRUNC_TIMESTAMP
DECRYPT_BIT	ENCRYPT_AES	NOW	VARCHAR_FORMAT
DECRYPT_CHAR	ENCRYPT_RC2	RAISE_ERROR	WEEK_ISO
1 E D . T . 1	. 1 . CERTITION CO	NITTO I DE LO DEDIGI	COLONI DD

¹ For DataLinks with an attribute of FILE LINK CONTROL and READ PERMISSION DB.

For more information about search-condition, see "Search conditions" on page 201.

DROP

PRIMARY KEY

Drops the definition of the primary key and all referential constraints in which the primary key is a parent key. The table must have a primary key.

UNIQUE constraint-name

Drops the unique constraint constraint-name and all referential constraints dependent on this unique constraint. The constraint-name must identify a unique constraint on the table. DROP UNIQUE will not drop a PRIMARY KEY unique constraint.

FOREIGN KEY constraint-name

Drops the referential constraint constraint-name. The constraint-name must identify a referential constraint in which the table is a dependent.

CHECK constraint-name

Drops the check constraint constraint-name. The constraint-name must identify a check constraint on the table.

CONSTRAINT constraint-name

Drops the constraint constraint-name. The constraint-name must identify a unique, referential, or check constraint on the table. If the constraint is a PRIMARY KEY or UNIQUE constraint, all referential constraints in which the primary key or unique key is a parent are also dropped.

CASCADE

Specifies for unique constraints that any referential constraints that are dependent on the constraint being dropped are also dropped.

RESTRICT

Specifies for unique constraints that the constraint cannot be dropped if any referential constraints are dependent on the constraint.

ADD partitioning-clause

Changes a non-partitioned table into a partitioned table. If the specified table is a distributed table or already a partitioned table, an error is returned. A table with an identity column cannot be partitioned. A DDS-created physical file cannot be partitioned. See "CREATE TABLE" on page 768 for a description of the *partitioning-clause*.

Changing a non-partitioned table that contains data into a partitioned table will require data movement between the data partitions. When using range partitioning, all existing data in the table must be assignable to the specified range partitions.

DROP PARTITIONING

Changes a partitioned table into a non-partitioned table. If the specified table is already non-partitioned, an error is returned.

Changing a partitioned table that contains data into a non-partitioned table will require data movement between the data partitions.

ADD PARTITION add-partition

Adds one or more partitions to a partitioned table. The specified table must be a partitioned table. The number of partitions must not exceed 256.

Changing the number of hash partitions in a partitioned table that contains data will require data movement between the data partitions.

partition-name

I

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Names the partition. A *partition-name* must not identify a data partition that already exists in the table.

If the clause is not specified, a unique partition name is generated by the database manager.

boundary-spec

Specifies the boundaries of a range partition. If the specified table is not a range partitioned table, an error is returned. Both a *starting-clause* and an *ending-clause* must be specified. See "CREATE TABLE" on page 768 for a description of the *boundary-spec*.

integer HASH PARTITIONS

Specifies the number of hash partitions to be added. If the specified table is not a hash partitioned table, an error is returned.

ALTER PARTITION

Alters the boundaries of a partition of a range partitioned table. If the specified table is not a range partitioned table, an error is returned.

Changing the boundaries of one or more partitions of a table that contains data may require data movement between the data partitions. All existing data in the table must be assignable to the specified range partitions.

partition-name

Specifies the name of the partition to alter. The *partition-name* must identify a data partition that exists in the table.

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Specifies the new boundaries of a range partition. Both a *starting-clause* and an *ending-clause* must be specified. See "CREATE TABLE" on page 768 for a description of the *boundary-spec*.

DROP PARTITION

Drops a partition of a partitioned table. If the specified table is not a partitioned table, an error is returned. If the last remaining partition of a partitioned table is specified, an error is returned.

partition-name

Specifies the name of the partition to drop. The *partition-name* must identify a data partition that exists in the table.

DELETE ROWS

Specifies that any data in the specified partition will be discarded. All data stored in the partition is dropped from the table without processing any delete triggers.

PRESERVE ROWS

Specifies that any data in the specified partition will be preserved by moving it to the remaining partitions without processing any delete or insert triggers. If the specified table is a range partitioned table, PRESERVE ROWS must not be specified. Dropping a hash partition will require data movement between the remaining data partitions.

ADD MATERIALIZED QUERY materialized-query-definition

Changes a base table to a materialized query table. If the specified table is already a materialized query table or if the table is referenced in another materialized query table, an error is returned.

select-statement

Defines the query on which the table is based. The columns of the existing table must meet the following characteristics:

- The number of columns in the table must be the same as the number of result columns in the *select-statement*.
- The column attributes of each column of the table must be compatible to the column attributes of the corresponding result column in the *select-statement*.

The *select-statement* for a materialized query table must not contain a reference to the table being altered, a view over the table being altered, or another materialized query table. For additional details about specifying *select-statement* for a materialized query table, see "CREATE TABLE" on page 768.

refreshable-table-options

Specifies the materialized query table options for altering a base table to a materialized query table.

DATA INITIALLY DEFERRED

Specifies that the data in the table is not validated as part of the ALTER TABLE statement. A REFRESH TABLE statement can be used to make sure the data in the materialized query table is the same as the result of the query in which the table is based.

DATA INITIALLY IMMEDIATE

Specifies that the data is inserted in the table from the result of the query as part of processing the ALTER TABLE statement.

MAINTAINED BY USER

Specifies that the materialized query table is maintained by the user. The user can use INSERT, DELETE, UPDATE, or REFRESH TABLE statements on the table.

ENABLE QUERY OPTIMIZATION or DISABLE QUERY OPTIMIZATION

Specifies whether this materialized query table can be used for query optimization.

ENABLE QUERY OPTIMIZATION

The materialized query table can be used for query optimization.

DISABLE QUERY OPTIMIZATION

The materialized query table will not be used for query optimization. The table can still be queried directly.

ALTER MATERIALIZED QUERY materialized-query-table-alteration

Changes the attributes of a materialized query table. The *table-name* must identify a materialized query table.

select-statement

Defines the query on which the table is based. The columns of the existing table must meet the following characteristics:

- The number of columns in the table must be the same as the number of result columns in the *select-statement*.
- The column attributes of each column of the table must be compatible to the column attributes of the corresponding result column in the *select-statement*.

The *select-statement* for a materialized query table must not contain a reference to the table being altered, a view over the table being altered, or another materialized query table. For additional details about specifying *select-statement* for a materialized query table, see "CREATE TABLE" on page 768.

refreshable-table-options

Specifies the materialized query table options for altering a base table to a materialized query table.

DATA INITIALLY DEFERRED

Specifies that the data in the table is not refreshed or validated as part of the ALTER TABLE statement. A REFRESH TABLE statement can be used to make sure the data in the materialized query table is the same as the result of the query in which the table is based.

DATA INITIALLY IMMEDIATE

Specifies that the data is inserted in the table from the result of the query as part of processing the ALTER TABLE statement.

REFRESH DEFERRED

Specifies that the data in the table can be refreshed at any time using the REFRESH TABLE statement. The data in the table only reflects the result of the query as a snapshot at the time when the REFRESH TABLE statement is processed or when it was last updated.

MAINTAINED BY USER

Specifies that the materialized query table is maintained by the user. The user can use INSERT, DELETE, UPDATE, or REFRESH TABLE statements on the table.

ENABLE QUERY OPTIMIZATION or DISABLE QUERY OPTIMIZATION

Specifies whether this materialized query table can be used for query optimization.

ENABLE QUERY OPTIMIZATION

The materialized query table can be used for query optimization.

DISABLE QUERY OPTIMIZATION

The materialized query table will not be used for query optimization. The table can still be queried directly.

SET refreshable-table-alteration

Changes how the table is maintained or whether the table can be used in query optimization.

MAINTAINED BY USER

Specifies that the materialized query table is maintained by the user. The user can use INSERT, DELETE, UPDATE, or REFRESH TABLE statements on the table.

REFRESH DEFERRED

Specifies that the data in the table can be refreshed at any time using the REFRESH TABLE statement. The data in the table only reflects the result of the query as a snapshot at the time when the REFRESH TABLE statement is processed or when it was last updated.

ENABLE QUERY OPTIMIZATION or DISABLE QUERY OPTIMIZATION

Specifies whether this materialized query table can be used for query optimization.

ENABLE QUERY OPTIMIZATION

The materialized query table can be used for query optimization.

DISABLE QUERY OPTIMIZATION

The materialized query table will not be used for query optimization. The table can still be queried directly.

DROP MATERIALIZED QUERY

Changes a materialized query table so that it is no longer a materialized query table. The table specified by *table-name* must be defined as a materialized query table. The definition of columns and data of the name are not changed, but the table can no longer be used for query optimization and is no longer valid for use with the REFRESH TABLE statement.

ACTIVATE NOT LOGGED INITIALLY

Activates the NOT LOGGED INITIALLY attribute of the table for this current unit of work.

Any changes made to the table by INSERT, DELETE, or UPDATE statements in the same unit of work after the table is altered by this statement are not logged (journaled).

At the completion of the current unit of work, the NOT LOGGED INITIALLY attribute is deactivated and all operations that are done on the table in subsequent units of work are logged (journaled).

ACTIVATE NOT LOGGED INITIALLY is not allowed in a transaction if data change operations are pending for *table-name* or cursors are currently open under commit that reference *table-name*.

ACTIVATE NOT LOGGED INITIALLY is ignored if the table has a DATALINK column with FILE LINK CONTROL or if running with isolation level No Commit (NC).

WITH EMPTY TABLE

Causes all data currently in the table to be removed. If the unit of work in which this ALTER statement was issued is rolled back, the table data will NOT be returned to its original state. When this action is requested, no DELETE triggers defined on the affected table are fired.

WITH EMPTY TABLE cannot be specified for a materialized query table or for a parent in a referential constraint.

A DELETE statement without a WHERE clause will typically perform as well or better than ACTIVATE NOT LOGGED INITIALLY WITH EMPTY TABLE and will allow a ROLLBACK to rollback the delete of the rows in the table.

VOLATILE or NOT VOLATILE

Indicates to the optimizer whether the cardinality of table *table-name* can vary significantly at run time. Volatility applies to the number of rows in the table, not to the table itself. The default is NOT VOLATILE.

VOLATILE

Specifies that the cardinality of *table-name* can vary significantly at run time, from empty to large. To access the table, the optimizer will typically use an index, if possible.

NOT VOLATILE

Specifies that the cardinality of *table-name* is not volatile. Access plans that reference this table will be based on the cardinality of the table at the time the access plan is built.

Notes

Column references: A column can only be referenced *once* in an ADD, ALTER, or DROP COLUMN clause in a single ALTER TABLE statement. However, that same column can be referenced multiple times for adding or dropping constraints in the same ALTER TABLE statement.

Order of operations: The order of operations within an ALTER TABLE statement is:

- drop constraints
- · drop materialized query table
- · drop partition
- · drop partitioning
- · drop columns for which the RESTRICT option was specified
- · alter all other column definitions
 - drop columns for which the CASCADE option was specified

ALTER TABLE

- alter column drop attributes (for example, DROP DEFAULT)
- alter column alter attributes
- alter column add attributes
- add columns
- alter partition
- add or alter materialized query table
- add partition or add partitioning
- add constraints

Within each of these stages, the order in which the user specifies the clauses is the order in which they are performed, with one exception. If any columns are being dropped, that operation is logically done before any column definitions are added or altered.

QTEMP considerations: Any views or logical files in another job's QTEMP that are dependent on the table being altered will be dropped as a result of an ALTER TABLE statement.

Authority checking: Authority checking is performed only on the table being altered and any object explicitly referenced in the ALTER TABLE statement (such as tables referenced in the fullselect). Other objects may be accessed by the ALTER TABLE statement, but no authority to those objects is required. For example, no authority is required on views that exist on the table being altered, nor on dependent tables that reference the table being altered through a referential constraint.

Backup recommendation: It is strongly recommended that a current backup of the table and dependent views and logical files exist prior to altering a table.

Performance considerations: The following performance considerations apply to an ALTER TABLE statement when adding, altering, or dropping columns from a table:

- The data in the table may be copied.⁷¹
 - Adding and dropping columns require the data to be copied.
 - Altering a column usually requires the data to be copied. The data does not need to be copied, however, if the alter only includes the following changes:
 - The length attribute of a VARCHAR column is increasing and the current length attribute is greater than 20.
 - The length attribute of a VARGRAPHIC column is increasing and the current length attribute is greater than 10.
 - The allocated length of a VARCHAR column is changing and the current and new allocated lengths are both less than or equal to 20.
 - The allocated length of a VARGRAPHIC column is changing and the current and new allocated lengths are both less than or equal to 10.
 - The CCSID of a column is changing but no conversion is necessary between the old and new CCSID. For example, if one CCSID is 65535, no data conversion is necessary.
 - The default value is changing, and the length of the default value is not greater than the current allocated length.

^{71.} In cases where enough storage does not exist to make a complete copy, a special copy that only requires approximately 16-32 megabytes of free storage is performed.

- DROP DEFAULT is specified.
- DROP NOT NULL is specified, but at least one nullable column will still exist in the table after the alter table is complete.
- Indexes may need to be rebuilt.⁷²

An index does not need to be rebuilt when columns are added to a table or when columns are dropped or altered and those columns are not referenced in the index key.

Altering a column that is used in the key of an index or constraint usually requires the index to be rebuilt. The index does not need to be rebuilt, however, in the following cases:

- The length attribute of a VARCHAR or VARGRAPHIC key is increasing.
- The CCSID of a column is changing but no conversion is necessary between the old and new CCSID. For example, if one CCSID is 65535.

Altering materialized query tables: The isolation level at the time when a base table is first altered to become a materialized query table by the ALTER TABLE statement is the isolation level for the materialized query table.

Altering a table to change it to a materialized query table with query optimization enabled makes the table eligible for use in optimization. Therefore, ensure that the data in the table is accurate. The DATA INITIALLY IMMEDIATE clause can be used to refresh the data when the table is altered.

Syntax alternatives: The following syntax is supported for compatibility to prior releases. The syntax is non-standard and should not be used:

- If an ADD constraint is the first clause of the ALTER TABLE statement, the ADD keyword is optional, but strongly recommended. Otherwise, it is required.
- *constraint-name* (without the CONSTRAINT keyword) may be specified following the FOREIGN KEY keywords in a *referential-constraint*.
- · PART is a synonym for PARTITION.
- PARTITION *partition-number* may be specified instead of PARTITION *partition-name*. A *partition-number* must not identify an existing partition of the table or a partition that was previously specified in the ALTER TABLE statement.

If a *partition-number* is not specified, a unique partition number is generated by the database manager.

- VALUES is a synonym for ENDING AT.
- SET MATERIALIZED QUERY AS DEFINITION ONLY is a synonym for DROP MATERIALIZED QUERY.
- SET SUMMARY AS DEFINITION ONLY is a synonym for DROP MATERIALIZED QUERY
- SET MATERIALIZED QUERY AS (*select-statement*) is a synonym for ADD MATERIALIZED QUERY (*select-statement*)
- SET SUMMARY AS (*select-statement*) is a synonym for ADD MATERIALIZED QUERY (*select-statement*)

^{72.} Any indexes that need to be rebuilt are rebuilt asynchronously by database server jobs.

Cascaded Effects

Adding a column has no cascaded effects to SQL views or most logical files. For example, adding a column to a table does not cause the column to be added to any dependent views, even if those views were created with a SELECT * clause.

Dropping or altering a column may cause several cascaded effects. Table 52 lists the cascaded effects of dropping a column.

Table 52. Cascaded effects of dropping a column

Operation	RESTRICT Effect	CASCADE Effect
Drop of a column referenced by a view	The drop of the column is not allowed.	The view and all views dependent on that view are dropped.
Drop of a column referenced by a non-view logical file	 The drop is allowed, and the column is dropped from the logical file if: The logical file shares a format with the file being altered, and The dropped column is not used as a key field or in select/omit specifications, and That format is not used again in the logical file with another based-on file. Otherwise, the drop of the column is not allowed. 	 The drop is allowed, and the column is dropped from the logical file if: The logical file shares a format with the file being altered, and The dropped column is not used as a key field or in select or omit specifications, and That format is not used again in the logical file with another based-on file. Otherwise, the logical file is dropped.
Drop of a column referenced in the key of an index	The drop of the index is not allowed.	The index is dropped.
Drop of a column referenced in a unique constraint	If all the columns referenced in the unique constraint are dropped in the same ALTER COLUMN statement and the unique constraint is not referenced by a referential constraint, the columns and the constraint are dropped. (Hence, the index used to satisfy the constraint is also dropped.) For example, if column A is dropped, and a unique constraint of UNIQUE (A) or PRIMARY KEY (A) exists and no referential constraints reference the unique constraint, the operation is allowed.	The unique constraint is dropped as are any referential constraints that refer to that unique constraint. (Hence, any indexes used by those constraints are also dropped).
	is not allowed.	

^{73.} A column will also be added to a logical file that shares its physical file's format when a column is added to that physical file (unless that format is used again in the logical file with another based-on file).

Table 52. Cascaded effects of dropping a column (continued)

Operation	RESTRICT Effect	CASCADE Effect
Drop of a column referenced in a referential constraint	If all the columns referenced in the referential constraint are dropped at the same time, the columns and the constraint are dropped. (Hence, the index used by the foreign key is also dropped). For example, if column B is dropped and a referential constraint of FOREIGN KEY (A) exists, the operation is allowed. Otherwise, the drop of the column is not allowed.	The referential constraint is dropped. (Hence, the index used by the foreign key is also dropped).
Drop of a column referenced in a trigger	The drop of the column is not allowed.	The trigger is dropped.
Drop of a column referenced in an MQT	The drop of the column is not allowed.	The MQT is dropped.

Table 53 lists the cascaded effects of altering a column. (Alter of a column in the following chart means altering a data type, precision, scale, length, or nullability characteristic.)

Table 53. Cascaded effects of altering a column

Operation	Effect
Alter of a column referenced by a view	The alter is allowed. The views that are dependent on the table will be recreated. The new column attributes will be used when recreating the views.
Alter of a column referenced by a non-view logical file	The alter is allowed. The non-view logical files that are dependent on the table will be recreated. If the logical file shares a format with the file being altered, and that format is not used again in the logical file with another based-on file, the new column attributes will be used when recreating the logical file. Otherwise, the new column attributes will not be used when recreating the logical file. Instead, the current logical file attributes are used.
Alter of a column referenced in the key of an index.	The alter is allowed. (Hence, the index will usually be rebuilt.)
Alter of a column referenced in a unique constraint	The alter is allowed. (Hence, the index will usually be rebuilt.) If the unique constraint is referenced by a referential constraint, the attributes of the foreign keys no longer match the attributes of the unique constraint. The constraint will be placed in a defined and check-pending state.

Table 53. Cascaded effects of altering a column (continued)

Operation	Effect
Alter of a column referenced in a referential constraint	The alter is allowed. • If the referential constraint is in the defined but check-pending state, the alter is allowed and an attempt is made to put the constraint in the enabled state. (Hence, the index used to satisfy the unique constraint will usually to be rebuilt.)
	 If the referential constraint is in the enabled state, the constraint is placed in the defined and check-pending state.
Alter of a column referenced in a trigger	The trigger is preserved.
Alter of a column referenced in an MQT	The MQT is recreated to include the new attributes.

Examples

Example 1: Add a new column named RATING, which is one character long, to the DEPARTMENT table.

```
ALTER TABLE DEPARTMENT ADD RATING CHAR
```

Example 2: Add a new column named PICTURE_THUMBNAIL to the EMPLOYEE table. Create PICTURE_THUMBNAIL as a BLOB column with a maximum length of 1K characters.

```
ALTER TABLE EMPLOYEE
ADD PICTURE_THUMBNAIL BLOB(1K)
```

Example 3: Assume a new table EQUIPMENT has been created with the following columns:

```
EQUIP_NO
INT

EQUIP_DESC
VARCHAR(50)

LOCATION
VARCHAR(50)

EQUIP_OWNER
CHAR(3)
```

Add a referential constraint to the EQUIPMENT table so that the owner (EQUIP_OWNER) must be a department number (DEPTNO) that is present in the DEPARTMENT table. If a department is removed from the DEPARTMENT table, the owner (EQUIP_OWNER) values for all equipment owned by that department should become unassigned (or set to null). Give the constraint the name DEPTQUIP.

```
ALTER TABLE EQUIPMENT
FOREIGN KEY DEPTQUIP (EQUIP_OWNER)
REFERENCES DEPARTMENT
ON DELETE SET NULL
```

Change the default value for the EQUIP_OWNER column to 'ABC'.

```
ALTER TABLE EQUIPMENT
ALTER COLUMN EQUIP_OWNER
SET DEFAULT 'ABC'
```

Drop the LOCATION column. Also drop any views, indexes, or constraints that are built on that column.

```
ALTER TABLE EQUIPMENT
DROP COLUMN LOCATION CASCADE
```

Alter the table so that a new column called SUPPLIER is added, the existing column called LOCATION is dropped, a unique constraint over the new column SUPPLIER is added, and a primary key is built over the existing column EQUIP_NO.

```
ALTER TABLE EQUIPMENT
ADD COLUMN SUPPLIER INT
DROP COLUMN LOCATION
ADD UNIQUE SUPPLIER
ADD PRIMARY KEY EQUIP NO
```

Notice that the column EQUIP_DESC is a variable length column. If an allocated length of 25 was specified, the following ALTER TABLE statement would not change that allocated length.

```
ALTER TABLE EQUIPMENT
ALTER COLUMN EQUIP_DESC
SET DATA TYPE VARCHAR(60)
```

Example 4: Alter the EMPLOYEE table. Add the check constraint named REVENUE defined so that each employee must make a total of salary and commission greater than \$30,000.

```
ALTER TABLE EMPLOYEE

ADD CONSTRAINT REVENUE

CHECK (SALARY + COMM > 30000)
```

Example 5: Alter EMPLOYEE table. Drop the constraint REVENUE which was previously defined.

```
ALTER TABLE EMPLOYEE
DROP CONSTRAINT REVENUE
```

Example 6: Alter the EMPLOYEE table. Alter the column PHONENO to accept up to 20 characters for a phone number.

```
ALTER TABLE EMPLOYEE
ALTER COLUMN PHONENO SET DATA TYPE VARCHAR (20)
```

Example 7: Alter the base table TRANSCOUNT to a materialized query table. The result of the *select-statement* must provide a set of columns that match the columns in the existing table (same number of columns and compatible attributes).

```
ALTER TABLE TRANSCOUNT

ADD MATERIALIZED QUERY

(SELECT ACCTID, LOCID, YEAR, COUNT(*) AS CNT
FROM TRANS
GROUP BY ACCTID, LOCID, YEAR)

DATA INITIALLY DEFERRED
REFRESH DEFERRED
MAINTAINED BY USER
```

BEGIN DECLARE SECTION

The BEGIN DECLARE SECTION statement marks the beginning of an SQL declare section. An SQL declare section contains declarations of host variables that are eligible to be used as host variables in SQL statements in a program.

Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in Java, RPG, or REXX.

Authorization

None required.

Syntax

▶►—BEGIN DECLARE SECTION—

Description

The BEGIN DECLARE SECTION statement is used to indicate the beginning of an SQL declare section. It can be coded in the application program wherever variable declarations can appear in accordance with the rules of the host language. It cannot be coded in the middle of a host structure declaration. An SQL declare section ends with an END DECLARE SECTION statement, described in "END DECLARE SECTION" on page 918.

The BEGIN DECLARE SECTION and the END DECLARE SECTION statements must be paired and cannot be nested.

SQL statements should not be included within a declare section, with the exception of the DECLARE VARIABLE and INCLUDE statements.

If SQL declare sections are specified in the program, only the variables declared within the SQL declare sections can be used as host variables. If SQL declare sections are not specified in the program, all variables in the program are eligible for use as host variables.

SQL declare sections should be specified for host languages, other than RPG and REXX, so that the source program conforms to the IBM SQL standard of SQL. SQL declare sections are required for all host variables in C++. The SQL declare section should appear before the first reference to the variable. Host variables are declared without the use of these statements in Java and RPG, and they are not declared at all in REXX.

Variables declared outside an SQL declare section should not have the same name as variables declared within an SQL declare section.

More than one SQL declare section can be specified in the program.

Examples

Example 1: Define the host variables hv_smint (SMALLINT), hv_vchar24 (VARCHAR(24)), and hv_double (DOUBLE) in a C program.

BEGIN DECLARE SECTION

Example 2: Define the host variables HV-SMINT (smallint), HV-VCHAR24 (varchar(24)), and HV-DEC72 (dec(7,2)) in a COBOL program.

```
WORKING-STORAGE SECTION.

EXEC SQL BEGIN DECLARE SECTION END-EXEC.

01 HV-SMINT PIC S9(4) BINARY.

01 HV-VCHAR24.

49 HV-VCHAR24-LENGTH PIC S9(4) BINARY.

49 HV-VCHAR24-VALUE PIC X(24).

01 HV-DEC72 PIC S9(5)V9(2) PACKED-DECIMAL.

EXEC SQL END DECLARE SECTION END-EXEC.
```

CALL

The CALL statement calls a procedure.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

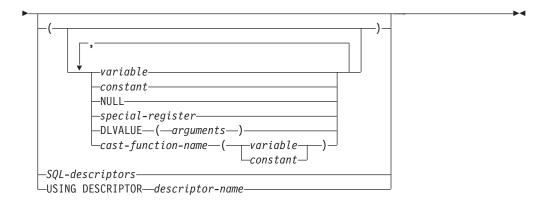
The privileges held by the authorization ID of the statement must include at least one of the following:

- If the procedure is an SQL procedure:
 - The EXECUTE privilege on the procedure, and
 - The system authority *EXECUTE on the library containing the SQL procedure
- If the procedure is a Java external procedure:
 - Read authority (*R) to the integrated file system file that contains the Java class.
 - Read and execute authority (*RX) to all directories that must be accessed in order to find the integrated file system file.
- If the procedure is a REXX external procedure:
 - The system authorities *OBJOPR, *READ, and *EXECUTE on the source file associated with the procedure,
 - The system authority *EXECUTE on the library containing the source file, and
 - The system authority *USE to the CL command,
- If the procedure is an external procedure, but not a REXX or Java external procedure:
 - The system authority *EXECUTE on the program or service program associated with the procedure, and
 - The system authority *EXECUTE on the library containing the program or service program associated with the procedure
- Administrative authority

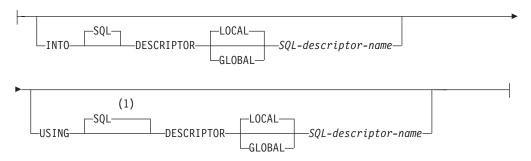
For information on the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure.

Syntax





SQL-descriptors:



Notes:

If an SQL descriptor is specified in the USING clause and the INTO clause is not specified, USING DESCRIPTOR is not allowed and USING SQL DESCRIPTOR must be specified.

Description

procedure-name or variable

Identifies the procedure to call by the specified *procedure-name* or the procedure name contained in the *variable*. The identified procedure must exist at the current server.

If a variable is specified:

- It must be a character-string variable or Unicode graphic-string.
- It must not be followed by an indicator variable.
- The procedure name that is contained within the variable must be left-justified and must be padded on the right with blanks if its length is less than that of the variable.
- The name of the procedure must be in uppercase unless the procedure name is a delimited name.

If the procedure name is unqualified, it is implicitly qualified based on the path and number of parameters. For more information see "Qualification of unqualified object names" on page 60.

If the procedure-name identifies a procedure that was defined by a DECLARE PROCEDURE statement, and the current server is a DB2 for i product, then:

• The DECLARE PROCEDURE statement determines the name of the external program, language, and calling convention.

• The attributes of the parameters of the procedure are defined by the DECLARE PROCEDURE statement.

Otherwise:

- · The current server determines the name of the external program, language, and calling convention.
- If the current server is DB2 for i:
 - The external program name is assumed to be the same as the external procedure name.
 - If the program attribute information associated with the program identifies a recognizable language, then that language is used. Otherwise, the language is assumed to be C.
 - The calling convention is assumed to be GENERAL.
- The application requester assumes all parameters that are variables or parameter markers are INOUT. All parameters that are not variables are assumed to be IN.
- The actual attributes of the parameters are determined by the current server. If the current server is a DB2 for i, the attributes of the parameters will be the same as the attributes of the arguments specified on the CALL statement.

variable **or** constant **or NULL or** special-register

Identifies a list of values to be passed as parameters to the procedure. The nth value corresponds to the nth parameter in the procedure.

Each parameter defined (using a CREATE PROCEDURE or DECLARE PROCEDURE statement) as OUT or INOUT must be specified as a variable.

The number of arguments specified must be the same as the number of parameters of a procedure defined at the current server with the specified procedure-name.

The application requester assumes all parameters that are variables are INOUT parameters except for Java, where it is assumed all parameters that are variables are IN unless the mode is explicitly specified in the variable reference. All parameters that are not variables are assumed to be input parameters. The actual attributes of the parameters are determined by the current server.

For an explanation of constant and variable, see "Constants" on page 112 and "References to host variables" on page 136. For a description of special-register, see "Special registers" on page 119. NULL specifies the null value.

DLVALUE(arguments)

Specifies the value for the parameter is the value resulting from a DLVALUE scalar function. A DLVALUE scalar function can only be specified for a DataLink parameter. The DLVALUE function requires a link value on insert (scheme, server, and path/file). The first argument of DLVALUE must be a constant, variable, or a typed parameter marker (CAST(? AS data-type)). The second and third arguments of DLVALUE must be constants or variables.

cast-function-name

This form of an argument can only be used with parameters defined as a distinct type, BLOB, CLOB, DBCLOB, DATE, TIME or TIMESTAMP data types. The following table describes the allowed uses of these *cast-functions*.

^{74.} Note that in the case of decimal constants, leading zeroes are significant when determining the attributes of the argument. Normally, leading zeroes are not significant.

Parameter Type Cast Function Name

Distinct type N based on a BLOB, CLOB, BLOB, CLOB, or DBCLOB *

or DBCLOB

Distinct type N based on a DATE, TIME, DATE, TIME, or TIMESTAMP *

or TIMESTAMP

BLOB, CLOB, or DBCLOB

DATE, TIME, or TIMESTAMP

BLOB, CLOB, or DBCLOB *

DATE, TIME, or TIMESTAMP *

Notes:

constant

Specifies a constant as the argument. The constant must conform to the rules of a constant for the source type of the distinct type or for the data type if not a distinct type. For BLOB, CLOB, DBCLOB, DATE, TIME, and TIMESTAMP functions, the constant must be a string constant.

variable

Specifies a variable as the argument. The variable must conform to the rules of a constant for the source type of the distinct type or for the data type if not a distinct type.

SQL-descriptors

If SQL descriptors are specified on CALL, a procedure that has IN and INOUT parameters requires an SQL descriptor to be specified in the USING clause; and a procedure that has OUT or INOUT parameters requires an SQL descriptor to be specified in the INTO clause. If all the parameters of the procedure are INOUT parameters, the same descriptor can be used for both clauses. For more information, see Multiple SQL descriptors on CALL.

INTO

Identifies an SQL descriptor which contains valid descriptions of the output variables to be used with the CALL statement. Before the CALL statement is executed, a descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. The COUNT field in the descriptor header must be set to reflect the number of OUT and INOUT parameters for the procedure. The item information, including TYPE, and where applicable, DATETIME_INTERVAL_CODE, LENGTH, DB2_CCSID, PRECISION, and SCALE, must be set for the variables that are used when processing the statement.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation. The information is returned from the descriptor known in this local scope.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session. The information is returned from the descriptor known to any program that executes using the same database connection.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

USING

Identifies an SQL descriptor which contains valid descriptions of the input variables to be used with the CALL statement. Before the CALL statement

^{*} The name of the function must match the name of the data type (or the source type of the distinct type) with an implicit or explicit schema name of QSYS2.

is executed, a descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. The COUNT field in the descriptor header must be set to reflect the number of IN and INOUT parameters for the procedure. The item information, including TYPE, and where applicable, DATETIME_INTERVAL_CODE, LENGTH, DB2_CCSID, PRECISION, and SCALE, must be set for the variables that are used when processing the statement. The DATA item and when nulls are used, the INDICATOR item, must be set for the input variables.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

USING DESCRIPTOR *descriptor-name*

Identifies an SQLDA that must contain a valid description of variables.

Before the CALL statement is processed, you must set the following fields in the SQLDA. (The rules for REXX are different. For more information, see the Embedded SQL Programming topic collection.)

- · SQLN to indicate the number of SQLVAR occurrences provided in the **SQLDA**
- SQLDABC to indicate the number of bytes of storage allocated for the **SQLDA**
- SQLD to indicate the number of variables used in the SQLDA when processing the statement
- SQLVAR occurrences to indicate the attributes of the variables.

The SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(80), where 80 is the length of an SQLVAR occurrence. If LOBs or distinct types are specified, there must be two SQLVAR entries for each parameter marker and SQLN must be set to two times the number of parameter markers.

SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN. It must be the same as the number of parameters in the CALL statement. The *n*th variable described by the SQLDA corresponds to the *n*th parameter marker in the prepared statement. (For a description of an SQLDA, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.)

Note that RPG/400 does not provide the function for setting pointers. Because the SQLDA uses pointers to locate the appropriate variables, you have to set these pointers outside your RPG/400 application.

The USING DESCRIPTOR clause is not supported for a CALL statement within a Java program.

Notes

Parameter assignments: When the CALL statement is executed, the value of each of its parameters is assigned (using storage assignment rules) to the corresponding parameter of the procedure. Control is passed to the procedure according to the calling conventions of the host language. When execution of the procedure is complete, the value of each parameter of the procedure is assigned (using retrieval assignment rules) to the corresponding parameter of the CALL statement defined as OUT or INOUT. For details on the assignment rules, see "Assignments and comparisons" on page 89.

Cursors and prepared statements in procedures: All cursors opened in the called procedure that are not result set cursors are closed, and all statements prepared in the called procedure are destroyed when the procedure ends. CLOSQLCSR(*ENDACTGRP) can be used to keep cursors open when the procedure ends. For more information, see "SET OPTION" on page 1085.

Result sets from procedures: Result sets are only returned when a procedure is directly called or a nested RETURN TO CLIENT procedure is indirectly called from one of the following interfaces:

- · ODBC,
- JDBC,
- OLE DB,
- .NET,
- · SQL Call Level Interface, or
- System i Access Family Optimized SQL API.

There are three ways to return result sets from a procedure:

- If a SET RESULT SETS statement is executed in the procedure, the SET RESULT SETS statement identifies the result sets. The result sets are returned in the order specified on the SET RESULT SETS statement.
- If a SET RESULT SETS statement is not executed in the procedure,
 - If no cursors have specified a WITH RETURN clause, each cursor that the
 procedure opens and leaves open when it returns identifies a result set. The
 result sets are returned in the order in which the cursors are opened.
 - If any cursors have specified a WITH RETURN clause, each cursor that is defined with the WITH RETURN clause that the procedure opens and leaves open when it returns identifies a result set. The result sets are returned in the order in which the cursors are opened.

When a result set is returned using an open cursor, the rows are returned starting with the current cursor position.

Locks in procedures: All locks that have been acquired in the called procedure are retained until the end of the unit of work.

Errors from procedures: A procedure can return errors (or warnings) using the SQLSTATE like other SQL statements. Applications should be aware of the possible SQLSTATEs that can be expected when invoking a procedure. The possible SQLSTATEs depend on how the procedure is coded. Procedures may also return SQLSTATEs such as those that begin with '38' or '39' if the database manager encounters problems executing the procedure. Applications should therefore be prepared to handle any error SQLSTATE that may result from issuing a CALL statement.

Nesting CALL statements: A program that is executing as a procedure, a user-defined function, or a trigger can issue a CALL statement. When a procedure,

user-defined function, or trigger calls a procedure, user-defined function, or trigger, the call is considered to be nested. There is no limit on how many levels procedures and functions can be nested, but triggers can only be nested up to 200 levels deep.

If a procedure returns any query result sets, the result sets are returned to the caller of the procedure. If the SQL CALL statement is nested, the result sets are visible only to the program that is at the previous nesting level. For example, if a client program calls procedure PROCA, which in turn calls procedure PROCB. Only PROCA can access any result sets that PROCB returns; the client program has no access to the query result sets.

When an SQL or an external procedure is called, an attribute is set for SQL data-access that was defined when the procedure was created. The possible values for the attribute are:

NONE CONTAINS READS MODIFIES

If a second procedure is invoked within the execution of the current procedure, an error is issued if:

- The invoked procedure possibly contains SQL and the invoking procedure does not allow SQL
- The invoked procedure reads SQL data and the invoking procedure does not allow reading SQL data
- The invoked procedure modifies SQL data and the invoking procedure does not allow modifying SQL data

REXX procedures: If the external procedure to be called is a REXX procedure, then the procedure must be declared using the CREATE PROCEDURE or DECLARE PROCEDURE statement.

Variables cannot be used in the CALL statement within a REXX procedure. Instead, the CALL must be the object of a PREPARE and EXECUTE using parameter markers.

Multiple SQL descriptors on CALL: If SQL descriptors are specified on CALL and a procedure has IN or INOUT parameters and OUT or INOUT parameters, two descriptors must be specified. The number of variables that must be allocated in the SQL descriptors depends on how the SQL descriptor attributes are set and the number of each type of parameter.

- If the input SQL descriptor attributes were set using DESCRIBE INPUT and the
 output SQL descriptor attributes were set using DESCRIBE (OUTPUT), the SQL
 descriptors will have attributes that match the actual procedure definition at the
 current server prior to calling the procedure. In this case, the output SQL
 descriptor will contain one variable for each OUT and INOUT parameter.
 Likewise, the input SQL descriptor will contain one variable for each IN and
 INOUT parameter.
 - This is the recommended technique for specifying multiple SQL descriptors on a CALL statement.
- Otherwise, the actual procedure definition at the current server is unknown
 prior to calling the procedure, so each parameter is assumed to be INOUT at the
 time the procedure is called. This means that both SQL descriptors must be
 specified, and since each parameter is assumed to be INOUT, they must have

the same number of variables and the TYPE, DATETIME_INTERVAL_CODE, LENGTH, DB2_CCSID, PRECISION, and SCALE of each variable in the output SQL descriptor must be exactly the same as the corresponding variable in the input SQL descriptor. Otherwise, an error is returned.

If multiple SQL descriptors are specified, the DATA or INDICATOR items associated with any INOUT parameters in the input SQL descriptor may also be modified when the procedure is called. Thus, a SET DESCRIPTOR may be necessary to reset the DATA and INDICATOR items for such an input SQL descriptor prior to its use in another SQL statement.

Examples

Example 1: Call procedure PGM1 and pass two parameters.

```
CALL PGM1 (:hv1,:hv2)
```

Example 2: In C, invoke a procedure called SALARY_PROCED using the SQLDA named INOUT_SQLDA.

```
struct sqlda *INOUT_SQLDA;
/* Setup code for SQLDA variables goes here */
CALL SALARY PROC USING DESCRIPTOR :*INOUT SQLDA;
```

Example 3: A Java procedure is defined in the database using the following statement:

```
CREATE PROCEDURE PARTS_ON_HAND (IN PARTNUM INTEGER,
OUT COST DECIMAL(7,2),
OUT QUANTITY INTEGER)

LANGUAGE JAVA PARAMETER STYLE JAVA
EXTERNAL NAME 'parts!onhand';
```

A Java application calls this procedure on the connection context 'ctx' using the following code fragment:

```
int variable1;
BigDecimal variable2;
Integer variable3;
...
#sql [ctx] {CALL PARTS_ON_HAND(:IN variable1, :OUT variable2, :OUT variable3)};
...
```

This application code fragment will invoke the Java method *onhand* in class *parts* since the *procedure-name* specified on the CALL statement is found in the database and has the external name 'parts!onhand'.

CLOSE

The CLOSE statement closes a cursor. If a result table was created when the cursor was opened, that table is destroyed.

Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

None required. See "DECLARE CURSOR" on page 845 for the authorization required to use a cursor.

Syntax

►►—CLOSF—cursor-name-

Description

cursor-name

Identifies the cursor to be closed. The *cursor-name* must identify a declared cursor as explained in the DECLARE CURSOR statement. When the CLOSE statement is executed, the cursor must be in the open state.

Notes

Implicit cursor close: All cursors in a program are in the closed state when:

- The program is called.
 - If CLOSQLCSR(*ENDPGM) is specified, all cursors are in the closed state each time the program is called.
 - If CLOSQLCSR(*ENDSQL) is specified, all cursors are in the closed state only the first time the program is called as long as one SQL program remains on the call stack.
 - If CLOSQLCSR(*ENDJOB) is specified, all cursors are in the closed state only the first time the program is called in the job.
 - If CLOSQLCSR(*ENDMOD) is specified, all cursors are in the closed state each time the module is initiated.
 - If CLOSQLCSR(*ENDACTGRP) is specified, all cursors are in the closed state
 the first time the module in the program is initiated within the activation
 group.
- A program starts a new unit of work by executing a COMMIT or ROLLBACK statement without a HOLD option. Cursors declared with the HOLD option are not closed by a COMMIT statement.

Note: The DB2 for i database manager will open files in order to implement queries. The closing of the files can be separate from the SQL CLOSE statement. For more information, see SQL Programming.

Close cursors for performance: Explicitly closing cursors as soon as possible can improve performance.

Procedure considerations: Special rules apply to cursors within procedures that have not been closed before returning to the calling program. For more information, see "CALL" on page 620.

Example

In a COBOL program, use the cursor C1 to fetch the values from the first four columns of the EMPPROJACT table a row at a time and put them in the following host variables:

- EMP (CHAR(6))
- PRJ (CHAR(6))
- ACT (SMALLINT)
- TIM (DECIMAL(5,2))

Finally, close the cursor.

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
  77 EMP
                      PIC X(6).
 77 PRJ
                      PIC X(6).
 77 ACT PIC S9(4) BINARY.
77 TIM PIC S9(3) V9(2) PA
                     PIC S9(3)V9(2) PACKED-DECIMAL.
EXEC SQL END DECLARE SECTION END-EXEC.
EXEC SQL DECLARE C1 CURSOR FOR
            SELECT EMPNO, PROJNO, ACTNO, EMPTIME
              FROM EMPPROJACT
                                                     END-EXEC.
EXEC SQL OPEN C1 END-EXEC.
EXEC SQL FETCH C1 INTO : EMP, : PRJ, : ACT, :TIM END-EXEC.
IF SQLSTATE = '02000'
  PERFORM DATA-NOT-FOUND
  PERFORM GET-REST-OF-ACTIVITY UNTIL SQLSTATE IS NOT EQUAL TO '00000'.
EXEC SQL CLOSE C1 END-EXEC.
GET-REST-OF-ACTIVITY
EXEC SQL FETCH C1 INTO : EMP, : PRJ, : ACT, : TIM END-EXEC.
```

COMMENT

The COMMENT statement adds or replaces comments in the catalog descriptions of various database objects.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

To comment on a table, view, alias, column, distinct type, package, or sequence, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the table, view, alias, distinct type, package, or sequence in the statement,
 - The ALTER privilege on the table, view, alias, distinct type, package, or sequence, and
 - The system authority *EXECUTE on the library that contains the table, view, alias, index, distinct type, package, or sequence
- Administrative authority

To comment on a constraint or trigger, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the subject table of the constraint or trigger in the statement:
 - The ALTER privilege on the subject table, and
 - The system authority *EXECUTE on the library that contains the subject table
- Administrative authority

To comment on an index, the privileges held by the authorization ID of the statement must include at least one of the following:

- · For the index identified in the statement,
 - The system authority *OBJALTER on the index, and
 - The system authority *EXECUTE on the library containing the index.
- Administrative authority

To comment on a function, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSFUNCS and SYSROUTINES catalog view and table:
 - The UPDATE privilege on SYSROUTINES,
 - The system authority *OBJOPR on SYSFUNCS, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To comment on a procedure, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSPROCS and SYSROUTINES catalog view and table:
 - The UPDATE privilege on SYSROUTINES,
 - The system authority *OBJOPR on SYSPROCS, and
 - The system authority *EXECUTE on library QSYS2

| | |

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• Administrative authority

To comment on a parameter, the privileges held by the authorization ID of the statement must include at least one of the following:

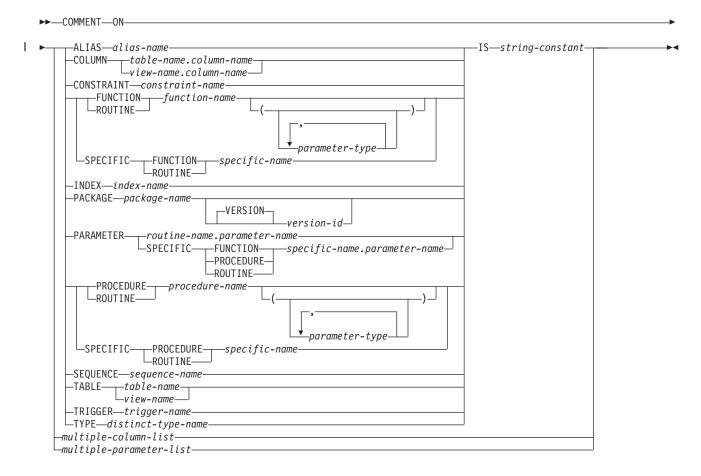
- For the SYSPARMS catalog table:
 - The UPDATE privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To comment on a sequence, the privileges held by the authorization ID of the statement must also include at least one of the following:

- *USE authority to the Change Data Area (CHGDTAARA), CL command
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View, Corresponding System Authorities When Checking Privileges to a Distinct Type, Corresponding System Authorities When Checking Privileges to a Sequence, and Corresponding System Authorities When Checking Privileges to a Package.

Syntax

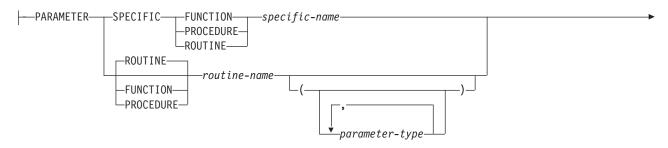


COMMENT

multiple-column-list:

```
-COLUMN-
                                -column-name—IS—string-constant-
```

multiple-parameter-list:





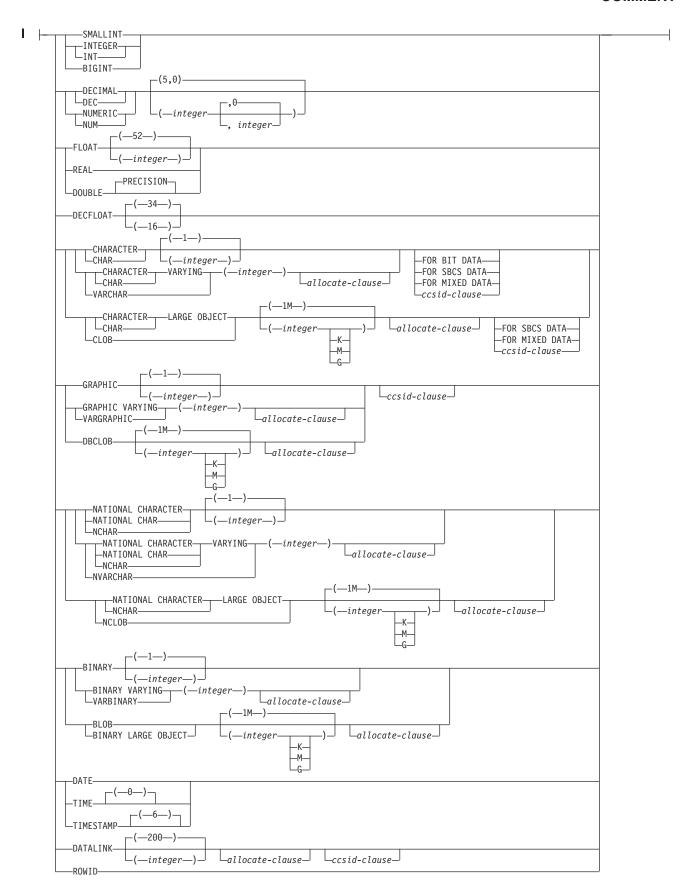
parameter-type:

```
—data-type-
            └AS LOCATOR
```

data-type:

```
-built-in-type-
-distinct-type-name—
```

built-in-type:



Description

ALIAS alias-name

Identifies the alias to which the comment applies. The *alias-name* must identify an alias that exists at the current server.

COLUMN

Specifies that a comment will be added to or replaced for a column.

table-name.column-name or view-name.column-name

Identifies the column to which the comment applies. The *table-name* or *view-name* must identify a table or view that exists at the current server, but must not identify a declared temporary table. The *column-name* must identify a column of that table or view.

CONSTRAINT

Specifies that a comment will be added to or replaced for a constraint.

constraint-name

Identifies the constraint to which the comment applies. The *constraint-name* must identify a constraint that exists at the current server.

FUNCTION or SPECIFIC FUNCTION

Identifies the function on which the comment applies. The function must exist at the current server and it must be a user-defined function. The function can be identified by its name, function signature, or specific name.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (*parameter-type*, ...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type*, ...) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance on which to comment. Synonyms for data types are considered a match.

If *function-name* () is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type, ...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

SPECIFIC FUNCTION specific-name

Identifies the function by its specific name. The *specific-name* must identify a specific function that exists at the current server.

INDEX index-name

Identifies the index to which the comment applies. The *index-name* must identify an index that exists at the current server.

PACKAGE package-name

Identifies the package to which the comment applies. The *package-name* must identify a package that exists at the current server. ⁷⁵

VERSION version-id

version-id is the version identifier that was assigned to the package when it was created. If *version-id* is not specified, a null string is used as the version identifier.

PARAMETER

Specifies that a comment will be added to or replaced for a parameter.

routine-name.parameter-name

Identifies the parameter to which the comment applies. The parameter could be for a procedure or a function. The *routine-name* must identify a procedure or function that exists at the current server, and the *parameter-name* must identify a parameter of that procedure or function.

^{75.} If the identified package has a version-id, the comment is limited to 176 bytes.

specific-name.parameter-name

Identifies the parameter to which the comment applies. The parameter could be for a procedure or a function. The *specific-name* must identify a procedure or function that exists at the current server, and the *parameter-name* must identify a parameter of that procedure or function.

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure to which the comment applies. The *procedure-name* must identify a procedure that exists at the current server.

PROCEDURE procedure-name

Identifies the procedure by its name. The *procedure-name* must identify exactly one procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE procedure-name (parameter-type, ...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The *procedure-name* (*parameter-type*, ...) must identify a procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types, and the logical concatenation of the data types is used to identify the specific procedure instance which is to be commented on. Synonyms for data types are considered a match.

If *procedure-name* () is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type, ...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a procedure defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE PROCEDURE
 statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

SPECIFIC PROCEDURE specific-name

Identifies the procedure by its specific name. The *specific-name* must identify a specific procedure that exists at the current server.

SEQUENCE sequence-name

Identifies the sequence to which the comment applies. The *sequence-name* must identify a sequence that exists at the current server.

TABLE table-name or view-name

Identifies the table or view to which the comment applies. The *table-name* or *view-name* must identify a table or view that exists at the current server, but must not identify a declared temporary table.

TRIGGER trigger-name

Identifies the trigger to which the comment applies. The *trigger-name* must identify a trigger that exists at the current server.

TYPE distinct-type-name

Identifies the distinct type to which the comment applies. The *distinct-type-name* must identify a distinct type that exists at the current server.

IS

Introduces the comment that to be added or replaced.

string-constant

Can be any character-string constant of up to 2000 characters (500 for a sequence).

multiple-column-list

To comment on more than one column in a table or view, specify the table or view name and then, in parenthesis, a list of the form:

```
(column-name IS string-constant,
  column-name IS string-constant, ...)
```

The column name must not be qualified, each name must identify a column of the specified table or view, and that table or view must exist at the current server.

multiple-parameter-list

To comment on more than one parameter in a procedure or function, specify the procedure name, function name, or specific name, and then, in parenthesis, a list of the form:

```
(parameter-name IS string-constant,
  parameter-name IS string-constant, ...)
```

The parameter name must not be qualified, each name must identify a parameter of the specified procedure or function, and that procedure or function must exist at the current server.

Notes

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword PROGRAM can be used as a synonym for PACKAGE.
- The keywords DATA TYPE or DISTINCT TYPE can be used as a synonym for TYPE.

Examples

Example 1: Insert a comment for the EMPLOYEE table.

```
COMMENT ON TABLE EMPLOYEE
IS 'Reflects first quarter 2000 reorganization'
```

Example 2: Insert a comment for the EMP_VIEW1 view.

```
COMMENT ON TABLE EMP_VIEW1

IS 'View of the EMPLOYEE table without salary information'
```

Example 3: Insert a comment for the EDLEVEL column of the EMPLOYEE table.

```
COMMENT ON COLUMN EMPLOYEE.EDLEVEL

IS 'Highest grade level passed in school'
```

Example 4: Enter comments on two columns in the DEPARTMENT table.

```
COMMENT ON DEPARTMENT

(MGRNO IS 'EMPLOYEE NUMBER OF DEPARTMENT MANAGER',

ADMRDEPT IS 'DEPARTMENT NUMBER OF ADMINISTERING DEPARTMENT')
```

Example 5: Insert a comment for the PAYROLL package.

```
COMMENT ON PACKAGE PAYROLL
IS 'This package is used for distributed payroll processing.'
```

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The COMMIT statement ends a unit of work and commits the database changes that were made by that unit of work.

Invocation

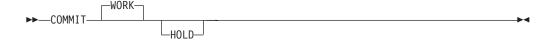
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

COMMIT is not allowed in a trigger if the trigger program and the triggering program run under the same commitment definition. COMMIT is not allowed in a procedure if the procedure is called on a Distributed Unit of Work connection to a remote application server or if the procedure is defined as ATOMIC. COMMIT is not allowed in a function.

Authorization

None required.

Syntax



Description

The COMMIT statement ends the unit of work in which it is executed and starts a new unit of work. It commits all changes made by SQL schema statements (except DROP SCHEMA) and SQL data change statements during the unit of work. For information about SQL schema statements and SQL data change statements see Chapter 5, "Statements," on page 529.

Connections in the release-pending state are ended.

WORK

COMMIT WORK has the same effect as COMMIT.

HOLD

Specifies a hold on resources. If specified, currently open cursors are not closed whether they are declared with a HOLD option or not. All resources acquired during the unit of work are held. Locks on specific rows and objects implicitly acquired during the unit of work are released.

All implicitly acquired locks are released; except for object level locks required for the cursors that are not closed.

All locators that are not held are released. For more information about held locators, see "HOLD LOCATOR" on page 990.

Notes

Recommended coding practices: An explicit COMMIT or ROLLBACK statement should be coded at the end of an application process. Either an implicit commit or rollback operation will be performed at the end of an application process

depending on the application environment. Thus, a portable application should explicitly execute a COMMIT or ROLLBACK before execution ends in those environments where explicit COMMIT or ROLLBACK is permitted.

An implicit COMMIT or ROLLBACK may be performed under the following circumstances.

- For the default activation group:
 - An implicit COMMIT is not performed when applications that run in the default activation group end. Interactive SQL, Query Manager, and non-ILE programs are examples of programs that run in the default activation group.
 - In order to commit work, you must issue a COMMIT.
- For non-default activation groups when the scope of the commitment definition is to the activation group:
 - If the activation group ends normally, the commitment definition is implicitly committed.
 - If the activation group ends abnormally, the commitment definition is implicitly rolled back.
- Regardless of the type of activation group, if the scope of the commitment definition is the job, an implicit commit is never performed.

Effect of commit: Commit without HOLD causes the following to occur:

- Connections in the release-pending state are ended.
 - For existing connections:
 - all open cursors that were declared with the WITH HOLD clause are preserved and their current position is maintained, although a FETCH statement is required before a Positioned UPDATE or Positioned DELETE statement can be executed.
 - all open cursors that were declared without the WITH HOLD clause are closed.
- All LOB locators that are not held are freed. Note that this is true even when the locators are associated with LOB values retrieved via a cursor that has the WITH HOLD property.
- All locks acquired by the LOCK TABLE statement are released. All implicitly
 acquired locks are released, except for those required for the cursors that were
 not closed.

Row lock limit: A unit of work can include the processing of up to 4 million rows, including rows retrieved during a SELECT or FETCH statement⁷⁶, and rows inserted, deleted, or updated as part of INSERT, DELETE, and UPDATE statements.⁷⁷

Unaffected statements: The commit and rollback operations do not affect the DROP SCHEMA statement, and this statement is not, therefore, allowed in an application program that also specifies COMMIT(*CHG), COMMIT(*CS), COMMIT(*ALL), or COMMIT(*RR).

^{76.} This limit also includes:

[·] Any rows accessed or changed through files opened under commitment control through high-level language file processing

Any rows deleted, updated, or inserted as a result of a trigger or CASCADE, SET NULL, or SET DEFAULT referential
integrity delete rule.

COMMIT Restrictions: A commit or rollback in a user-defined function in a secondary thread is not allowed.

Commitment definition use: The commitment definition used by SQL is determined as follows:

- If the activation group of the program calling SQL is already using an activation group level commitment definition, then SQL uses that commitment definition.
- If the activation group of the program calling SQL is using the job level commitment definition, then SQL uses the job level commitment definition.
- If the activation group of the program calling SQL is not currently using a commitment definition but the job commitment definition is started, then SQL uses the job commitment definition.
- If the activation group of the program calling SQL is not currently using a commitment definition and the job commitment definition is not started, then SQL implicitly starts a commitment definition. SQL uses the Start Commitment Control (STRCMTCTL) command with:
 - A CMTSCOPE(*ACTGRP) parameter
 - A LCKLVL parameter based on the COMMIT option specified on either the CRTSQLxxx, STRSQL, or RUNSQLSTM commands. In REXX, the LCKLVL parameter is based on the commit option in the SET OPTION statement.

Example

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In a C program, transfer a certain amount of commission (COMM) from one employee (EMPNO) to another in the EMPLOYEE table. Subtract the amount from one row and add it to the other. Use the COMMIT statement to ensure that no permanent changes are made to the database until both operations are completed successfully.

```
void main ()
     EXEC SQL BEGIN DECLARE SECTION;
     decimal(5,2) AMOUNT;
     char FROM EMPNO[7];
     char TO_EMPNO[7];
     EXEC SQL END DECLARE SECTION;
     EXEC SQL INCLUDE SQLCA;
     EXEC SQL WHENEVER SQLERROR GOTO SQLERR;
    EXEC SQL UPDATE EMPLOYEE
               SET COMM = COMM - : AMOUNT
               WHERE EMPNO = :FROM EMPNO;
     EXEC SQL UPDATE EMPLOYEE
               SET COMM = COMM + : AMOUNT
               WHERE EMPNO = :TO EMPNO;
  FINISHED:
    EXEC SQL COMMIT WORK;
     return;
  SOLERR:
     EXEC SQL WHENEVER SQLERROR CONTINUE; /* continue if error on rollback */
     EXEC SQL ROLLBACK WORK;
     return;
```

CONNECT (Type 1)

The CONNECT (TYPE 1) statement connects an activation group within an application process to the identified application server using the rules for remote unit of work. This server is then the current server for the activation group. This type of CONNECT statement is used if RDBCNNMTH(*RUW) was specified on the CRTSQLxxx command.

Differences between the two types of statements are described in "CONNECT (Type 1) and CONNECT (Type 2) differences" on page 1223. Refer to "Application-directed distributed unit of work" on page 43 for more information about connection states.

Invocation

This statement can only be embedded within an application program or issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

CONNECT is not allowed in a trigger, a function, or a procedure if the procedure is called on a remote application server.

Authorization

The privileges held by the authorization ID of the statement must include communications-level security. (See the section about security in Distributed Database Programming).

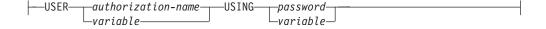
If the application server is DB2 for i, the user profile of the person issuing the statement must also be a valid user profile on the application server system, **UNLESS:**

- · User is specified. In this case, the USER clause must specify a valid user profile on the application server system.
- TCP/IP is used with a server authorization entry for the application server. In this case, the server authorization entry must specify a valid user profile on the application server system.

Syntax 1 4 1



authorization:



Description

TO *server-name* **or** *variable*

Identifies the application server by the specified server name or the server name contained in the variable. If a variable is specified:

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable.
- The server name must be left-justified within the variable and must conform to the rules for forming an ordinary identifier.
- If the length of the server name is less than the length of the variable, it must be padded on the right with blanks.

When the CONNECT statement is executed, the specified server name or the server name contained in the variable must identify an application server described in the local directory and the activation group must be in the connectable state.

If the *server-name* is a local relational database and an *authorization-name* is specified, it must be the user of the job. If the specified *authorization-name* is different than the user of the job, an error occurs and the application is left in the unconnected state.

USER authorization-name or variable

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Identifies the authorization name that will be used to connect to the application server.

If a variable is specified,

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable.
- The authorization name must be left-justified within the variable and must conform to the rules of forming an authorization name.
- If the length of the authorization name is less than the length of the variable, it must be padded on the right with blanks.
- The value of the server name must not contain lowercase characters.

USING password or variable

Identifies the password that will be used to connect to the application server.

If password is specified as a literal, it must be a character string. The maximum length is 128 characters. It must be left justified. The literal form of the password is not allowed in static SQL or REXX.

If a variable is specified,

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable.
- The password must be left-justified within the variable.
- If the length of the password is less than that of the variable, it must be padded on the right with blanks.

RESET

CONNECT RESET is equivalent to CONNECT TO x where x is the local server name.

CONNECT with no operand

This form of the CONNECT statement returns information about the current server and has no effect on connection states, open cursors, prepared statements, or locks. The connection information is returned in the connection information items in the SQL Diagnostics Area (or the SQLCA).

Notes

Successful connection: If the CONNECT statement is successful:

CONNECT (Type 1)

- All open cursors are closed, all prepared statements are destroyed, and all locks are released from the current connection.
- The activation group is disconnected from all current and dormant connections, if any, and connected to the identified application server.
- The name of the application server is placed in the CURRENT SERVER special register.
- Information about the application server is placed in the *connection-information-items* in the SQL Diagnostics Area.
- Information about the application server is also placed in the SQLERRP and SQLERRD(4) fields of the SQLCA. If the application server is an IBM relational database product, the information in the SQLERRP field has the form *pppvvrrm*, where:
 - ppp identifies the product as follows:
 - ARI for DB2 for VM and VSE
 - DSN for DB2 for z/OS
 - QSQ for DB2 for i
 - SQL for all other DB2 products
 - vv is a two-digit version identifier such as '08'
 - rr is a two-digit release identifier such as '01'
 - *m* is a one-character modification level such as '0'

For example, if the application server is Version 9 of DB2 for z/OS, the value of SQLERRP is 'DSN09010'.

The SQLERRD(4) field of the SQLCA contains values indicating whether the application server allows commitable updates to be performed. For a CONNECT (Type 1) statement SQLERRD(4) will always contain the value 1. The value 1 indicates that commitable updates can be performed, and the connection:

- Uses an unprotected conversation⁷⁸, or
- Is a connection to an application requester driver program using the *RUW connection method, or
- Is a local connection using the *RUW connection method.
- Additional information about the connection is placed in the SQLERRMC field of the SQLCA. Refer to Appendix C, "SQLCA (SQL communication area)," on page 1225

Unsuccessful connection: If the CONNECT statement is unsuccessful, the DB2_MODULE_DETECTING_ERROR condition information item in the SQL Diagnostics Area (or the SQLERRP field of the SQLCA) is set to the name of the module at the application requester that detected the error. Note that the first three characters of the module name identify the product. For example, if the application requester is DB2 LUW for Windows the first three characters are 'SQL'.

If the CONNECT statement is unsuccessful because the activation group is not in the connectable state, the connection state of the activation group is unchanged.

If the CONNECT statement is unsuccessful for any other reason:

• The activation group remains in a connectable, but unconnected state

^{78.} To reduce the possibility of confusion between network connections and SQL connections, in this book the term 'conversation' will be used to apply to network connections over TCP/IP as well as over APPC, even though it formally applies only to APPC connections.

 All open cursors are closed, all prepared statements are destroyed, and all locks are released from all current and dormant connections.

An application in a connectable but unconnected state can only execute the CONNECT or SET CONNECTION statements.

Implicit connect:

- When running in the default activation group, the SQL program implicitly connects to a remote relational database when:
 - The activation group is in a connectable state.
 - The first SQL statement in the first SQL program on the program stack is executed.
- When running in a non-default activation group, the SQL program implicitly connects to a remote relational database when the first SQL statement in the first SQL program for that activation group is executed.

Note: It is a good practice for the first SQL statement executed by an activation group to be the CONNECT statement.

When APPC is used for connecting to an RDB, implicit connect always sends the *authorization-name* of the application requester job and does not send passwords. If the *authorization-name* of the application server job is different, or if a password must be sent, an explicit connect statement must be used.

When TCP/IP is used for connecting to an RDB, an implicit connect is not bound by the above restrictions. Use of the ADDSVRAUTE and other -SVRAUTE commands allows one to specify, for a given user under which the implicit (or explicit) CONNECT is done, the remote authorization-name and password to be used in connecting to a given RDB.

In order for the password to be stored with the ADDSVRAUTE or CHGSVRAUTE command, the QRETSVRSEC system value must be set to '1' rather than the default of '0'. When using these commands for DRDA connection, it is very important to realize that the value of the RDB name entered into the SERVER parameter must be in UPPER CASE. For more information, see Example 2 under Type 2 CONNECT.

For more information about implicit connect, refer to the SQL Programming topic collection. Once a connection to a relational database for a user profile is established, the password, if specified, may not be validated again on subsequent connections to the same relational database with the same user profile. Revalidation of the password depends on if the conversation is still active. See the Distributed Database Programming topic collection for more details.

Connection states: For a description of connection states, see "Remote unit of work connection management" on page 41. Consecutive CONNECT statements can be executed successfully because CONNECT does not remove the activation group from the connectable state.

A CONNECT to either a current or dormant connection in the application group is executed as follows:

 If the connection identified by the server-name was established using a CONNECT (Type 1) statement, then no action is taken. Cursors are not closed, prepared statements are not destroyed, and locks are not released.

CONNECT (Type 1)

• If the connection identified by the server-name was established using a CONNECT (Type 2) statement, then the CONNECT statement is executed like any other CONNECT statement.

CONNECT cannot execute successfully when it is preceded by any SQL statement other than CONNECT, COMMIT, DISCONNECT, SET CONNECTION, RELEASE, or ROLLBACK. To avoid an error, execute a commit or rollback operation before a CONNECT statement is executed.

If any previous current or dormant connections were established using protected conversations, then the CONNECT (Type 1) statement will fail. Either, a CONNECT (Type 2) statement must be used, or the connections using protected conversations must be ended by releasing the connections and successfully committing.

For more information about connecting to a remote relational database and the local directory, see SQL Programming and the Distributed Database Programming.

SET SESSION AUTHORIZATION: If a SET SESSION AUTHORIZATION statement has been executed in the thread, a CONNECT to the local server will fail unless prior to the connect statement, the SYSTEM_USER value is the same as SESSION USER.

This incudes an implicit connect due to invoking a program that specifies ACTGRP(*NEW).

Examples

Example 1: In a C program, connect to the application server TOROLAB. EXEC SQL **CONNECT TO** TOROLAB;

Example 2: In a C program, connect to an application server whose name is stored in the variable APP_SERVER (VARCHAR(18)). Following a successful connection, copy the product identifier of the application server to the variable PRODUCT.

```
void main ()
  {
    char product[9] = " ";
    EXEC SQL BEGIN DECLARE SECTION;
    char APP_SERVER[19];
    char username[11]:
    char userpass[129];
    EXEC SQL END DECLARE SECTION;
    EXEC SQL INCLUDE SQLCA;
    strcpy(APP_SERVER, "TOROLAB");
    strcpy(username,"JOE");
strcpy(userpass,"XYZ1");
EXEC SQL CONNECT TO :APP_SERVER
              USER :username USING :userpass;
    if (strncmp(SQLSTATE, "00000", 5) )
      { EXEC SQL GET DIAGNOSTICS CONDITION 1
           product = DB2_PRODUCT_ID; }
    return;
```

CONNECT (Type 2)

The CONNECT (Type 2) statement connects an activation group within an application process to the identified application server using the rules for application directed distributed unit of work. This server is then the current server for the activation group. This type of CONNECT statement is used if RDBCNNMTH(*DUW) was specified on the CRTSQLxxx command.

Differences between the two types of statements are described in "CONNECT (Type 1) and CONNECT (Type 2) differences" on page 1223. Refer to "Application-directed distributed unit of work" on page 43 for more information about connection states.

Invocation

This statement can only be embedded in an application program or issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

CONNECT is not allowed in a trigger, a function, or a procedure if the procedure is called on a remote application server.

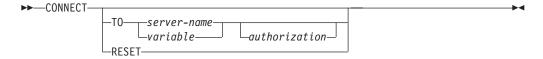
Authorization

The privileges held by the authorization ID of the statement must include communications-level security. (See the section about security in the Distributed Database Programming topic collection.)

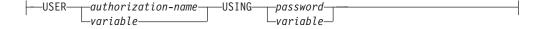
If the application server is DB2 for i, the profile ID of the person issuing the statement must also be a valid user profile on the application server system, UNLESS:

- USER is specified. If USER is specified, the USER clause must specify a valid user profile on the application server system.
- TCP/IP is used with a server authorization entry for the application server. If this is the case, the server authorization entry must specify a valid user profile on the application server system.

Syntax



authorization:



Description

TO server-name or variable

Identifies the application server by the specified server name or the server name contained in the variable. If a variable is specified:

CONNECT (Type 2)

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable
- The server name must be left-justified within the variable and must conform to the rules for forming an ordinary identifier
- If the length of the server name is less than the length of the variable, it must be padded on the right with blanks.
- The value of the server name must not contain lowercase characters.

When the CONNECT statement is executed, the specified server name or the server name contained in the variable must identify an application server described in the local directory.

Let S denote the specified server name or the server name contained in the variable. S must not identify an existing connection of the application process.

USER authorization-name or variable

Identifies the authorization name that will be used to connect to the application server.

If a variable is specified:

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable. The authorization name must be left-justified within the variable and must conform to the rules of forming an authorization name.
- If the length of the authorization name is less than the length of the variable, it must be padded on the right with blanks.

USING password or variable

Identifies the password that will be used to connect to the application server.

If password is specified as a literal, it must be a character string. The maximum length is 128 characters. It must be left justified. The literal form of the password is not allowed in static SQL or REXX.

If a variable is specified:

- It must be a CHAR or VARCHAR host variable.
- It must not be followed by an indicator variable.
- The password must be left-justified within the variable.
- If the length of the password is less than that of the variable, it must be padded on the right with blanks.

RESET

CONNECT RESET is equivalent to CONNECT TO *x* where *x* is the local server name.

CONNECT with no operand

This form of the CONNECT statement returns information about the current server and has no effect on connection states, open cursors, prepared statements, or locks. The connection information is returned in the connection information items in the SQL Diagnostics Area (or the SQLCA).

In addition, the DB2_CONNECTION_STATUS connection information item in the SQL Diagnostics Area (or the SQLERRD(3) field of the SQLCA) will indicate the status of connection for this unit of work. It will have one of the following values:

 1 - Commitable updates can be performed on the connection for this unit of work. • 2 - No commitable updates can be performed on the connection for this unit of work.

Notes

Successful connection: If the CONNECT statement is successful:

- A connection to application server S is created and placed in the current and held states. The previous connection, if any, is placed in the dormant state.
- S is placed in the CURRENT SERVER special register.
- Information about the application server is placed in the connection-informationitems in the SQL Diagnostics Area.
- Information about application server S is also placed in the SQLERRP and SQLERRD(4) fields of the SQLCA. If the application server is an IBM relational database product, the information in the SQLERRP field has the form pppvvrrm, where:
 - ppp identifies the product as follows:
 - ARI for DB2 for VM and VSE
 - DSN for DB2 for z/OS
 - QSQ for DB2 for i
 - SQL for all other DB2 products
 - vv is a two-digit version identifier such as '08'
 - rr is a two-digit release identifier such as '01'
 - m is a one-character modification level such as '0'

For example, if the application server is Version 9 of DB2 for z/OS, the value of SQLERRP is 'DSN09010'.

The SQLERRD(4) field of the SQLCA contains values indicating whether application server S allows commitable updates to be performed. Following is a list of values and their meanings for the SQLERRD(4) field of the SQLCA on the CONNECT:

- 1 commitable updates can be performed. Conversation is unprotected. ⁷⁸
- 2 No commitable updates can be performed. Conversation is unprotected.
- 3 It is unknown if commitable updates can be performed. Conversation is protected.
- 4 It is unknown if commitable updates can be performed. Conversation is unprotected.
- 5 It is unknown if commitable updates can be performed. The connection is either a local connection or a connection to an application requester driver program.
- Additional information about the connection is placed in the SQLERRMC field of the SQLCA. Refer to Appendix C, "SQLCA (SQL communication area)," on page 1225.

Unsuccessful connection: If the CONNECT statement is unsuccessful, the connection state of the activation group and the states of its connections are unchanged.

Implicit connect: Implicit connect will always send the *authorization-name* of the application requester job and will not send passwords. If the authorization-name of the application server job is different or if a password must be sent, an explicit connect statement must be used.

Chapter 5. Statements

CONNECT (Type 2)

When TCP/IP is used for connecting to an RDB, an implicit connect is not bound by the above restrictions. Use of the ADDSVRAUTE and other -SVRAUTE commands allows one to specify, for a given user under which the implicit (or explicit) CONNECT is done, the remote authorization-name and password to be used in connecting to a given RDB.

In order for the password to be stored with the ADDSVRAUTE or CHGSVRAUTE command, the QRETSVRSEC system value must be set to '1' rather than the default of '0'. When using these commands for DRDA connection, it is very important to realize that the value of the RDB name entered into the SERVER parameter must be in UPPER CASE. For more information, see Example 2 under Type 2 CONNECT.

For more information about implicit connect, refer to SQL Programming. Once a connection to a relational database for a user profile is established, the password, if specified, may not be validated again on subsequent connections to the same relational database with the same user profile. Revalidation of the password depends on if the conversation is still active. See Distributed Database Programming for more details.

SET SESSION AUTHORIZATION: If a SET SESSION AUTHORIZATION statement has been executed in the thread, a CONNECT to the local server will fail unless prior to the connect statement, the SYSTEM_USER value is the same as SESSION_USER.

This incudes an implicit connect due to invoking a program that specifies ACTGRP(*NEW).

Examples

Example 1: Execute SQL statements at TOROLAB and SVLLAB. The first CONNECT statement creates the TOROLAB connection and the second CONNECT statement places it in the dormant state.

```
EXEC SQL CONNECT TO TOROLAB;

(execute statements referencing objects at TOROLAB)

EXEC SQL CONNECT TO SVLLAB;

(execute statements referencing objects at SVLLAB)
```

Example 2: Connect to a remote server specifying a userid and password, perform work for the user and then connect as another user to perform further work.

```
EXEC SQL CONNECT TO SVLLAB USER :AUTHID USING :PASSWORD;

(execute SQL statements accessing data on the server)

EXEC SQL COMMIT;

(set AUTHID and PASSWORD to new values)

EXEC SQL CONNECT TO SVLLAB USER :AUTHID USING :PASSWORD;

(execute SQL statements accessing data on the server)
```

Example 3: User JOE wants to connect to TOROLAB3 and execute SQL statements under the user ID ANONYMOUS which has a password of SHIBBOLETH. The RDB directory entry for TOROLAB3 specifies *IP for the connection type.

Before running the application, some setup must be done.

This command will be required to allow server security information to be retained in the IBM i operating system, if it has not been previously run:

```
CHGSYSVAL SYSVAL(QRETSVRSEC) VALUE('1')
```

This command adds the required server authorization entry:

ADDSVRAUTE USRPRF(JOE) SERVER(TOROLAB3) USRID(ANONYMOUS) +

PASSWORD(SHIBBOLETH)

This statement, run under JOE's user profile, will now make the wanted connection:

```
EXEC SQL CONNECT TO TOROLAB3; (execute statements referencing objects at TOROLAB3)
```

CREATE ALIAS

The CREATE ALIAS statement defines an alias on a table, partition of a table, view, or member of a database file at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- · Administrative authority

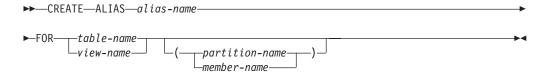
The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE to the Create DDM File (CRTDDMF) command
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the alias is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- Administrative authority

Syntax



Description

alias-name

Names the alias. The name, including the implicit or explicit qualifier, must not be the same as an index, table, view, alias or file that already exists at the current server.

If the *alias-name* is qualified, the schema name should not be a system schema.

If SQL names were specified, the alias will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the alias will be created in the schema that is specified by the qualifier. If not qualified, the alias will be created in the same schema as the table or view for which the alias was created. If the table is not qualified and does not exist at the time the alias is created:

- If the value of the CURRENT SCHEMA special register is *LIBL, the alias will be created in the current library (*CURLIB).
- Otherwise, the alias will be created in the current schema.

If the alias name is not a valid system name, DB2 for i will generate a system name. For information about the rules for generating a name, see "Rules for Table Name Generation" on page 810.

FOR table-name or view-name

Identifies the table or view at the current server for which the alias is to be defined. An alias name cannot be specified (an alias cannot refer to another alias).

The *table-name* or *view-name* need not identify a table or view that exists at the time the alias is created. If the table or view does not exist when the alias is created, a warning is returned. If the table or view does not exist when the alias is used, an error is returned.

If SQL names were specified and the *table-name* or *view-name* was not qualified, then the qualifier is the implicit qualifier. For more information, see "Naming conventions" on page 52.

If system names were specified and the *table-name* or *view-name* is not qualified and does not exist when the alias is created, the *table-name* or *view-name* is qualified by the library in which the alias is created.

partition-name

Identifies a partition of a partitioned table.

If a partition is specified, the alias cannot be used in SQL schema statements. If a partition is not specified, all partitions in the table are included in the alias.

member-name

Identifies a member of a database file. If a member name is not specified, *FIRST is used.

If a member is specified, the alias cannot be used in most SQL schema statements. It can be used in CREATE PROCEDURE, CREATE FUNCTION and in a CREATE TABLE with an *as-result-table* clause.

Notes

The Override Database File (OVRDBF) CL command allows the database manager to process individual members of a database file. Creating an alias over a partition of a table or member of a database file, however, is easier and performs better by eliminating the need to perform the override.

An alias can be defined to reference either the system name or SQL name. However, since system names are generated during create processing, it is recommended that the SQL name be specified.

Alias attributes: An alias is created as a special form of a DDM file.

An alias created over a distributed table is only created on the current server. For more information about distributed tables, see DB2 Multisystem.

Alias ownership: If SQL names were specified:

• If a user profile with the same name as the schema into which the alias is created exists, the *owner* of the alias is that user profile.

CREATE ALIAS

• Otherwise, the *owner* of the alias is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the alias is the user profile or group user profile of the job executing the statement.

Alias authority: If SQL names are used, aliases are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, aliases are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the alias is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the alias.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

• The keyword SYNONYM can be used as a synonym for ALIAS.

Examples

Example 1: Create an alias named CURRENT_PROJECTS for the PROJECT table.

CREATE ALIAS CURRENT_PROJECTS

FOR PROJECT

Example 2: Create an alias named SALES_JANUARY on the JANUARY partition of the SALES table. The sales table has 12 partitions (one for each month of the year).

CREATE ALIAS SALES_JANUARY
FOR SALES(JANUARY)

CREATE FUNCTION

The CREATE FUNCTION statement defines a user-defined function at the current server.

The following types of functions can be defined:

External Scalar

The function is written in a programming language such as C or Java and returns a scalar value. The external program is referenced by a function defined at the current server along with various attributes of the function. See "CREATE FUNCTION (External Scalar)" on page 659.

• External Table

The function is written in a programming language such as C or Java and returns a set of rows. The external program is referenced by a function defined at the current server along with various attributes of the function. See "CREATE FUNCTION (External Table)" on page 677.

Sourced

The function is implemented by invoking another function (built-in, external, sourced, or SQL) that already exists at the current server. A sourced function can return a scalar result, or the result of an aggregate function. See "CREATE FUNCTION (Sourced)" on page 693. The function inherits attributes of the underlying source function.

SQL Scalar

The function is written exclusively in SQL and returns a scalar value. The function body is defined at the current server along with various attributes of the function. See "CREATE FUNCTION (SQL Scalar)" on page 703.

SQL Table

The function is written exclusively in SQL and returns a set of rows. The function body is defined at the current server along with various attributes of the function. See "CREATE FUNCTION (SQL Table)" on page 713.

Notes

Choosing the schema and function name: If a qualified function name is specified, the *schema-name* cannot be one of the system schemas (see "Schemas" on page 5). If *function-name* is not qualified, it is implicitly qualified with the default schema name.

The unqualified function name must not be one of the following names reserved for system use even if they are specified as delimited identifiers:

=	<	>	>=
<=	<>	7=	¬<
¬<	!=	!<	!>
ALL	DISTINCT	NODENAME	SIMILAR
AND	EXCEPT	NODENUMBER	SOME
ANY	EXISTS	NOT	STRIP
BETWEEN	EXTRACT	NULL	SUBSTRING
BOOLEAN	FALSE	ONLY	TABLE
CASE	FOR	OR	THEN
CAST	FROM	OVERLAPS	TRIM
CHECK	HASHED_VALUE	PARTITION	TRUE
DATAPARTITIONNAME	IN	POSITION	TYPE

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DATAPARTITIONNUM	IS	RID	UNIQUE
DBPARTITIONNAME	LIKE	RRN	UNKNOWN
DBPARTITIONNUM	MATCH	SELECT	WHEN

Defining the parameters: The input parameters for the function are specified as a list within parenthesis.

The maximum number of parameters allowed in CREATE FUNCTION is 90.

A function can have no input parameters. In this case, an empty set of parenthesis must be specified, for example:

CREATE FUNCTION WOOFER()

The data type of the result of the function is specified in the RETURNS clause for the function.

- Choosing data types for parameters: When choosing the data types of the input and result parameters for a function, the rules of promotion that can affect the values of the parameters need to be considered. See "Promotion of data types" on page 84. For example, a constant that is one of the input arguments to the function might have a built-in data type that is different from the data type that the function expects, and more significantly, might not be promotable to that expected data type. Based on the rules of promotion, using the following data types is recommended:
 - INTEGER instead of SMALLINT
 - DOUBLE instead of REAL
 - VARCHAR instead of CHAR
 - VARGRAPHIC instead of GRAPHIC

For portability of functions across platforms that are not DB2 for i, do not use the following data type names, which might have different representations on different platforms:

- FLOAT. Use DOUBLE or REAL instead.
- NUMERIC. Use DECIMAL instead.
- Specifying AS LOCATOR for a parameter: Passing a locator instead of a value can result in fewer bytes being passed in or out of the function. This can be useful when the value of the parameter is very large. The AS LOCATOR clause specifies that a locator to the value of the parameter is passed instead of the actual value. Specify AS LOCATOR only for parameters that have a LOB data type or a distinct type based on a LOB data type and only when LANGUAGE JAVA is not in effect.

The AS LOCATOR clause has no effect on determining whether data types can be promoted, nor does it affect the function signature, which is used in function resolution.

AS LOCATOR cannot be specified for SQL functions.

Determining the uniqueness of functions in a schema: The same name can be used for more than one function in a schema if the function signature of each function is unique. The function signature is the qualified function name combined with the number and data types of the input parameters. The combination of name, schema name, the number of parameters, and the data type each parameter (without regard for other attributes such as length, precision, scale, or CCSID) must not identify a user-defined function that exists at the current server. The return type has no impact on the determining uniqueness of a function. Two

different schemas can each contain a function with the same name that have the same data types for all of their corresponding data types. However, a schema must not contain two functions with the same name that have the same data types for all of their corresponding data types.

When determining whether corresponding data types match, the database manager does not consider any length, precision, or scale attributes in the comparison. The database manager considers the synonyms of data types a match. For example, REAL and FLOAT, and DOUBLE and FLOAT are considered a match. Therefore, CHAR(8) and CHAR(35) are considered to be the same, as are DECIMAL(11,2), and DECIMAL(4,3). Furthermore, the character and graphic types are considered to be the same. For example, the following are considered to be the same type: CHAR and GRAPHIC, VARCHAR and VARGRAPHIC, and CLOB and DBCLOB. CHAR(13) and GRAPHIC(8) are considered to be the same type. An error is returned if the signature of the function being created is a duplicate of a signature for an existing user-defined function with the same name and schema.

Assume that the following statements are executed to create four functions in the same schema. The second and fourth statements fail because they create functions that are duplicates of the functions that the first and third statements created.

```
CREATE FUNCTION PART (INT, CHAR(15) ... CREATE FUNCTION PART (INTEGER, CHAR(40) ... CREATE FUNCTION ANGLE (DECIMAL(12,2)) ... CREATE FUNCTION ANGLE (DEC(10,7)) ...
```

Specifying a specific name for a function: When defining multiple functions with the same name and schema (with different parameter lists), it is recommended that a specific name also be specified. The specific name can be used to uniquely identify the function such as when sourcing on this function, dropping the function, or commenting on the function. However, the function cannot be invoked by its specific name.

The specific name is implicitly or explicitly qualified with a schema name. If a schema name is not specified on CREATE FUNCTION, it is the same as the explicit or implicit schema name of the function name (*function-name*). If a schema name is specified, it must be the same as the explicit or implicit schema name of the function name. The name, including the schema name must not identify the specific name of another function or procedure that exists at the current server.

If a specific name is not specified, it is set to the function name. If a function or procedure with that specific name already exists, a unique name is generated similar to the rules used to generate unique table names.

Extending or overriding a built-in function:

Giving a user-defined function the same name as a built-in function is not a recommended practice unless the functionality of the built-in function needs to be extended or overridden.

• Extending the functionality of existing built-in functions:

Create the new user-defined function with the same name as the built-in function, and a unique function signature. For example, a user-defined function similar to the built-in function ROUND that accepts the distinct type MONEY as input rather than the built-in numeric types might be necessary. In this case, the signature for the new user-defined function named ROUND is different from all the function signatures supported by the built-in ROUND function.

CREATE FUNCTION

• Overriding a built-in function:

Create the new user-defined function with the same name and signature as an existing built-in function. The new function has the same name and data type as the corresponding parameters of the built-in function but implements different logic. For example, a user-defined function similar to the built-in function ROUND that uses different rules for rounding than the built-in ROUND function might be necessary. In this case, the signature for the new user-defined function named ROUND will be the same as a signature that is supported by the built-in ROUND function.

Once a built-in function has been overridden, if the schema for the new function appears in the SQL path before the system schemas, the database manager may choose a user-defined function rather than the built-in function. An application that uses the unqualified function name and was previously successful using the built-in function of that name might fail, or perhaps even worse, appear to run successfully but provide a different result if the user-defined function is chosen by the database manager rather than the built-in function.

The DISTINCT keyword can be passed on the invocation of a user-defined function that is sourced on one of the built-in aggregate functions. For example, assume that MY_AVG is a user-defined function that is sourced on the built-in AVG function. The user-defined function could be invoked with MY_AVG (DISTINCT *expression*). This results in the underlying built-in AVG function being invoked with the DISTINCT keyword.

Special registers in functions: The settings of the special registers of the invoker are inherited by the function on invocation and restored upon return to the invoker. Special registers may be changed in a function that can execute SQL statements, but these changes do not affect the caller.

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CREATE FUNCTION (External Scalar)

This CREATE FUNCTION (External Scalar) statement defines an external scalar function at the current server. A user-defined external scalar function returns a single value each time it is invoked.

Invocation

This statement can be embedded in an application program, or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization id of the statement must include at least one of the following:

- For the SYSFUNCS catalog view and SYSPARMS catalog table⁷⁹:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- · Administrative Authority

If the external program or service program exists, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the external program or service program that is referenced in the SQL statement:
 - The system authority *EXECUTE on the library that contains the external program or service program.
 - The system authority *EXECUTE on the external program or service program, and
 - The system authority *CHANGE on the program or service program. The
 system needs this authority to update the program object to contain the
 information necessary to save/restore the function to another system. If user
 does not have this authority, the function is still created, but the program
 object is not updated.
- Administrative Authority

If SQL names are specified and a user profile exists that has the same name as the library into which the function is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- Administrative authority

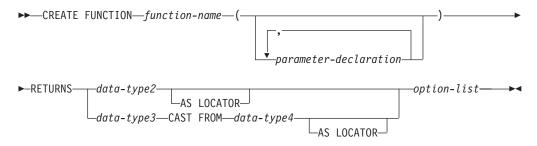
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

CREATE FUNCTION (External Scalar)

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax



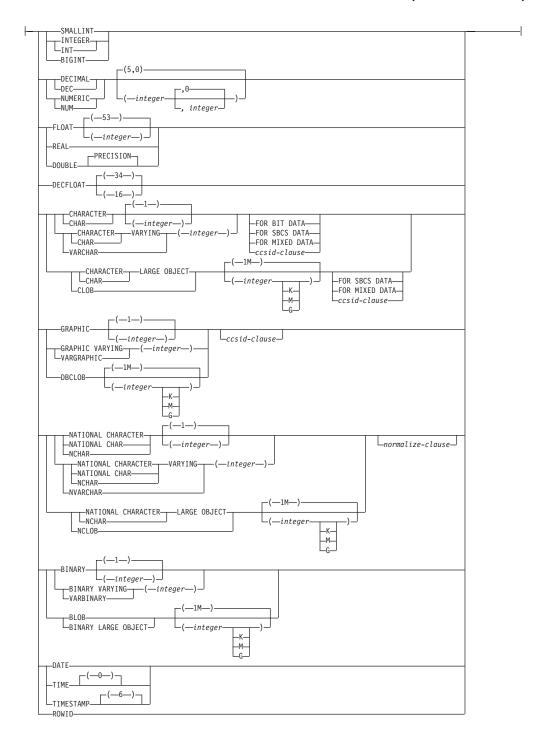
parameter-declaration:



data-type1, data-type2, data-type3, data-type4:

```
-__built-in-type-
distinct-type-name-
```

built-in-type:



ccsid-clause:

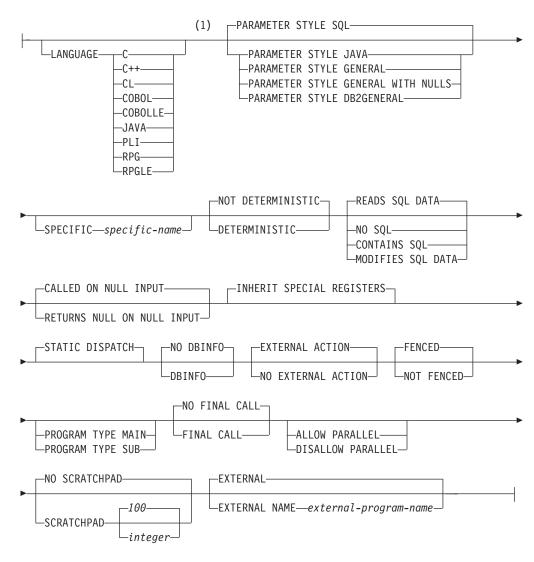
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CREATE FUNCTION (External Scalar)

normalize-clause:



option-list:



Notes:

This clause and the clauses that follow in the option-list can be specified in any order. Each clause can be specified at most once.

Description

function-name

Names the user-defined function. The combination of name, schema name, the number of parameters, and the data type of each parameter (without regard for any length, precision, scale, or CCSID attributes of the data type) must not identify a user-defined function that exists at the current server.

For SQL naming, the function will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the function will be created in the schema that is specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the function will be created in the current library (*CURLIB).
- Otherwise, the function will be created in the current schema.

In general, more than one function can have the same name if the function signature of each function is unique.

Certain function names are reserved for system use. For more information see Choosing the Schema and Function Name.

(parameter-declaration,...)

Specifies the number of input parameters of the function and the data type of each parameter. Each *parameter-declaration* specifies an input parameter for the function. A maximum of 90 parameters can be specified. A function can have zero or more input parameters. There must be one entry in the list for each parameter that the function expects to receive. All the parameters for a function are input parameters and are nullable. In the case of JAVA, numeric parameters other than the DECIMAL and NUMERIC types are not nullable. A runtime error will occur if a null value is input to such a parameter for a CALLED ON NULL INPUT function. For more information, see Defining the parameters.

parameter-name

Names the parameter. Although not required, a parameter name can be specified for each parameter. The name cannot be the same as any other *parameter-name* in the parameter list.

data-type1

Specifies the data type of the input parameter. The data type can be a built-in data type or a distinct type.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768. Some data types are not supported in all languages. For details on the mapping between the SQL data types and host language data types, see Embedded SQL Programming topic collection. Built-in data type specifications can be specified if they correspond to the language that is used to write the user-defined function.

distinct-type-name

Specifies a user-defined distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those specified on CREATE TYPE). For more information on creating a distinct type, see "CREATE TYPE" on page 827.

If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path.

If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

AS LOCATOR

Specifies that a locator to the value of the parameter is passed to the function instead of the actual value. Specify AS LOCATOR only for parameters with a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

RETURNS

Specifies the data type for the result of the function. Consider this clause in conjunction with the optional CAST FROM clause.

data-type2

Specifies the data type and attributes of the output.

You can specify any built-in data type (except LONG VARCHAR, LONG VARGRAPHIC, or DataLink) or a distinct type (that is not based on a DataLink).

If a CCSID is specified,

- If AS LOCATOR is not specified, the result returned is assumed to be encoded in that CCSID.
- If AS LOCATOR is specified and the CCSID of the data the locator points to is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified,

- If AS LOCATOR is not specified, the result returned is assumed to be encoded in the CCSID of the job (or associated graphic CCSID of the job for graphic string return values).
- If AS LOCATOR is specified, the data the locator points to is converted to the CCSID of the job, if the CCSID of the data the locator points to is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

AS LOCATOR

Specifies that the function returns a locator to the value rather than the actual value. Specify AS LOCATOR only if the result of the function has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

data-type3 CAST FROM data-type4

Specifies the data type and attributes of the function (*data-type4*) and the data type in which that result is returned to the invoking statement (*data-type3*). The two data types can be different. For example, for the following definition, the function returns a DOUBLE value, which the database manager converts to a DECIMAL value and then passes to the statement that invoked the function:

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CREATE FUNCTION SQRT (DECIMAL15,0))
RETURNS DECIMAL(15,0)
CAST FROM DOUBLE

The value of *data-type4* must not be a distinct type and must be castable to *data-type3*. The value for *data-type3* can be any built-in data type or distinct type. (For information on casting data types, see "Casting between data types" on page 86).

For CCSID information, see the preceding description of data-type2.

AS LOCATOR

Specifies that the function returns a locator to the value rather than the actual value. Specify AS LOCATOR only if the result of the function has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

LANGUAGE

Specifies the language interface convention to which the function body is written. All programs must be designed to run in the server's environment.

If LANGUAGE is not specified, the LANGUAGE is determined from the program attribute information associated with the external program at the time the function is created. The language of the program is assumed to be C if:

- The program attribute information associated with the program does not identify a recognizable language
- The program cannot be found

 \mathbf{C}

The external program is written in C.

C++

The external program is written in C++.

CL

The external program is written in CL or ILE CL.

COBOL

The external program is written in COBOL.

COBOLLE

The external program is written in ILE COBOL.

IAVA

The external program is written in JAVA. The database manager will call the user-defined function, which must be a public static method of the specified Java class

When LANGUAGE JAVA is specified, specify the EXTERNAL NAME clause with a valid *external-java-routine-name*. Do not specify LANGUAGE JAVA when SCRATCHPAD, FINAL CALL, or DBINFO is specified.

PLI

The external program is written in PL/I.

RPG

The external program is written in RPG.

RPGLE

The external program is written in ILE RPG.

PARAMETER STYLE

Specifies the conventions used for passing parameters to and returning the values from functions:

SQL

All applicable parameters are passed. The parameters are defined to be in the following order:

- *n* parameters for the input parameters that are specified for the function.
- A parameter for the result of the function.
- *n* parameters for indicator variables for the input parameters.
- A parameter for the indicator variable for the result.
- A CHAR(5) output parameter for SQLSTATE. The SQLSTATE returned indicates the success or failure of the function. The SQLSTATE returned can either be:
 - the SQLSTATE from the last SQL statement executed in the external program,
 - an SQLSTATE that is assigned by the external program.
 The user may set the SQLSTATE to any valid value in the external program to return an error or warning from the function.
- A VARCHAR(517) input parameter for the fully qualified function name.
- A VARCHAR(128) input parameter for the specific name.
- A VARCHAR(1000) output parameter for the message text.

When control is returned to the invoking program, the message text can be found in the 6th token of the SQLERRMC field of the SQLCA. Only a portion of the message text is available. For information on the layout of the message data in the SQLERRMC, see the replacement data descriptions for message SQL0443 in message file QSQLMSG. The complete message text can be retrieved using the GET DIAGNOSTICS statement. For more information, see "GET DIAGNOSTICS" on page 943.

- Zero to three optional parameters:
 - A structure (consisting of an INTEGER followed by a CHAR(n)) input and output parameter for the scratchpad, if SCRATCHPAD was specified on the CREATE FUNCTION statement.
 - An INTEGER input parameter for the call type, if FINAL CALL was specified on the CREATE FUNCTION statement.
 - A structure for the dbinfo structure, if DBINFO was specified on the CREATE FUNCTION statement.

These parameters are passed according to the specified LANGUAGE. For example, if the language is C or C++, the VARCHAR parameters are passed as NUL-terminated strings. For more information about the parameters passed, see the include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

DB2GENERAL

This parameter style is used to specify the conventions for passing parameters to and returning the value from external functions that are defined as a method in a Java class. All applicable parameters are passed. The parameters are defined to be in the following order:

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- The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.
- A parameter for the result of the function.

DB2GENERAL is only allowed when the LANGUAGE is JAVA.

GENERAL

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All applicable parameters are passed. The parameters are defined to be in the following order:

 The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.

Note that the result is returned as a value of a C value returning function. For example:

```
return_val func(parameter-1, parameter-2, ...)
```

GENERAL is only allowed when EXTERNAL NAME identifies a service program.

GENERAL WITH NULLS

All applicable parameters are passed. The parameters are defined to be in the following order:

- The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.
- An additional argument is passed for an indicator variable array.
- A parameter for the indicator variable for the result.

Note that the result is returned as a value of a C value returning function. For example:

```
return val func(parameter-1, parameter-2, ...)
```

GENERAL WITH NULLS is only allowed when EXTERNAL NAME identifies a service program.

JAVA

Specifies that the function will use a parameter passing convention that conforms to the Java language and ISO/IEC FCD 9075-13:2003, *Information technology - Database languages - SQL - Part 13: Java Routines and Types* (*SQL/JRT*) specification. All applicable parameters are passed. The parameters are defined to be in the following order:

• The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.

Note that the result is returned as a value of a C value returning function. For example:

```
return val func(parameter-1, parameter-2, ...)
```

JAVA is only allowed when the LANGUAGE is JAVA.

Note that the language of the external function determines how the parameters are passed. For example, in C, any VARCHAR or CHAR parameters are passed as NUL-terminated strings. For more information, see the SQL Programming topic collection. For Java routines, see the IBM Developer Kit for Java topic collection.

SPECIFIC *specific-name*

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a function.

CREATE FUNCTION (External Scalar)

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the function returns the same results each time that the function is invoked with the same input arguments. The default is NOT DETERMINISTIC.

NOT DETERMINISTIC

Specifies that the function might not return the same result each time that the function is invoked with the same input arguments. The function depends on some state values that affect the results. The database manager uses this information during optimization of SQL statements. An example of a function that is not deterministic is one that generates random numbers.

A function that is not deterministic might return incorrect results if the function is executed by parallel tasks. Specify the DISALLOW PARALLEL clause for these functions.

NOT DETERMINISTIC should be specified if the function contains a reference to a special register, a non-deterministic function, or a sequence.

DETERMINISTIC

Specifies that the function always returns the same result each time that the function is invoked with the same input arguments. The database manager uses this information during optimization of SQL statements. An example of a deterministic function is a function that calculates the square root of the input argument.

CONTAINS SQL, READS SQL DATA, MODIFIES SQL DATA, or NO SQL

Specifies the classification of SQL statements that the function can execute. The database manager verifies that the SQL statements that the function issues are consistent with this specification. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213.

CONTAINS SQL

Specifies that the function can execute only SQL statements with a data access classification of CONTAINS SQL or NO SQL. The function cannot execute any SQL statements that read or modify data.

NO SQL

Specifies that the function can execute only SQL statements with a data access classification of NO SQL.

READS SOL DATA

Specifies that the function can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL. The function cannot execute SQL statements that modify data.

MODIFIES SQL DATA

The function can execute any SQL statement except those statements that are not supported in any function.

RETURNS NULL ON NULL INPUT or CALLED ON NULL INPUT

Specifies whether the function is called if any of the input arguments is null at execution time. CALLED ON NULL INPUT is the default.

RETURNS NULL ON INPUT

Specifies that the function is not invoked if any of the input arguments is null. The result is the null value.

CALLED ON NULL INPUT

Specifies that the function is to be invoked, if any, or all, argument values

are null. This specification means that the function must be coded to test for null argument values. The function can return a null or nonnull value.

INHERIT SPECIAL REGISTERS

Specifies that existing values of special registers are inherited upon entry to the function.

STATIC DISPATCH

Specifies that the function is dispatched statically. All functions are statically dispatched.

NO DBINFO or DBINFO

Specifies whether additional status information is passed when the function is invoked. The default is NO DBINFO.

NO DBINFO

Specifies that no additional information is passed.

DBINFO

Specifies that the database manager should pass a structure containing status information to the function. Table 54 contains a description of the DBINFO structure. Detailed information about the DBINFO structure can be found in include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

DBINFO is only allowed with PARAMETER STYLE SQL or PARAMETER STYLE DB2GENERAL.

Table 54. DBINFO fields

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I	Field	Data Type	Description
I	Relational database	VARCHAR(128)	The name of the current server.
I	Authorization ID	VARCHAR(128)	The run-time authorization ID.
	CCSID Information	INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER INTEGER	The CCSID information of the job. Three sets of three CCSIDs are returned. The following information identifies the three CCSIDs in each set: • SBCS CCSID • DBCS CCSID • Mixed CCSID Following the three sets of CCSIDs is an integer that indicates which set of three sets of CCSIDs is applicable and eight bytes of reserved space. Each set of CCSIDs is for a different encoding scheme (EBCDIC, ASCII, and Unicode). If a CCSID is not explicitly specified for a parameter on the CREATE FUNCTION statement, the input string is assumed to be encoded in the CCSID of the job at the time the function is executed. If the CCSID of the input string is not the same as the CCSID of the parameter, the input string passed to the external function will be converted before calling the external program.
I		CHAR(8)	

CREATE FUNCTION (External Scalar)

Table 54. DBINFO fields (continued)

I	Field	Data Type	Description
 	Target column	VARCHAR(128)	If a user-defined function is specified on the right-hand side of a SET clause in an UPDATE statement, the following information identifies
1		VARCHAR(128)	the target column:
			Schema name
		VARCHAR(128)	Base table name
			Column name
 			If the user-defined function is not on the right-hand side of a SET clause in an UPDATE statement, these fields are blank.
L	Version and release	CHAR(8)	The version, release, and modification level of the database manager.
I	Platform	INTEGER	The server's platform type.

EXTERNAL ACTION or NO EXTERNAL ACTION

Specifies whether the function takes an action that changes the state of an object that the database manager does not manage. An example of an external action is sending a message or writing a record to a stream file. The default is EXTERNAL ACTION.

EXTERNAL ACTION

Specifies that the function can take an action that changes the state of an object that the database manager does not manage. Thus, the function must be invoked with each successive function invocation. EXTERNAL ACTION should be specified if the function contains a reference to another function that has an external action.

NO EXTERNAL ACTION

The function does not perform an external action. It need not be called with each successive function invocation.

NO EXTERNAL ACTION functions might perform better than EXTERNAL ACTION functions because they might not be invoked for each successive function invocation.

FENCED or NOT FENCED

Specifies whether the external function runs in an environment that is isolated from the database manager environment. FENCED is the default.

FENCED

The function will run in a separate thread.

FENCED functions cannot keep SQL cursors open across individual calls to the function. However, the cursors in one thread are independent of the cursors in any other threads which reduces the possibility of cursor name conflicts.

NOT FENCED

The function may run in the same thread as the invoking SQL statement.

NOT FENCED functions can keep SQL cursors open across individual calls to the function. Since cursors can be kept open, the cursor position will also be preserved between calls to the function. However, cursor names may conflict since the UDF is now running in the same thread as the invoking SQL statement and other NOT FENCED UDFs.

NOT FENCED functions usually perform better than FENCED functions.

PROGRAM TYPE MAIN or PROGRAM TYPE SUB

This parameter is allowed for compatibility with other products. It indicates whether the routine's external program is a program (*PGM) or a procedure in a service program (*SRVPGM).

PROGRAM TYPE MAIN

Specifies that the routine executes as the main entry point in a program. The external program must be a *PGM object.

PROGRAM TYPE SUB

Specifies that the routine executes as a procedure in a service program. The external program must be a *SRVPGM object.

NO FINAL CALL or FINAL CALL

Specifies whether a *final call* is made to the function. A final call enables the function to free any system resources that it has acquired. A final call is useful when the function has been defined with the SCRATCHPAD keyword and the function acquires system resources and stores them in the scratchpad. The default is NO FINAL CALL.

NO FINAL CALL

Specifies that a final call is not made to the function. The function does not receive an additional argument that specifies the type of call.

FINAL CALL

Specifies that a final call is made to the function. To differentiate between final calls and other calls, the function receives an additional argument that specifies the type of call.

FINAL CALL is only allowed with PARAMETER STYLE SQL or PARAMETER STYLE DB2GENERAL.

The types of calls are:

First Call

Specifies the first call to the function for this reference to the function in this SQL statement. A first call is a normal call. SQL arguments are passed and the function is expected to return a result.

Normal Call

Specifies that SQL arguments are passed and the function is expected to return a result.

Final Call

Specifies the last call to the function to enable the function to free resources. A final call is not a normal call. If an error occurs, the database manager attempts to make the final call.

A final call occurs at these times:

- *End of statement:* When the cursor is closed for cursor-oriented statements, or the execution of the statement has completed.
- *End of a parallel task:* When the function is executed by parallel tasks.
- *End of transaction:* When normal end of statement processing does not occur. For example, the logic of an application, for some reason, bypasses closing the cursor.

Some functions that use a final call can receive incorrect results if parallel tasks execute the function. For example, if a function sends a note for each final call to it, one note is sent for each parallel task

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CREATE FUNCTION (External Scalar)

instead of once for the function. Specify the DISALLOW PARALLEL clause for functions that have inappropriate actions when executed in parallel.

If a commit operation occurs while a cursor defined as WITH HOLD is open, a final call is made when the cursor is closed or the application ends. If a commit occurs at the end of a parallel task, a final call is made regardless of whether a cursor defined as WITH HOLD is open.

Commitable operations should not be performed during a FINAL CALL, because the FINAL CALL may occur during a close that is invoked as part of a COMMIT operation.

ALLOW PARALLEL or DISALLOW PARALLEL

Specifies whether the function can be run in parallel.

The default is DISALLOW PARALLEL if one or more of the following clauses are specified: NOT DETERMINISTIC, EXTERNAL ACTION, FINAL CALL, MODIFIES SQL DATA, or SCRATCHPAD. Otherwise, ALLOW PARALLEL is the default.

ALLOW PARALLEL

Specifies that the database manager can consider parallelism for the function. The database manager is not required to use parallelism on the SQL statement that invokes the function or on any SQL statement issued from within the function.

See the descriptions of NOT DETERMINISTIC, EXTERNAL ACTION, MODIFIES SQL DATA, SCRATCHPAD, and FINAL CALL for considerations that apply to specification of ALLOW PARALLEL.

DISALLOW PARALLEL

Specifies that the database manager must not use parallelism for the function.

NO SCRATCHPAD or SCRATCHPAD

Specifies whether the function requires a static memory area.

NO SCRATCHPAD

Specifies that the function does not require a persistent memory area.

SCRATCHPAD *integer*

Specifies that the function requires a persistent memory area of length integer. The integer can range from 1 to 16,000,000. If the memory area is not specified, the size of the area is 100 bytes. If parameter style DB2SQL is specified, a pointer is passed following the required parameters that points to a static storage area. If PARALLEL is specified, a memory area is allocated for each user-defined function reference in the statement. If DISALLOW PARALLEL is specified, only 1 memory area will be allocated for the function.

The scope of a scratchpad is the SQL statement. For each reference to the function in an SQL statement, there is one scratchpad. For example, assuming that function UDFX was defined with the SCRATCHPAD keyword, three scratchpads are allocated for the three references to UDFX in the following SQL statement:

```
SELECT A, UDFX(A)
 FROM TABLEB
 WHERE UDFX(A) > 103 OR UDFX(A) < 19
```

If the function is run under parallel tasks, one scratchpad is allocated for each parallel task of each reference to the function in the SQL statement. This can lead to unpredictable results. For example, if a function uses the scratchpad to count the number of times that it is invoked, the count reflects the number of invocations done by the parallel task and not the SQL statement. Specify the DISALLOW PARALLEL clause for functions that will not work correctly with parallelism.

SCRATCHPAD is only allowed with PARAMETER STYLE SQL or PARAMETER STYLE DB2GENERAL.

EXTERNAL

Specifies that the CREATE FUNCTION statement is being used to define a new function that is based on code that is written in an external programming

If external-program-name is not specified, the external program name is assumed to be the same as the function name.

NAME *external-program-name*

Specifies the program, service program, or Java class that will be executed when the function is invoked in an SQL statement. The name must identify a program, service program, or Java class that exists at the application server at the time the function is invoked. If the naming option is *SYS and the name is not qualified:

- The current path will be used to search for the program at the time the function is invoked.
- *LIBL will be used to search for the program or service program at the time GRANT or REVOKE operations are performed on the function.

The validity of the name is checked at the application server. If the format of the name is not correct, an error is returned.

The program, service program, or Java class need not exist at the time the function is created, but it must exist at the time the function is invoked.

CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, and SET TRANSACTION statements are not allowed in the external program of the function.

Notes

General considerations for defining user-defined functions: See "CREATE FUNCTION" on page 655 for general information on defining user-defined functions.

Creating the function: When an external function associated with an ILE external program or service program is created, an attempt is made to save the function's attributes in the associated program or service program object. If the *PGM or *SRVPGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

The attributes can be saved for external functions subject to the following restrictions:

- The external program library must not be QSYS.
- The external program must exist when the CREATE FUNCTION statement is issued.

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If system naming is specified and the external program name is not qualified, the external program must be found in the library list.

- The external program must be an ILE *PGM or *SRVPGM object.
- The external program must not already contain attributes for 32 routines.

If the object cannot be updated, the function will still be created.

During restore of the function:

- If the specific name was specified when the function was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- If the signature is not unique, the function cannot be registered, and an error is issued.
- If the same function signature already exists in the catalog:
 - If the external program or service program name is the same as the one registered in the catalog, the function information in the catalog will be replaced.
 - Otherwise, the function cannot be registered, and an error is issued.

Invoking the function: When an external function is invoked, it runs in whatever activation group was specified when the external program or service program was created. However, ACTGRP(*CALLER) should normally be used so that the function runs in the same activation group as the calling program. ACTGRP(*NEW) is not allowed.

Notes for Java functions: To be able to run Java functions, you must have the IBM Developer Kit for Java (5761-JV1) installed on your system. Otherwise, an SQLCODE of -443 will be returned and a CPDB521 message will be placed in the job log.

If an error occurs while running a Java function, an SQLCODE of -443 will be returned. Depending on the error, other messages may exist in the job log of the job where the function was run.

MODIFIES SQL DATA and EXTERNAL ACTION functions: If a MODIFIES SQL DATA or EXTERNAL ACTION function is invoked in other than the outermost select list, the results are unpredictable since the number of times the function is invoked will vary depending on the access plan used.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- · The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The keywords SIMPLE CALL can be used as a synonym for GENERAL.
- The keyword DB2GENRL may be used as a synonym for DB2GENERAL.
- The value DB2SQL may be used as a synonym for SQL.
- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are optional.

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 The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.

Examples

Example 1: Assume an external function program in C is needed that implements the following logic:

```
rslt = 2 * input - 4
```

The function should return a null value if and only if one of the input arguments is null. The simplest way to avoid a function call and get a null result when an input value is null is to specify RETURNS NULL ON NULL INPUT on the CREATE FUNCTION statement. The following statement defines the function, using the specific name MINENULL1.

```
CREATE FUNCTION NTEST1 (SMALLINT)
      RETURNS SMALLINT
      EXTERNAL NAME NTESTMOD
      SPECIFIC MINENULL1
      LANGUAGE C
      DETERMINISTIC
      NO SQL
      FENCED
      PARAMETER STYLE SQL
      RETURNS NULL ON NULL INPUT
      NO EXTERNAL ACTION
The program code:
  void nudft1
    (int *input,
                                     /* ptr to input argument
     int *output,
                                     /* ptr to output argument
     short *input ind,
                                     /* ptr to input indicator
     short *output ind,
                                     /* ptr to output indicator
      char sqlstate[6], /* sqlstate
     char fname[140], /* fully qualified function name */ char finst[129], /* function specific name */ char msgtext[71]) /* msg text buffer */
    if (*input_ind == -1)
      *output_ind = -1;
    else
      *output = 2*(*input)-4;
      *output ind = 0;
    return;
```

Example 2: Assume that a user wants to define an external function named CENTER. The function program will be written in C. The following statement defines the function, and lets the database manager generate a specific name for the function. The name of the program containing the function body is the same as the name of the function, so the EXTERNAL clause does not include 'NAME external-program-name'.

```
CREATE FUNCTION CENTER (INTEGER, FLOAT)
RETURNS FLOAT
LANGUAGE C
DETERMINISTIC
NO SQL
PARAMETER STYLE SQL
NO EXTERNAL ACTION
```

CREATE FUNCTION (External Scalar)

Example 3: Assume that user McBride (who has administrative authority) wants to define an external function named CENTER in the SMITH schema. McBride plans to give the function specific name FOCUS98. The function program uses a scratchpad to perform some one-time only initialization and save the results. The function program returns a value with a DOUBLE data type. The following statement written by user McBride defines the function and ensures that when the function is invoked, it returns a value with a data type of DECIMAL(8,4).

```
CREATE FUNCTION SMITH.CENTER (DOUBLE, DOUBLE, DOUBLE)
RETURNS DECIMAL(8,4)
CAST FROM DOUBLE
EXTERNAL NAME CMOD
SPECIFIC FOCUS98
LANGUAGE C
DETERMINISTIC
NO SQL
FENCED
PARAMETER STYLE SQL
NO EXTERNAL ACTION
SCRATCHPAD
NO FINAL CALL
```

Example 4: The following example defines a Java user-defined function that returns the position of the first vowel in a string. The user-defined function is written in Java, is to be run fenced, and is the FINDVWL method of class JAVAUDFS.

```
CREATE FUNCTION FINDV (VARCHAR(32000))
RETURNS INTEGER
FENCED
LANGUAGE JAVA
PARAMETER STYLE JAVA
EXTERNAL NAME 'JAVAUDFS.FINDVWL'
NO EXTERNAL ACTION
CALLED ON NULL INPUT
DETERMINISTIC
NO SQL
```

This CREATE FUNCTION (External Table) statement defines an external table function at the current server. The function returns a result table.

An external user-defined table function may be used in the FROM clause of a subselect, and returns a table to the subselect by returning one row each time it is invoked.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization id of the statement must include at least one of the following:

- For the SYSFUNCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative Authority

If the external program or service program exists, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the external program or service program that is referenced in the SQL statement:
 - The system authority *EXECUTE on the library that contains the external program or service program.
 - The system authority *EXECUTE on the external program or service program,
 - The system authority *CHANGE on the program or service program. The system needs this authority to update the program object to contain the information necessary to save/restore the function to another system. If user does not have this authority, the function is still created, but the program object is not updated.
- · Administrative Authority

If SQL names are specified and a user profile exists that has the same name as the library into which the function is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

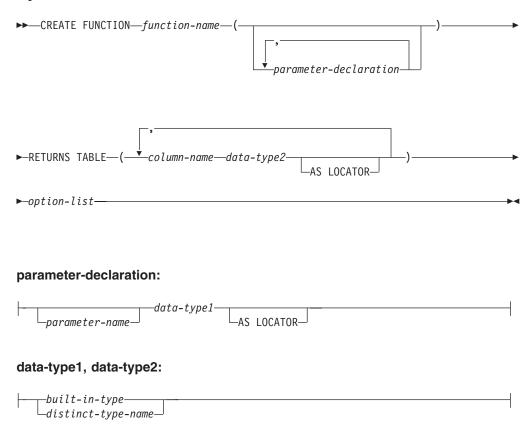
- The system authority *ADD to the user profile with that name
- Administrative authority

If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

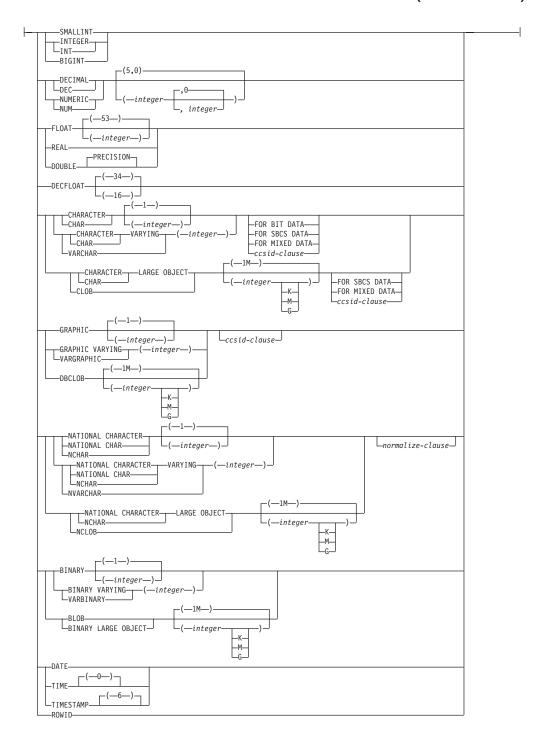
- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax



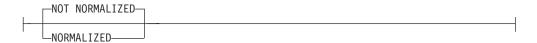
built-in-type:



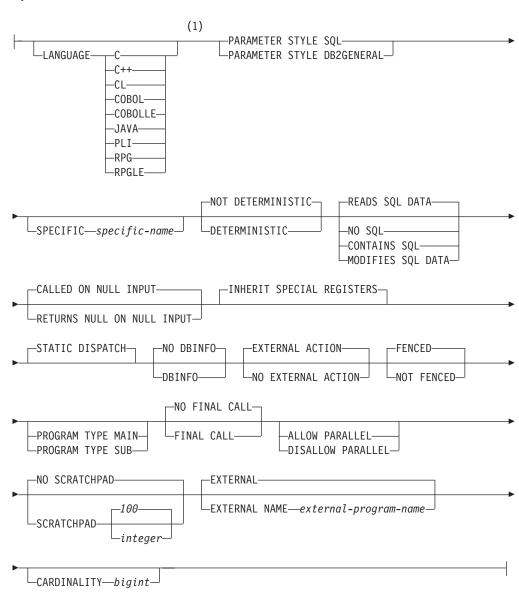
ccsid-clause:

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normalize-clause:



option-list:



Notes:

This clause and the clauses that follow in the option-list can be specified in any order. Each clause can be specified at most once.

Description

function-name

Names the user-defined function. The combination of name, schema name, the number of parameters, and the data type of each parameter (without regard

for any length, precision, scale, or CCSID attributes of the data type) must not identify a user-defined function that exists at the current server.

For SQL naming, the function will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the function will be created in the schema that is specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the function will be created in the current library (*CURLIB).
- Otherwise, the function will be created in the current schema.

In general, more than one function can have the same name if the function signature of each function is unique.

Certain function names are reserved for system use. For more information see Choosing the Schema and Function Name.

(parameter-declaration,...)

Specifies the number of input parameters of the function and the data type of each parameter. Each *parameter-declaration* specifies an input parameter for the function. A maximum of 90 parameters can be specified. A function can have zero or more input parameters. There must be one entry in the list for each parameter that the function expects to receive. All the parameters for a function are input parameters and are nullable. In the case of JAVA, numeric parameters other than the DECIMAL and NUMERIC types are not nullable. A runtime error will occur if a null value is input to such a parameter for a CALLED ON NULL INPUT function. For more information, see Defining the parameters.

parameter-name

Names the parameter. Although not required, a parameter name can be specified for each parameter. The name cannot be the same as any other *parameter-name* in the parameter list.

data-type1

Specifies the data type of the input parameter. The data type can be a built-in data type or a distinct type.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768. Some data types are not supported in all languages. For details on the mapping between the SQL data types and host language data types, see Embedded SQL Programming topic collection. Built-in data type specifications can be specified if they correspond to the language that is used to write the user-defined function.

distinct-type-name

Specifies a user-defined distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those specified on CREATE TYPE). For more information about creating a distinct type, see "CREATE TYPE" on page 827

If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path.

Parameters with a large object (LOB) data type are not supported when PARAMETER STYLE JAVA is specified.

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If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

AS LOCATOR

Specifies that the input parameter is a locator to the value rather than the actual value. You can specify AS LOCATOR only if the input parameter has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

RETURNS TABLE

Specifies that the output of the function is a table. The parenthesis that follow this clause enclose a list of names and the data types of the columns of the

Assume that the number of parameters is *n*. For PARAMETER STYLE DB2GENERAL, there must be no more than (255-(n*2))/2 columns. For PARAMETER STYLE SQL, there must be no more than $(247-(n^2))/2$ columns.

column-name

Specifies the name of a column of the output table. Do not specify the same name more than once.

data-type2

Specifies the data type of the column. The column is nullable.

You can specify any built-in data type (except LONG VARCHAR, LONG VARGRAPHIC, or DataLink) or a distinct type (that is not based on a DataLink).

If a DATE or TIME is specified, the table function must return the date or time in ISO format.

If a CCSID is specified,

- If AS LOCATOR is not specified, the result returned is assumed to be encoded in that CCSID.
- If AS LOCATOR is specified and the CCSID of the data the locator points to is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified,

- If AS LOCATOR is not specified, the result returned is assumed to be encoded in the CCSID of the job (or associated graphic CCSID of the job for graphic string return values).
- If AS LOCATOR is specified, the data the locator points to is converted to the CCSID of the job, if the CCSID of the data the locator points to is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

AS LOCATOR

Specifies that the function returns a locator to the value for the column rather than the actual value. You can specify AS LOCATOR only for a

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LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

LANGUAGE

The language clause specifies the language of the external program.

If LANGUAGE is not specified, the LANGUAGE is determined from the program attribute information associated with the external program at the time the function is created. The language of the program is assumed to be C if:

- The program attribute information associated with the program does not identify a recognizable language
- The program cannot be found

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The external program is written in C.

C++

The external program is written in C++.

CL

The external program is written in CL or ILE CL.

COBOL

The external program is written in COBOL.

COBOLLE

The external program is written in ILE COBOL.

JAVA

The external program is written in JAVA. The database manager will call the user-defined function as a method in a Java class.

PLI

The external program is written in PL/I.

RPG

The external program is written in RPG.

RPGLE

The external program is written in ILE RPG.

PARAMETER STYLE

Specifies the conventions used for passing parameters to and returning the values from functions:

DB2GENERAL

This parameter style is used to specify the conventions for passing parameters to and returning the value from external functions that are defined as a method in a Java class. All applicable parameters are passed. The parameters are defined to be in the following order:

- The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.
- The next M parameters are the result columns of the function that are specified on the RETURNS TABLE clause.

DB2GENERAL is only allowed when the LANGUAGE is JAVA.

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All applicable parameters are passed. The parameters are defined to be in the following order:

- The first N parameters are the input parameters that are specified on the CREATE FUNCTION statement.
- The next M parameters are the result columns of the function that are specified on the RETURNS TABLE clause.
- N parameters for indicator variables for the input parameters.
- M parameters for the indicator variables of the result columns of the function that are specified on the RETURNS TABLE clause
- A CHAR(5) output parameter for SQLSTATE. The SQLSTATE returned indicates the success or failure of the function. The SQLSTATE returned either be:
 - the SQLSTATE from the last SQL statement executed in the external program,
 - an SQLSTATE that is assigned by the external program.
 The user may set the SQLSTATE to any valid value in the external program to return an error or warning from the function.
- A VARCHAR(517) input parameter for the fully qualified function name.
- A VARCHAR(128) input parameter for the specific name.
- A VARCHAR(1000) output parameter for the message text.
- A structure (consisting of an INTEGER followed by a CHAR(n)) input and output parameter for the scratchpad, if SCRATCHPAD was specified on the CREATE FUNCTION statement.
- An INTEGER input parameter for the call type.
- A structure for the dbinfo structure, if DBINFO was specified on the CREATE FUNCTION statement.

These parameters are passed according to the specified LANGUAGE. For example, if the language is C or C++, the VARCHAR parameters are passed as NUL-terminated strings. For more information about the parameters passed, see the include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

Note that the language of the external function determines how the parameters are passed. For example, in C, any VARCHAR or CHAR parameters are passed as NUL-terminated strings. For more information, see the SQL Programming topic collection. For Java routines, see the IBM Developer Kit for Java topic collection.

SPECIFIC specific-name

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a function.

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the function returns the same results each time that the function is invoked with the same input arguments. The default is NOT DETERMINISTIC.

NOT DETERMINISTIC

Specifies that the function might not return the same result each time that the function is invoked with the same input arguments. The function depends on some state values that affect the results. The database manager uses this information during optimization of SQL statements. An example

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of a table function that is not deterministic is one that references special registers, non-deterministic functions, or a sequence in a way that affects the table function result table.

DETERMINISTIC

Specifies that the function always returns the same result table each time that the function is invoked with the same input arguments, provided that the referenced data in the database has not changed. The database manager uses this information during optimization of SQL statements.

CONTAINS SQL, READS SQL DATA, MODIFIES SQL DATA, or NO SQL

Specifies the classification of SQL statements that the function can execute. The database manager verifies that the SQL statements that the function issues are consistent with this specification. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213.

CONTAINS SQL

Specifies that the function can execute only SQL statements with a data access classification of CONTAINS SQL or NO SQL. The function cannot execute any SQL statements that read or modify data.

NO SQL

Specifies that the function can execute only SQL statements with a data access classification of NO SQL.

READS SQL DATA

Specifies that the function can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL. The function cannot execute SQL statements that modify data.

MODIFIES SQL DATA

The function can execute any SQL statement except those statements that are not supported in any function.

RETURNS NULL ON NULL INPUT or CALLED ON NULL INPUT

Specifies whether the function is called if any of the input arguments is null at execution time. CALLED ON NULL INPUT is the default.

RETURNS NULL ON NULL INPUT

Specifies that the function is not called if any of the input arguments is null. The result is an empty table, which is a table with no rows.

CALLED ON NULL INPUT

Specifies that the function is to be invoked, if any argument values are null. This specification means that the function must be coded to test for null argument values. The function can return an empty table, depending on its logic.

INHERIT SPECIAL REGISTERS

Specifies that existing values of special registers are inherited upon entry to the function.

STATIC DISPATCH

Specifies that the function is dispatched statically. All functions are statically dispatched.

NO DBINFO or DBINFO

Specifies whether additional status information is passed when the function is invoked. The default is NO DBINFO.

NO DBINFO

Specifies that no additional information is passed.

DBINFO

Specifies that the database manager should pass a structure containing status information to the function. Table 55 contains a description of the DBINFO structure. Detailed information about the DBINFO structure can be found in sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

Table 55. DBINFO fields

Field	Data Type	Description	
Relational database VARCHAR(128) The name of the current server.		The name of the current server.	
Authorization ID	VARCHAR(128)	The run-time authorization ID.	
CCSID Information	INTEGER INTEGER INTEGER	The CCSID information of the job. Three sets of three CCSIDs are returned. The following information identifies the three CCSIDs in each set: • SBCS CCSID • DBCS CCSID • Mixed CCSID	
	INTEGER INTEGER INTEGER	Following the three sets of CCSIDs is an integer that indicates which set of three sets of CCSIDs is applicable and eight bytes of reserved space.	
		Each set of CCSIDs is for a different encoding scheme (EBCDIC, ASCII, and Unicode).	
	INTEGER INTEGER INTEGER	If a CCSID is not explicitly specified for a parameter on the CREATE FUNCTION statement, the input string is assumed to be encoded in the CCSID of the job at the time the function is executed. If the CCSID of the input string is not the same as the CCSID of the parameter, the input string passed to the external function will be converted before	
	INTEGER	calling the external program.	
	CHAR(8)		
Target column	VARCHAR(128) VARCHAR(128)	If a user-defined function is specified on the right-hand side of a SET clause in an UPDATE statement, the following information identifies the target column:	
	,	Schema name	
	VARCHAR(128)	Base table name	
		Column name	
		If the user-defined function is not on the right-hand side of a SET clause in an UPDATE statement, these fields are blank.	
Version and release	CHAR(8)	The version, release, and modification level of the database manager.	
Platform	INTEGER	TEGER The server's platform type.	
Number of table function column list entries	SMALLINT	The number of non-zero entries in the table function column list specified in the "Table function column list" field below.	
Reserved	CHAR(24)	Reserved for future use.	

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Table 55. DBINFO fields (continued)

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Field	Data Type	Description
Table function column list	Pointer (16 Bytes)	This field is a pointer to an array of short integers which is dynamically allocated by the database manager. Only the first n entries, where n is specified in the "Number of table function column list entries" field, are of interest, n may be equal to 0, and is less than or equal to the number of result columns defined for the function in the RETURNS TABLE clause. The values correspond to the ordinal numbers of the columns which this statement needs from the table function. A value of 1 means the first defined result column, 2 means the second defined result column, and so on. The values may be in any order. Note that n could be equal to zero for a statement that is similar to SELECT COUNT(*) FROM TABLE(TF()) AS QQ, where no actual column values are needed by the query. This array represents an opportunity for optimization. The function need not return all values for all the result columns of the table function. Only a subset of the values may be needed in a particular context, and these are the columns identified (by number) in the array. Since this optimization may complicate the function logic, the function can choose to return every defined column.

EXTERNAL ACTION or NO EXTERNAL ACTION

Specifies whether the function takes an action that changes the state of an object that the database manager does not manage. An example of an external action is sending a message or writing a record to a stream file. The default is EXTERNAL ACTION.

EXTERNAL ACTION

Specifies that the function can take an action that changes the state of an object that the database manager does not manage. Thus, the function must be invoked with each successive function invocation. EXTERNAL ACTION should be specified if the function contains a reference to another function that has an external action.

NO EXTERNAL ACTION

The function does not perform an external action. It need not be called with each successive function invocation.

NO EXTERNAL ACTION functions might perform better than EXTERNAL ACTION functions because they might not be invoked for each successive function invocation.

FENCED or NOT FENCED

Specifies whether the external function runs in an environment that is isolated from the database manager environment. FENCED is the default.

FENCED

The function will run in a separate thread.

FENCED functions cannot keep SQL cursors open across individual calls to the function. However, the cursors in one thread are independent of the cursors in any other threads which reduces the possibility of cursor name conflicts.

NOT FENCED

The function may run in the same thread as the invoking SQL statement.

NOT FENCED functions can keep SQL cursors open across individual calls to the function. Since cursors can be kept open, the cursor position will

also be preserved between calls to the function. However, cursor names may conflict since the UDF is now running in the same thread as the invoking SQL statement and other NOT FENCED UDFs.

NOT FENCED functions usually perform better than FENCED functions.

PROGRAM TYPE MAIN or PROGRAM TYPE SUB

This parameter is allowed for compatibility with other products. It indicates whether the routine's external program is a program (*PGM) or a procedure in a service program (*SRVPGM).

PROGRAM TYPE MAIN

Specifies that the routine executes as the main entry point in a program. The external program must be a *PGM object.

PROGRAM TYPE SUB

Specifies that the routine executes as a procedure in a service program. The external program must be a *SRVPGM object.

NO FINAL CALL or FINAL CALL

Specifies whether a separate *first call* and *final call* are made to the function. To differentiate between types of calls, the function receives an additional argument that specifies the type of call. For table functions, the *call-type* argument is always present (regardless of whether FINAL CALL or NO FINAL CALL is in effect), and it indicates first call, open call, fetch call, close call, or final call.

With NO FINAL CALL, the database manager will only make three types of calls to the table function: open, fetch and close. However, if FINAL CALL is specified, then in addition to open, fetch and close, a first call and a final call can be made to the table function.

A final call enables the function to free any system resources that it has acquired. A final call is useful when the function has been defined with the SCRATCHPAD keyword and the function acquires system resources and stores them in the scratchpad. The default is NO FINAL CALL.

NO FINAL CALL

Specifies that separate first and final calls are not made to the function. However, the open, fetch, and close calls are still made to the function, and the table function always receives an additional argument that specifies the type of call.

FINAL CALL

Specifies that separate first and final calls are made to the function. It also controls when the scratchpad is re-initialized.

The types of calls are:

First Call

Specifies the first call to the function for this reference to the function in this SQL statement.

Open Call

Specifies a call to open the table function result in this SQL statement.

Fetch Call

Specifies a call to fetch a row from the table function in this SQL statement.

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Close Call Spe

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Specifies a call to close the table function result in this SQL statement.

Final Call

Specifies the last call to the function to enable the function to free resources. If an error occurs, the database manager attempts to make the final call.

A final call occurs at these times:

- *End of statement:* When the cursor is closed for cursor-oriented statements, or the execution of the statement has completed.
- *End of transaction:* When normal end of statement processing does not occur. For example, the logic of an application, for some reason, bypasses closing the cursor.

If a commit operation occurs while a cursor defined as WITH HOLD is open, a final call is made when the cursor is closed or the application ends.

Commitable operations should not be performed during a FINAL CALL, because the FINAL CALL may occur during a close invoked as part of a COMMIT operation.

ALLOW PARALLEL or DISALLOW PARALLEL

Specifies whether the function can be run in parallel.

The default is DISALLOW PARALLEL if one or more of the following clauses are specified: NOT DETERMINISTIC, EXTERNAL ACTION, FINAL CALL, MODIFIES SQL DATA, or SCRATCHPAD. Otherwise, ALLOW PARALLEL is the default.

ALLOW PARALLEL

Specifies that the database manager can consider parallelism for the function. The database manager is not required to use parallelism on the SQL statement that invokes the function or on any SQL statement issued from within the function.

See the descriptions of NOT DETERMINISTIC, EXTERNAL ACTION, MODIFIES SQL DATA, SCRATCHPAD, and FINAL CALL for considerations that apply to specification of ALLOW PARALLEL.

DISALLOW PARALLEL

Specifies that the database manager must not use parallelism for the function.

NO SCRATCHPAD or SCRATCHPAD

Specifies whether the function requires a static memory area.

NO SCRATCHPAD

Specifies that the function does not require a persistent memory area.

SCRATCHPAD integer

Specifies that the function requires a persistent memory area of length integer. The integer can range from 1 to 16,000,000. If the memory area is not specified, the size of the area is 100 bytes. If parameter style SQL is specified, a pointer is passed following the required parameters that points to a static storage area. Only 1 memory area will be allocated for the function.

The scope of a scratchpad is the SQL statement. For each reference to the function in an SQL statement, there is one scratchpad. For example,

assuming that function UDFX was defined with the SCRATCHPAD keyword, two scratchpads are allocated for the two references to UDFX in the following SQL statement:

SELECT A.C1, B.C1
FROM TABLE(UDFX(:hv1)) AS A, TABLE(UDFX(:hv1)) AS B

EXTERNAL

Specifies that the CREATE FUNCTION statement is being used to define a new function that is based on code that is written in an external programming language.

If *external-program-name* is not specified, the external program name is assumed to be the same as the function name.

NAME external-program-name

Specifies the program, service program, or Java class that will be executed when the function is invoked in an SQL statement. The name must identify a program, service program, or Java class that exists at the application server at the time the function is invoked. If the naming option is *SYS and the name is not qualified:

- The current path will be used to search for the program at the time the function is invoked.
- *LIBL will be used to search for the program or service program at the time GRANT or REVOKE operations are performed on the function.

The validity of the name is checked at the application server. If the format of the name is not correct, an error is returned.

The program, service program, or Java class need not exist at the time the function is created, but it must exist at the time the function is invoked.

CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, and SET TRANSACTION statements are not allowed in the external program of the function.

CARDINALITY bigint

Specifies an estimate of the expected number of rows to be returned by the function for the database manager to use during optimization. *bigint* must be in the range from 0 to 9 223 372 036 854 775 807 inclusive. The database manager assumes a finite value if CARDINALITY is not specified.

A table function that returns a row every time it is called and never returns the end-of-table condition has infinite cardinality. A query that invokes such a function and requires an eventual end-of-table condition before it can return any data will not return unless interrupted. Table functions that never return the end-of-table condition should not be used in queries involving DISTINCT, GROUP BY, or ORDER BY.

Notes

General considerations for defining user-defined functions: See "CREATE FUNCTION" on page 655 for general information about defining user-defined functions.

Creating the function: When an external function associated with an ILE external program or service program is created, an attempt is made to save the function's attributes in the associated program or service program object. If the *PGM or *SRVPGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

The attributes can be saved for external functions subject to the following restrictions:

- The external program library must not be SYSIBM, QSYS, or QSYS2.
- The external program must exist when the CREATE FUNCTION statement is issued.

If system naming is specified and the external program name is not qualified, the external program must be found in the library list.

- The external program must be an ILE *PGM or *SRVPGM object.
- The external program must not already contain attributes for 32 routines.

If the object cannot be updated, the function will still be created.

During restore of the function:

- If the specific name was specified when the function was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- If the same function signature already exists in the catalog:
 - If the external program or service program name is the same as the one registered in the catalog, the function information in the catalog will be replaced.
 - Otherwise, the function cannot be registered, and an error is issued.

Invoking the function: When an external function is invoked, it runs in whatever activation group was specified when the external program or service program was created. However, ACTGRP(*CALLER) should normally be used so that the function runs in the same activation group as the calling program. ACTGRP(*NEW) is not allowed.

Notes for Java functions: To be able to run Java functions, you must have the IBM Developer Kit for Java (5761-JV1) installed on your system. Otherwise, an SQLCODE of -443 will be returned and a CPDB521 message will be placed in the job log.

If an error occurs while running a Java function, an SQLCODE of -443 will be returned. Depending on the error, other messages may exist in the job log of the job where the function was run.

MODIFIES SQL DATA and EXTERNAL ACTION functions: If a MODIFIES SQL DATA or EXTERNAL ACTION function is invoked in other than the outermost select list, the results are unpredictable since the number of times the function is invoked will vary depending on the access plan used.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The value DB2GENRL may be used as a synonym for DB2GENERAL.
- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are optional.

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- The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.
- The keywords PARAMETER STYLE DB2SQL may be used as a synonym for PARAMETER STYLE SQL.

Example

The following creates a table function written to return a row consisting of a single document identifier column for each known document in a text management system. The first parameter matches a given subject area and the second parameter contains a given string.

Within the context of a single session, the UDF will always return the same table, and therefore it is defined as DETERMINISTIC. Note the RETURNS clause which defines the output from DOCMATCH. FINAL CALL must be specified for each table function. Although the size of the output for DOCMATCH is highly variable, CARDINALITY 20 is a representative value, and is specified to help the optimizer.

CREATE FUNCTION DOCMATCH (VARCHAR(30), VARCHAR(255))

RETURNS TABLE (DOCID CHAR(16)) EXTERNAL NAME 'MYLIB/RAJIV(UDFMATCH)' LANGUAGE C PARAMETER STYLE SQL NO SQL **DETERMINISTIC** NO EXTERNAL ACTION NOT FENCED **SCRATCHPAD** FINAL CALL **DISALLOW PARALLEL CARDINALITY** 20

CREATE FUNCTION (Sourced)

This CREATE FUNCTION (Sourced) statement defines a user-defined function, based on another existing scalar or aggregate function, at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization id of the statement must include at least one of the following:

- For the SYSFUNCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- · Administrative authority

If the source function is a user-defined function, the authorization ID of the statement must include at least one of the following for the source function:

- The EXECUTE privilege on the function
- Administrative authority

To create a sourced function, the privileges held by the authorization ID of the statement must also include at least one of the following:

- The following system authorities:
 - *USE to the Create Service Program (CRTSRVPGM) command or
 - *USE to the Create Program (CRTPGM) command
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the function is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- · Administrative authority

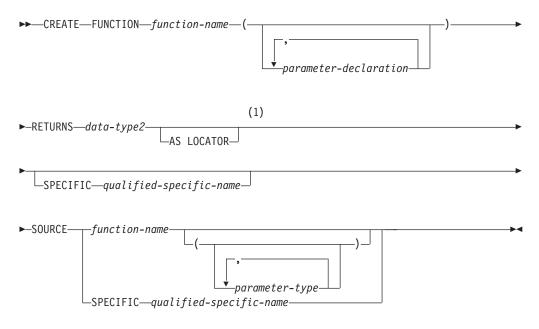
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

CREATE FUNCTION (Sourced)

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View, Corresponding System Authorities When Checking Privileges to a Function or Procedure, and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax



parameter-declaration:



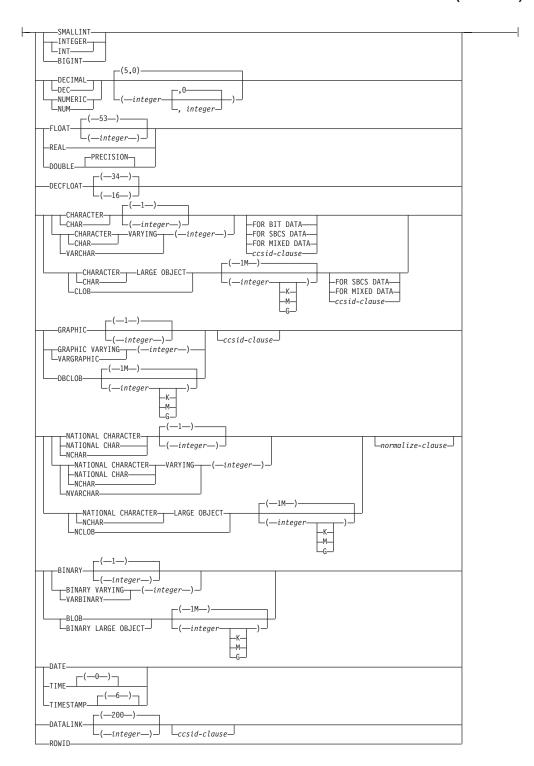
data-type1, data-type2, data-type3:

```
-built-in-type-
└distinct-type-name
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Notes:

The RETURNS, SPECIFIC, and SOURCE clauses can be specified in any order.

built-in-type:



ccsid-clause:

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normalize-clause:

parameter-type:

Description

function-name

Names the user-defined function. The combination of name, schema name, the number of parameters, and the data type of each parameter (without regard for any length, precision, scale, or CCSID attributes of the data type) must not identify a user-defined function that exists at the current server.

For SQL naming, the function will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the function will be created in schema that is specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the function will be created in the current library (*CURLIB).
- Otherwise, the function will be created in the current schema.

If the function is sourced on an existing function to enable the use of the existing function with a distinct type, the name can be the same name as the existing function. In general, more than one function can have the same name if the function signature of each function is unique.

Certain function names are reserved for system use. For more information see Choosing the Schema and Function Name.

(parameter-declaration,...)

Specifies the number of input parameters of the function and the data type of each parameter. Each *parameter-declaration* specifies an input parameter for the function. A maximum of 90 parameters can be specified. A function can have zero or more input parameters. There must be one entry in the list for each parameter that the function expects to receive. All the parameters for a function are input parameters and are nullable. In the case of JAVA, numeric parameters other than the DECIMAL and NUMERIC types are not nullable. A runtime error will occur if a null value is input to such a parameter for a CALLED ON NULL INPUT function. For more information, see Defining the parameters.

parameter-name

Names the parameter. Although not required, a parameter name can be specified for each parameter. The name cannot be the same as any other *parameter-name* in the parameter list.

data-type1

Specifies the data type of the parameter. The data type can be a built-in data type or a distinct data type.

Any valid SQL data type may be used, provided that it is castable to the type of the corresponding parameter of the function identified in the SOURCE clause (for information, see "Casting between data types" on page 86

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page 86). However, this checking does not guarantee that an error will not occur when the function is invoked. For more information, see Considerations for invoking a sourced user-defined function.

built-in-type

The data type of the input parameter is a built-in data type. See "CREATE TABLE" on page 768 for a more complete description of each built-in data type.

distinct-type-name

The data type of the input parameter is a distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those specified on CREATE TYPE). See "CREATE TYPE" on page 827 for more information.

If the name of the distinct type is specified without a schema name, the database manager resolves the schema name by searching the schemas in the SQL path.

DataLinks are not allowed for functions sourced on external functions.

If a CCSID is specified, the parameter is converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

AS LOCATOR

Specifies that the input parameter is a locator to the value rather than the actual value. You can specify AS LOCATOR only if the input parameter has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

RETURNS

Specifies the result of the function.

data-type2

Specifies the data type of the column. The column is nullable. The data type can be a built-in data type (except LONG VARCHAR, LONG VARGRAPHIC, or a DataLink) or distinct type (that is not based on a DataLink).

Any valid SQL data type can be used provided it is castable from the result type of the source function. (For information about casting data types, see "Casting between data types" on page 86) However, this checking does not guarantee that an error will not occur when this new function is invoked. For more information, see Considerations for invoking a sourced user-defined function.

AS LOCATOR

Specifies that the function returns a locator to the value rather than the actual value. You can specify AS LOCATOR only if the output from the function has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified. The AS LOCATOR clause is not allowed for functions sourced on SQL functions.

CREATE FUNCTION (Sourced)

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

SPECIFIC *qualified-specific-name*

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a function.

SOURCE

Specifies that the new function is being defined as a sourced function. A *sourced function* is implemented by another function (the *source function*). The function must be a scalar or aggregate function that exists at the current server, and it must be one of the following types of functions:

- · A function that was defined with a CREATE FUNCTION statement
- · A cast function that was generated by a CREATE TYPE statement
- A built-in function

If the source function is not a built-in function, the particular function can be identified by its name, function signature, or specific name.

If the source function is a built-in function, the SOURCE clause must include a function signature for the built-in function. The source function must not be any of the following built-in functions (If a particular syntax is shown, only the indicated form cannot be specified.):

- BINARY when more than one argument is specified
- BLOB when more than one argument is specified
- · CHAR when more than one argument is specified
- · CLOB when more than one argument is specified
- COALESCE
- CONTAINS
- DATAPARTITIONNAME
- DATAPARTITIONNUM
- DBCLOB when more than one argument is specified
- DBPARTITIONNAME
- DBPARTITIONNUM
- DECFLOAT when more than one argument is specified
- DECIMAL when more than one argument is specified
- DECRYPT_BIN when more than one argument is specified
- DECRYPT_BINARY when more than one argument is specified
- DECRYPT_BIT when more than one argument is specified
- DECRYPT_CHAR when more than one argument is specified
- DECRYPT_DB when more than one argument is specified
- EXTRACT
- GRAPHIC when more than one argument is specified
- HASH
- HASHED_VALUE
- LAND
- LOR
- MAX
- MIN
- NODENAME

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- PARTITION
- POSITION
- RAISE_ERROR
- RID
- RRN
- SCORE
- STRIP
- SUBSTRING
- TRANSLATE when more than one argument is specified
- TRIM
- VALUE
- VARBINARY when more than one argument is specified
- VARCHAR when more than one argument is specified
- · VARGRAPHIC when more than one argument is specified
- XOR
- · ZONED when more than one argument is specified

function-name

Identifies the function to be used as the source function by its function name. The source function can be defined with any number of parameters. If more than one function is defined with the specified name in the specified or implicit schema, an error is returned.

If an unqualified *function-name* is specified, the SQL path is used to locate the function. The database manager selects the first schema that has only one function with this name on which the user has EXECUTE authority. An error is returned if a function is not found, or if the database manager encounters a schema that has more than one function with this name.

function-name (parameter-type, ...)

Identifies the function to be used as the source function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type,...*) must identify a function with the specified signature at the current server. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance. Synonyms for data types are considered a match.

If *function-name*() is specified, the function identified must have zero parameters.

To use a built-in function as the source function, this syntax variation must be used.

function-name

Identifies the name of the source function. If an unqualified name is specified, the schemas of the SQL path are searched. Otherwise, the database manager searches for the function in the specified schema.

parameter-type,...

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

CREATE FUNCTION (Sourced)

Empty parentheses are allowed for some data types that are specified in this context. For data types that have a length, precision or scale attribute, use one of the following specifications:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

For data types with a subtype or CCSID attribute, specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If you specify either clause, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified. If AS LOCATOR is specified and a length is explicitly specified, the data type length is ignored.

For more information on the AS LOCATOR clause, see Specifying AS LOCATOR for a parameter.

SPECIFIC *qualified-specific-name*

Identifies the function to be used as the source function by its specific name. The *qualified-specific-name* must identify a specific function that exists in the specified or implicit schema. If an unqualified *qualified-specific-name* is specified, the default schema is used as the qualifier (not the path).

The number of input parameters in the function that is being created must be the same as the number of parameters in the source function. If the data type of each input parameter is not the same as or castable to the corresponding parameter of the source function, an error occurs. The data type of the final result of the source function must match or be castable to the result of the sourced function.

If a CCSID is specified and the CCSID of the return data is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified the return data is converted to the CCSID of the job (or associated graphic CCSID of the job for graphic string return values), if the CCSID of the return data is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially

important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

Notes

General considerations for defining user-defined functions: See "CREATE FUNCTION" on page 655 for general information about defining user-defined functions.

Function ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the function is created exists, the *owner* of the function is that user profile.
- Otherwise, the *owner* of the function is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the function is the user profile or group user profile of the job executing the statement.

Function authority: If SQL names are used, functions are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, functions are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the function is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the function.

Considerations for invoking a sourced user-defined function: When a sourced function is invoked, each argument to the function is assigned to the associated parameter defined for the function. The values are then cast (if necessary) to the data type of the corresponding parameters of the underlying function. An error can occur either in the assignment or in the cast. For example: an argument passed on input to a function that matches the data type and length or precision attributes of the parameter for the function might not be castable if the corresponding parameter of the underlying source function has a shorter length or less precision. It is recommended that the data types of the parameters of a sourced function be defined with attributes that are less than or equal to the attributes of the corresponding parameters of the underlying function.

The result of the underlying function is assigned to the RETURNS data type of the sourced function. The RETURNS data type of the underlying function might not be castable to the RETURNS data type of the source function. This can occur when the RETURNS data type of this new source function has a shorter length or less precision than the RETURNS data type of the underlying function. For example, an error would occur when function A is invoked assuming the following functions exist. Function A returns an INTEGER. Function B is a sourced function, is defined to return a SMALLINT, and the definition references function A in the SOURCE clause. It is recommended that the RETURNS data type of a sourced function be defined with attributes that are the same or greater than the attributes defined for the RETURNS data type of the underlying function.

Considerations when the function is based on a user-defined function: If the sourced function is based directly or indirectly on an external scalar function, the sourced function inherits the attributes of the EXTERNAL clause of the external scalar function. This can involve several layers of sourced functions. For example,

CREATE FUNCTION (Sourced)

assume that function A is sourced on function B, which in turn is sourced on function C. Function C is an external scalar function. Functions A and B inherit all of the attributes that are specified on the EXTERNAL clause of the CREATE FUNCTION statement for function C.

Creating the function: When a sourced function is created, a small service program object is created that represents the function. When this service program is saved and restored to another system, the attributes from the CREATE FUNCTION statement are automatically added to the catalog on that system.

Examples

Example 1: Assume that distinct type HATSIZE is defined and is based on the built-in data type INTEGER. An AVG function could be defined to compute the average hat size of different departments. Create a sourced function that is based on built-in function AVG.

```
CREATE FUNCTION AVG (HATSIZE)
  RETURNS HATSIZE
  SOURCE AVG (INTEGER)
```

The syntax of the SOURCE clause includes an explicit parameter list because the source function is a built-in function.

When distinct type HATSIZE was created, two cast functions were generated, which allow HATSIZE to be cast to INTEGER for the argument and INTEGER to be cast to HATSIZE for the result of the function.

Example 2: After Smith created the external scalar function CENTER in his schema, there is a need to use this function, function, but the invocation of the function needs to accept two INTEGER arguments instead of one INTEGER argument and one DOUBLE argument. Create a sourced function that is based on CENTER.

```
CREATE FUNCTION MYCENTER (INTEGER, INTEGER)
  RETURNS DOUBLE
  SOURCE SMITH.CENTER (INTEGER, DOUBLE);
```

CREATE FUNCTION (SQL Scalar)

This CREATE FUNCTION (SQL Scalar) statement creates an SQL function at the current server. The function returns a single result.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization id of the statement must include at least one of the following:

- For the SYSFUNCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative Authority

The privileges held by the authorization ID of the statement must also include at least one of the following:

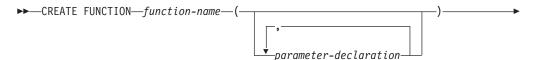
- The following system authorities:
 - *USE to the Create Service Program (CRTSRVPGM) command or
- Administrative authority

If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

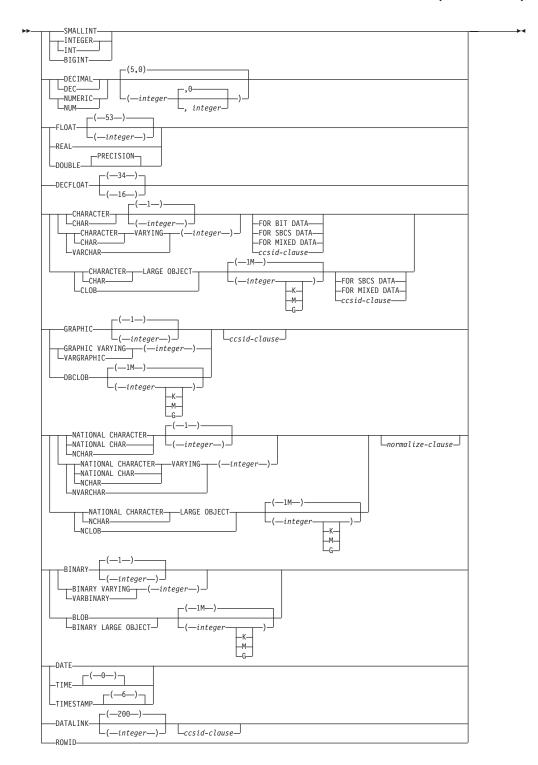
Syntax



CREATE FUNCTION (SQL Scalar)

I	►—RETURNS—data-type2—option-list————————————————————————————————————
	parameter-declaration:
	parameter-namedata-type1
	data-type:
	built-in-type

built-in-type



ccsid-clause:

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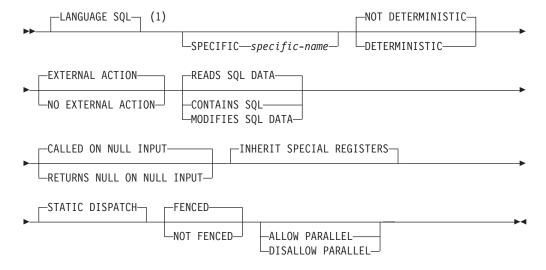
```
--CCSID-integer-normalize-clause-
```

normalize-clause:

CREATE FUNCTION (SQL Scalar)



option-list



Notes:

This clause and the clauses that follow in the option-list can be specified in any order. Each clause can be specified at most once.

SQL-routine-body



Description

function-name

Names the user-defined function. The combination of name, schema name, the number of parameters, and the data type of each parameter (without regard for any length, precision, scale, or CCSID attributes of the data type) must not identify a user-defined function that exists at the current server.

For SQL naming, the function will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the function will be created in the schema that is specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the function will be created in the current library (*CURLIB).
- Otherwise, the function will be created in the current schema.

In general, more than one function can have the same name if the function signature of each function is unique.

Certain function names are reserved for system use. For more information see Choosing the Schema and Function Name.

(parameter-declaration,...)

Specifies the number of input parameters of the function and the data type of

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each parameter. Each *parameter-declaration* specifies an input parameter for the function. A maximum of 90 parameters can be specified. A function can have zero or more input parameters. There must be one entry in the list for each parameter that the function expects to receive. All the parameters for a function are input parameters and are nullable. For more information, see Defining the parameters.

parameter-name

Names the parameter. The name is used to refer to the parameter within the body of the function. The name cannot be the same as any other *parameter-name* in the parameter list.

data-type1

Specifies the data type of the input parameter. The data type can be a built-in data type or a distinct data type.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768.

distinct-type-name

Specifies a distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those specified on CREATE TYPE). For more information about creating a distinct type, see "CREATE TYPE" on page 827.

If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path.

If a CCSID is specified, the parameter is converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

RETURNS

Specifies the result of the function.

data-type2

Specifies the expression that is to be returned for the function. The result data type of the expression must be assignable (using storage assignment rules) to the data type that is defined in the RETURNS clause. For more information, see "Assignments and comparisons" on page 89.

You can specify any built-in data type (except LONG VARCHAR, or LONG VARGRAPHIC) or a distinct type.

If a CCSID is specified and the CCSID of the return data is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified, the return data is converted to the CCSID of the job (or associated graphic CCSID of the job for graphic string return values), if the CCSID of the return data is encoded in a different CCSID. To avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

LANGUAGE SQL

Specifies that this is an SQL function.

CREATE FUNCTION (SQL Scalar)

SPECIFIC *specific-name*

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a function.

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the function returns the same results each time that the function is invoked with the same input arguments. The default is NOT DETERMINISTIC.

NOT DETERMINISTIC

Specifies that the function might not return the same result each time that the function is invoked with the same input arguments. The function depends on some state values that affect the results. The database manager uses this information during optimization of SQL statements. An example of a function that is not deterministic is one that generates random numbers.

A function that is not deterministic might return incorrect results if the function is executed by parallel tasks. Specify the DISALLOW PARALLEL clause for these functions.

NOT DETERMINISTIC should be specified if the function contains a reference to a special register, a non-deterministic function, or a sequence.

DETERMINISTIC

Specifies that the function always returns the same result each time that the function is invoked with the same input arguments. The database manager uses this information during optimization of SQL statements. An example of a deterministic function is a function that calculates the square root of the input argument.

EXTERNAL ACTION or NO EXTERNAL ACTION

Specifies whether the function takes an action that changes the state of an object that the database manager does not manage. An example of an external action is sending a message or writing a record to a stream file. The default is EXTERNAL ACTION.

EXTERNAL ACTION

Specifies that the function can take an action that changes the state of an object that the database manager does not manage. Thus, the function must be invoked with each successive function invocation. EXTERNAL ACTION should be specified if the function contains a reference to another function that has an external action.

NO EXTERNAL ACTION

The function does not perform an external action. It need not be called with each successive function invocation.

NO EXTERNAL ACTION functions might perform better than EXTERNAL ACTION functions because they might not be invoked for each successive function invocation.

CONTAINS SQL, READS SQL DATA, or MODIFIES SQL DATA

Specifies the classification of SQL statements that the function can execute. The database manager verifies that the SQL statements that the function issues are consistent with this specification. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213.

CONTAINS SQL

Specifies that the function can execute only SQL statements with a data

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| | | access classification of CONTAINS SQL or NO SQL. The function cannot execute any SQL statements that read or modify data.

READS SQL DATA

Specifies that the function can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL. The function cannot execute SQL statements that modify data.

MODIFIES SQL DATA

The function can execute any SQL statement except those statements that are not supported in any function.

RETURNS NULL ON NULL INPUT or CALLED ON NULL INPUT

Specifies whether the function is called if any of the input arguments is null at execution time.

RETURNS NULL ON INPUT

Specifies that the function is not invoked if any of the input arguments is null. The result is the null value.

CALLED ON NULL INPUT

Specifies that the function is to be invoked if any or all argument values are null. This specification means that the function must be coded to test for null argument values. The function can return a null or nonnull value.

INHERIT SPECIAL REGISTERS

Specifies that existing values of special registers are inherited upon entry to the function.

STATIC DISPATCH

Specifies that the function is dispatched statically. All functions are statically dispatched.

FENCED or NOT FENCED

Specifies whether the SQL function runs in an environment that is isolated from the database manager environment. FENCED is the default.

FENCED

The function will run in a separate thread.

FENCED functions cannot keep SQL cursors open across individual calls to the function. However, the cursors in one thread are independent of the cursors in any other threads which reduces the possibility of cursor name conflicts.

NOT FENCED

The function may run in the same thread as the invoking SQL statement.

NOT FENCED functions can keep SQL cursors open across individual calls to the function. Since cursors can be kept open, the cursor position will also be preserved between calls to the function. However, cursor names may conflict since the UDF is now running in the same thread as the invoking SQL statement and other NOT FENCED UDFs.

NOT FENCED functions usually perform better than FENCED functions.

ALLOW PARALLEL or DISALLOW PARALLEL

Specifies whether the function can be run in parallel.

The default is DISALLOW PARALLEL if one or more of the following clauses are specified: NOT DETERMINISTIC, EXTERNAL ACTION, or MODIFIES SQL DATA. Otherwise, ALLOW PARALLEL is the default.

CREATE FUNCTION (SQL Scalar)

ALLOW PARALLEL

Specifies that the database manager can consider parallelism for the function. The database manager is not required to use parallelism on the SQL statement that invokes the function or on any SQL statement issued from within the function.

See the descriptions of NOT DETERMINISTIC, EXTERNAL ACTION, and MODIFIES SQL DATA for considerations that apply to specification of ALLOW PARALLEL.

DISALLOW PARALLEL

Specifies that the database manager must not use parallelism for the function.

SET OPTION-statement

Specifies the options that will be used to create the function. For example, to create a debuggable function, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the CREATE FUNCTION statement.

SQL-routine-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL functions.

A call to a procedure that issues a CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, and SET TRANSACTION statement is not allowed in a function.

If the *SQL-routine-body* is a compound statement, it must contain at least one RETURN statement and a RETURN statement must be executed when the function is called.

ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*.

Notes

General considerations for defining user-defined functions: For general information about defining user-defined functions, see "CREATE FUNCTION" on page 655.

SQL path and function resolution: Resolution of function invocations inside the function body is done according to the SQL path that is in effect for the CREATE FUNCTION statement and does not change after the function is created.

Function ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the function is created exists, the *owner* of the function is that user profile.
- Otherwise, the *owner* of the function is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the function is the user profile or group user profile of the job executing the statement.

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Function authority: If SQL names are used, functions are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, functions are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the function is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the function.

Creating the function: When an SQL function is created, the database manager creates a temporary source file that will contain C source code with embedded SQL statements. A *SRVPGM object is then created using the CRTSRVPGM command. The SQL options used to create the service program are the options that are in effect at the time the CREATE FUNCTION statement is executed. The service program is created with ACTGRP(*CALLER).

The specific name is used to determine the name of the source file member and *SRVPGM object. If the specific name is a valid system name, it will used as the name of member and program. If the member already exists, it will be overlaid. If a program already exists in the specified library, a unique name is generated using the rules for generating system table names. If the specific name is not a valid system name, a unique name is generated using the rules for generating system table names.

The function's attributes are saved in the associated service program object. If the *SRVPGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

During restore of the function:

- If the specific name was specified when the function was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- If the same function signature already exists in the catalog:
 - If the name of the service program that was created is the same as the one registered in the catalog, the function information in the catalog will be replaced.
 - Otherwise, the function cannot be registered, and an error is issued.

Invoking the function: When an SQL function is invoked, it runs in the activation group of the calling program.

If a function is specified in the select-list of a select-statement and if the function specifies EXTERNAL ACTION or MODIFIES SQL DATA, the function will only be invoked for each row returned. Otherwise, the UDF may be invoked for rows that are not selected.

Dependent objects: An SQL routine is dependent on objects that are referenced in the *SQL-routine-body*. The names of the dependent objects are stored in catalog view SYSROUTINEDEP. If the object reference in the *SQL-routine-body* is a fully qualified name or, in SQL naming, if an unqualified name is qualified by the current schema, then the schema name of the object in SYSROUTINEDEP will be set to the specified name or the value of the current schema. Otherwise, the schema name is not set to a specific schema name. If a name is not set to a specific schema name, then DROP and ALTER statements will not be able to determine whether the routine is dependent on the object being altered or dropped.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.

Example

Example 1: Define a scalar function that returns the tangent of a value using the existing SIN and COS built-in functions.

```
CREATE FUNCTION TAN
     (X DOUBLE)
  RETURNS DOUBLE
 LANGUAGE SQL
 CONTAINS SQL
 NO EXTERNAL ACTION
 DETERMINISTIC
 RETURN SIN(X)/COS(X)
```

Notice that a parameter name (X) is specified for the input parameter to function TAN. The parameter name is used within the body of the function to refer to the input parameter. The invocations of the SIN and COS functions, within the body of the TAN user-defined function, pass the parameter X as input.

Example 2: Define a scalar function that returns a date formatted as mm/dd/yyyy followed by a string of up to 3 characters:

```
CREATE FUNCTION BADPARM
     (INP1 DATE,)
      USA VARCHAR(3))
  RETURNS VARCHAR (20)
 LANGUAGE SQL
 CONTAINS SQL
 NO EXTERNAL ACTION
 DETERMINISTIC
 RETURN CHAR (INP1, USA) CONCAT USA
```

Assume that the function is invoked as in the following statement:

```
SELECT BADPARM(BIRTHDATE, 'ISO')
    FROM EMPLOYEE WHERE EMPNO='000010'
```

The result is '08/24/1933ISO'. Notice that parameter names (INP1 and USA) are specified for the input parameters to function BADPARM. Although there is an input parameter named USA, the instance of USA in the parameter list for the CHAR function is taken as the keyword parameter for the built-in CHAR function and not the parameter named USA.

CREATE FUNCTION (SQL Table)

This CREATE FUNCTION (SQL table) statement creates an SQL table function at the current server. The function returns a single result table.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization id of the statement must include at least one of the following:

- For the SYSFUNCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- · Administrative Authority

The privileges held by the authorization ID of the statement must also include at least one of the following:

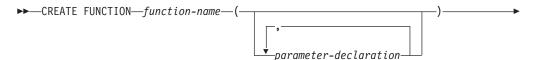
- The following system authorities:
 - *USE to the Create Service Program (CRTSRVPGM) command or
- Administrative authority

If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

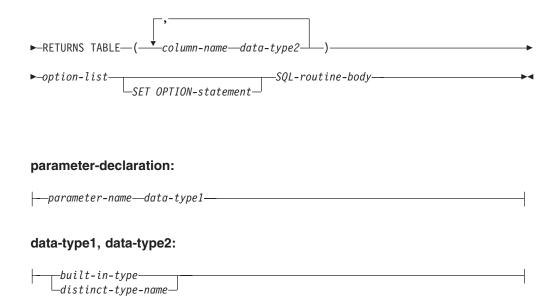
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

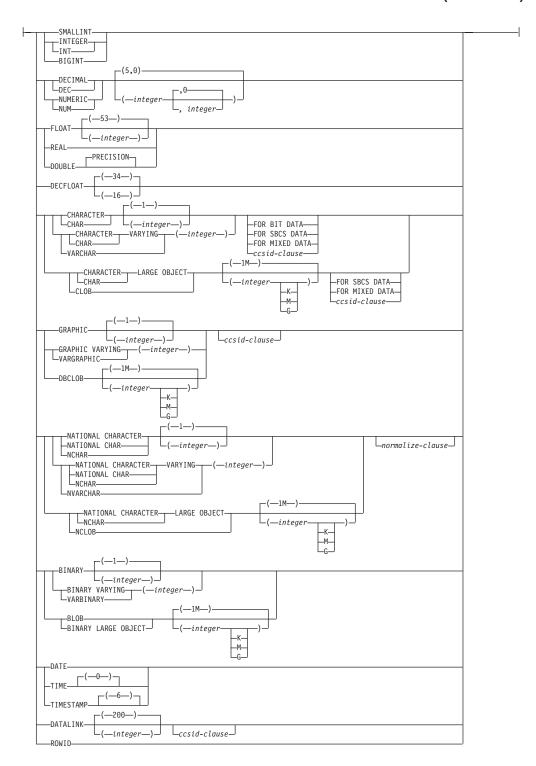


CREATE FUNCTION (SQL Table)

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built-in-type:



ccsid-clause:

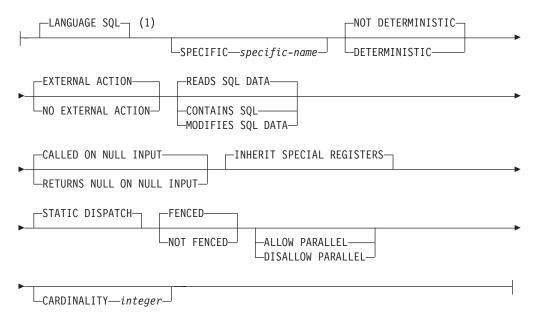
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normalize-clause:

CREATE FUNCTION (SQL Table)



option-list:



Notes:

This clause and the clauses that follow in the option-list can be specified in any order. Each clause can be specified at most once.

SQL-routine-body:

---SQL-control-statement---

Description

function-name

Names the user-defined function. The combination of name, schema name, the number of parameters, and the data type of each parameter (without regard for any length, precision, scale, or CCSID attributes of the data type) must not identify a user-defined function that exists at the current server.

For SQL naming, the function will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the function will be created in the schema that is specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the function will be created in the current library (*CURLIB).
- Otherwise, the function will be created in the current schema.

In general, more than one function can have the same name if the function signature of each function is unique.

Certain function names are reserved for system use. For more information see Choosing the Schema and Function Name.

(parameter-declaration,...)

Specifies the number of input parameters of the function and the data type of each parameter. Each parameter-declaration specifies an input parameter for the function. A maximum of 90 parameters can be specified. A function can have zero or more input parameters. There must be one entry in the list for each parameter that the function expects to receive. All the parameters for a function are input parameters and are nullable. For more information, see Defining the parameters.

parameter-name

Names the parameter. The name is used to refer to the parameter within the body of the function. The name cannot be the same as any other parameter-name in the parameter list.

data-type1

Specifies the data type of the input parameter. The data type can be a built-in data type or a distinct data type.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768.

distinct-type-name

Specifies a distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those specified on CREATE TYPE). For more information about creating a distinct type, see "CREATE TYPE" on page 827.

If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path.

If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the function. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the function is invoked.

RETURNS TABLE

Specifies the output table of the function.

Assume the number of parameters is N. There must be no more than (247-(N*2))/2 columns.

column-name

Specifies the name of a column of the output table. Do not specify the same name more than once.

data-type2

Specifies the data type and attributes of the output.

You can specify any built-in data type (except LONG VARCHAR, or LONG VARGRAPHIC) or a distinct type. When the function is invoked the results are assigned to these data types (using storage assignment rules).

If a CCSID is specified and the CCSID of the return data is encoded in a different CCSID, the data is converted to the specified CCSID.

If a CCSID is not specified the return data is converted to the CCSID of the job (or associated graphic CCSID of the job for graphic string return values), if the CCSID of the return data is encoded in a different CCSID. To

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CREATE FUNCTION (SQL Table)

avoid any potential loss of characters during the conversion, consider explicitly specifying a CCSID that can represent any characters that will be returned from the function. This is especially important if the data type is graphic string data. In this case, consider using CCSID 1200 or 13488 (Unicode graphic string data).

LANGUAGE SQL

Specifies that this is an SQL function.

SPECIFIC *specific-name*

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a function.

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the function returns the same results each time that the function is invoked with the same input arguments. The default is NOT DETERMINISTIC.

NOT DETERMINISTIC

Specifies that the function might not return the same result each time that the function is invoked with the same input arguments. The function depends on some state values that affect the results. The database manager uses this information during optimization of SQL statements. An example of a table function that is not deterministic is one that references special registers, non-deterministic functions, or a sequence in a way that affects the table function result table.

DETERMINISTIC

Specifies that the function always returns the same result table each time that the function is invoked with the same input arguments, provided that the referenced data in the database has not changed. The database manager uses this information during optimization of SQL statements.

EXTERNAL ACTION or NO EXTERNAL ACTION

Specifies whether the function takes an action that changes the state of an object that the database manager does not manage. An example of an external action is sending a message or writing a record to a stream file. The default is EXTERNAL ACTION.

EXTERNAL ACTION

Specifies that the function can take an action that changes the state of an object that the database manager does not manage. Thus, the function must be invoked with each successive function invocation. EXTERNAL ACTION should be specified if the function contains a reference to another function that has an external action.

NO EXTERNAL ACTION

The function does not perform an external action. It need not be called with each successive function invocation.

NO EXTERNAL ACTION functions might perform better than EXTERNAL ACTION functions because they might not be invoked for each successive function invocation.

CONTAINS SQL, READS SQL DATA, or MODIFIES SQL DATA

Specifies the classification of SQL statements that the function can execute. The database manager verifies that the SQL statements that the function issues are consistent with this specification. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213.

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CONTAINS SQL

Specifies that the function can execute only SQL statements with a data access classification of CONTAINS SQL or NO SQL. The function cannot execute any SQL statements that read or modify data.

READS SOL DATA

Specifies that the function can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL. The function cannot execute SQL statements that modify data.

MODIFIES SOL DATA

The function can execute any SQL statement except those statements that are not supported in any function.

RETURNS NULL ON NULL INPUT or CALLED ON NULL INPUT

Specifies whether the function is called if any of the input arguments is null at execution time.

RETURNS NULL ON NULL INPUT

Specifies that the function is not called if any of the input arguments is null. The result is an empty table, which is a table with no rows. RETURNS NULL ON NULL INPUT is the default.

CALLED ON NULL INPUT

Specifies that the function is to be invoked if any argument values are null. This specification means that the function must be coded to test for null argument values. The function can return an empty table, depending on its logic.

INHERIT SPECIAL REGISTERS

Specifies that existing values of special registers are inherited upon entry to the function.

STATIC DISPATCH

Specifies that the function is dispatched statically. All functions are statically dispatched.

FENCED or NOT FENCED

Specifies whether the SQL function runs in an environment that is isolated from the database manager environment. FENCED is the default.

FENCED

The function will run in a separate thread.

FENCED functions cannot keep SQL cursors open across individual calls to the function. However, the cursors in one thread are independent of the cursors in any other threads which reduces the possibility of cursor name conflicts.

NOT FENCED

The function may run in the same thread as the invoking SQL statement.

NOT FENCED functions can keep SQL cursors open across individual calls to the function. Since cursors can be kept open, the cursor position will also be preserved between calls to the function. However, cursor names may conflict since the UDF is now running in the same thread as the invoking SQL statement and other NOT FENCED UDFs.

NOT FENCED functions usually perform better than FENCED functions.

ALLOW PARALLEL or DISALLOW PARALLEL

Specifies whether the function can be run in parallel.

CREATE FUNCTION (SQL Table)

The default is DISALLOW PARALLEL if one or more of the following clauses are specified: NOT DETERMINISTIC, EXTERNAL ACTION, or MODIFIES SQL DATA. Otherwise, ALLOW PARALLEL is the default.

ALLOW PARALLEL

Specifies that the database manager can consider parallelism for the function. The database manager is not required to use parallelism on the SQL statement that invokes the function or on any SQL statement issued from within the function.

See the descriptions of NOT DETERMINISTIC, EXTERNAL ACTION, and MODIFIES SQL DATA for considerations that apply to specification of ALLOW PARALLEL.

DISALLOW PARALLEL

Specifies that the database manager must not use parallelism for the function.

CARDINALITY integer

This optional clause provides an estimate of the expected number of rows to be returned by the function for optimization purposes. Valid values for integer range from 0 to 2 147 483 647 inclusive.

If the CARDINALITY clause is not specified for a table function, the database manager will assume a finite value as a default.

SET OPTION-statement

Specifies the options that will be used to create the function. For example, to create a debuggable function, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the CREATE FUNCTION statement. CLOSQLCSR(*ENDACTGRP) is always used for SQL table functions.

SQL-routine-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL functions.

A call to a procedure that issues a CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK and SET TRANSACTION statement is not allowed in a function.

If the *SQL-routine-body* is a compound statement, it must contain exactly one RETURN statement and it must be executed when the function is called.

ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*.

Notes

General considerations for defining user-defined functions: See Chapter 6, "SQL control statements," on page 1143 for general information about defining user-defined functions.

Function ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the function is created exists, the *owner* of the function is that user profile.
- Otherwise, the *owner* of the function is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the function is the user profile or group user profile of the job executing the statement.

Function authority: If SQL names are used, functions are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, functions are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the function is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the function.

Creating the function: When an SQL function is created, the database manager creates a temporary source file that will contain C source code with embedded SQL statements. A *SRVPGM object is then created using the CRTSRVPGM command. The SQL options used to create the service program are the options that are in effect at the time the CREATE FUNCTION statement is executed. The service program is created with ACTGRP(*CALLER).

The specific name is used to determine the name of the source file member and *SRVPGM object. If the specific name is a valid system name, it will used as the name of member and program. If the member already exists, it will be overlaid. If a program already exists in the specified library, a unique name is generated using the rules for generating system table names. If the specific name is not a valid system name, a unique name is generated using the rules for generating system table names.

The function's attributes are saved in the associated service program object. If the *SRVPGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

During restore of the function:

- If the specific name was specified when the function was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- If the same function signature already exists in the catalog:
 - If the name of the service program is the same as the one registered in the catalog, the function information in the catalog will be replaced.
 - Otherwise, the function cannot be registered, and an error is issued.

Invoking the function: When an SQL function is invoked, it runs in the activation group of the calling program.

Dependent objects: An SQL routine is dependent on objects that are referenced in the *SQL-routine-body*. The names of the dependent objects are stored in catalog view SYSROUTINEDEP. If the object reference in the *SQL-routine-body* is a fully qualified name or, in SQL naming, if an unqualified name is qualified by the current schema, then the schema name of the object in SYSROUTINEDEP will be set to the specified name or the value of the current schema. Otherwise, the

CREATE FUNCTION (SQL Table)

schema name is not set to a specific schema name. If a name is not set to a specific schema name, then DROP and ALTER statements will not be able to determine whether the routine is dependent on the object being altered or dropped.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL and NOT NULL CALL can be used as synonyms for CALLED ON NULL INPUT and RETURNS NULL ON NULL INPUT.
- The keywords IS DETERMINISTIC may be used as a synonym for DETERMINISTIC.

Example

Define a table function that returns the employees in a specified department number.

```
CREATE FUNCTION DEPTEMPLOYEES (DEPTNO CHAR(3))
 RETURNS TABLE (EMPNO CHAR(6),
                 LASTNAME VARCHAR(15),
                 FIRSTNAME VARCHAR(12))
 LANGUAGE SQL
 READS SQL DATA
 NO EXTERNAL ACTION
 DETERMINISTIC
 DISALLOW PARALLEL
 RETURN
      SELECT EMPNO, LASTNAME, FIRSTNME
        FROM EMPLOYEE
       WHERE EMPLOYEE.WORKDEPT =DEPTEMPLOYEES.DEPTNO
```

CREATE INDEX

The CREATE INDEX statement creates an index on a table at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- · Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE to the Create Logical File (CRTLF) command
 - *CHANGE to the data dictionary if the library into which the index is created is an SQL schema with a data dictionary
- · Administrative authority

The privileges held by the authorization ID of the statement must also include at least one of the following:

- For the referenced table:
 - The INDEX privilege on the table
 - The system authority *EXECUTE on the library containing the table
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the table is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

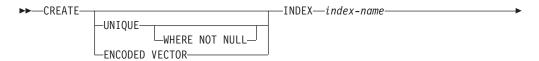
- The system authority *ADD to the user profile with that name
- · Administrative authority

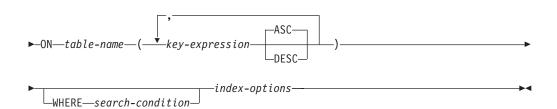
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

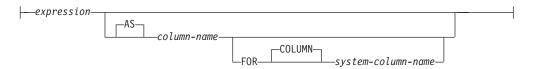
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax

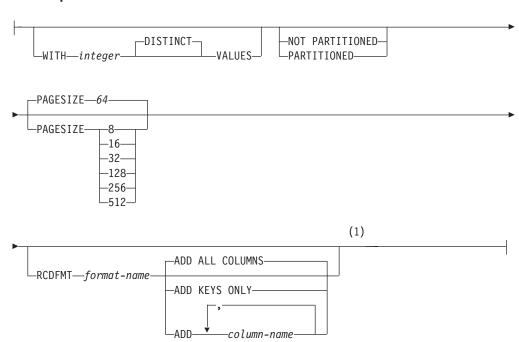




key-expression:



index-options:



Notes:

The index-options may be specified in any order.

Description

UNIQUE

Prevents the table from containing two or more rows with the same value of the index key. When UNIQUE is used, all null values for a column are considered equal. For example, if the key is a single column that can contain null values, that column can contain only one null value. The constraint is enforced when rows of the table are updated or new rows are inserted.

The constraint is also checked during the execution of the CREATE INDEX statement. If the table already contains rows with duplicate key values, the index is not created.

UNIQUE WHERE NOT NULL

Prevents the table from containing two or more rows with the same value of the index key, where all null values for a column are not considered equal. Multiple null values in a column are allowed. Otherwise, this is identical to UNIQUE.

ENCODED VECTOR

Specifies that the resulting index will be an encoded vector index (EVI).

An encoded vector index cannot be used to ensure an ordering of rows. It is used by the database manager to improve the performance of queries. For more information, see the Database Performance and Query Optimization topic collection.

index-name

Names the index. The name, including the implicit or explicit qualifier, must not be the same as an index, table, view, alias, or file that already exists at the current server.

If SQL names were specified, the index will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the index name will be created in the schema that is specified by the qualifier. If not qualified, the index name will be created in the same schema as the table over which the index is created.

If the index name is not a valid system name, DB2 for i will generate a system name. For information about the rules for generating a name, see "Rules for Table Name Generation" on page 810.

ON table-name

Identifies the table on which the index is to be created. The *table-name* must identify a base table (not a view) that exists at the current server.

If the table is a partitioned table, an alias may be specified which identifies a single partition. The created index will then only be created over the specified partition.

key-expression

Identifies a column or expression that will be part of the index key.

The number of keys defined for the index must not exceed 120, and the sum of their byte lengths must not exceed 32766-n, where n is the number of keys specified that allow nulls.

expression

If *expression* contains only a *column-name*, it must be an unqualified name that identifies a column of the table. The same *column-name* cannot be specified more than once if:

· a WHERE clause or RCDFMT clause is specified,

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CREATE INDEX

1	• an ovnross	ion is defined as par	t of an index key or			
I	 an expression is defined as part of an index key, or a column is renamed using the AS clause.					
1	<u> </u>					
	A <i>column-name</i> must not identify a LOB or DATALINK column, or a distinct type based on a LOB or DATALINK column. If the <i>expression</i> is not					
1	a column name, it must not reference a ROWID or DATALINK column, or					
	a distinct type based on a ROWID or DATALINK column. It must not					
1	contain any of the following:					
1	SubqueriesAggregate functions					
1		Variables				
I	Parameter markers					
I	Complex expressions that contain LOBs (such as concatenation)					
I	Special registers					
i I	Sequence references					
· 1	OLAP specifications					
1	ROW CHANGE expressions					
1	User-defined functions other than functions that were implicitly					
1	generated with the creation of a distinct type					
I	 Any function that is not deterministic 					
1	 The following built-in scalar functions: 					
1	ATAN2	DECRYPT_DB	ENCRYPT_TDES	RAND		
I	CURDATE	DIFFERENCE	GENERATE_UNIQUE	REPEAT		
1	CURTIME DATAPARTITIONNAME	DLURLCOMPLETE ¹	GETHINT IDENTITY_VAL_LOCAL	REPLACE ROUND_TIMESTAMP		
i	DATAPARTITIONNUM	DLURLPATHONLY	INSERT	SOUNDEX		
	DAYNAME	DLURLSCHEME	MONTHIS RETAILED	TIMESTAMP_FORMAT		
	DBPARTITIONNAME DECRYPT_BINARY	DLURLSERVER DLVALUE	MONTHS_BETWEEN NEXT_DAY	TIMESTAMPDIFF TRUNC_TIMESTAMP		
1	DECRYPT_BIT	ENCRYPT_AES	NOW	VARCHAR_FORMAT		
I	DECRYPT_CHAR	ENCRYPT_RC2	RAISE_ERROR	WEEK_ISO		
1	¹ For DataLinks with an attribute of FILE LINK CONTROL and READ PERMISSION DB.					
I	column-name					
1	Names a column of the index. Do not use the same name for more than					
	one column of the index or for a system-column-name of the index.					
1	If the <i>expression</i> is not a column name and is not named, a name will be					
	generated for the index key column. The name will be SQLIXxxxxx, where <i>xxxxxx</i> is a number that makes the column name unique for the index.					
I	FOR COLUMN system-column-name					
 	Provides an IBM i name for the column. Do not use the same name for more than one column of the index or for a column-name of the index.					
1	If the system-column-name is not specified, and the column-name is not a					
1	valid system-column-name, a system column name is generated. The name					
I I	will be SQLIXxxxxx, where <i>xxxxx</i> is a number that makes the column name unique for the index.					
I	ASC					
	Specifies that the index entries are to be kept in ascending order of the					
I	column values. ASC is the default.					

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DESC

Specifies that the index entries are to be kept in descending order of the column values.

Ordering is performed in accordance with the comparison rules described in "Assignments and comparisons" on page 89. The null value is higher than all other values.

WHERE search-condition

Specifies the condition to apply for a row to be included in the index. The search-condition cannot contain a predicate with a subquery. It must not contain any of the items listed as restrictions for *key-expression*.

WITH integer DISTINCT VALUES

Specifies the estimated number of distinct key values. This clause may be specified for any type of index.

For encoded vector indexes this is used to determine the initial size of the codes assigned to each distinct key value. The default value is 256.

For non-encoded vector indexes, this clause is ignored.

PARTITIONED

Specifies that an index partition should be created for each data partition defined for the table using the specified columns. The table-name must identify a partitioned table. If the index is unique, the columns of the index must be the same or a superset of the columns of the data partition key. PARTITIONED is the default if the index is not unique and the table is partitioned.

NOT PARTITIONED

Specifies that a single index should be created that spans all of the data partitions defined for the table. The table-name must identify a partitioned table. NOT PARTITIONED is the default if the index is unique and the table is partitioned. An index on a table that is not partitioned is also by default not partitioned.

If an encoded vector index is specified, NOT PARTITIONED is not allowed.

PAGESIZE

Specifies the logical page used for the index in kilobytes. Indexes with larger logical page sizes are typically more efficient when scanned during query processing. Indexes with smaller logical page sizes are typically more efficient for simple index probes and individual key look ups.

The default value for PAGESIZE is determined by the length of the key and has a minimum value of 64.

If an encoded vector index is specified, PAGESIZE is not allowed.

RCDFMT *format-name*

An unqualified name that designates the IBM i record format name of the index. A *format-name* is a system identifier.

If a record format name is not specified, the format-name is the same as the system-object-name of the index. If no key columns are expressions and no key columns have been explicitly named using the AS clause, the index will share the format of table-name.

ADD ALL COLUMNS

Specifies that all columns of table-name will be added to the format for the

CREATE INDEX

index. All the columns will be defined in the same order as they appear in the format of table-name and will precede any expressions defined as index keys.

ADD KEYS ONLY

Specifies that only the columns specified as index key columns will be added to the format for the index. Other columns from table-name will not be added.

ADD column-name

Specifies that the listed columns will be added to the format for the index. The index key columns will be first, followed by the added columns.

Notes

Effects of the statement: CREATE INDEX creates a description of the index. If the named table already contains data, CREATE INDEX creates the index entries for it. If the table does not yet contain data, the index entries are created when data is inserted into the table.

Collating sequence: Any index created over columns containing SBCS or mixed data is created with the collating sequence in effect at the time the statement is executed. For collating sequences other than *HEX, the key for SBCS data or mixed data is the weighted value of the key based on the collating sequence.

Index attributes: An index is created as a keyed logical file. When an index is created, the file wait time and record wait time attributes are set to the default that is specified on the WAITFILE and WAITRCD keywords of the Create Logical File (CRTLF) command.

An index created over a distributed table is created on all of the servers across which the table is distributed. For more information about distributed tables, see DB2 Multisystem.

Index ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the index is created exists, the *owner* of the index is that user profile.
- Otherwise, the owner of the index is the user profile or group user profile of the job executing the statement.

If system names were specified, the owner of the index is the user profile or group user profile of the job executing the statement.

Index authority: If SQL names are used, indexes are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, indexes are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the index is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the index.

Examples

Example 1: Create an index named UNIQUE_NAM on the PROJECT table. The purpose of the index is to ensure that there are not two entries in the table with the same value for project name (PROJNAME). The index entries are to be in ascending order.

```
CREATE UNIQUE INDEX UNIQUE_NAM
    ON PROJECT(PROJNAME)
```

Example 2: Create an index named JOB_BY_DPT on the EMPLOYEE table. Arrange the index entries in ascending order by job title (JOB) within each department (WORKDEPT).

```
CREATE INDEX JOB_BY_DPT
ON EMPLOYEE (WORKDEPT, JOB)
```

Example 3: Create an index named DEPT_TYPE on the DEPARTMENT table. Arrange the index entries in ascending order by type of department, which is determined by the second and third characters of the department number (DEPTNO).

```
CREATE INDEX DEPT_TYPE
ON DEPARTMENT (SUBSTR(DEPTN0,2,2))
```

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CREATE PROCEDURE

The CREATE PROCEDURE statement defines a procedure at the current server.

The following types of procedures can be defined:

External

The procedure program or service program is written in a programming language such as C, COBOL, or Java. The external executable is referenced by a procedure defined at the current server along with various attributes of the procedure. See "CREATE PROCEDURE (External)" on page 731.

• SQL

The procedure is written exclusively in SQL. The procedure body is defined at the current server along with various attributes of the procedure. See "CREATE PROCEDURE (SQL)" on page 745.

Notes

Choosing data types for parameters: For portability of procedures across platforms that are not DB2 for i, do not use the following data types, which might have different representations on different platforms:

- FLOAT. Use DOUBLE or REAL instead.
- NUMERIC. Use DECIMAL instead.

Specifying AS LOCATOR for a parameter: Passing a locator instead of a value can result in fewer bytes being passed in or out of the procedure. This can be useful when the value of the parameter is very large. The AS LOCATOR clause specifies that a locator to the value of the parameter is passed instead of the actual value. Specify AS LOCATOR only for parameters with a LOB data type or a distinct type based on a LOB data type.

AS LOCATOR cannot be specified for SQL procedures.

Determining the uniqueness of procedures in a schema: At the current server, each procedure signature must be unique. The signature of a procedure is the qualified procedure name combined with the number of the parameters (the data types of the parameters are not part of a procedure's signature). This means that two different schemas can each contain a procedure with the same name that have the same number of parameters. However, a schema must not contain two procedures with the same name that have the same number of parameters.

The specific name for a procedure: When defining multiple procedures with the same name and schema (with different number of parameters), it is recommended that a specific name also be specified. The specific name can be used to uniquely identify the procedure when dropping, granting to, revoking from, or commenting on the procedure.

If *specific-name* is not specified, it is the same as the procedure name. If a function or procedure with that specific name already exists, a unique name is generated similar to the rules used to generate unique table names.

Special registers in procedures: The settings of the special registers of the caller are inherited by the procedure when called and restored upon return to the caller. Special registers may be changed within a procedure, but these changes do not affect the caller.

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The CREATE PROCEDURE (External) statement defines an external procedure at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSPROCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

If the external program or service program exists, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the external program or service program that is referenced in the SQL statement:
 - The system authority *EXECUTE on the library that contains the external program or service program.
 - The system authority *EXECUTE on the external program or service program, and
 - The system authority *CHANGE on the program or service program. The system needs this authority to update the program or service program object to contain the information necessary to save/restore the procedure to another system. If user does not have this authority, the procedure is still created, but the program or service program object is not updated.
- · Administrative Authority

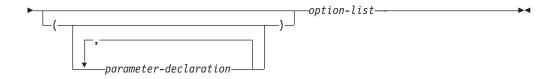
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

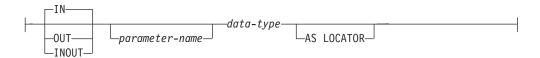
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

►►—CREATE PROCEDURE—procedure-name-



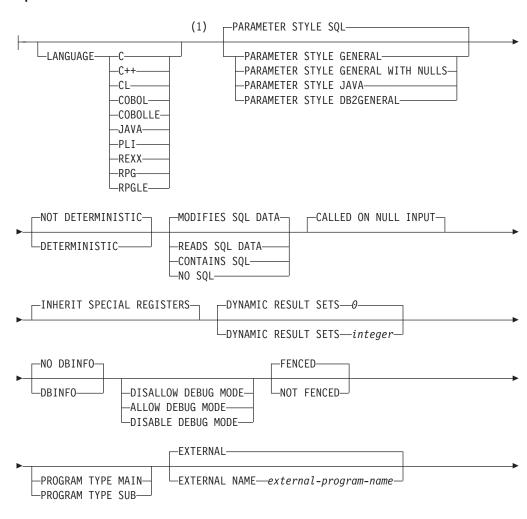
parameter-declaration:

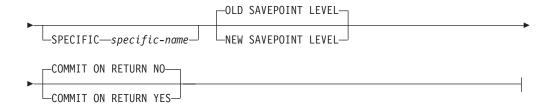


data-type:

```
-built-in-type-
└distinct-type-name-
```

option-list:

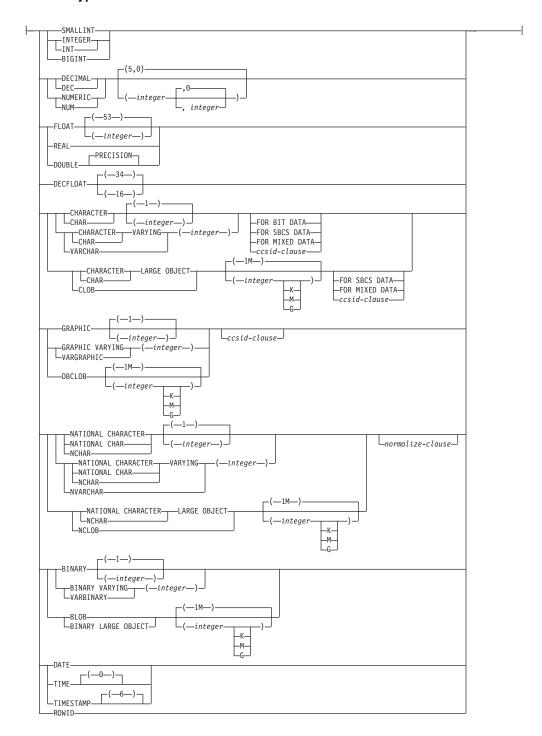




Notes:

1 The optional clauses can be specified in a different order.

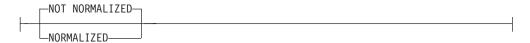
built-in-type:



ccsid-clause:

```
-CCSID-integer
                └normalize-clause
```

normalize-clause:



Description

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procedure-name

Names the procedure. The combination of name, schema name, the number of parameters must not identify a procedure that exists at the current server.

For SQL naming, the procedure will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the procedure will be created in the schema specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the procedure will be created in the current library (*CURLIB).
- Otherwise, the procedure will be created in the current schema.

(parameter-declaration,...)

Specifies the number of parameters of the procedure and the data type of each parameter. A parameter for a procedure can be used only for input, only for output, or for both input and output. Although not required, you can give each parameter a name.

The maximum number of parameters allowed in CREATE PROCEDURE depends on the language and the parameter style:

- If PARAMETER STYLE GENERAL is specified, in C and C++, the maximum is 1024. Otherwise, the maximum is 255.
- If PARAMETER STYLE GENERAL WITH NULLS is specified, in C and C++, the maximum is 1023. Otherwise, the maximum is 254.
- If PARAMETER STYLE SQL is specified, in C and C++, the maximum is 508. Otherwise, the maximum is 90.
- If PARAMETER STYLE JAVA or PARAMETER STYLE DB2GENERAL is specified, the maximum is 90.

The maximum number of parameters is also limited by the maximum number of parameters allowed by the licensed program used to compile the external program or service program.

IN Identifies the parameter as an input parameter to the procedure. Any changes made to the parameter within the procedure are not available to the calling SQL application when control is returned.⁸⁰ The default is IN.

OUT

Identifies the parameter as an output parameter that is returned by the procedure.

A DataLink or a distinct type based on a DataLink cannot be specified as an output parameter.

INOUT

Identifies the parameter as both an input and output parameter for the procedure.

^{80.} When the language type is REXX, all parameters must be input parameters.

A DataLink or a distinct type based on a DataLink cannot be specified as an input and output parameter.

parameter-name

Names the parameter. The name cannot be the same as any other *parameter-name* for the procedure.

data-type

Specifies the data type of the parameter.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768.

distinct-type-name

Specifies a distinct type. Any length, precision, scale, or encoding scheme attributes for the parameter are those of the source type of the distinct type as specified using "CREATE TYPE" on page 827.

If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path.

If a CCSID is specified, the parameter will be converted to that CCSID before passing it to the procedure. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the procedure is invoked.

Some data types are not supported in all languages. For details on the mapping between the SQL data types and host language data types, see Embedded SQL Programming topic collection. Built-in data type specifications can be specified if they correspond to the language that is used to write the procedure.

AS LOCATOR

Specifies that the parameter is a locator to the value rather than the actual value. You can specify AS LOCATOR only if the parameter has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

LANGUAGE

Specifies the language that the external program or service program is written in. The language clause is required if the external program is a REXX procedure.

If LANGUAGE is not specified, the LANGUAGE is determined from the attribute information associated with the external program or service program at the time the procedure is created. If the attribute information associated with the program or service program does not identify a recognizable language or the program or service program cannot be found, then the language is assumed to be C.

C The external program is written in C.

C++

The external program is written in C++.

CL

The external program is written in CL.

COBOL

The external program is written in COBOL.

COBOLLE

The external program is written in ILE COBOL.

The external program is written in JAVA.

PLI

The external program is written in PL/I.

REXX

The external program is a REXX procedure.

RPG

The external program is written in RPG.

RPGLE

The external program is written in ILE RPG.

PARAMETER STYLE

Specifies the conventions used to pass parameters to and returning the values from procedures:

SQL

Specifies that in addition to the parameters on the CALL statement, several additional parameters are passed to the procedure. The parameters are defined to be in the following order:

- The first *n* parameters are the parameters that are specified on the CREATE PROCEDURE statement.
- *n* parameters for indicator variables for the parameters.
- A CHAR(5) output parameter for SQLSTATE. The SQLSTATE returned indicates the success or failure of the procedure. The SQLSTATE returned is assigned by the external program.

The user may set the SQLSTATE to any valid value in the external program to return an error or warning from the procedure.

- A VARCHAR(517) input parameter for the fully qualified procedure
- A VARCHAR(128) input parameter for the specific name.
- A VARCHAR(1000) output parameter for the message text.

The following additional parameter may be passed as the last parameter:

• A parameter for the dbinfo structure, if DBINFO was specified on the CREATE PROCEDURE statement.

These parameters are passed according to the specified LANGUAGE. For example, if the language is C or C++, the VARCHAR parameters are passed as NUL-terminated strings. For more information about the parameters passed, see the include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

PARAMETER STYLE SQL cannot be used with LANGUAGE JAVA.

DB2GENERAL

Specifies that the procedure will use a parameter passing convention that is defined for use with Java methods.

PARAMETER STYLE DB2GENERAL can only be specified with LANGUAGE JAVA. For details on passing parameters in JAVA, see the IBM Developer Kit for Java.

GENERAL

Specifies that the procedure will use a parameter passing mechanism where the procedure receives the parameters specified on the CALL. Additional arguments are not passed for indicator variables.

PARAMETER STYLE GENERAL cannot be used with LANGUAGE JAVA.

GENERAL WITH NULLS

Specifies that in addition to the parameters on the CALL statement as specified in GENERAL, another argument is passed to the procedure. This additional argument contains an indicator array with an element for each of the parameters of the CALL statement. In C, this would be an array of short INTs. For more information about how the indicators are handled, see the SQL Programming topic collection.

PARAMETER STYLE GENERAL WITH NULLS cannot be used with LANGUAGE JAVA.

JAVA

Specifies that the procedure will use a parameter passing convention that conforms to the Java language and ISO/IEC FCD 9075-13:2003, *Information technology - Database languages - SQL - Part 13: Java Routines and Types (SQL/JRT)* specification. INOUT and OUT parameters will be passed as single entry arrays to facilitate returning values.

PARAMETER STYLE JAVA can only be specified with LANGUAGE JAVA. For increased portability, you should write Java procedures that use the PARAMETER STYLE JAVA conventions. For details on passing parameters in JAVA, see the IBM Developer Kit for Java topic collection.

Note that the language of the external procedure determines how the parameters are passed. For example, in C, any VARCHAR or CHAR parameters are passed as NUL-terminated strings. For more information, see the SQL Programming topic collection. For Java routines, see the IBM Developer Kit for Java topic collection.

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the procedure returns the same results each time the procedure is called with the same IN and INOUT arguments. The default is NOT DETERMINISTIC.

NOT DETERMINISTIC

The procedure may not return the same result each time the procedure is called with the same IN and INOUT arguments, even when the referenced data in the database has not changed.

DETERMINISTIC

The procedure always returns the same results each time the procedure is called with the same IN and INOUT arguments, provided the referenced data in the database has not changed.

MODIFIES SQL DATA, READS SQL DATA, CONTAINS SQL, or NO SQL

Specifies the classification of SQL statements that this procedure, or any routine called by this procedure, can execute. The database manager verifies that the SQL statements issued by the procedure and all routines called by the procedure are consistent with this specification. The default is MODIFIES SQL DATA. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213.

MODIFIES SQL DATA Specifies that the pro

Specifies that the procedure can execute any SQL statement except statements that are not supported in procedures.

READS SQL DATA

Specifies that the procedure can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL.

CONTAINS SQL

Specifies that the procedure can only execute statements with a data access classification of CONTAINS SQL or NO SQL.

NO SQL

Specifies that the procedure can execute only SQL statements with a data access classification of NO SQL.

CALLED ON NULL INPUT

Specifies that the procedure is to be called if any or all argument values are null. This specification means that the procedure must be coded to test for null argument values.

INHERIT SPECIAL REGISTERS

Specifies that existing values of special registers are inherited upon entry to the procedure.

FENCED or NOT FENCED

This parameter is allowed for compatibility with other products and is not used by DB2 for i.

DYNAMIC RESULT SETS integer

Specifies the maximum number of result sets that can be returned from the procedure. The minimum value for *integer* is zero and the maximum value is 32768.

If no DYNAMIC RESULT SETS clause is specified, result sets are returned for all cursors that remain open when the procedure ends.

Result sets are returned in the order in which the corresponding cursors are opened, unless a SET RESULT SETS statement is executed in the procedure. If the number of cursors that are still open for result sets when the procedure ends exceeds the maximum number specified on the DYNAMIC RESULT SETS clause, a warning is returned on the CALL statement and the number of result sets specified on the DYNAMIC RESULT SETS clause is returned.

If the SET RESULT SETS statement is issued, the number of results returned is the minimum of the number of result sets specified on this keyword and the SET RESULT SETS statement. If the SET RESULT SETS statement specifies a number larger than the maximum number of result sets, a warning is returned. Note that any result sets from cursors that have a RETURN TO CLIENT attribute are included in the number of result sets of the outermost procedure.

The result sets are scrollable if a cursor is used to return a result set and the cursor is scrollable. If a cursor is used to return a result set, the result set starts with the current position. Thus, if 5 FETCH NEXT operations have been performed before returning from the procedure, the result set starts with the 6th row of the result set.

Result sets are only returned if both the following are true:

 The procedure is directly called or if the procedure is a RETURN TO CLIENT procedure and is indirectly called from ODBC, JDBC, OLE DB, .NET, the SQL Call Level Interface, or the System i Access Family Optimized SQL API.

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CREATE PROCEDURE (External)

• The external program does not have an attribute of ACTGRP(*NEW), and the result set is not an array result set.

For more information about result sets, see "SET RESULT SETS" on page 1106.

DISALLOW DEBUG MODE, ALLOW DEBUG MODE, or DISABLE DEBUG MODE

Indicates whether the procedure is created so it can be debugged by the Unified Debugger. If DEBUG MODE is not specified, the procedure will be created with the debug mode specified by the CURRENT DEBUG MODE special register.

DEBUG MODE can only be specified with LANGUAGE JAVA.

DISALLOW DEBUG MODE

The procedure cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is DISALLOW, the procedure can be subsequently altered to change the debug mode attribute.

ALLOW DEBUG MODE

The procedure can be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is ALLOW, the procedure can be subsequently altered to change the debug mode attribute.

DISABLE DEBUG MODE

The procedure cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is DISABLE, the procedure cannot be subsequently altered to change the debug mode attribute.

PROGRAM TYPE

This parameter is allowed for compatibility with other products. It indicates whether the routine's external program is a program (*PGM) or a procedure in a service program (*SRVPGM).

SUB

Specifies that the procedure executes as a procedure in a service program. The external program must be a *SRVPGM object.

MAIN

Specifies that the routine executes as the main entry point in a program. The external program must be a *PGM object.

DBINFO

Specifies whether additional status information is passed to the procedure when it is called. The default is NO DBINFO.

NO DBINFO

Additional information is not passed.

DBINFO

An additional argument is passed when the procedure is called.

The argument is a structure that contains information such as the name of the current server, the application run-time authorization ID, and identification of the version and release of the database manager that called the procedure. See Table 56 on page 741 for further details. Detailed information about the DBINFO structure can be found in include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

DBINFO is only allowed with PARAMETER STYLE SQL.

Table 56. DBINFO fields

Field	Data Type	Description
Relational database	VARCHAR(128)	The name of the current server.
Authorization ID	VARCHAR(128)	The run-time authorization ID.
CCSID information	INTEGER INTEGER INTEGER	The CCSID information of the job. Three sets of three CCSIDs are returned. The following information identifies the three CCSIDs in each set: • SBCS CCSID • DBCS CCSID • Mixed CCSID
	INTEGER INTEGER INTEGER	Following the three sets of CCSIDs is an integer that indicates which set of three sets of CCSIDs is applicable and 8 bytes of reserved space.
		Each set of CCSIDs is for a different encoding scheme (EBCDIC, ASCII, and Unicode).
	INTEGER INTEGER INTEGER	If a CCSID is not explicitly specified for a parameter on the CREATE PROCEDURE statement, the input string is assumed to be encoded in the CCSID of the job at the time the procedure is executed. If the CCSID of the input string is not the same as the CCSID of the parameter, the input string passed to the external procedure will be converted before calling the external program.
	INTEGER	
	CHAR(8)	
Target column	VARCHAR(128)	Not applicable for a call to a procedure.
	VARCHAR(128)	
	VARCHAR(128)	
Version and release	CHAR(8)	The version, release, and modification level of the database manager.
Platform	INTEGER	The server's platform type.

EXTERNAL

Specifies that the CREATE PROCEDURE statement is being used to define a new procedure based on code written in an external programming language.

If NAME clause is not specified, "NAME procedure-name" is assumed. In this case, procedure-name must not be longer than 8 characters. The NAME clause is required for a LANGUAGE JAVA procedure since the default name is not valid for a Java procedure.

NAME external-program-name

Specifies the program or service program that will be executed when the procedure is called by the CALL statement. The program name must identify a program or service program that exists at the application server at the time the procedure is called. If the naming option is *SYS and the name is not qualified:

- The current path will be used to search for the program at the time the procedure is called.
- *LIBL will be used to search for the program or service program at the time GRANT or REVOKE operations are performed on the procedure.

CREATE PROCEDURE (External)

The validity of the name is checked at the application server. If the format of the name is not correct, an error is returned.

The external program or service program need not exist at the time the procedure is created, but it must exist at the time the procedure is called.

CONNECT, SET CONNECTION, RELEASE, DISCONNECT, and SET TRANSACTION statements are not allowed in a procedure that is running on a remote application server. COMMIT and ROLLBACK statements are not allowed in an ATOMIC SQL procedure or in a procedure that is running on a connection to a remote application server.

SPECIFIC *specific-name*

Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a procedure.

OLD SAVEPOINT LEVEL or NEW SAVEPOINT LEVEL

Specifies whether a new savepoint level is to be created on entry to the procedure.

OLD SAVEPOINT LEVEL

A new savepoint level is not created. Any SAVEPOINT statements issued within the procedure with OLD SAVEPOINT LEVEL implicitly or explicitly specified on the SAVEPOINT statement are created at the same savepoint level as the caller of the procedure. This is the default.

NEW SAVEPOINT LEVEL

A new savepoint level is created on entry to the procedure. Any savepoints set within the procedure are created at a savepoint level that is nested deeper than the level at which this procedure was invoked. Therefore, the name of any new savepoint set within the procedure will not conflict with any existing savepoints set in higher savepoint levels (such as the savepoint level of the calling program or service program) with the same name.

COMMIT ON RETURN

Specifies whether the database manager commits the transaction immediately on return from the procedure.

NO

The database manager does not issue a commit when the procedure returns. NO is the default.

YES

The database manager issues a commit if the procedure returns successfully. If the procedure returns with an error, a commit is not issued.

The commit operation includes the work that is performed by the calling application process and the procedure.81

If the procedure returns result sets, the cursors that are associated with the result sets must have been defined as WITH HOLD to be usable after the commit.

Notes

General considerations for defining procedures: See "CREATE PROCEDURE" on page 730 for general information about defining procedures.

^{81.} If the external program or service program was created with ACTGRP(*NEW) and the job commitment definition is not used, the work that is performed in the procedure will be committed or rolled back as a result of the activation group ending.

Language considerations: For information needed to create the programs for a procedure, see Embedded SQL Programming.

Error handling considerations: Values of arguments passed to a procedure which correspond to OUT parameters are undefined and those which correspond to INOUT parameters are unchanged when an error is returned by the procedure.

Creating the procedure: When an external procedure associated with an ILE external program or service program is created, an attempt is made to save the procedure's attributes in the associated program or service program object. If the *PGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

The attributes can be saved for external procedures subject to the following restrictions:

- The external program library must not be QSYS.
- The external program must exist when the CREATE PROCEDURE statement is issued.

If system naming is specified and the external program name is not qualified, the external program must be found in the library list.

- The external program must be an ILE *PGM or *SRVPGM object.
- The external program must not already contain attributes for 32 routines.

If the object cannot be updated, the procedure will still be created.

During restore of the procedure:

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- If the specific name was specified when the procedure was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- · If the same procedure name and number of parameters already exists,
 - If the external program name or service program name is the same as the one registered in the catalog, the procedure information in the catalog will be replaced.
 - Otherwise, the procedure cannot be registered, and an error is issued.

Calling the procedure: If a DECLARE PROCEDURE statement defines a procedure with the same name as a created procedure, and a static CALL statement where the procedure name is not identified by a variable is executed from the same source program, the attributes from the DECLARE PROCEDURE statement will be used rather than the attributes from the CREATE PROCEDURE statement.

The CREATE PROCEDURE statement applies to static and dynamic CALL statements as well as to a CALL statement where the procedure name is identified by a variable.

When an external procedure is invoked, it runs in whatever activation group was specified when the external program or service program was created. However, ACTGRP(*CALLER) should normally be used so that the procedure runs in the same activation group as the calling program.

Notes for Java procedures: To be able to run Java procedures, you must have the IBM Developer Kit for Java installed on your system. Otherwise, an SQLCODE of -443 will be returned and a CPDB521 message will be placed in the job log.

CREATE PROCEDURE (External)

If an error occurs while running a Java procedure, an SQLCODE of -443 will be returned. Depending on the error, other messages may exist in the job log of the job where the procedure was run.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL can be used as synonyms for CALLED ON NULL INPUT.
- The keywords SIMPLE CALL can be used as a synonym for GENERAL.
- The value DB2GENRL may be used as a synonym for DB2GENERAL.
- DYNAMIC RESULT SET, RESULT SETS, and RESULT SET may be used as synonyms for DYNAMIC RESULT SETS.
- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are optional.
- The keywords PARAMETER STYLE DB2SQL can be used as a synonym for PARAMETER STYLE SQL.

Example

Example 1: Create the procedure definition for a procedure, written in Java, that is passed a part number and returns the cost of the part and the quantity that are currently available.

```
CREATE PROCEDURE PARTS_ON_HAND (IN PARTNUM OUT COST DECIMAL(7,2),

OUT QUANTITY INTEGER)

LANGUAGE JAVA
PARAMETER STYLE JAVA
EXTERNAL NAME 'parts.onhand'
```

Example 2: Create the procedure definition for a procedure, written in C, that is passed an assembly number and returns the number of parts that make up the assembly, total part cost and a result set that lists the part numbers, quantity and unit cost of each part.

```
CREATE PROCEDURE ASSEMBLY_PARTS (IN ASSEMBLY_NUM OUT NUM_PARTS INTEGER, OUT COST DOUBLE)

LANGUAGE C
PARAMETER STYLE GENERAL
DYNAMIC RESULT SETS 1
FENCED
```

EXTERNAL NAME ASSEMBLY

CREATE PROCEDURE (SQL)

The CREATE PROCEDURE (SQL) statement creates an SQL procedure at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSPROCS catalog view and SYSPARMS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- · Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE on the Create Program (CRTPGM) command, and
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the procedure is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- Administrative authority

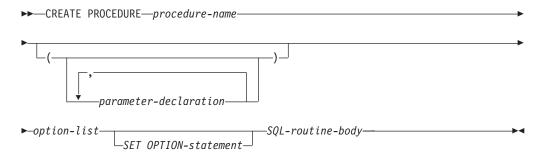
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

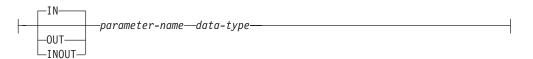
For information on the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Function or Procedure and Corresponding System Authorities When Checking Privileges to a Distinct Type.

CREATE PROCEDURE (SQL)

Syntax



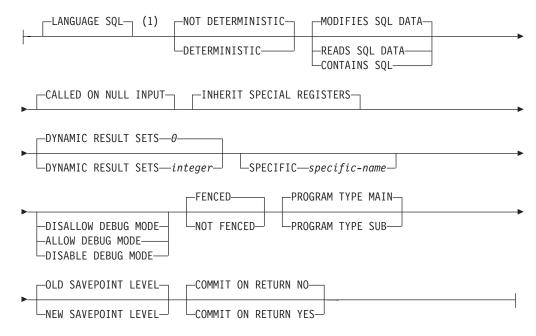
parameter-declaration:



data-type:

```
-__built-in-type-
distinct-type-name-
```

option-list:



Notes:

1 The optional clauses can be specified in a different order.

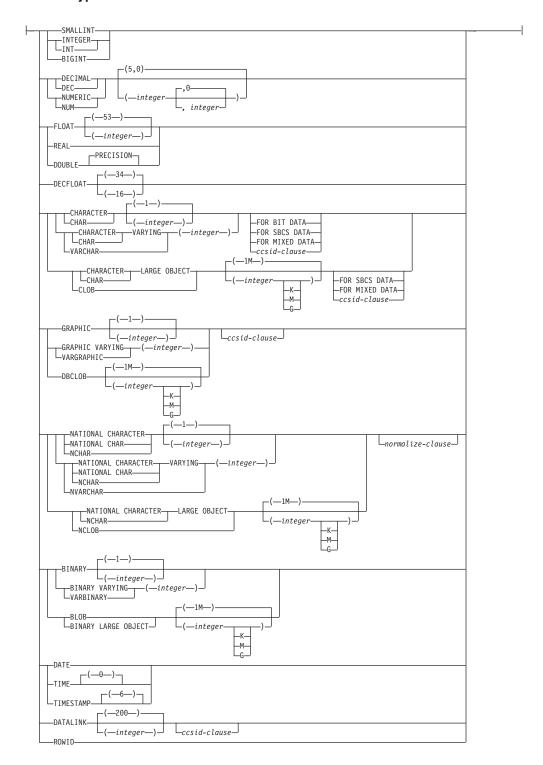
SQL-routine-body:

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COL sentual at at an and	
—SQL-control-statement—	
-ALLOCATE DESCRIPTOR-statement	1
—ALTER FUNCTION-statement—	1
—ALTER PROCEDURE-statement—	1
—ALTER SEQUENCE-statement———————	1
—ALTER TABLE-statement—	1
COMMENT-statement	1
-COMMIT-statement	-
-CONNECT-statement	-
CREATE ALIAS-statement-	-
-CREATE FUNCTION (External Scalar)-statement-	-
—CREATE FUNCTION (External Table)-statement—	-
-CREATE FUNCTION (Sourced)-statement-	-
-CREATE INDEX-statement	_
	_
-CREATE SCHEMA-statement	
-CREATE SEQUENCE-statement	
-CREATE TABLE-statement	
-CREATE TYPE-statement	
-CREATE VIEW-statement-	1
	1
—DEALLOCATE DESCRIPTOR-statement	1
—DECLARE GLOBAL TEMPORARY TABLE-statement—	
—DELETE-statement	1
DESCRIBE-statement-	1
—DESCRIBE INPUT-statement—	1
—DESCRIBE TABLE-statement—	1
—DISCONNECT-statement—	-
—DROP-statement—	-
-EXECUTE IMMEDIATE-statement-	-
—GET DESCRIPTOR-statement—	-
-GRANT-statement-	-
-INSERT-statement-	-
LABEL-statement	-
-LOCK TABLE-statement-	_
-REFRESH TABLE-statement-	
-RELEASE-statement	
-RELEASE SAVEPOINT-statement-	
RENAME-statement—	
-REVOKE-statement-	
-ROLLBACK-statement	
SAVEPOINT-statement-	1
—SELECT INTO-statement—	1
—SET CONNECTION-statement—	1
—SET CURRENT DEBUG MODE-statement—————	1
├─SET CURRENT DECFLOAT ROUNDING MODE-statement	-
—SET CURRENT DEGREE-statement—	-
-SET DESCRIPTOR-statement-	-
SET ENCRYPTION PASSWORD-statement	-
—SET PATH-statement	
SET RESULT SETS-statement—	_
-SET SCHEMA-statement]
-SET TRANSACTION-statement-	
-UPDATE-statement	
	1
└─VALUES INTO-statement-	_

CREATE PROCEDURE (SQL)

built-in-type:



ccsid-clause:

normalize-clause:



Description

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procedure-name

Names the procedure. The combination of name, schema name, the number of parameters must not identify a procedure that exists at the current server.

For SQL naming, the procedure will be created in the schema specified by the implicit or explicit qualifier.

For system naming, the procedure will be created in the schema specified by the qualifier. If no qualifier is specified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the procedure will be created in the current library (*CURLIB).
- Otherwise, the procedure will be created in the current schema.

The schema-name cannot be QSYS2, QSYS, QTEMP, or SYSIBM.

(parameter-declaration,...)

Specifies the number of parameters of the procedure and the data type of each parameter. A parameter for a procedure can be used only for input, only for output, or for both input and output. Although not required, you can give each parameter a name.

The maximum number of parameters allowed in an SQL procedure is 1024.

IN Identifies the parameter as an input parameter to the procedure. Any changes made to the parameter within the procedure are not available to the calling SQL application when control is returned. The default is IN.

OUT

Identifies the parameter as an output parameter that is returned by the procedure. If the parameter is not set within the procedure, the null value is returned.

INOUT

Identifies the parameter as both an input and output parameter for the procedure. If the parameter is not set within the procedure, its input value is returned.

parameter-name

Names the parameter. The name cannot be the same as any other *parameter-name* for the procedure.

data-tupe

Specifies the data type of the parameter. The data type can be a built-in data type or a distinct data type.

built-in-type

Specifies a built-in data type. For a more complete description of each built-in data type, see "CREATE TABLE" on page 768.

distinct-type-name

Specifies a distinct type. The length, precision, or scale attributes for the parameter are those of the source type of the distinct type (those

CREATE PROCEDURE (SQL)

specified on CREATE TYPE). For more information on creating a distinct type, see "CREATE TYPE" on page 827. . If the name of the distinct type is unqualified, the database manager resolves the schema name by searching the schemas in the SQL path. If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the procedure. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the procedure is called. LANGUAGE SOL Specifies that this procedure is written exclusively in SQL. **SPECIFIC** specific-name Specifies a unique name for the function. For more information on specific names, see Specifying a specific name for a procedure. **DETERMINISTIC or NOT DETERMINISTIC** Specifies whether the procedure returns the same results each time the procedure is called with the same IN and INOUT arguments. The default is NOT DETERMINISTIC. **NOT DETERMINISTIC** The procedure may not return the same result each time the procedure is called with the same IN and INOUT arguments, even when the referenced data in the database has not changed. **DETERMINISTIC** The procedure always returns the same results each time the procedure is called with the same IN and INOUT arguments, provided the referenced data in the database has not changed. MODIFIES SQL DATA, READS SQL DATA, or CONTAINS SQL Specifies the classification of SQL statements that this procedure, or any routine called by this procedure, can execute. The database manager verifies that the SQL statements issued by the procedure and all routines called by the procedure are consistent with this specification. The default is MODIFIES SQL DATA. For the classification of each statement, see Appendix B, "Characteristics of SQL statements," on page 1213. **MODIFIES SQL DATA** Specifies that the procedure can execute any SQL statement except statements that are not supported in procedures. **READS SOL DATA** Specifies that the procedure can execute statements with a data access classification of READS SQL DATA, CONTAINS SQL, or NO SQL. **CONTAINS SQL** Specifies that the procedure can only execute statements with a data access classification of CONTAINS SQL or NO SQL. **CALLED ON NULL INPUT**

INHERIT SPECIAL REGISTERS

argument values.

Specifies that existing values of special registers are inherited upon entry to the procedure.

Specifies that the procedure is to be called if any or all argument values are null. This specification means that the procedure must be coded to test for null

DYNAMIC RESULT SETS integer

Specifies the maximum number of result sets that can be returned from the procedure. The minimum value for integer is zero and the maximum value is 32768. The default is DYNAMIC RESULT SETS 0.

Result sets are returned in the order in which the corresponding cursors are opened, unless a SET RESULT SETS statement is executed in the procedure. If the number of cursors still open for result sets when the procedure ends exceeds the maximum number specified on the DYNAMIC RESULT SETS clause, a warning is returned on the CALL statement and the number of result sets specified on the DYNAMIC RESULT SETS clause is returned.

If the SET RESULT SETS statement is issued, the number of results returned is the minimum of the number of result sets specified on this keyword and the SET RESULT SETS statement. If the SET RESULT SETS statement specifies a number larger than the maximum number of result sets, a warning is returned. Note that any result sets from cursors that have a RETURN TO CLIENT attribute are included in the number of result sets of the outermost procedure.

The result sets are scrollable if the cursor is used to return a result set and the cursor is scrollable. If a cursor is used to return a result set, the result set starts with the current position. Thus, if 5 FETCH NEXT operations have been performed prior to returning from the procedure, the result set will start with the 6th row of the result set.

Result sets are only returned if the procedure is directly called or if the procedure is a RETURN TO CLIENT procedure and is indirectly called from ODBC, JDBC, OLE DB, .NET, the SQL Call Level Interface, or the System i Access Family Optimized SQL API. For more information about result sets, see "SET RESULT SETS" on page 1106.

DISALLOW DEBUG MODE, ALLOW DEBUG MODE, or DISABLE DEBUG **MODE**

Indicates whether the procedure is created so it can be debugged by the Unified Debugger. If DEBUG MODE is specified, a DBGVIEW option in the SET OPTION statement must not be specified.

DISALLOW DEBUG MODE

The procedure cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is DISALLOW, the procedure can be subsequently altered to change the debug mode attribute.

ALLOW DEBUG MODE

The procedure can be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is ALLOW, the procedure can be subsequently altered to change the debug mode attribute.

DISABLE DEBUG MODE

The procedure cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of the procedure is DISABLE, the procedure cannot be subsequently altered to change the debug mode attribute.

If DEBUG MODE is not specified, but a DBGVIEW option in the SET OPTION statement is specified, the procedure cannot be debugged by the Unified Debugger, but may be debugged by the system debug facilities. If neither DEBUG MODE nor a DBGVIEW option is specified, the debug mode used is from the CURRENT DEBUG MODE special register.

CREATE PROCEDURE (SQL)

FENCED or NOT FENCED

This parameter is allowed for compatibility with other products and is not used by DB2 for i.

PROGRAM TYPE MAIN or PROGRAM TYPE SUB

Specifies whether the procedure is created as a program (*PGM) or a procedure in a service program (*SRVPGM).

PROGRAM TYPE MAIN

Specifies that the procedure is created as a program (*PGM).

PROGRAM TYPE SUB

Specifies that the procedure is created as a procedure in a service program (*SRVPGM).

PROGRAM TYPE SUB procedures usually perform slightly better than PROGRAM TYPE MAIN procedures.

OLD SAVEPOINT LEVEL or NEW SAVEPOINT LEVEL

Specifies whether a new savepoint level is to be created on entry to the procedure.

OLD SAVEPOINT LEVEL

A new savepoint level is not created. Any SAVEPOINT statements issued within the procedure with OLD SAVEPOINT LEVEL implicitly or explicitly specified on the SAVEPOINT statement are created at the same savepoint level as the caller of the procedure. This is the default.

NEW SAVEPOINT LEVEL

A new savepoint level is created on entry to the procedure. Any savepoints set within the procedure are created at a savepoint level that is nested deeper than the level at which this procedure was invoked. Therefore, the name of any new savepoint set within the procedure will not conflict with any existing savepoints set in higher savepoint levels (such as the savepoint level of the calling program) with the same name.

COMMIT ON RETURN

Specifies whether the database manager commits the transaction immediately on return from the procedure.

NO

The database manager does not issue a commit when the procedure returns. NO is the default.

YES

The database manager issues a commit if the procedure returns successfully. If the procedure returns with an error, a commit is not issued.

The commit operation includes the work that is performed by the calling application process and the procedure.

If the procedure returns result sets, the cursors that are associated with the result sets must have been defined as WITH HOLD to be usable after the commit.

SET OPTION-statement

Specifies the options that will be used to create the procedure. For example, to create a debuggable procedure, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CLOSQLCSR, CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the CREATE PROCEDURE statement.

SQL-routine-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL procedures.

CONNECT, SET CONNECTION, RELEASE, DISCONNECT, and SET TRANSACTION statements are not allowed in a procedure that is running on a remote application server. COMMIT and ROLLBACK statements are not allowed in an ATOMIC SQL procedure or in a procedure that is running on a connection to a remote application server.

ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), and ALTER FUNCTION (SQL Table) with a REPLACE keyword are not allowed in an *SQL-routine-body*.

Notes

General considerations for defining procedures: See "CREATE PROCEDURE" on page 730 for general information on defining procedures.

Procedure ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the procedure is created exists, the *owner* of the procedure is that user profile.
- Otherwise, the *owner* of the procedure is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the procedure is the user profile or group user profile of the job executing the statement.

Procedure authority: If SQL names are used, procedures are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, procedures are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the procedure is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the procedure.

Error handling in procedures: Consideration should be given to possible exceptions that can occur for each SQL statement in the body of a procedure. Any exception SQLSTATE that is not handled within the procedure using a handler within a compound statement results in the exception SQLSTATE being returned to the caller of the procedure. Values of arguments passed to a procedure that correspond to OUT parameters are undefined and those that correspond to INOUT parameters are unchanged when an error is returned by the procedure.

Creating the procedure: When an SQL procedure is created, SQL creates a temporary source file that will contain C source code with embedded SQL statements. A program object is then created using the CRTPGM command. The SQL options used to create the program are the options that are in effect at the time the CREATE PROCEDURE statement is executed. The program is created with ACTGRP(*CALLER).

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CREATE PROCEDURE (SQL)

When an SQL procedure is created, the procedure's attributes are stored in the created program object. If the *PGM object is saved and then restored to this or another system, the catalogs are automatically updated with those attributes.

During restore of the procedure:

- If the specific name was specified when the procedure was originally created and it is not unique, an error is issued.
- If the specific name was not specified, a unique name is generated if necessary.
- · If the same procedure name and number of parameters already exists,
 - If the name of the created program is the same as the one registered in the catalog, the procedure information in the catalog will be replaced.
 - Otherwise, the procedure cannot be registered, and an error is issued.

The specific procedure name is used as the name of the member in the source file and the name of the program object, if it is a valid system name. If the procedure name is not a valid system name, a unique name is generated. If a source file member with the same name already exists, the member is overlaid. If a module or a program with the same name already exists, the objects are not overlaid, and a unique name is generated. The unique names are generated according to the rules for generating system table names.

Invoking the procedure: If a DECLARE PROCEDURE statement defines a procedure with the same name as a created procedure, and a static CALL statement where the procedure name is not identified by a variable is executed from the same source program, the attributes from the DECLARE PROCEDURE statement will be used rather than the attributes from the CREATE PROCEDURE statement.

The CREATE PROCEDURE statement applies to static and dynamic CALL statements as well as to a CALL statement where the procedure name is identified by a variable.

SQL procedures must be called using the SQL CALL statement. When called, the SQL procedure runs in the activation group of the calling program.

Dependent objects: An SQL routine is dependent on objects that are referenced in the *SQL-routine-body*. The names of the dependent objects are stored in catalog view SYSROUTINEDEP. If the object reference in the *SQL-routine-body* is a fully qualified name or, in SQL naming, if an unqualified name is qualified by the current schema, then the schema name of the object in SYSROUTINEDEP will be set to the specified name or the value of the current schema. Otherwise, the schema name is not set to a specific schema name. If a name is not set to a specific schema name, then DROP and ALTER statements will not be able to determine whether the routine is dependent on the object being altered or dropped.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL can be used as synonyms for CALLED ON NULL INPUT.
- DYNAMIC RESULT SET, RESULT SETS, and RESULT SET may be used as synonyms for DYNAMIC RESULT SETS.

Example

Create an SQL procedure that returns the median staff salary. Return a result set containing the name, position, and salary of all employees who earn more than the median salary.

```
CREATE PROCEDURE MEDIAN_RESULT_SET (OUT medianSalary DECIMAL(7,2))
     LANGUAGE SQL
     DYNAMIC RESULT SETS 1
BEGIN
     DECLARE v numRecords INTEGER DEFAULT 1;
     DECLARE v counter INTEGER DEFAULT 0;
     DECLARE c1 CURSOR FOR
        SELECT salary
           FROM staff
           ORDER BY salary;
     DECLARE c2 CURSOR WITH RETURN FOR
        SELECT name, job, salary
           FROM staff
           WHERE salary > medianSalary
           ORDER BY salary;
     DECLARE EXIT HANDLER FOR NOT FOUND
        SET medianSalary = 6666;
     SET medianSalary = 0;
     SELECT COUNT(*) INTO v numRecords FROM STAFF;
     OPEN c1;
     WHILE v_counter < (v_numRecords / 2 + 1)</pre>
        DO FETCH c1 INTO medianSalary;
        SET v_counter = v_counter + 1;
     END WHILE;
     CLOSE c1;
     OPEN c2;
END
```

CREATE SCHEMA

The CREATE SCHEMA statement defines a schema at the current server and optionally creates tables, views, aliases, indexes, and distinct types. Comments and labels may be added in the catalog description of tables, views, aliases, indexes, columns, and distinct types. Table, view, and distinct type privileges can be granted to users.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The *USE system authority to the following CL commands:
 - Create Library (CRTLIB)
 - If WITH DATA DICTIONARY is specified, Create Data Dictionary (CRTDTADCT)
- Administrative authority

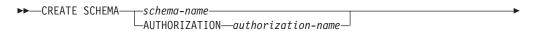
The privileges held by the authorization ID of the statement must include at least one of the following:

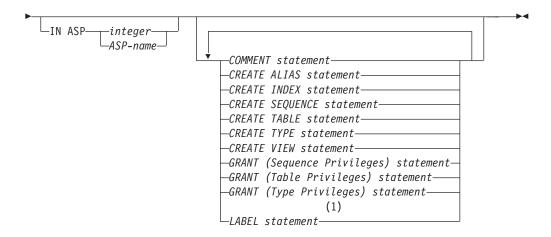
- The privileges defined for each SQL statement included in the CREATE SCHEMA statement
- Administrative authority

If the AUTHORIZATION clause is specified, the privileges held by the authorization ID of the statement must also include at least one of the following:

- The system authority *ADD to the user profile identified by authorization-name
- · Administrative authority

Syntax





Notes:

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1 Labels and comments on packages, procedures, functions, and parameters are not supported in the CREATE SCHEMA statement.

Description

schema-name

Names the schema. A schema is created using this name. If schema-name is specified, the authorization ID of the statement is the run-time authorization ID. The name must not be the same as the name of an existing schema at the current server.

authorization-name

Identifies the authorization ID of the statement. This authorization name is also the schema-name. The name must not be the same as the name of an existing schema at the current server.

IN ASP integer

Specifies the auxiliary storage pool (ASP) in which to create the schema. The integer must be between 1 and 32. If 1 is specified, the schema is created on the system ASP. If this clause is omitted, an ASP of 1 is assumed.

IN ASP ASP-name

Specifies the auxiliary storage pool (ASP) in which to create the schema. The name must identify an auxiliary storage pool that exists at the current server.

COMMENT statement

Adds or replaces comments in the catalog descriptions of tables, views, sequences, or columns. Comments on packages are not allowed. See the COMMENT statement "COMMENT" on page 630.

CREATE ALIAS statement

Creates an alias into the schema. See the CREATE ALIAS statement "CREATE ALIAS" on page 652.

CREATE INDEX statement

Creates an index into the schema. See the CREATE INDEX statement "CREATE INDEX" on page 723.

CREATE SEQUENCE statement

Creates a sequence into the schema. See the CREATE SEQUENCE statement "CREATE SEQUENCE" on page 761.

CREATE TABLE statement

Creates a table into the schema. See the CREATE TABLE statement "CREATE TABLE" on page 768.

CREATE TYPE statement

Creates a user-defined distinct type into the schema. See the CREATE TYPE statement "CREATE TYPE" on page 827.

CREATE VIEW statement

Creates a view into the schema. See the CREATE VIEW statement "CREATE VIEW" on page 835.

GRANT (Sequence Privileges) statement

Grants privileges for sequences in the schema. See the GRANT statement "GRANT (Sequence Privileges)" on page 978.

GRANT (Table Privileges) statement

Grants privileges for tables and views in the schema. See the GRANT statement "GRANT (Table or View Privileges)" on page 981.

GRANT (Type Privileges) statement

Grants privileges for types in the schema. See the GRANT statement "GRANT (Type Privileges)" on page 987.

LABEL statement

Adds or replaces labels in the catalog descriptions of tables, views, sequences, or columns in the schema. Labels on packages are not allowed. See the LABEL statement "LABEL" on page 1005.

Notes

Schema attributes: A schema is created as:

- A library: A library groups related objects, and allows you to find objects by name.
- A catalog: A catalog contains descriptions of the tables, views, indexes, and packages in the schema. A catalog consists of a set of views. For more information, see SQL Programming.
- A journal and journal receiver: A journal QSQJRN and journal receiver QSQJRN0001 is created in the schema, and is used to record changes to all tables subsequently created in the schema. For more information, see Journal Management.

An index created over a distributed table is created on all of the servers across which the table is distributed. For more information about distributed tables, see DB2 Multisystem.

Object ownership: The owner of the schema and created objects is determined as follows:

- If an AUTHORIZATION clause is specified, the specified authorization ID owns the schema and all objects created by the statement.
- If an AUTHORIZATION clause is not specified and SQL names are specified:
 - If a user profile with the same name as the schema exists, the *owner* of the schema and all objects created by the statement is that user profile.
 - Otherwise, the *owner* of the schema and all objects created by the statement is the user profile or group user profile of the job executing the statement.
- Otherwise, the *owner* of the schema and all objects created by the statement is the user profile or the group user profile of the job executing the statement.

Object authority: If SQL names are used, the schema and any other objects are created with the system authority of *EXCLUDE on *PUBLIC and the library is created with the create authority parameter CRTAUT(*EXCLUDE). The owner is the only user having any authority to the schema. If other users require authority to the schema, the owner can grant authority to the objects created; using the CL command Grant Object Authority (GRTOBJAUT).

If system names are used, the schema and any other objects are created with the system authority given to *PUBLIC is determined by the system value QCRTAUT, and the library is created with CRTAUT(*SYSVAL). For more information about system security, see Security Reference, and SQL Programming.

If the owner of the schema is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the schema.

Object names: If a CREATE TABLE, CREATE INDEX, CREATE ALIAS, CREATE TYPE, CREATE SEQUENCE, or CREATE VIEW statement contains a qualified name for the table, index, alias, distinct type, sequence, or view being created, the schema name specified in that qualified name must be the same as the name of the schema being created. Any other object names referenced within the schema definition may be qualified by any schema name. Unqualified table, index, alias, distinct type, sequence, or view names in any SQL statement are implicitly qualified with the name of the created schema.

Delimiters are not used between the SQL statements.

SQL statement length: If the CREATE SCHEMA statement is executed via the RUNSQLSTM command, the maximum length of any individual CREATE TABLE, CREATE INDEX, CREATE TYPE, CREATE ALIAS, CREATE SEQUENCE, CREATE VIEW, COMMENT, LABEL, or GRANT statements within the CREATE SCHEMA statement is 2 097 152. Otherwise, the entire CREATE SCHEMA statement is limited to 2 097 152.

Syntax alternatives: The COLLECTION keyword can be used as a synonym for SCHEMA for compatibility to prior releases. This keyword is non-standard and should not be used.

Deprecated features: The WITH DATA DICTIONARY clause causes an IDDU data dictionary to be created in the schema. While the clause can still be specified at the end of the CREATE SCHEMA statement and is still supported; it is not recommended.

A schema created with a data dictionary cannot contain tables with LOB or DATALINK columns. The clause has no effect on the creation of catalog views.

Examples

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Example 1: Create a schema that has an inventory part table and an index over the part number. Give authority to the schema to the user profile JONES.

CREATE SCHEMA INVENTORY

CREATE TABLE PART (PARTNO SMALLINT NOT NULL,

DESCR VARCHAR(24),

QUANTITY INT)

CREATE SCHEMA

CREATE INDEX PARTIND ON PART (PARTNO)

GRANT ALL ON PART TO JONES

Example 2: Create a schema using the authorization ID of SMITH. Create a student table that has a comment on the student number column.

CREATE SCHEMA AUTHORIZATION SMITH

CREATE TABLE SMITH.STUDENT (STUDNBR SMALLINT NOT NULL UNIQUE, LASTNAME CHAR(20), FIRSTNAME CHAR(20), ADDRESS CHAR(50))

COMMENT ON STUDENT (STUDNBR IS 'THIS IS A UNIQUE ID#')

CREATE SEQUENCE

The CREATE SEQUENCE statement creates a sequence at the application server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE to the Create Data Area (CRTDTAARA) command
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSSEQOBJECTS catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

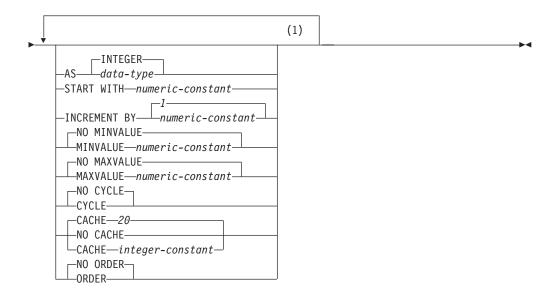
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Sequence and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

►►—CREATE SEQUENCE—sequence-name-

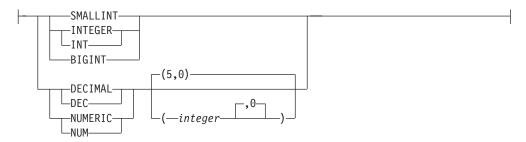


Notes:

1 The same clause must not be specified more than once.

data-type:

built-in-type:



Description

sequence-name

Names the sequence. The name, including the implicit or explicit qualifier, must not identify a sequence or data area that already exists at the current server. If a qualified sequence name is specified, the *schema-name* cannot be QSYS2, QSYS, or SYSIBM.

If SQL names were specified, the sequence will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the sequence will be created in the schema that is specified by the qualifier. If not qualified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the sequence will be created in the current library (*CURLIB).
- Otherwise, the sequence will be created in the current schema.

AS data-type

Specifies the data type to be used for the sequence value. The data type can be any exact numeric type (SMALLINT, INTEGER, BIGINT, DECIMAL, or NUMERIC) with a scale of zero, or a user-defined distinct type for which the source type is an exact numeric type with a scale of zero. The default is INTEGER.

built-in-type

Specifies the built-in data type used as the basis for the internal representation of the sequence. If the data type is DECIMAL or NUMERIC, the precision must be less than or equal to 63 and the scale must be 0. See "CREATE TABLE" on page 768 for a more complete description of each built-in data type.

For portability of applications across platforms, use DECIMAL instead of a NUMERIC data type.

distinct-type-name

Specifies that the data type of the sequence is a distinct type (a user-defined data type). If the source type is DECIMAL or NUMERIC, the precision of the sequence is the precision of the source type of the distinct type. The precision of the source type must be less than or equal to 63 and the scale must be 0. If a distinct type name is specified without a schema name, the distinct type name is resolved by searching the schemas on the SQL path.

START WITH numeric-constant

Specifies the first value that is generated for the sequence. The value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence, without non-zero digits to the right of the decimal point.

If a value is not explicitly specified when the sequence is defined, the default is the MINVALUE for an ascending sequence and the MAXVALUE for a descending sequence.

This value is not necessarily the value that a sequence would cycle to after reaching the maximum or minimum value of the sequence. The START WITH clause can be used to start a sequence outside the range that is used for cycles. The range used for cycles is defined by MINVALUE and MAXVALUE.

INCREMENT BY numeric-constant

Specifies the interval between consecutive values of the sequence. The value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence, and does not exceed the value of a large integer constant, without nonzero digits existing to the right of the decimal point.

If the value is 0 or positive, this is an ascending sequence. If the value is negative, this is a descending sequence. The default is 1.

NO MINVALUE or MINVALUE

Specifies the minimum value at which a descending sequence either cycles or stops generating values, or an ascending sequence cycles to after reaching the maximum value. The default is NO MINVALUE.

NO MINVALUE

For an ascending sequence, the value is the START WITH value, or 1 if START WITH is not specified. For a descending sequence, the value is the minimum value of the data type (and precision, if DECIMAL or NUMERIC) associated with the sequence.

MINVALUE numeric-constant

Specifies the numeric constant that is the minimum value. This value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence and without non-zero digits to the right of the decimal point. The value must be less than or equal to the maximum value.

NO MAXVALUE or MAXVALUE

Specifies the maximum value at which an ascending sequence either cycles or stops generating values, or a descending sequence cycles to after reaching the minimum value. The default is NO MAXVALUE.

NO MAXVALUE

For an ascending sequence, the value is the maximum value of the data type (and precision, if DECIMAL or NUMERIC) associated with the sequence. For a descending sequence, the value is the START WITH value, or -1 if START WITH is not specified.

MAXVALUE numeric-constant

Specifies the numeric constant that is the maximum value. This value can be any positive or negative value that could be assigned to a column of the data type associated with the sequence and without non-zero digits to the right of the decimal point. The value must be greater than or equal to the minimum value.

NO CYCLE or CYCLE

Specifies whether this sequence should continue to generate values once the maximum or minimum value of the sequence has been reached. The default is NO CYCLE.

NO CYCLE

Specifies that values will not be generated for the sequence once the maximum or minimum value for the sequence has been reached.

Specifies that values continue to be generated for this sequence after the maximum or minimum value has been reached. If this option is used, after an ascending sequence reaches the maximum value of the sequence, it generates its minimum value. After a descending sequence reaches its minimum value of the sequence, it generates its maximum value. The maximum and minimum values for the column determine the range that is used for cycling.

When CYCLE is in effect, then duplicate values can be generated for the sequence.

CACHE or NO CACHE

Specifies whether to keep some preallocated values in memory. Preallocating and storing values in the cache improves the performance of the NEXT VALUE sequence expression. The default is CACHE 20.

CACHE *integer-constant*

Specifies the maximum number of sequence values that are preallocated and kept in memory. Preallocating and storing values in the cache improves performance.

In certain situations, such as system failure, all cached sequence values that have not been used in committed statements are lost, and thus, will never be used. The value specified for the CACHE option is the maximum number of sequence values that could be lost in these situations.

The minimum value that can be specified is 2.

NO CACHE

Specifies that values for the sequence are not preallocated. If NO CACHE is specified, the performance of the NEXT VALUE sequence expression will be worse than if CACHE is specified.

ORDER or NO ORDER

Specifies whether the sequence values must be generated in order of request. The default is NO ORDER.

NO ORDER

Specifies that the sequence numbers do not need to be generated in order of request.

ORDER

Specifies that the sequence numbers are generated in order of request. If ORDER is specified, the performance of the NEXT VALUE sequence expression will be worse than if NO ORDER is specified.

Notes

Sequence attributes: A sequence is created as a *DTAARA object. The *DTAARA objects should not be changed with the Change Data Area (*CHGDTAARA) or any other similar interface because doing so may cause unexpected failures or unexpected results when attempting to use the SQL sequence through SQL.

Sequence ownership: The *owner* of the sequence is the user profile or group user profile of the job executing the statement.

Sequence authority: If SQL names are used, sequences are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, sequences are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the sequence is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the sequence.

Relationship of MINVALUE and MAXVALUE: Typically, MINVALUE will be less than MAXVALUE, but this is not required. MINVALUE could be equal to MAXVALUE. If START WITH was the same value as MINVALUE and MAXVALUE, and CYCLE is implicitly or explicitly specified, this would be a constant sequence. In this case a request for the next value appears to have no effect because all the values generated by the sequence are in fact the same.

MINVALUE must not be greater than MAXVALUE

Defining constant sequences: It is possible to define a sequence that would always return a constant value. This could be done by specifying an INCREMENT value of zero and a START WITH value that does not exceed MAXVALUE, or by specifying the same value for START WITH, MINVALUE and MAXVALUE. For a constant sequence, each time a NEXT VALUE expression is processed the same value is returned. A constant sequence can be used as a numeric global variable. ALTER SEQUENCE can be used to adjust the values that will be generated for a constant sequence.

CREATE SEQUENCE

Defining Sequences That Cycle: A sequence can be cycled manually by using the ALTER SEQUENCE statement. If NO CYCLE is implicitly or explicitly specified, the sequence can be restarted or extended using the ALTER SEQUENCE statement to cause values to continue to be generated once the maximum or minimum value for the sequence has been reached.

A sequence can be explicitly defined to cycle by specifying the CYCLE keyword. Use the CYCLE option when defining a sequence to indicate that the generated values should cycle once the boundary is reached. When a sequence is defined to automatically cycle (for example CYCLE was explicitly specified), then the maximum or minimum value generated for a sequence may not be the actual MAXVALUE or MINVALUE specified, if the increment is a value other than 1 or -1. For example, the sequence defined with START WITH=1, INCREMENT=2, MAXVALUE=10 will generate a maximum value of 9, and will not generate the value 10.

When defining a sequence with CYCLE, then any application conversion tools (for converting applications from other vendor platforms to DB2) should also explicitly specify MINVALUE, MAXVALUE and START WITH.

Caching sequence numbers: A range of sequence numbers can be kept in memory for fast access. When an application accesses a sequence that can allocate the next sequence number from the cache, the sequence number allocation can happen quickly. However, if an application accesses a sequence that cannot allocate the next sequence number from the cache, the sequence number allocation will require an update to the *DTAARA object.

Choosing a high value for CACHE allows faster access to more successive sequence numbers. However, in the event of a failure, all sequence values in the cache are lost. If the NO CACHE option is used, the values of the sequence are not stored in the sequence cache. In this case every access to the sequence requires an update to the *DTAARA object. The choice of the value for CACHE should be made keeping the trade-off between performance and application requirements in mind.

Persistence of the most recently generated sequence value: The database manager remembers the most recently generated value for a sequence within the SQL-session, and returns this value for a PREVIOUS VALUE expression specifying the sequence name. The value persists until either the next value is generated for the sequence, the sequence is dropped or altered, or until the end of the application session. The value is unaffected by COMMIT and ROLLBACK statements.

PREVIOUS VALUE is defined to have a linear scope within the application session. Therefore, in a nested application:

- on entry to a nested function, procedure, or trigger, the nested application inherits the most recently generated value for a sequence. That is, specifying an invocation of a PREVIOUS VALUE expression in a nested application will reflect sequence activity done in the invoking application, routine, or trigger before entering the nested application. An invocation of PREVIOUS VALUE expression in a nested application results in an error if a NEXT VALUE expression for the specified sequence had not yet been done in the invoking application, routine, or trigger.
- on return from a function, procedure, or trigger, the invoking application, routine or trigger will be affected by any sequence activity in the function,

procedure, or trigger. That is, an invocation of PREVIOUS VALUE in the invoking application, routine, or trigger after returning from the nested application will reflect any sequence activity that occurred in the lower level applications.

Sequence journaling: When a sequence is created, journaling may be automatically started.

- If a data area called QDFTJRN exists in the same schema that the sequence is created into and the user is authorized to the data area, journaling will be started to the journal named in the data area if all the following are true:
 - The identified schema for the table must not be QSYS, QSYS2, QRECOVERY, QSPL, QRCL, QRPLOBJ, QGPL, QTEMP, SYSIBM, or any of the IASP equivalents to these libraries.
 - The journal specified in the data area must exist and the user must be authorized to start journaling to the journal.
 - The first 10 bytes of the data area must contain the name of the schema in which to find the journal.
 - The second 10 bytes must contain the name of the journal.
 - The remaining bytes contain the object types being implicitly journaled and the options that affect when implicit journaling is performed. The object type must include the value *DTAARA or *ALL. The value *NONE can be used to prevent journaling from being started.

For more information, see the Journal Management topic collection.

• If the sequence is created into a schema that has specified (using the STRJRNLIB command) that journaling should implicitly be started.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases of other DB2 products. These keywords are non-standard and should not be used:

- The keywords NOMINVALUE, NOMAXVALUE, NOCYCLE, NOCACHE, and NOORDER can be used as synonyms for NO MINVALUE, NO MAXVALUE, NO CYCLE, NO CACHE, and NO ORDER.
- A comma can be used to separate multiple sequence options.

Examples

Create a sequence called ORG_SEQ that starts at 1, increments by 1, does not cycle, and caches 24 values at a time:

```
CREATE SEQUENCE ORG_SEQ
START WITH 1
INCREMENT BY 1
NO MAXVALUE
NO CYCLE
CACHE 24
```

The options START WITH 1, INCREMENT 1, NO MAXVALUE, and NO CYCLE are the values that would have been used if they had not been explicitly specified.

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CREATE TABLE

The CREATE TABLE statement defines a table at the current server. The definition must include its name and the names and attributes of its columns. The definition may include other attributes of the table such as primary key.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- · Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - *USE to the Create Physical File (CRTPF) command
 - *CHANGE to the data dictionary if the library into which the table is created is an SQL schema with a data dictionary
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the table is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- · Administrative authority

To define a foreign key, the privileges held by the authorization ID of the statement must include at least one of the following on the parent table:

- The REFERENCES privilege or object management authority for the table
- · The REFERENCES privilege on each column of the specified parent key
- · Ownership of the table
- · Administrative authority

If the LIKE clause or *select-statement* is specified, the privileges held by the authorization ID of the statement must include at least one of the following on the tables or views specified in these clauses:

- The SELECT privilege for the table or view
- · Ownership of the table or view
- Administrative authority

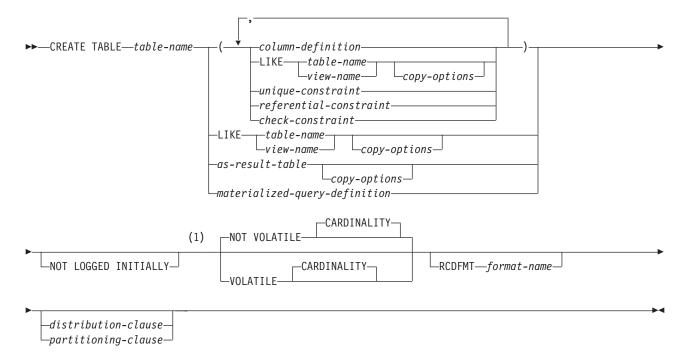
If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and

- The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

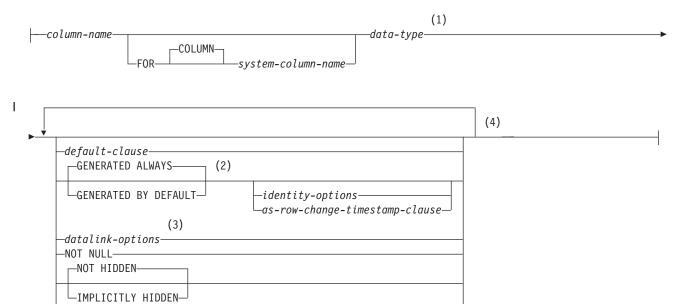


Notes:

1 The optional clauses can be specified in any order.

CREATE TABLE

column-definition:



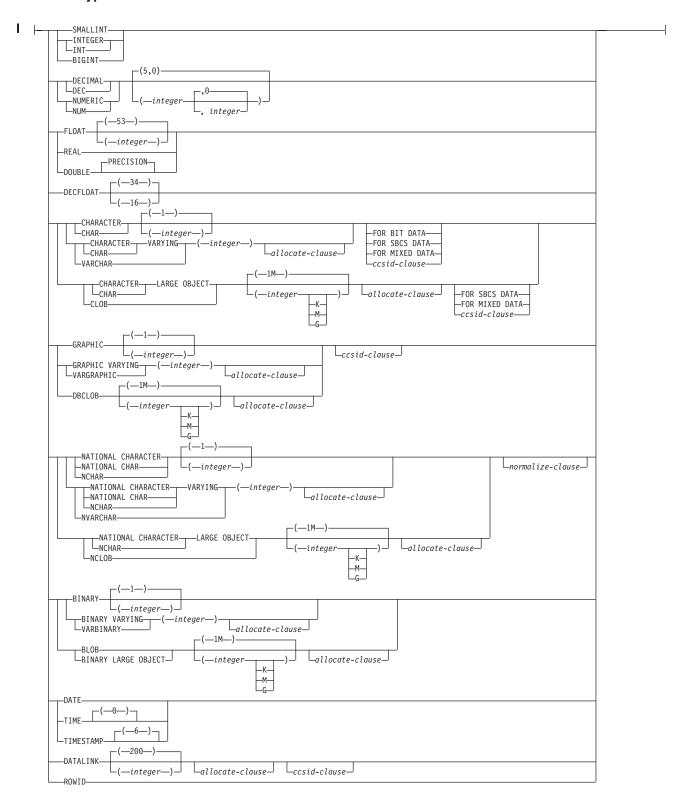
data-type:

-column-constraint

Notes:

- 1 data-type is optional for row change timestamp columns
- 2 GENERATED can be specified only if the column has a ROWID data type (or a distinct type that is based on a ROWID data type), or the column is an identity column, or the column is a row change timestamp.
- 3 The datalink-options can only be specified for DATALINKs and distinct-types sourced on DATALINKs.
- 4 The same clause must not be specified more than once.

built-in-type:



CREATE TABLE

allocate-clause:

——ALLOCATE—(integer)—

ccsid-clause:

---CCSID-integer -normalize-clause—

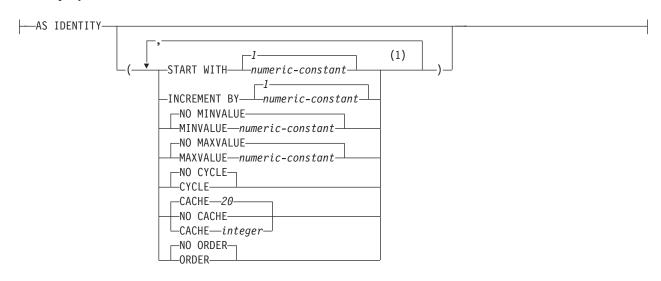
normalize-clause:

-NOT NORMALIZED--NORMALIZED-

default-clause:

```
-WITH-
        -DEFAULT-
                     -constant-
                    -USER-
                    -NULL-
                    -CURRENT_DATE
                    -CURRENT_TIME-
                    —CURRENT TIMESTAMP-
                    dashcast-function-name-(-
                                                 -constant-
                                                -USER-
                                                -CURRENT_DATE-
                                                -CURRENT_TIME-
                                                __CURRENT_TIMESTAMP_
```

identity-options:



Notes:

The same clause must not be specified more than once.

as-row-change-timestamp-clause:

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP

column-constraint:

```
CONSTRAINT—constraint-name—

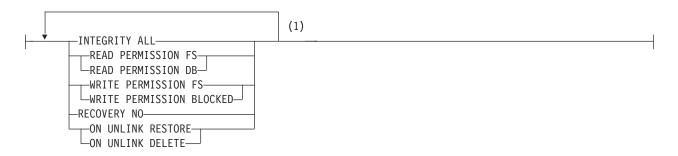
UNIQUE—

—references-clause—
—CHECK—(—check-condition—)—
```

datalink-options:

```
FILE LINK CONTROL——file-link-options——MODE DB20PTIONS——
```

file-link-options:



Notes:

1 All five *file-link-options* must be specified, but they can be specified in any order.

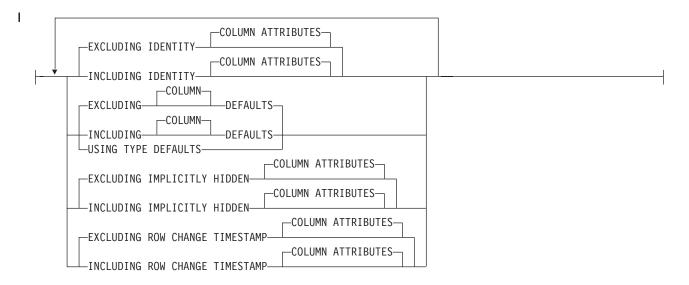
CREATE TABLE

as-result-table:

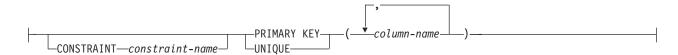
```
-column-name
                                   -COLUMN-
                                                system-column-name

ightharpoonup-AS—(—select-statement—)-
                                     -WITH NO DATA-
                                     -WITH DATA-
```

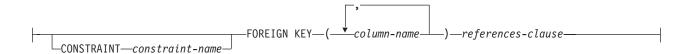
copy-options:



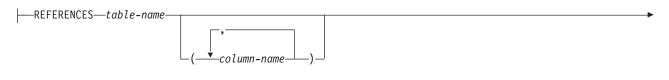
unique-constraint:

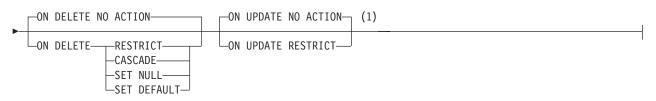


referential-constraint:



references-clause:





check-constraint:

```
-CHECK-(-check-condition-)-
```

distribution-clause:



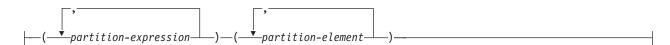
Notes:

The ON DELETE and ON UPDATE clauses may be specified in either order.

CREATE TABLE

partitioning-clause:

range-partition-spec:



partition-expression:

```
-column-name-NULLS EIRST-NULLS FIRST-
```

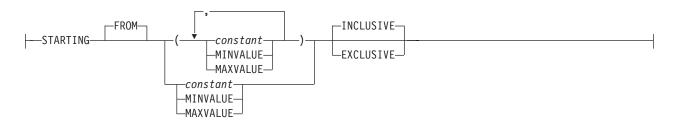
partition-element:

```
PARTITION—partition-name— (1)
boundary-spec—EVERY—(—integer-constant——DAY——DAYS——MONTH——MONTHS—YEAR—YEARS—YEARS—
```

boundary-spec:

```
starting-clause ending-clause
```

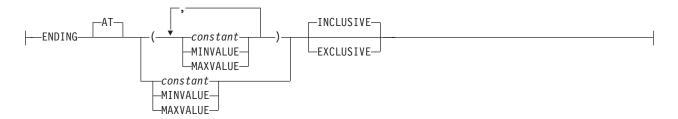
starting-clause:



Notes:

1 This syntax for a *partition-element* is valid if there is only one *partition-expression* with a numeric or datetime data type.

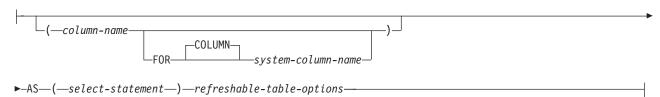
ending-clause:



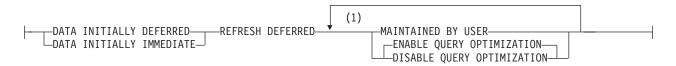
hash-partition-spec:



materialized-query-definition:



refreshable-table-options:



Notes:

The same clause must not be specified more than once. MAINTAINED BY USER must be specified.

Description

table-name

Names the table. The name, including the implicit or explicit qualifier, must not identify an alias, file, index, table, or view that already exists at the current server.

If SQL names were specified, the table will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the table will be created in the schema that is specified by the qualifier. If not qualified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the table will be created in the current library (*CURLIB).
- Otherwise, the table will be created in the current schema.

column-definition

Defines the attributes of a column. There must be at least one column definition and no more than 8000 column definitions.

The sum of the row buffer byte counts of the columns must not be greater than 32766 or, if a VARCHAR or VARGRAPHIC column is specified, 32740. Additionally, if a LOB is specified, the sum of the row data byte counts of the columns must not be greater than 3 758 096 383 at the time of insert or update. For information about the byte counts of columns according to data type, see "Maximum row sizes" on page 807.

column-name

Names a column of the table. Do not qualify *column-name* and do not use the same name for more than one column of the table or for a *system-column-name* of the table.

FOR COLUMN system-column-name

Provides an IBM i name for the column. Do not use the same name for more than one column of the table or for a column-name of the table.

If the system-column-name is not specified, and the column-name is not a valid system-column-name, a system column name is generated. For more information about how system column names are generated, see "Rules for Column Name Generation" on page 809.

data-type

Specifies the data type of the column.

built-in-type

For built-in-types, use:

SMALLINT

For a small integer.

INTEGER or INT

For a large integer.

BIGINT

For a big integer.

DECIMAL(integer,integer) or DEC(integer,integer)

DECIMAL(integer) or **DEC**(integer)

DECIMAL or DEC

For a packed decimal number. The first integer is the precision of the number; that is, the total number of digits; it can range from 1 to 63. The second integer is the scale of the number (the number of digits to the right of the decimal point). It can range from 0 to the precision of the number.

You can use DECIMAL(p) for DECIMAL(p,0), and DECIMAL for DECIMAL(5,0).

NUMERIC(integer,integer) or NUM(integer,integer)

NUMERIC(integer) or NUM(integer)

NUMERIC or NUM

For a zoned decimal number. The first integer is the precision of the number, that is, the total number of digits; it may range from 1 to 63. The second integer is the scale of the number, (the number of digits to the right of the decimal point). It may range from 0 to the precision of the number.

You can use NUMERIC(p) for NUMERIC(p,0), and NUMERIC for NUMERIC(5,0).

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FLOAT

For a double-precision floating-point number.

FLOAT(integer)

For a single- or double-precision floating-point number, depending on the value of integer. The value of integer must be in the range 1 through 53. The values 1 through 24 indicate single-precision, the values 25 through 53 indicate double-precision. The default is 53.

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For single-precision floating point.

DOUBLE PRECISION or DOUBLE

For double-precision floating point.

DECFLOAT(integer)

DECFLOAT

For a IEEE decimal floating-point number. The value of *integer* must be either 16 or 34 and represents the number of significant digits that can be stored. If *integer* is omitted, then the DECFLOAT column will be capable of representing 34 significant digits.

CHARACTER(integer) or CHAR(integer)

CHARACTER or CHAR

For a fixed-length character string of length *integer* bytes. The integer can range from 1 through 32766 (32765 if null capable). If FOR MIXED DATA or a mixed data CCSID is specified, the range is 4 through 32766 (32765 if null capable). If the length specification is omitted, a length of 1 is assumed.

CHARACTER VARYING (integer) or CHAR VARYING (integer) or VARCHAR (integer)

For a varying-length character string of maximum length *integer* bytes, which can range from 1 through 32740 (32739 if null capable). If FOR MIXED DATA or a mixed data CCSID is specified, the range is 4 through 32740 (32739 if null capable).

CHARACTER LARGE OBJECT (integer[K|M|G]) or CHAR LARGE OBJECT (integer[K|M|G]) or CLOB (integer[K|M|G])

CHARACTER LARGE OBJECT or CHAR LARGE OBJECT or CLOB

For a character large object string of the specified maximum length in bytes. The maximum length must be in the range of 1 through 2 147 483 647. If FOR MIXED DATA or a mixed data CCSID is specified, the range is 4 through 2 147 483 647. If the length specification is omitted, a length of 1 megabyte is assumed. A CLOB is not allowed in a distributed table.

integer

The maximum value for integer is 2 147 483 647. The maximum length of the string is *integer*.

integer **K**

The maximum value for integer is 2 097 152. The maximum length of the string is 1024 times *integer*.

integer M

The maximum value for integer is 2 048. The maximum length of the string is 1 048 576 times *integer*.

integer G

The maximum value for integer is 2. The maximum length of the string is 1 073 741 824 times *integer*.

GRAPHIC(integer)

GRAPHIC

For a fixed-length graphic string of length *integer*, which can range from 1 through 16383 (16382 if null capable). If the length specification is omitted, a length of 1 is assumed.

VARGRAPHIC(integer) or GRAPHIC VARYING(integer)

For a varying-length graphic string of maximum length *integer*, which can range from 1 through 16370 (16369 if null capable).

DBCLOB(integer[K | M | G])

DBCLOB

For a double-byte character large object string of the specified maximum length.

The maximum length must be in the range of 1 through 1 073 741 823. If the length specification is omitted, a length of 1 megabyte is assumed. A DBCLOB is not allowed in a distributed table.

integer

The maximum value for integer is 1 073 741 823. The maximum length of the string is *integer*.

integer **K**

The maximum value for integer is 1 028 576. The maximum length of the string is 1024 times *integer*.

integer **M**

The maximum value for integer is 1 024. The maximum length of the string is 1 048 576 times *integer*.

integer **G**

The maximum value for integer is 1. The maximum length of the string is 1 073 741 824 times *integer*.

NATIONAL CHARACTER (integer) or NATIONAL CHAR (integer) or NCHAR (integer)

NATIONAL CHARACTER or NATIONAL CHAR or NCHAR

For a fixed-length Unicode graphic string of length *integer*, which can range from 1 through 16383 (16382 if null capable). If the length specification is omitted, a length of 1 is assumed. The CCSID is 1200.

NATIONAL CHARACTER VARYING (integer) or NATIONAL CHAR

VARYING (*integer*) or NCHAR VARYING (*integer*) or NVARCHAR (*integer*) For a varying-length Unicode graphic string of maximum length *integer*, which can range from 1 through 16370 (16369 if null capable). The CCSID is 1200.

NATIONAL CHARACTER LARGE OBJECT (integer[K|M|G]) or NCHAR LARGE OBJECT (integer[K|M|G]) or NCLOB(integer[K|M|G]) NATIONAL CHARACTER LARGE OBJECT or NCHAR LARGE OBJECT or NCLOB

For a Unicode double-byte character large object string of the specified maximum length.

The maximum length must be in the range of 1 through 1 073 741 823. If the length specification is omitted, a length of 1 megabyte is assumed. The CCSID is 1200. An NCLOB is not allowed in a distributed table.

integer

The maximum value for integer is 1 073 741 823. The maximum length of the string is *integer*.

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integer K

The maximum value for integer is 1 028 576. The maximum length of the string is 1024 times *integer*.

integer M

The maximum value for integer is 1 024. The maximum length of the string is 1 048 576 times *integer*.

integer G

The maximum value for integer is 1. The maximum length of the string is 1 073 741 824 times *integer*.

BINARY(integer)

BINARY

For a fixed-length binary string of length *integer*. The integer can range from 1 through 32766 (32765 if null capable). If the length specification is omitted, a length of 1 is assumed.

BINARY VARYING (integer) or VARBINARY(integer)

For a varying-length binary string of maximum length *integer*, which can range from 1 through 32740 (32739 if null capable).

BLOB(integer[K|M|G]) or BINARY LARGE OBJECT(integer[K|M|G]) BLOB or BINARY LARGE OBJECT

For a binary large object string of the specified maximum length. The maximum length must be in the range of 1 through 2 147 483 647. If the length specification is omitted, a length of 1 megabyte is assumed. A BLOB is not allowed in a distributed table.

integer

The maximum value for integer is 2 147 483 647. The maximum length of the string is *integer*.

integer K

The maximum value for integer is 2 097 152. The maximum length of the string is 1024 times *integer*.

integer M

The maximum value for integer is 2 048. The maximum length of the string is 1 048 576 times *integer*.

integer G

The maximum value for integer is 2. The maximum length of the string is 1 073 741 824 times *integer*.

DATE

For a date.

TIME

For a time.

TIMESTAMP

For a timestamp.

DATALINK(integer) or **DATALINK**

For a DataLink of the specified maximum length. The maximum length must be in the range of 1 through 32717. If FOR MIXED DATA or a mixed data CCSID is specified, the range is 4 through 32717. The specified length must be sufficient to contain both the largest expected URL and any DataLink comment. If the length specification is omitted, a length of 200 is assumed. A DATALINK is not allowed in a distributed table.

A DATALINK value is an encapsulated value with a set of built-in scalar functions. The DLVALUE function creates a DATALINK value. The following functions can be used to extract attributes from a DATALINK value.

- DLCOMMENT
- DLLINKTYPE
- DLURLCOMPLETE
- DLURLPATH
- DLURLPATHONLY
- DLURLSCHEME
- DLURLSERVER

A DataLink cannot be part of any index. Therefore, it cannot be included as a column of a primary key, foreign key, or unique constraint.

ROWID

For a row ID. Only one ROWID column is allowed in a table. A ROWID is not allowed in a partitioned table.

distinct-type-name

Specifies that the data type of the column is a distinct type (a user-defined data type). The length, precision, and scale of the column are respectively the length, precision, and scale of the source type of the distinct type. If a distinct type name is specified without a schema name, the distinct type name is resolved by searching the schemas on the SQL path.

ALLOCATE(*integer*)

Specifies for VARCHAR, VARGRAPHIC, VARBINARY, and LOB types the space to be reserved for the column in each row. Column values with lengths less than or equal to the allocated value are stored in the fixed-length portion of the row. Column values with lengths greater than the allocated value are stored in the variable-length portion of the row and require additional input/output operations to retrieve. The allocated value may range from 1 to maximum length of the string, subject to the maximum row buffer size limit. For information about the maximum row buffer size, see "Maximum row sizes" on page 807. If FOR MIXED DATA or a mixed data CCSID is specified, the range is 4 to the maximum length of the string. If the allocated length specification is omitted, an allocated length of 0 is assumed. For VARGRAPHIC, the integer is the number of DBCS or Unicode graphic characters. If a constant is specified for the default value and the ALLOCATE length is less than the length of the default value, the ALLOCATE length is assumed to be the length of the default value.

FOR BIT DATA

Specifies that the values of the column are not associated with a coded character set and are never converted. FOR BIT DATA is only valid for CHARACTER or VARCHAR columns. The CCSID of a FOR BIT DATA column is 65535. FOR BIT DATA is not allowed for CLOB columns.

FOR SBCS DATA

Specifies that the values of the column contain SBCS (single-byte character set) data. FOR SBCS DATA is the default for CHAR, VARCHAR, and CLOB columns if the default CCSID at the current server at the time the table is created is not DBCS-capable or if the length of the column is less than 4. FOR SBCS DATA is only valid for CHARACTER, VARCHAR, or

CLOB columns. The CCSID of FOR SBCS DATA is determined by the default CCSID at the current server at the time the table is created.

FOR MIXED DATA

Specifies that the values of the column contain both SBCS data and DBCS data. FOR MIXED DATA is the default for CHAR, VARCHAR, and CLOB columns if the default CCSID at the current server at the time the table is created is DBCS-capable and the length of the column is greater than 3. Every FOR MIXED DATA column is a DBCS-open application server field. FOR MIXED DATA is only valid for CHARACTER, VARCHAR, or CLOB columns. The CCSID of FOR MIXED DATA is determined by the default CCSID at the current server at the time the table is created.

CCSID integer

Specifies that the values of the column contain data of CCSID integer. If the integer is an SBCS CCSID, the column is SBCS data. If the integer is a mixed data CCSID, the column is mixed data and the length of the column must be greater than 3. For character columns, the CCSID must be an SBCS CCSID or a mixed data CCSID. For graphic columns, the CCSID must be a DBCS, UTF-16, or UCS-2 CCSID. If a CCSID is not specified for a graphic column, the CCSID is determined by the default CCSID at the current server at the time the table is created. For a list of valid CCSIDs, see Appendix E, "CCSID values," on page 1251.

CCSID 1208 (UTF-8) or 1200 (UTF-16) data can contain *combining characters*. Combining character support allows a resulting character to be comprised of more than one character. After the first character, up to 300 different non-spacing accent characters (umlauts, accent, etc.) can follow in the data string. If the resulting character is one that is already defined in the character set, that character has more than one representation. *Normalization* replaces the string of combining characters with the hex value of the defined character. This ensures that the same character is represented in a single consistent way. If normalization is not performed, two strings that look identical will not compare equal.

NOT NORMALIZED

The data should not be normalized when passed from the application.

NORMALIZED

The data should be normalized when passed from the application.

DEFAULT

Specifies a default value for the column. This clause cannot be specified more than once in a *column-definition*. DEFAULT cannot be specified for a ROWID column, an identity column (a column that is defined AS IDENTITY), or a row change timestamp column. The database manager generates default values for ROWID columns, identity columns, and row change timestamp columns. If a value is not specified following the DEFAULT keyword, then:

- if the column is nullable, the default value is the null value.
- if the column is not nullable, the default depends on the data type of the column:

Data type	Default value
Numeric	0
Fixed-length character or graphic string	Blanks
Fixed-length binary string	Hexadecimal zeros

CREATE TABI	LE			
I	Data type	Default value		
I	Varying-length string	A string length of 0		
I	Date	The current date at the time of INSERT		
I	Time	The current time at the time of INSERT		
I	Timestamp	The current timestamp at the time of INSERT		
I	Datalink	A value corresponding to DLVALUE(",'URL',")		
 	distinct-type	The default value of the corresponding source type of the distinct type.		
 	Omission of NOT NULL and DEFAULT from a <i>column-definition</i> is an implicit specification of DEFAULT NULL.			
I	constant	constant		
I .	Specifies the constant as the default for the column. The specified constant			
 		must represent a value that could be assigned to the column in accordance		
 		with the rules of assignment as described in "Assignments and comparisons" on page 89. A floating-point constant or decimal		
	floating-point const	floating-point constant must not be used for a SMALLINT, INTEGER, DECIMAL, or NUMERIC column. A decimal constant must not contain		

USER

column.

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value of the column. The data type of the column must be CHAR or VARCHAR with a length attribute that is greater than or equal to the length attribute of the USER special register.

more digits to the right of the decimal point than the specified scale of the

NULL

Specifies null as the default for the column. If NOT NULL is specified, DEFAULT NULL must not be specified within the same *column-definition*.

NULL is the only default value allowed for a datalink column.

CURRENT DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the column must be DATE or a distinct type based on a DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the column must be TIME or a distinct type based on a TIME.

CURRENT_TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the column must be TIMESTAMP or a distinct type based on a TIMESTAMP.

cast-function-name

This form of a default value can only be used with columns defined as a distinct type, BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME or TIMESTAMP data types. The following table describes the allowed uses of these *cast-functions*.

		CREATE TABLE	
1	Data Type	Cast Function Name	
 	Distinct type N based on a BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *	
1	Distinct type N based on a DATE, TIME, or TIMESTAMP	N (the user-defined cast function that was generated when N was created) **	
 		or DATE, TIME, or TIMESTAMP *	
 	Distinct type N based on other data types	N (the user-defined cast function that was generated when N was created) **	
 	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *	
1	DATE, TIME, or TIMESTAMP Notes:	DATE, TIME, or TIMESTAMP *	
] 		* The name of the function must match the name of the data type (or the source type of the distinct type) with an implicit or explicit schema name of QSYS2.	
 	qualified with a schema name, it must be t	** The name of the function must match the name of the distinct type for the column. If qualified with a schema name, it must be the same as the schema name for the distinct type. If not qualified, the schema name from function resolution must be the same as the schema name for the distinct type.	
 	rules of a constant for the s data type if not a distinct t	argument. The constant must conform to the source type of the distinct type or for the ype. For BINARY, VARBINARY, BLOB, ME, and TIMESTAMP functions, the onstant.	
1	LICED		

USER

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value for the column. The data type of the source type of the distinct type of the column must be CHAR or VARCHAR with a length attribute greater than or equal to the length attribute of the USER special register.

CURRENT_DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the source type of the distinct type of the column must be DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the source type of the distinct type of the column must be TIME.

CURRENT_TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the source type of the distinct type of the column must be TIMESTAMP.

If the value specified is not valid, an error is returned.

GENERATED

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Specifies that the database manager generates values for the column. GENERATED may be specified if the column is to be considered an identity column (defined with the AS IDENTITY clause) or a row change timestamp

CREATE TABLE

column. It may also be specified if the data type of the column is a ROWID (or a distinct type that is based on a ROWID). Otherwise, it must not be specified.

ALWAYS

Specifies that the database manager will always generate a value for the column when a row is inserted into the table. ALWAYS is the recommended value.

BY DEFAULT

Specifies that the database manager will generate a value for the column when a row is inserted only if a value is not specified for the column. If a value is specified, the database manager uses that value.

For a ROWID column, the database manager uses a specified value, but it must be a valid unique row ID value that was previously generated by the database manager or DB2 for i.

For an identity column or row change timestamp column, the database manager inserts a specified value but does not verify that it is a unique value for the column unless the identity column or row change timestamp column has a unique constraint or a unique index that solely specifies the identity column or row change timestamp column.

AS IDENTITY

Specifies that the column is an identity column for the table. A table can have only one identity column. An identity column is not allowed in a partitioned table or distributed table. AS IDENTITY can be specified only if the data type for the column is an exact numeric type with a scale of zero (SMALLINT, INTEGER, BIGINT, DECIMAL, or NUMERIC with a scale of zero, or a distinct type based on one of these data types). If a DECIMAL or NUMERIC data type is specified, the precision must not be greater than 31.

An identity column is implicitly NOT NULL.

START WITH numeric-constant

Specifies the first value that is generated for the identity column. The value can be any positive or negative value that could be assigned to the column without non-zero digits existing to the right of the decimal point.

If a value is not explicitly specified when the identity column is defined, the default is the MINVALUE for an ascending sequence and the MAXVALUE for a descending sequence. This value is not necessarily the value that a sequence would cycle to after reaching the maximum or minimum value of the sequence. The START WITH clause can be used to start a sequence outside the range that is used for cycles. The range used for cycles is defined by MINVALUE and MAXVALUE.

INCREMENT BY numeric-constant

Specifies the interval between consecutive values of the identity column. The value must not exceed the value of a large integer constant without any non-zero digits existing to the right of the decimal point. The value must be assignable to the column. The default is 1.

If the value is zero or positive, the sequence of values for the identity column ascends. If the value is negative, the sequence of values descends.

MAXVALUE or MINVALUE

Specifies the maximum value at which an ascending identity column either cycles or stops generating values, or a descending identity column cycles to after reaching the minimum value.

MAXVALUE numeric-constant

Specifies the numeric constant that is the maximum value that is generated for this identity column. This value can be any positive or negative value that could be assigned to this column, but the value must be greater than the minimum value.

If a value is not explicitly specified when the identity column is defined, this is the maximum value of the data type for an ascending sequence; or the START WITH value, or -1 if START WITH was not specified, for a descending sequence.

MINVALUE numeric-constant

Specifies the numeric constant that is the minimum value that is generated for this identity column. This value can be any positive or negative value that could be assigned to this column, but the value must be less than the maximum value.

If a value is not explicitly specified when the identity column is defined, this is the START WITH value, or 1 if START WITH was not specified, for an ascending sequence; or the minimum value of the data type (and precision, if DECIMAL) for a descending sequence.

CACHE or NO CACHE

Specifies whether to keep some preallocated values in memory. Preallocating and storing values in the cache improves the performance of inserting rows into a table.

CACHE integer

Specifies the number of values of the identity column sequence that the database manager preallocates and keeps in memory. The minimum value that can be specified is 2, and the maximum is the largest value that can be represented as an integer. The default is 20.

In certain situations, such as system failure, all cached identity column values that have not been used in committed statements are lost, and thus, will never be used. The value specified for the CACHE option is the maximum number of identity column values that could be lost in these situations.

NO CACHE

Specifies that values for the identity column are not preallocated.

CYCLE or NO CYCLE

Specifies whether this identity column should continue to generate values after reaching either the maximum or minimum value of the sequence.

CYCLE

Specifies that values continue to be generated for this column after the maximum or minimum value has been reached. If this option is used, after an ascending sequence reaches the maximum value of the sequence, it generates its minimum value. After a descending sequence reaches its minimum value of the sequence, it generates its maximum value. The maximum and minimum values for the column determine the range that is used for cycling.

When CYCLE is in effect, duplicate values can be generated by the database manager for an identity column. If a unique constraint or unique index exists on the identity column, and a non-unique value is generated for it, an error occurs.

NO CYCLE

Specifies that values will not be generated for the identity column once the maximum or minimum value for the sequence has been reached. This is the default.

ORDER or NO ORDER

Specifies whether the identity values must be generated in order of request.

ORDER

Specifies that the values are generated in order of request.

NO ORDER

Specifies that the values do not need to be generated in order of request. This is the default.

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP

Specifies that the column is a timestamp and the values will be generated by the database manager. The database manager generates a value for the column for each row as a row is inserted, and for every row in which any column is updated. The value generated for a row change timestamp column is a timestamp corresponding to the time of the insert or update of the row. If multiple rows are inserted with a single SQL statement, the value for the row change timestamp column may be different for each row to reflect when each row was inserted. The generated value is not guaranteed to be unique.

A table can have only one row change timestamp column. If *data-type* is specified, it must be a TIMESTAMP or a distinct type based on a TIMESTAMP. A row change timestamp column cannot have a DEFAULT clause and must be NOT NULL.

datalink-options

Specifies the options associated with a DATALINK data type.

LINKTYPE URL

Defines the type of link as a Uniform Resource Locator (URL).

NO LINK CONTROL

Specifies that there will not be any check made to determine that the linked files exist. Only the syntax of the URL will be checked. There is no database manager control over the linked files.

FILE LINK CONTROL

Specifies that a check should be made for the existence of the linked files. Additional options may be used to give the database manager further control over the linked files.

If FILE LINK CONTROL is specified, each file can only be linked once. That is, its URL can only be specified in a single FILE LINK CONTROL column in a single table.

file-link-options

Additional options to define the level of database manager control of the linked files.

INTEGRITY

Specifies the level of integrity of the link between a DATALINK value and the actual file.

ALL

Any file specified as a DATALINK value is under the control of the

database manager and may NOT be deleted or renamed using standard file system programming interfaces.

READ PERMISSION

Specifies how permission to read the file specified in a DATALINK value is determined.

FS The read access permission is determined by the file system permissions. Such files can be accessed without retrieving the file name from the column.

DB

The read access permission is determined by the database. Access to the file will only be allowed by passing a valid file access token, returned on retrieval of the DATALINK value from the table, in the open operation. If READ PERMISSION DB is specified, WRITE PERMISSION BLOCKED must be specified.

WRITE PERMISSION

Specifies how permission to write to the file specified in a DATALINK value is determined.

FS The write access permission is determined by the file system permissions. Such files can be accessed without retrieving the file name from the column.

BLOCKED

Write access is blocked. The file cannot be directly updated through any interface. An alternative mechanism must be used to perform updates to the information. For example, the file is copied, the copy updated, and then the DATALINK value updated to point to the new copy of the file.

RECOVERY

Specifies whether the database manager will support point in time recovery of files referenced by values in this column.

NO

Specifies that point in time recovery will not be supported.

ON UNLINK

Specifies the action taken on a file when a DATALINK value is changed or deleted (unlinked). Note that this is not applicable when WRITE PERMISSION FS is used.

RESTORE

Specifies that when a file is unlinked, the DataLink File Manager will attempt to return the file to the owner with the permissions that existed at the time the file was linked. In the case where the user is no longer registered with the file server, the result depends on the file system that contains the files. If the files are in the AIX® file system, the owner is "dfmunknown". If the files are in IFS, the owner is QDLFM. This can only be specified when INTEGRITY ALL and WRITE PERMISSION BLOCKED are also specified.

DELETE

Specifies that the file will be deleted when it is unlinked. This can only be specified when READ PERMISSION DB and WRITE PERMISSION BLOCKED are also specified.

This mode defines a set of default file link options. The defaults defined by DB2OPTIONS are:

- INTEGRITY ALL
- READ PERMISSION FS
- WRITE PERMISSION FS
- RECOVERY NO

NOT NULL

Prevents the column from containing null values. Omission of NOT NULL implies that the column can be null. NOT NULL is required for a row change timestamp column.

NOT HIDDEN

Indicates the column is included in implicit references to the table in SQL statements. This is the default.

IMPLICITLY HIDDEN

Indicates the column is not visible in SQL statements unless it is referred to explicitly by name. For example, SELECT * does not include any hidden columns in the result. A table must contain at least one column that is not IMPLICITLY HIDDEN.

column-constraint

CONSTRAINT constraint-name

Names the constraint. A *constraint-name* must not identify a constraint that was previously specified in the CREATE TABLE statement and must not identify a constraint that already exists at the current server.

If the clause is not specified, a unique constraint name is generated by the database manager.

PRIMARY KEY

Provides a shorthand method of defining a primary key composed of a single column. Thus, if PRIMARY KEY is specified in the definition of column C, the effect is the same as if the PRIMARY KEY(C) clause is specified as a separate clause.

This clause must not be specified in more than one column definition and must not be specified at all if the UNIQUE clause is specified in the column definition. The column must not be a LOB or DATALINK column.

When a primary key is added, a CHECK constraint is implicitly added to enforce the rule that the NULL value is not allowed in the column that makes up the primary key.

UNIQUE

Provides a shorthand method of defining a unique constraint composed of a single column. Thus, if UNIQUE is specified in the definition of column C, the effect is the same as if the UNIQUE (C) clause is specified as a separate clause.

This clause cannot be specified more than once in a column definition and must not be specified if PRIMARY KEY is specified in the column definition. The column must not be a LOB or DATALINK column.

references-clause

The *references-clause* of a *column-definition* provides a shorthand method of defining a foreign key composed of a single column. Thus, if a references-clause is specified in the definition of column C, the effect is the

1

same as if that references-clause were specified as part of a FOREIGN KEY clause in which C is the only identified column. The *references-clause* is not allowed if the table is a partitioned table or a distributed table. The column cannot be a row change timestamp column.

CHECK(*check-condition*)

The CHECK(check-condition) of a column-definition provides a shorthand method of defining a check constraint whose check-condition only references a single column. Thus, if CHECK is specified in the column definition of column C, no columns other than C can be referenced in the check-condition of the check constraint. The effect is the same as if the check constraint were specified as a separate clause.

ROWID and DATALINK with FILE LINK CONTROL columns cannot be referenced in a CHECK constraint. For additional restrictions see, "check-constraint" on page 797.

LIKE

table-name or view-name

Specifies that the columns of the table have exactly the same name and description as the columns of the identified table (*table-name*) or view (*view-name*). The name must identify a table or view that exists at the current server.

The use of LIKE is an implicit definition of n columns, where n is the number of columns in the identified table or view. The implicit definition includes the following attributes of the n columns (if applicable to the data type):

- · Column name (and system column name)
- · Data type, length, precision, and scale
- CCSID

If the LIKE clause is specified immediately following the *table-name* and not enclosed in parenthesis, the following column attributes are also included, otherwise they are not included (the default value, identity, row change timestamp, and hidden attributes can also be controlled by using the *copy-options*):

- Default value, if a *table-name* is specified (*view-name* is not specified)
- Nullability
- · Hidden attributes
- · Identity attributes
- Column heading and text (see "LABEL" on page 1005)

The implicit definition does not include any other optional attributes of the identified table or view. For example, the new table does not automatically include primary keys, foreign keys, or triggers. The new table has these and other optional attributes only if the optional clauses are explicitly specified.

If the specified table or view is a non-SQL created physical file or logical file, any non-SQL attributes are removed. For example, the date and time format will be changed to ISO.

copy-options

INCLUDING IDENTITY COLUMN ATTRIBUTES or EXCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies whether identity column attributes are inherited.

INCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies that the table inherits the identity attribute, if any, of the columns resulting from *select-statement*, *table-name*, or *view-name*. In general, the identity attribute is copied if the element of the corresponding column in the table, view, or *select-statement* is the name of a table column or the name of a view column that directly or indirectly maps to the name of a base table column with the identity attribute. If the INCLUDING IDENTITY COLUMN ATTRIBUTES clause is specified with the AS *select-statement* clause, the columns of the new table do not inherit the identity attribute in the following cases:

- The select list of the *select-statement* includes multiple instances of an identity column name (that is, selecting the same column more than once).
- The select list of the *select-statement* includes multiple identity columns (that is, it involves a join).
- The identity column is included in an expression in the select list.
- The select-statement includes a set operation (UNION or INTERSECT).

If INCLUDING IDENTITY is not specified, the table will not have an identity column.

EXCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies that the table does not inherit the identity attribute, if any, of the columns resulting from the *fullselect*, *table-name*, or *view-name*.

EXCLUDING COLUMN DEFAULTS or INCLUDING COLUMN DEFAULTS or USING TYPE DEFAULTS

Specifies whether column defaults are inherited.

EXCLUDING COLUMN DEFAULTS

Specifies that the column defaults are not inherited from the definition of the source table. The default values of the column of the new table are either null or there are no default values. If the column can be null, the default is the null value. If the column cannot be null, there is no default value, and an error occurs if a value is not provided for a column on INSERT for the new table.

INCLUDING COLUMN DEFAULTS

Specifies that the table inherits the default values of the columns resulting from the *select-statement*, *table-name*, or *view-name*. A default value is the value assigned to a column when a value is not specified on an INSERT.

Do not specify INCLUDING COLUMN DEFAULTS, if you specify USING TYPE DEFAULTS.

If INCLUDING COLUMN DEFAULTS is not specified, the default values are not inherited.

USING TYPE DEFAULTS

Specifies that the default values for the table depend on the data type of the columns that result from the *select-statement*, *table-name*, or *view-name*. If the column is nullable, then the default value is the null value. Otherwise, the default value is as follows:

Data type	Default value
Numeric	0
Fixed-length character or graphic string	Blanks

Data type	Default value	
Fixed-length binary string	Hexadecimal zeros	
Varying-length string	A string length of 0	
Date	The current date at the time of INSERT	
Time	The current time at the time of INSERT	
Timestamp	The current timestamp at the time of INSERT	
Datalink	A value corresponding to DLVALUE(",'URL',")	
distinct-type	The default value of the corresponding source type of the distinct type.	

Do not specify USING TYPE DEFAULTS if INCLUDING COLUMN DEFAULTS is specified.

INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES or EXCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies whether implicitly hidden columns are inherited.

INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies that the table inherits implicitly hidden columns from *select-statement, table-name*, or *view-name* and those columns will be defined with the implicitly hidden attribute in the new table.

If INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES is not specified, the table will not have any implicitly hidden columns.

EXCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies that the table does not inherit implicitly hidden columns from the *fullselect*, *table-name*, or *view-name*.

INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES or EXCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies whether the row change timestamp attribute is inherited.

INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies that the table inherits the row change timestamp attribute, if any, of the columns resulting from *select-statement*, *table-name*, or *view-name*. In general, the row change timestamp attribute is copied if the element of the corresponding column in the table, view, or *select-statement* is the name of a table column or the name of a view column that directly or indirectly maps to the name of a base table column with the row change timestamp attribute. If the INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES clause is specified with the AS *select-statement* clause, the columns of the new table do not inherit the row change timestamp in the following cases:

- The select list of the *select-statement* includes multiple instances of a row change timestamp column name (that is, selecting the same column more than once).
- The select list of the *select-statement* includes multiple row change timestamp columns (that is, it involves a join).
- The row change timestamp column is included in an expression in the select list.
- The select-statement includes a set operation (UNION or INTERSECT).

If INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES is not specified, the table will not have a row change timestamp column.

EXCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies that the table does not inherit the row change timestamp attribute, if any, of the columns resulting from the fullselect, table-name, or view-name.

as-result-table

column-name

Names a column in the table. If a list of column names is specified, it must consist of as many names as there are columns in the result table of the select-statement. Each column-name must be unique and unqualified. If a list of column names is not specified, the columns of the table inherit the names of the columns of the result table of the select-statement.

A list of column names must be specified if the result table of the select-statement has duplicate column names or an unnamed column. An unnamed column is a column derived from a constant, function, expression, or set operation (UNION or INTERSECT) that is not named using the AS clause of the select list.

FOR COLUMN system-column-name

Provides an IBM i name for the column. Do not use the same name for more than one column of the table or for a column-name of the table.

If the system-column-name is not specified, and the column-name is not a valid system-column-name, a system column name is generated. For more information about how system column names are generated, see "Rules for Table Name Generation" on page 810.

select-statement

Specifies that the columns of the table have the same name and description as the columns that would appear in the derived result table of the select-statement if the select-statement were to be executed. The use of AS (select-statement) is an implicit definition of n columns for the table, where n is the number of columns that would result from the select-statement.

The implicit definition includes the following attributes of the n columns (if applicable to the data type):

- Column name (and system column name)
- Data type, length, precision, and scale
- CCSID
- Nullability
- Column heading and text (see "LABEL" on page 1005)

The following attributes are not included (they may be included by using the copy-options):

- Default value
- · Hidden attribute
- · Identity attributes
- Row change timestamp attribute

The implicit definition does not include any other optional attributes of the identified table or view. For example, the new table does not automatically include a primary key or foreign key from a table. The new table has these and other optional attributes only if the optional clauses are explicitly specified.

The *select-statement* must not refer to variables or include parameter markers.

The *select-statement* must not contain a PREVIOUS VALUE or a NEXT VALUE expression. The UPDATE, SKIP LOCKED DATA, and USE AND KEEP EXCLUSIVE LOCKS clauses may not be specified.

WITH DATA

Specifies that the *select-statement* is executed. After the table is created, the result table rows of the *select-statement* are automatically inserted into the table.

WITH NO DATA

Specifies that the *select-statement* is used only to define the attributes of the new table. The table is not populated using the results of the *select-statement*.

unique-constraint

CONSTRAINT constraint-name

Names the constraint. A *constraint-name* must not identify a constraint that was previously specified in the CREATE TABLE statement and must not identify a constraint that already exists at the current server.

If the clause is not specified, a unique constraint name is generated by the database manager.

PRIMARY KEY(column-name,...)

Defines a primary key composed of the identified columns. A table can only have one primary key. Thus, this clause cannot be specified more than once and cannot be specified at all if the shorthand form has been used to define a primary key for the table. The identified columns cannot be the same as the columns specified in another UNIQUE constraint specified earlier in the CREATE TABLE statement. For example, PRIMARY KEY(A,B) would not be allowed if UNIQUE (B,A) had already been specified.

Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. The column must not be a LOB or DATALINK column. The number of identified columns must not exceed 120, and the sum of their byte counts must not exceed 32766-*n*, where *n* is the number of columns specified that allow nulls. For information about byte-counts see Table 57 on page 807.

The unique index is created as part of the system physical file, not a separate system logical file. When a primary key is added, a CHECK constraint is implicitly added to enforce the rule that the NULL value is not allowed in any of the columns that make up the primary key.

UNIQUE (column-name,...)

Defines a unique constraint composed of the identified columns. The UNIQUE clause can be specified more than once. The identified columns cannot be the same as the columns specified in another UNIQUE constraint or PRIMARY KEY that was specified earlier in the CREATE TABLE statement. For determining if a unique constraint is the same as another constraint specification, the column lists are compared. For example, UNIQUE (A,B) is the same as UNIQUE (B,A).

Each column-name must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. The column must not be a LOB or DATALINK column. The number of identified columns must not exceed 120, and the sum of their byte counts must not exceed 32766-*n*, where *n* is the number of columns specified that allows nulls. For information about byte-counts see Table 57 on page 807.

referential-constraint

CONSTRAINT constraint-name

Names the constraint. A *constraint-name* must not identify a constraint that was previously specified in the CREATE TABLE statement and must not identify a constraint that already exists at the current server.

If the clause is not specified, a unique constraint name is generated by the database manager.

FOREIGN KEY

Each specification of the FOREIGN KEY clause defines a referential constraint. FOREIGN KEY is not allowed if the table is a partitioned table.

(column-name,...)

The foreign key of the referential constraint is composed of the identified columns. Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. The column must not be a LOB or DATALINK column and must not be a row change timestamp column. The number of identified columns must not exceed 120, and the sum of their lengths must not exceed 32766-*n*, where *n* is the number of columns specified that allow nulls.

REFERENCES table-name

The *table-name* specified in a REFERENCES clause must identify the table being created or a base table that already exists at the application server, but it must not identify a catalog table, a declared temporary table, a partitioned table, or a distributed table.

A referential constraint is a *duplicate* if its foreign key, parent key, and parent table are the same as the foreign key, parent key, and parent table of a previously specified referential constraint. Duplicate referential constraints are allowed, but not recommended.

Let T2 denote the identified parent table and let T1 denote the table being created.

The specified foreign key must have the same number of columns as the parent key of T2. The description of the *n*th column of the foreign key and the description of the *n*th column of that parent key must have identical data types, lengths, and CCSIDs.

(column-name,...)

The parent key of the referential constraint is composed of the identified columns. Each *column-name* must be an unqualified name that identifies a column of T2. The same column must not be identified more than once. The column must not be a LOB or DATALINK column and must not be a row change timestamp column. The number of identified columns must not exceed 120, and the sum of their byte counts must not exceed 32766-*n*, where *n* is the number of columns specified that allow nulls. For information about byte-counts see Table 57 on page 807.

The list of column names must be identical to the list of column names in the primary key of T2 or a UNIQUE constraint that exists on T2. The names need not be specified in the same order as in the primary key; however, they must be specified in corresponding order to the list

of columns in the foreign key clause. If a column name list is not specified, then T2 must have a primary key. Omission of the column name list is an implicit specification of the columns of that primary key.

The referential constraint specified by a FOREIGN KEY clause defines a relationship in which T2 is the parent and T1 is the dependent.

ON DELETE

Specifies what action is to take place on the dependent tables when a row of the parent table is deleted. There are five possible actions:

- NO ACTION (default)
- RESTRICT
- CASCADE
- SET NULL
- SET DEFAULT

SET NULL must not be specified unless some column of the foreign key allows null values.

CASCADE must not be specified if T1 contains a DataLink column with FILE LINK CONTROL.

The delete rule applies when a row of T2 is the object of a DELETE or propagated delete operation and that row has dependents in T1. Let p denote such a row of T2.

- If RESTRICT or NO ACTION is specified, an error occurs and no rows are deleted.
- If CASCADE is specified, the delete operation is propagated to the dependents of p in T1.
- · If SET NULL is specified, each nullable column of the foreign key of each dependent of p in T1 is set to null.
- If SET DEFAULT is specified, each column of the foreign key of each dependent of *p* in T1 is set to its default value.

ON UPDATE

Specifies what action is to take place on the dependent tables when a row of the parent table is updated.

The update rule applies when a row of T2 is the object of an UPDATE or propagated update operation and that row has dependents in T1. Let p denote such a row of T2.

• If RESTRICT or NO ACTION is specified, an error occurs and no rows are updated.

check-constraint

CONSTRAINT constraint-name

Names the check constraint. A constraint-name must not identify a constraint that was previously specified in the CREATE TABLE statement and must not identify a constraint that already exists at the current server.

If the clause is not specified, a unique constraint name is generated by the database manager.

CHECK (check-condition)

Defines a check constraint. At any time, the *check-condition* must be true or unknown for every row of the table.

CREATE TABLE

The check-condition is a search-condition except:

- It can only refer to columns of the table
- It cannot reference ROWID or DATALINK with FILE LINK CONTROL columns.
- It must not contain any of the following:
 - Subqueries
 - Aggregate functions
 - Variables
 - Parameter markers
 - Sequence-references
 - Complex expressions that contain LOBs (such as concatenation)
 - OLAP specifications
 - ROW CHANGE expressions
 - Special registers
 - User-defined functions other than functions that were implicitly generated with the creation of a distinct type
 - The following built-in scalar functions:

ATAN2	DECRYPT_DB	ENCRYPT_TDES	RAND
CURDATE	DIFFERENCE	GENERATE_UNIQUE	REPEAT
CURTIME	DLURLCOMPLETE 1	GETHINT	REPLACE
DATAPARTITIONNAME	DLURLPATH	IDENTITY_VAL_LOCAL	ROUND_TIMESTAMP
DATAPARTITIONNUM	DLURLPATHONLY	INSERT	SOUNDEX
DAYNAME	DLURLSCHEME	MONTHNAME	TIMESTAMP_FORMAT
DBPARTITIONNAME	DLURLSERVER	MONTHS_BETWEEN	TIMESTAMPDIFF
DECRYPT_BINARY	DLVALUE	NEXT_DAY	TRUNC_TIMESTAMP
DECRYPT_BIT	ENCRYPT_AES	NOW	VARCHAR_FORMAT
DECRYPT_CHAR	ENCRYPT_RC2	RAISE_ERROR	WEEK_ISO

¹ For DataLinks with an attribute of FILE LINK CONTROL and READ PERMISSION DB.

For more information about search-condition, see "Search conditions" on page 201. For more information about check constraints involving LOB data types and expressions, see the Database Programming topic collection.

NOT LOGGED INITIALLY

Any changes made to the table by INSERT, DELETE, or UPDATE statements in the same unit of work after the table is created by this statement are not logged (journaled).

At the completion of the current unit of work, the NOT LOGGED INITIALLY attribute is deactivated and all operations that are done on the table in subsequent units of work are logged (journaled).

The NOT LOGGED INITIALLY option is useful for situations where a large result set needs to be created with data from an alternate source (another table or a file) and recovery of the table is not necessary. Using this option will save the overhead of logging (journaling) the data.

ACTIVATE NOT LOGGED INITIALLY is ignored if the table has a DATALINK column with FILE LINK CONTROL.

VOLATILE or NOT VOLATILE

Indicates to the optimizer whether the cardinality of table *table-name* can vary significantly at run time. Volatility applies to the number of rows in the table, not to the table itself. The default is NOT VOLATILE.

VOLATILE

Specifies that the cardinality of *table-name* can vary significantly at run time, from empty to large. To access the table, the optimizer will typically use an index, if possible.

NOT VOLATILE

Specifies that the cardinality of *table-name* is not volatile. Access plans that reference this table will be based on the cardinality of the table at the time the access plan is built. NOT VOLATILE is the default.

RCDFMT

Indicates the record format name of the table.

RCDFMT format-name

An unqualified name that designates the IBM i record format name of the table. A *format-name* is a system identifier.

If a record format name is not specified, the *format-name* is the same as the *system-object-name* of the table.

distribution-clause

IN NODEGROUP nodegroup-name

Specifies the nodegroup across which the data in the table will be distributed. The name must identify a nodegroup that exists at the current server. If this clause is specified, the table is created as a distributed table across all the systems in the nodegroup.

A LOB, DATALINK, or IDENTITY column is not allowed in a distributed table.

The DB2 Multisystem product must be installed to create a distributed table. For more information about distributed tables, see the DB2 Multisystem topic collection.

DISTRIBUTE BY HASH (column-name,...)

Specifies the partitioning key. The partitioning key is used to determine on which node in the nodegroup a row will be placed. Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. If the DISTRIBUTE BY clause is not specified, the first column of the primary key is used as the partitioning key. If there is no primary key, the first column of the table that is not floating point, decimal floating-point, date, time, or timestamp is used as the partitioning key.

The columns that make up the partitioning key must be a subset of the columns that make up any unique constraints over the table. Floating point, decimal floating-point, LOB, DataLink, and ROWID columns cannot be used in a partitioning key.

partitioning-clause

PARTITION BY RANGE

Specifies that ranges of column values are used to determine the target data partition when inserting a row into the table. The number of partitions must not exceed 256. A table cannot be partitioned if it contains an identity column.

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CREATE TABLE

partition-expression Specifies the key data over which the range is defined to determine the target data partition of the data. column-name Identifies a column in the data partitioning key. The partitioning key is used to determine into which partition in the table a row will be placed. The column-name must be an unqualified name that identifies a column of the table. The same column must not be identified more than once. Decimal floating-point, LOB, DataLink, ROWID, and row change timestamp columns cannot be used in a partitioning key. The number of identified columns must not exceed 120. The sum of length attributes of the columns must not be greater than 2000. **NULLS LAST** Indicates that null values compare high. **NULLS FIRST** Indicates that null values compare low. partition-element Specifies ranges for a data partitioning key. **PARTITION** partition-name Names the data partition. The name must not be the same as any other data partition for the table. If the clause is not specified, a unique partition name is generated by the database manager. boundary-spec Specifies the boundaries of a range partition. The boundaries must be specified in ascending sequence. The ranges must not overlap. starting-clause Specifies the low end of the range for a data partition. The number of specified starting values must be the same as the number of columns in the partitioning key. If a starting-clause is not specified for the first boundary-spec, the default is MINVALUE INCLUSIVE for each column of the partitioning key. If a starting-clause is not specified for a subsequent boundary-spec, the previous adjacent boundary-spec must contain an ending-clause. The default is the same as that ending-clause except that the INCLUSIVE or EXCLUSIVE attribute is reversed. STARTING FROM Introduces the *starting-clause*. constant Specifies a constant that must conform to the rules of a constant for the data type of the corresponding column of the partition key. If the corresponding column of the partition key is a distinct type, the constant must conform to the rules of the source type of the distinct type. The value must not be in the range of any other *boundary-spec* for the table. **MINVALUE** Specifies a value that is lower than the lowest possible

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value for the data type of the *column-name* to which it corresponds. If MINVALUE is specified, all subsequent values in the *starting-clause* must also be MINVALUE.

MAXVALUE

Specifies a value that is greater than the greatest possible value for the data type of the *column-name* to which it corresponds. If MAXVALUE is specified, all subsequent values in the *ending-clause* must also be MAXVALUE.

INCLUSIVE

Indicates that the specified range values are included in the data partition.

EXCLUSIVE

Indicates that the specified range values are excluded from the data partition. This specification is ignored when MINVALUE or MAXVALUE is specified.

ending-clause

Specifies the high end of the range for a data partition. The number of specified ending values must be the same as the number of columns in the data partitioning key. An *ending-clause* must be specified for the last *boundary-spec*. If an *ending-clause* is not specified for a previous *boundary-spec*, the next adjacent *boundary-spec* must contain a *starting-clause*. The default is the same as that *starting-clause* except that the INCLUSIVE or EXCLUSIVE attribute is reversed.

ENDING AT

Introduces the ending-clause.

constant

Specifies a constant that must conform to the rules of a constant for the data type of the corresponding column of the partition key. If the corresponding column of the partition key is a distinct type, the constant must conform to the rules of the source type of the distinct type. The value must not be in the range of any other *boundary-spec* for the table.

MINVALUE

Specifies a value that is lower than the lowest possible value for the data type of the *column-name* to which it corresponds. If MINVALUE is specified, all subsequent values in the *starting-clause* must also be MINVALUE.

MAXVALUE

Specifies a value that is greater than the greatest possible value for the data type of the *column-name* to which it corresponds. If MAXVALUE is specified, all subsequent values in the *ending-clause* must also be MAXVALUE.

INCLUSIVE

Indicates that the specified range values are included in the data partition.

EXCLUSIVE

Indicates that the specified range values are excluded from the data partition. This specification is ignored when MINVALUE or MAXVALUE is specified.

EVERY integer-constant

Specifies that multiple data partitions will be added where *integer-constant* specifies the width of each data partition range. If EVERY is specified, only a single SMALLINT, INTEGER, BIGINT, DECIMAL, NUMERIC, DATE, or TIMESTAMP column can be specified for the partition key.

The starting value of the first data partition is the specified STARTING value. The starting value of each subsequent partition is the starting value of the previous partition + *integer-constant*. If the *starting-clause* specified EXCLUSIVE, the starting value of every partition is EXCLUSIVE. Otherwise, the starting value of every partition is INCLUSIVE.

The ending value of every partition of the range is (start + integer-constant - 1). If the ending-clause specified EXCLUSIVE, the ending value of every partition is EXCLUSIVE. Otherwise, the ending value of every partition is INCLUSIVE.

The number of partitions added is determined by adding *integer-constant* repeatedly to the STARTING value until the ENDING value is reached. For example:

```
CREATE TABLE F00
(A INT)
PARTITION BY RANGE(A)
(STARTING(1) ENDING(10) EVERY(2))
```

is equivalent to the following CREATE TABLE statement:

```
CREATE TABLE FOO

(A INT)

(PARTITION BY RANGE(A)

(STARTING(1) ENDING(2),

STARTING(3) ENDING(4),

STARTING(5) ENDING(6),

STARTING(7) ENDING(8),

STARTING(9) ENDING(10))
```

In the case of dates and timestamps, the EVERY value must be a labeled duration. For example:

```
CREATE TABLE F00
(A DATE)
PARTITION BY RANGE(A)
(STARTING('2001-01-01') ENDING('2010-01-01') EVERY(3 MONTHS))
```

PARTITION BY HASH

Specifies that the hash function is used to determine the target data partition when inserting a row into the table. A table cannot be partitioned if it contains an identity column.

```
(column-name,...)
```

Specifies the partitioning key. The partitioning key is used to determine into which partition in the table a row will be placed. Each *column-name* must be an unqualified name that identifies a column of the table. The same column must not be identified more than once.

The columns that make up the partitioning key must be a subset of the columns that make up any unique constraints over the table. Floating point, decimal floating-point, LOB, date, time, timestamp, DataLink, ROWID, and row change timestamp columns cannot be used in a partitioning key.

INTO integer **PARTITIONS**

Specifies the number of partitions. The number of partitions must not exceed 256.

materialized-query-definition

column-name

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Names a column in the table. If a list of column names is specified, it must consist of as many names as there are columns in the result table of the *select-statement*. Each *column-name* must be unique and unqualified. If a list of column names is not specified, the columns of the table inherit the names of the columns of the result table of the *select-statement*.

A list of column names must be specified if the result table of the *select-statement* has duplicate column names or an unnamed column. An unnamed column is a column derived from a constant, function, expression, or set operation (UNION or INTERSECT) that is not named using the AS clause of the select list.

FOR COLUMN *system-column-name*

Provides an IBM i name for the column. Do not use the same name for more than one column of the table or for a column-name of the table.

If the *system-column-name* is not specified, and the column-name is not a valid *system-column-name*, a system column name is generated. For more information about how system column names are generated, see "Rules for Table Name Generation" on page 810.

select-statement

Specifies that the columns of the table have the same name and description as the columns that would appear in the derived result table of the *select-statement* if the *select-statement* were to be executed. The use of AS (*select-statement*) is an implicit definition of *n* columns for the table, where *n* is the number of columns that would result from the *select-statement*.

The implicit definition includes the following attributes of the n columns (if applicable to the data type):

- Column name (and system column name)
- · Data type, length, precision, and scale
- CCSID
- Nullability
- Column heading and text (see "LABEL" on page 1005)

The following attributes are not included:

- Default value
- Hidden attribute
- Identity attributes
- Row change timestamp attribute

The implicit definition does not include any other optional attributes of the identified table or view. For example, the new table does not automatically include a primary key or foreign key from a table. The new table has these and other optional attributes only if the optional clauses are explicitly specified.

The *select-statement* must not refer to variables or include parameter markers.

The *select-statement* must not contain a PREVIOUS VALUE or a NEXT VALUE expression. The UPDATE, SKIP LOCKED DATA, and USE AND KEEP EXCLUSIVE LOCKS clauses may not be specified.

CREATE TABLE

refreshable-table-options Specifies that the table is a *materialized query table* and the REFRESH TABLE statement can be used to populate the table with the results of the select-statement. A materialized query table whose select-statement contains a GROUP BY clause is summarizing data from the tables referenced in the select-statement. Such a materialized query table is also known as a summary table. A summary table is a specialized type of materialized query table. When a materialized query table is defined, the following *select-statement* restrictions apply: • The select-statement cannot contain a reference to another materialized query table or to a view that refers to a materialized query table. The select-statement cannot contain a reference to a declared temporary table, a table in QTEMP, a program-described file, or a non-SQL logical file in the FROM clause. • The select-statement cannot contain a data-change-file-reference. The select-statement cannot contain a reference to a view that references another materialized query table or a declared temporary table. When a materialized query table is defined with ENABLE QUERY OPTIMIZATION, the select-statement cannot contain a reference to a view that contains one of the restrictions from the following paragraph. The select-statement cannot contain an expression with a DataLink or a distinct type based on a DataLink where the DataLink is FILE LINK CONTROL. The select-statement cannot contain a result column that is a not an SQL data type, such as binary with precision, DBCS-ONLY, or DBCS-EITHER. When a materialized guery table is defined with ENABLE QUERY OPTIMIZATION, the following additional *select-statement* restrictions apply: Must not include any special registers. Must not include any non-deterministic functions. • The ORDER BY clause is allowed, but is only used by REFRESH. It may improve locality of reference of data in the materialized query table. • If the subselect references a view, the *select-statement* in the view definition must satisfy the preceding restrictions. DATA INITIALLY DEFERRED Specifies that the data is not inserted into the materialized query table when it is created. Use the REFRESH TABLE statement to populate the materialized query table, or use the INSERT statement to insert data into a materialized query table. DATA INITIALLY IMMEDIATE Specifies that the data is inserted into the materialized query table when it is created. REFRESH DEFERRED Specifies that the data in the table can be refreshed at any time using the REFRESH TABLE statement. The data in the table only reflects the result of the query as a snapshot at the time when the REFRESH TABLE statement is processed or when it was last updated.

MAINTAINED BY USER

Specifies that the materialized query table is maintained by the user. The user can use INSERT, DELETE, UPDATE, or REFRESH TABLE statements on the table.

ENABLE QUERY OPTIMIZATION or DISABLE QUERY OPTIMIZATION

Specifies whether this materialized query table can be used for optimization. The default is ENABLE QUERY OPTIMIZATION.

ENABLE QUERY OPTIMIZATION

Specifies that the materialized query table can be used for query optimization. If the *select-statement* specified does not satisfy the restrictions for query optimization, an error is returned.

DISABLE QUERY OPTIMIZATION

Specifies that the materialized query table cannot be used for query optimization. The table can still be queried directly.

Notes

Table attributes: Tables are created as physical files. When a table is created, the file wait time and record wait time attributes are set to the default that is specified on the WAITFILE and WAITRCD keywords of the Create Physical File (CRTPF) command.

SQL tables are created so that space used by deleted rows will be reclaimed by future insert requests. This attribute can be changed via the command *CHGPF* and specifying the *REUSEDLT*(*NO) parameter. For more information about the *CHGPF* command, see CL Reference.

A distributed table is created on all of the servers across which the table is distributed. For more information about distributed tables, seeDB2 Multisystem.

Table journaling: When a table is created, journaling may be automatically started.

- If a data area called QDFTJRN exists in the same schema that the table is created into and the user is authorized to the data area, journaling will be started to the journal named in the data area if all the following are true:
 - The identified schema for the table must not be QSYS, QSYS2, QRECOVERY, QSPL, QRCL, QRPLOBJ, QGPL, QTEMP, SYSIBM, or any of the iASP equivalents to these libraries.
 - The journal specified in the data area must exist and the user must be authorized to start journaling to the journal.
 - The first 10 bytes of the data area must contain the name of the schema in which to find the journal.
 - The second 10 bytes must contain the name of the journal.
 - The remaining bytes contain the object types being implicitly journaled and the options that affect when implicit journaling is performed. The object type must include the value *FILE or *ALL. The value *NONE can be used to prevent journaling from being started.

For more information, see Journal Management.

- If the table is created into a schema that has specified (using the STRJRNLIB command) that journaling should implicitly be started.
- If a data area called QDFTJRN does not exist in the same schema that the table is created into or the user is not authorized to the data area and the schema has

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not specified that journaling should be started, journaling will be started to a journal called QSQJRN if it exists in the same schema that the table is created into.

Table ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the table is created exists, the *owner* of the table is that user profile.
- Otherwise, the *owner* of the table is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the table is the user profile or group user profile of the job executing the statement.

Table authority: If SQL names are used, tables are created with the system authority of *EXCLUDE to *PUBLIC. If system names are used, tables are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the table is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the table.

Using an identity column: When a table has an identity column, the database manager can automatically generate sequential numeric values for the column as rows are inserted into the table. Thus, identity columns are ideal for primary keys.

Identity columns and ROWID columns are similar in that both types of columns contain values that the database manager generates. ROWID columns can be useful in direct-row access. ROWID columns contain values of the ROWID data type, which returns a 40-byte VARCHAR value that is not regularly ascending or descending. ROWID data values are therefore not well suited to many application uses, such as generating employee numbers or product numbers. For data that does not require direct-row access, identity columns are usually a better approach, because identity columns contain existing numeric data types and can be used in a wide variety of uses for which ROWID values would not be suitable.

When a table is recovered to a point-in-time (using RMVJRNCHG), it is possible that a large gap in the sequence of generated values for the identity column might result. For example, assume a table has an identity column that has an incremental value of 1 and that the last generated value at time T1 was 100 and the database manager subsequently generates values up to 1000. Now, assume that the table is recovered back to time T1. The generated value of the identity column for the next row that is inserted after the recovery completes will be 1001, leaving a gap from 100 to 1001 in the values of the identity column.

When CYCLE is specified duplicate values for a column may be generated even when the column is GENERATED ALWAYS, unless a unique constraint or unique index is defined on the column.

Creating materialized query tables: To ensure that the materialized query table has data before being used by a query:

- DATA INITIALLY IMMEDIATE should be used to create materialized query tables, or
- the materialized query table should be created with query optimization disabled and then enable the table for query optimization after it is refreshed.

The isolation level at the time when the CREATE TABLE statement is executed is the isolation level for the materialized query table. The *isolation-clause* can be used to explicitly specify the isolation level.

Partitioned table performance: The larger the number of partitions in a partitioned table, the greater the overhead in SQL data change and SQL data statements. You should create a partitioned table with the minimum number of partitions that are required to minimize this overhead. It is also highly recommended that a parallelism degree greater than one be considered when accessing a partitioned table.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- constraint-name (without the CONSTRAINT keyword) may be specified following the FOREIGN KEY keywords in a referential-constraint
- · DEFINITION ONLY is a synonym for WITH NO DATA
- PARTITIONING KEY is a synonym for DISTRIBUTE BY HASH.
- PART is a synonym for PARTITION.
- PARTITION *partition-number* may be specified instead of PARTITION *partition-name*. A *partition-number* must not identify a partition that was previously specified in the CREATE TABLE statement.
 - If a *partition-number* is not specified, a unique partition number is generated by the database manager.
- VALUES is a synonym for ENDING AT.
- SUMMARY between CREATE and TABLE when creating a materialized query table.

Maximum row sizes

There are two maximum row size restrictions referred to in the description of *column-definition*.

- The maximum row buffer size is 32766 or, if a VARCHAR, VARGRAPHIC, or LOB column is specified, 32740.
- The maximum row data size is 3 758 096 383, if a LOB is specified. If a LOB is not specified, then the maximum row data size is 32766 or, if a VARCHAR or VARGRAPHIC column is specified, 32740.

To determine the length of a row buffer and row data or both, add the corresponding length of each column of that row based on the byte counts of the data type.

The follow table gives the byte counts of columns by data type for columns that do not allow null values. If any column allows null values, one byte is required for every eight columns.

Table 57. Byte Counts of Columns by Data Type

Data Type	Row Buffer Byte Count	Row Data Byte Count
SMALLINT	2	2
INTEGER	4	4
BIGINT	8	8
DECIMAL(p, s)	The integral part of $(p/2) + 1$	The integral part of $(p/2) + 1$

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Table 57. Byte Counts of Columns by Data Type (continued)

Data Type	Row Buffer Byte Count	Row Data Byte Count
NUMERIC(p, s)	p	p
FLOAT (single precision)	4	4
FLOAT (double precision)	8	8
DECFLOAT(16)	8	8
DECFLOAT(34)	16	16
CHAR(n)	n	n
VARCHAR(n)	n+2	n+2
CLOB(n)	29+pad	n+29
GRAPHIC(n)	n*2	n*2
VARGRAPHIC (n)	n*2+2	n*2+2
DBCLOB(n)	29+pad	n*2+29
BINARY(n)	n	n
VARBINARY(n)	n+2	n+2
BLOB(n)	29+pad	n+29
DATE	10	4
TIME	8	3
TIMESTAMP	26	10
DATALINK(n)	n+24	n+24
ROWID	42	28
distinct-type	The byte count for the source type.	The byte count for the source type.
Notes:		

pad is a value from 1 to 15 necessary for boundary alignment.

Precision as described to the database:

- Floating-point fields are defined in the DB2 for i database with a decimal precision, not a bit precision. The algorithm used to convert the number of bits to decimal is *decimal precision* = CEILING(n/3.31), where n is the number of bits to convert. The decimal precision is used to determine how many digits to display using interactive SQL.
- SMALLINT fields are stored with a decimal precision of 4,0.
- INTEGER fields are stored with a decimal precision of 9,0.
- BIGINT fields are stored with a decimal precision of 19,0.

LONG VARCHAR and LONG VARGRAPHIC

The non-standard syntax of LONG VARCHAR and LONG VARGRAPHIC is supported, but deprecated. The alternative standard syntax of VARCHAR(integer) and VARGRAPHIC(integer), is preferred. VARCHAR(integer) and VARGRAPHIC(integer) are recommended. After the CREATE TABLE statement is processed, the database manager considers a LONG VARCHAR column to be VARCHAR and a LONG VARGRAPHIC column to be VARGRAPHIC. The maximum length is calculated in a product-specific fashion that is not portable.

LONG VARCHAR 82

For a varying length character string whose maximum length is determined by the amount of space available in the row.

LONG VARGRAPHIC 82

For a varying length graphic string whose maximum length is determined by the amount of space available in the row.

The maximum length of a LONG column is determined as follows. Let:

- i be the sum of the row buffer byte counts of all columns in the table that are not LONG VARCHAR or LONG VARGRAPHIC
- j be the number of LONG VARCHAR and LONG VARGRAPHIC columns in the table
- k be the number of columns in the row that allow nulls.

The length of each LONG VARCHAR column is INTEGER((32716 - i-((k+7)/8))/j).

The length of each LONG VARGRAPHIC column is determined by taking the length calculated for a LONG VARCHAR column and dividing it by 2. The integer portion of the result is the length.

Rules for System Name Generation

There are specific instances when the system generates a system table, view, index, or column name. These instances and the name generation rules are described in the following sections.

Rules for Column Name Generation

A system-column-name is generated if the system-column-name is not specified when a table or view is created and the column-name is not a valid system-column-name.

If the column-name does not contain special characters and is longer than 10 characters, a 10-character system-column-name will be generated as:

- The first 5 characters of the name
- A 5 digit unique number

For example:

The system-column-name for LONGCOLUMNNAME would be LONGC00001

If the column name is delimited:

- The first 5 characters from within the delimiters will be used as the first 5 characters of the system-column-name. If there are fewer than 5 characters within the delimiters, the name will be padded on the right with underscore (_) characters. Lower case characters are folded to upper case characters. The only valid characters in a system-column-name are: A-Z, 0-9, @, #, \$, and _. Any other characters will be changed to the underscore (_) character. If the first character ends up as an underscore, it will be changed to the letter Q.
- A 5 digit unique number is appended to the 5 characters.

^{82.} This option is provided for compatibility with other products. It is recommended that VARCHAR(integer) or VARGRAPHIC(integer) be specified instead.

For example:

```
The system-column-name for "abc" would be ABC\_00001 The system-column-name for "COL2.NAME" would be COL2\_00001 The system-column-name for "C 3" would be C\_3\_00001 The system-column-name for "??" would be Q\_00001 The system-column-name for "*column1" would be QCOLU00001
```

Rules for Table Name Generation

A system name will be generated if a table, view, alias, or index is created with either:

- A name longer than 10 characters
- · A name that contains characters not valid in a system name

The SQL name or its corresponding system name may both be used in SQL statements to access the file once it is created. However, the SQL name is only recognized by DB2 for i and the system name must be used in other environments.

There are two separate methods for generating the system name:

• If a data area with the name QGENOBJNAM exists in the same schema that the table is created into, the user can influence the generated name.

The data area is subject to the following restrictions:

- The user must be authorized to read the data area.
- The data area must have an attribute of CHAR(10).
- The first 5 characters of the data area value must be '?????'.
- The next 5 characters of the data area value must contain 5 numeric digits.

If any of the above conditions are not satisfied or any error occurs while accessing the starting value in the data area, the default name generation rules will be used as if the data area did not exist at all.

If the data area meets all of the restrictions above, the generated name will be the same as if the default name generation rules below except that after the first 5 (or 4) characters of the name, the unique number will initially contain the 5 digits specified in the data area (instead of '00001' or '0001').

For example, if the value of the data area was '?????00999':

```
The system name for "??" would be "__00999"
The system name for "longtablename" would be "lon00999"
The system name for "LONGTableName" would be LONG00999
The system name for "A b " would be "A b00999"
```

• Otherwise, the default name generation rules are used:

If the name does not contain special characters and is longer than 10 characters, a 10-character system name will be generated as:

- The first 5 characters of the name
- A 5 digit unique number

For example:

The system name for LONGTABLENAME would be LONGT00001

If the SQL name contains special characters, the system name is generated as:

- The first 4 characters of the name
- A 4 digit unique number

In addition:

- All special characters are replaced by the underscore (_)
- Any trailing blanks are removed from the name

- The name is delimited by double quotes (") if the delimiters are required for the name to be a valid system name.

For example:

```
The system name for "??" would be "__0001"
The system name for "longtablename" would be "long0001"
The system name for "LONGTableName" would be LONG0001
The system name for "A b " would be "A_b0001"
```

SQL ensures the system name is unique by searching the cross reference file. If the name already exists in the cross reference file, the number is incremented until the name is no longer a duplicate.

If a unique name cannot be determined using the above rules, an additional character is added to the counter in the name, and the number is incremented until a unique name can be found or the range is exhausted. For example, if creating "longtablename" and names "long0001" through "long9999" already exist, the name would become "lon00001".

Examples

Example 1: Given administrative authority, create a table named 'ROSSITER.INVENTORY' with the following columns:

Part number

Small integer, must not be null

Description

Character of length 0 to 24, allows nulls

Quantity on hand,

Integer allows nulls

```
CREATE TABLE ROSSITER.INVENTORY
```

```
(PARTNO SMALLINT NOT NULL, DESCR VARCHAR(24), QONHAND INT)
```

Example 2: Create a table named DEPARTMENT with the following columns:

Department number

Character of length 3, must not be null

Department name

Character of length 0 through 36, must not be null

Manager number

Character of length 6

Administrative dept.

Character of length 3, must not be null

Location name

Character of length 16, allows nulls

The primary key is column DEPTNO.

```
CREATE TABLE DEPARTMENT
(DEPTNO CHAR(3) NOT NULL,
DEPTNAME VARCHAR(36) NOT NULL,
MGRNO CHAR(6),
ADMRDEPT CHAR(3) NOT NULL,
LOCATION CHAR(16),
PRIMARY KEY(DEPTNO))
```

CREATE TABLE

Example 3: Create a table named REORG_PROJECTS which has the same column definitions as the columns in the view PRJ_LEADER.

```
CREATE TABLE REORG PROJECTS
  LIKE PRJ LEADER
```

Example 4: Create an EMPLOYEE2 table with an identity column named EMP_NO. Define the identity column so that DB2 for i will always generate the values for the column. Use the default value, which is 1, for the first value that should be assigned and for the incremental difference between the subsequently generated consecutive numbers.

```
CREATE TABLE EMPLOYEE2
  ( EMPNO INTEGER GENERATED ALWAYS AS IDENTITY,
    ID SMALLINT.
    NAME CHAR(30).
    SALARY DECIMAL(5,2),
    DEPTNO SMALLINT)
```

Example 5: Assume a very large transaction table named TRANS contains one row for each transaction processed by a company. The table is defined with many columns. Create a materialized query table for the TRANS table that contains daily summary data for the date and amount of a transaction.

```
CREATE TABLE STRANS
  AS (SELECT YEAR AS SYEAR, MONTH AS SMONTH, DAY AS SDAY, SUM(AMOUNT) AS SSUM
      FROM TRANS
      GROUP BY YEAR, MONTH, DAY )
  DATA INITIALLY DEFERRED
  REFRESH DEFERRED
  MAINTAINED BY USER
```

CREATE TRIGGER

The CREATE TRIGGER statement defines a trigger at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- Each of the following:
 - The ALTER privilege on the table or view on which the trigger is defined,
 - The SELECT privilege on the table or view on which the trigger is defined,
 - The SELECT privilege on any table or view referenced in the *search-condition* in the *trigger-action*,
 - The UPDATE privilege on the table on which the trigger is defined, if the BEFORE UPDATE trigger contains a SET statement that modifies the NEW correlation variable,
 - The privileges required to execute each triggered-SQL-statement, and
 - The system authority *EXECUTE on the library containing the table or view on which the trigger is defined.
- Administrative authority

If an INSTEAD OF trigger is added to a view that is not inherently updatable, the *OBJMGT system authority is also required on the view.

In addition, the privileges held by the authorization ID of the statement must include at least one of the following:

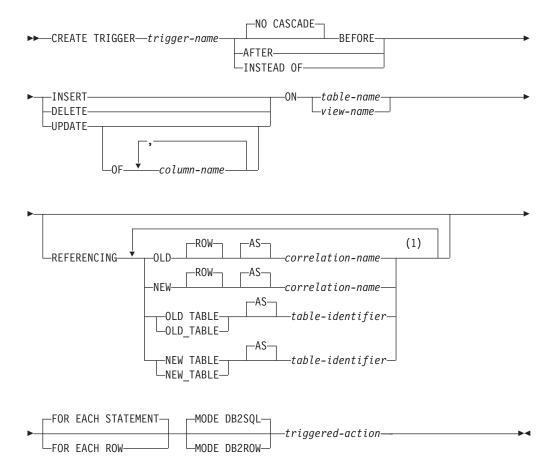
- The following system authorities:
 - *USE on the Add Physical File Trigger (ADDPFTRG) command,
 - *USE on the Create Program (CRTPGM) command
- Administrative authority

If SQL names are specified, and a user profile exists that has the same name as the library into which the trigger is created, and the name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- *ALLOBJ and *SECADM special authority
- · Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

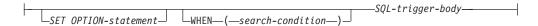
Syntax



Notes:

1 The same clause must not be specified more than once.

triggered-action:



SQL-trigger-body:

-SQL-control-statement--fullselect--ALLOCATE DESCRIPTOR-statement--ALTER FUNCTION-statement--ALTER PROCEDURE-statement--ALTER SEQUENCE-statement-—ALTER TABLE-statement— -COMMENT statement---CREATE ALIAS-statement -CREATE FUNCTION (External Scalar)-statement--CREATE FUNCTION (External Table)-statement--CREATE INDEX-statement--CREATE PROCEDURE (External)-statement--CREATE SCHEMA-statement--CREATE SEOUENCE-statement--CREATE TABLE-statement--CREATE TYPE-statement--CREATE VIEW-statement--DEALLOCATE DESCRIPTOR-statement--DECLARE declared temporary table-statement--DELETE-statement--DESCRIBE-statement--DESCRIBE INPUT-statement--DESCRIBE TABLE-statement--DROP-statement----EXECUTE IMMEDIATE-statement— -GET DESCRIPTOR-statement— -GRANT-statement--INSERT**-**statement--LABEL-statement-—LOCK TABLE-statement— —REFRESH TABLE-statement— -RELEASE-statement--RELEASE SAVEPOINT-statement--RENAME-statement--REVOKE-statement--SAVEPOINT-statement--SELECT INTO-statement----SET CURRENT DEBUG MODE-statement— -SET CURRENT DECFLOAT ROUNDING MODE-statement--SET CURRENT DEGREE-statement— -SET DESCRIPTOR-statement— -SET ENCRYPTION PASSWORD-statement-—SET PATH-statement— —SET SCHEMA-statement— -SET TRANSACTION-statement--SET transition-variable-statement---UPDATE-statement —VALUES-statement— dashVALUES INTO-statement $-\!\!\!-$

Description

trigger-name

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Names the trigger. The name, including the implicit or explicit qualifier, must not be the same as a trigger that already exists at the current server. QTEMP cannot be used as the *trigger-name* schema qualifier.

If SQL names were specified, the trigger will be created in the schema specified by the implicit or explicit qualifier.

CREATE TRIGGER

If system names were specified, the trigger will be created in the schema that is specified by the qualifier. If not qualified, the trigger will be created in the same schema as the subject table.

If the trigger name is not a valid system name, or if a program with the same name already exists, the database manager will generate a system name. For information about the rules for generating a name, see "Rules for Table Name Generation" on page 810.

NO CASCADE

NO CASCADE is allowed for compatibility with other products and is not used by DB2 for i.

BEFORE

Specifies that the trigger is a *before* trigger. The database manager executes the *triggered-action* before it applies any changes caused by an insert, delete, or update operation on the subject table. It also specifies that the *triggered-action* does not activate other triggers because the *triggered-action* of a before trigger cannot contain any updates.

BEFORE must not be specified when a *view-name* is specified. FOR EACH STATEMENT must not be specified for a BEFORE trigger.

AFTER

Specifies that the trigger is an *after* trigger. The database manager executes the *triggered-action* after it applies any changes caused by an insert, delete, or update operation on the subject table.

INSTEAD OF

Specifies that the trigger is an instead of trigger. The associated triggered action replaces the action against the subject view. Only one INSTEAD OF trigger is allowed for each kind of operation on a given subject view. The database manager executes the *triggered-action* instead of the insert, delete, or update operation on the subject view.

INSTEAD OF must not be specified when *table-name* is specified. The WHEN clause must not be specified for an INSTEAD OF trigger. FOR EACH STATEMENT must not be specified for an INSTEAD OF trigger.

INSERT

Specifies that the trigger is an insert trigger. The database manager executes the *triggered-action* whenever there is an insert operation on the subject table.

DELETE

Specifies that the trigger is a delete trigger. The database manager executes the *triggered-action* whenever there is a delete operation on the subject table.

A DELETE trigger cannot be added to a table with a referential constraint of ON DELETE CASCADE.

UPDATE

Specifies that the trigger is an update trigger. The database manager executes the *triggered-action* whenever there is an update operation on the subject table.

An UPDATE trigger event cannot be added to a table with a referential constraint of ON DELETE SET NULL.

If an explicit *column-name* list is not specified, an update operation on any column of the subject table, including columns that are subsequently added with the ALTER TABLE statement, activates the *triggered-action*.

OF column-name, ...

Each column-name specified must be a column of the subject table, and

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must appear in the list only once. An update operation on any of the listed columns activates the triggered-action. This clause cannot be specified for an INSTEAD OF trigger.

ON table-name

Identifies the subject table of a BEFORE or AFTER trigger definition. The name must identify a base table that exists at the current server, but must not identify a catalog table, a table in QTEMP, or a declared temporary table.

ON view-name

Identifies the subject view of an INSTEAD OF trigger definition. The name must identify a view that exists at the current server, but must not identify a catalog view, or a view in QTEMP. The name must not specify a view that is defined using WITH CHECK OPTION, or a view on which a WITH CHECK OPTION view has been defined, directly or indirectly

REFERENCING

Specifies the correlation names for the transition tables and the table names for the transition tables. Correlation-names identify a specific row in the set of rows affected by the triggering SQL operation. Table-identifiers identify the complete set of affected rows.

Each row affected by the triggering SQL operation is available to the triggered-action by qualifying columns with correlation-names specified as follows:

OLD ROW AS correlation-name

Specifies a correlation name that identifies the values in the row prior to the triggering SQL operation.

NEW ROW AS correlation-name

Specifies a correlation name which identifies the values in the row as modified by the triggering SQL operation and any SET statement in a before trigger that has already executed.

The complete set of rows affected by the triggering SQL operation is available to the triggered-action by using a temporary table name specified as follows:

OLD TABLE AS *table-identifier*

Specifies the name of a temporary table that identifies the values in the complete set of affected rows prior to the triggering SQL operation. The OLD TABLE includes the rows that were affected by the trigger if the current activation of the trigger was caused by statements in the *SQL-trigger-body* of a trigger.

NEW TABLE AS table-identifier

Specifies the name of a temporary table that identifies the state of the complete set of affected rows as modified by the triggering SQL operation and by any SET statement in a before trigger that has already been executed.

Only one OLD and one NEW correlation-name may be specified for a trigger. Only one OLD_TABLE and one NEW_TABLE table-identifier may be specified for a trigger. All of the correlation-names and table-identifiers must be unique from one another.

The OLD correlation-name and the OLD_TABLE table-identifier are valid only if the triggering event is either a delete operation or an update operation. For a delete operation, the OLD correlation-name captures the values of the columns in the deleted row, and the OLD_TABLE table-identifier captures the values in

CREATE TRIGGER

the set of deleted rows. For an update operation, OLD *correlation-name* captures the values of the columns of a row before the update operation, and the OLD_TABLE *table-identifier* captures the values in the set of updated rows.

The NEW ROW correlation-name and the NEW TABLE table-identifier are valid only if the triggering event is either an INSERT operation or an UPDATE operation. For both operations, the NEW ROW correlation-name captures the values of the columns in the inserted or updated row, and the NEW TABLE table-identifier captures the values in the set of inserted or updated rows. For before triggers, the values of the updated rows include the changes from any SET statements in the triggered-action of before triggers.

The OLD ROW and NEW ROW *correlation-name* variables cannot be modified in an AFTER trigger or INSTEAD OF trigger.

The tables below summarizes the allowable combinations of correlation variables and transition tables.

Granularity: FOR EACH ROW

MODE	Activation Time	Triggering Operation	Correlation Variables Allowed	Transition Tables Allowed
DB2ROW	BEFORE	DELETE	OLD	NONE
		INSERT	NEW	
		UPDATE	OLD, NEW	
	AFTER or	DELETE	OLD	
	INSTEAD OF	INSERT	NEW	
		UPDATE	OLD, NEW	
DB2SQL	BEFORE	DELETE	OLD	
		INSERT	NEW	
		UPDATE	OLD, NEW	
	AFTER or	DELETE	OLD	OLD TABLE
	INSTEAD OF	INSERT	NEW	NEW TABLE
		UPDATE	OLD, NEW	OLD TABLE, NEW TABLE

Granularity: FOR EACH STATEMENT

MODE	Activation Time	Triggering Operation	Correlation Variables Allowed	Transition Tables Allowed
DB2SQL	AFTER or	DELETE	NONE	OLD TABLE
INSTEAD OF	INSERT		NEW TABLE	
		UPDATE		OLD TABLE, NEW TABLE

A transition variable that has a character data type inherits the CCSID of the column of the subject table. During the execution of the *triggered-action*, the transition variables are treated like variables. Therefore, character conversion might occur.

The temporary transition tables are read-only. They cannot be modified.

The scope of each *correlation-name* and each *table-identifier* is the entire trigger definition.

FOR EACH ROW

Specifies that the database manager executes the *triggered-action* for each row of the subject table that the triggering operation modifies. If the triggering operation does not modify any rows, the *triggered-action* is not executed.

FOR EACH STATEMENT

Specifies that the database manager executes the *triggered-action* only once for the triggering operation. Even if the triggering operation does not modify or delete any rows, the triggered action is still executed once.

FOR EACH STATEMENT cannot be specified for a BEFORE trigger.

FOR EACH STATEMENT cannot be specified for a MODE DB2ROW trigger.

MODE DB2SQL

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MODE DB2SQL triggers are activated after all of the row operations have occurred.

MODE DB2ROW

MODE DB2ROW triggers are activated on each row operation.

MODE DB2ROW is valid for both the BEFORE and AFTER activation time.

triggered-action

Specifies the action to be performed when a trigger is activated. The *triggered-action* is composed of one or more SQL statements and by an optional condition that controls whether the statements are executed.

SET OPTION-statement

Specifies the options that will be used to create the trigger. For example, to create a debuggable trigger, the following statement could be included:

SET OPTION DBGVIEW = *SOURCE

For more information, see "SET OPTION" on page 1085.

The options CLOSQLCSR, CNULRQD, COMPILEOPT, NAMING, and SQLCA are not allowed in the CREATE TRIGGER statement.

The options DATFMT, DATSEP, TIMFMT, and TIMSEP cannot be used if OLD ROW or NEW ROW is specified.

WHEN (search-condition)

Specifies a condition that evaluates to true, false, or unknown. The triggered SQL statements are executed only if the *search-condition* evaluates to true. If the WHEN clause is omitted, the associated SQL statements are always executed.

A WHEN clause must not be specified with an INSTEAD OF trigger.

SQL-trigger-body

Specifies a single SQL statement, including a compound statement. See Chapter 6, "SQL control statements," on page 1143 for more information about defining SQL triggers.

A call to a procedure that issues a CONNECT, SET CONNECTION, RELEASE, DISCONNECT, COMMIT, ROLLBACK, SET TRANSACTION, and SET RESULT SETS statement is not allowed in the *triggered-action* of a trigger.

CREATE TRIGGER

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If the trigger is a BEFORE trigger, then the *SQL-trigger-body* must not contain an INSERT, UPDATE, DELETE, ALTER TABLE, COMMENT, any CREATE statement, DECLARE declared temporary table, DROP, any GRANT statement, LABEL, REFRESH TABLE, RENAME, or any REVOKE statement. It must not contain a reference to a procedure or function that modifies SQL data.

An UNDO handler is not allowed in a trigger.

All tables, views, aliases, distinct types, user-defined functions, and procedures referenced in the *triggered-action* must exist at the current server when the trigger is created. The table or view that an alias refers to must also exist when the trigger is created. This includes objects in library QTEMP. While objects in QTEMP can be referenced in the *triggered-action*, dropping those objects in QTEMP will not cause the trigger to be dropped.

All transition variable names are column names of the subject table. System column names of the subject table cannot be used as transition variable names.

The statements in the *triggered-action* can invoke a procedure or a user-defined function that can access a server other than the current server if the procedure or user-defined function runs in a different activation group.

Notes

Trigger ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the trigger is created exists, the *owner* of the trigger is that user profile.
- Otherwise, the *owner* of the trigger is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the trigger is the user profile or group user profile of the job executing the statement.

Trigger authority: The trigger program object authorities are:

- When SQL naming is in effect, the trigger program will be created with the public authority of *EXCLUDE, and adopt authority from the schema qualifier of the trigger-name if a user profile with that name exists. If a user profile for the schema qualifier does exist, then the owner of the trigger program will be the user profile for the schema qualifier. Note that the special authorities *ALLOBJ and *SECADM are required to create the trigger program object in the schema qualifier library if a user profile exists that has the same name as the schema qualifier, and the name is different from the authorization ID of the statement. If a user profile for the schema qualifier does not exist, then the owner of the trigger program will be the user profile or group user profile of the job executing the SQL CREATE TRIGGER statement. The group user profile will be the owner of the trigger program object, only if OWNER(*GRPPRF) was specified on the user's profile who is executing the statement. If the owner of the trigger program is a member of a group profile, and if OWNER(*GRPPRF) was specified on the user's profile, the program will run with the adopted authority of the group profile.
- When System naming is in effect, the trigger program will be created with public authority of *EXCLUDE, and adopt authority from the user or group user profile of the job executing the SQL CREATE TRIGGER statement.

Execution authorization: The user executing the triggering SQL operation does not need authority to execute a static *triggered-SQL-statement*. A static *triggered-SQL-statement* will execute using the authority of the *owner* of the trigger.

Activating a trigger: Only insert, delete, or update operations can activate a trigger. A delete operation that occurs as a result of a referential constraint will not activate a trigger. Hence,

- A trigger with a DELETE trigger event cannot be added to a table with a referential constraint of ON DELETE CASCADE.
- A trigger with an UPDATE trigger event cannot be added to a table with a referential constraint of ON DELETE SET NULL or ON DELETE SET DEFAULT.

The activation of a trigger may cause *trigger cascading*. This is the result of the activation of one trigger that executes SQL statements that cause the activation of other triggers or even the same trigger again. The triggered actions may also cause updates as a result of the original modification, which may result in the activation of additional triggers. With trigger cascading, a significant chain of triggers may be activated causing significant change to the database as a result of a single delete, insert or update statement. The number of levels of cascading is limited to 200 or the maximum amount of storage allowed in the job or process, whichever comes first.

Adding triggers to enforce constraints: Adding a trigger to a table that already has rows in it will not cause the triggered actions to be executed. Thus, if the trigger is designed to enforce constraints on the data in the table, the data in the existing rows might not satisfy those constraints.

Read-only views: The addition of an INSTEAD OF trigger for a view affects the read-only characteristic of the view. If a read-only view has a dependency relationship with an INSTEAD OF trigger, the type of operation that is defined for the INSTEAD OF trigger defines whether the view is deletable, insertable, or updatable.

Transition variable values and INSTEAD OF triggers: The initial values for new transition variables or new transition table columns visible in an INSTEAD OF INSERT trigger are set as follows:

- If a value is explicitly specified for a column in the INSERT statement, the corresponding new transition variable or new transition table column is that explicitly specified value.
- If a value is not explicitly specified for a column in the INSERT statement or the DEFAULT keyword is specified, the corresponding new transition variable or new transition table column is:
 - the default value of the underlying table column if the view column is updatable (without the INSTEAD OF trigger) and not based on a generated column (identity column or ROWID),
 - otherwise, the null value.

The initial values for new transition variables or new transition table columns visible in an INSTEAD OF UPDATE trigger are set as follows:

 If a value is explicitly specified for a column in the UPDATE statement, the corresponding new transition variable or new transition table column is that explicitly specified value.

- If the DEFAULT keyword is explicitly specified for a column in the UPDATE statement, the corresponding new transition variable or new transition table column is:
 - the default value of the underlying table column if the view column is updatable (without the INSTEAD OF trigger) and not based on a generated column (identity column or ROWID),
 - otherwise, the null value.
- Otherwise, the corresponding new transition variable or new transition table column is the existing value of the column in the row.

Multiple triggers: Multiple triggers that have the same triggering SQL operation and activation time can be defined on a table. The triggers are activated based on the mode and the order in which they were created:

- MODE DB2ROW triggers (and native triggers created via the ADDPFTRG CL command) are fired first in the order in which they were created
- MODE DB2SQL triggers are fired next in the order in which they were created

For example, a MODE DB2ROW trigger that was created first is executed first, the MODE DB2ROW trigger that was created second is executed second.

A maximum of 300 triggers can be added to any given source table.

Adding columns to a subject table or a table referenced in the triggered action: If a column is added to the subject table after triggers have been defined, the following rules apply:

- If the trigger is an UPDATE trigger that was defined without an explicit column list, then an update to the new column will cause the activation of the trigger.
- If the SQL statements in the *triggered-action* refer to the triggering table, the new column is not accessible to the SQL statements until the trigger is recreated.
- The OLD_TABLE and NEW_TABLE transition tables will contain the new column, but the column cannot be referenced unless the trigger is recreated.

If a column is added to any table referenced by the SQL statements in the triggered-action, the new column is not accessible to the SQL statements until the trigger is recreated.

Dropping or revoking privileges on a table referenced in the triggered action: If an object such as a table, view or alias, referenced in the triggered-action is dropped, the access plans of the statements that reference the object will be rebuilt when the trigger is fired. If the object does not exist at that time, the corresponding INSERT, UPDATE or DELETE operation on the subject table will fail.

If a privilege that the creator of the trigger is required to have for the trigger to execute is revoked, the access plans of the statements that reference the object will be rebuilt when the trigger is fired. If the appropriate privilege does not exist at that time, the corresponding INSERT, UPDATE or DELETE operation on the subject table will fail.

Errors executing triggers: If a SIGNAL statement is executed in the SQL-trigger-body, an SQLCODE -438 and the SQLSTATE specified in the SIGNAL statement will be returned.

Other errors that occur during the execution of SQL-trigger-body statements are returned using SQLSTATE 09000 and SQLCODE -723.

Special registers in triggers: The values of the special registers are saved before a trigger is activated and are restored on return from the trigger. The values of the special registers are inherited from the triggering SQL operation.

Transaction isolation: All triggers, when they are activated, perform a SET TRANSACTION statement unless the isolation level of the application program invoking the trigger is the same as the default isolation level of the trigger program. This is necessary so that all of the operations by the trigger are performed with the same isolation level as the application program that caused the trigger to be run. The user may put their own SET TRANSACTION statements in an *SQL-control-statement* in the *SQL-trigger-body* of the trigger. If the user places a SET TRANSACTION statement within the *SQL-trigger-body* of the trigger, then the trigger will run with the isolation level specified in the SET TRANSACTION statement, instead of the isolation level of the application program that caused the trigger to be run.

If the application program that caused a trigger to be activated, is running with an isolation level other than No Commit (COMMIT(*NONE) or COMMIT(*NC)), the operations within the trigger will be run under commitment control and will not be committed or rolled back until the application commits its current unit of work. If ATOMIC is specified in the *SQL-trigger-body* of the trigger, and the application program that caused the ATOMIC trigger to be activated is running with an isolation level of No Commit (COMMIT(*NONE) or COMMIT(*NC)), the operations within the trigger will not be run under commitment control. If the application that caused the trigger to be activated is running with an isolation level of No Commit (COMMIT(*NONE) or COMMIT(*NC)), then the operations of a trigger are written to the database immediately, and cannot be rolled back.

If both system triggers defined by the Add Physical File Trigger (ADDPFTRG) CL command and SQL triggers defined by the CREATE TRIGGER statement are defined for a table, it is recommended that the system triggers perform a SET TRANSACTION statement so that they are run with the same isolation level as the original application that caused the triggers to be activated. It is also recommended that the system triggers run in the Activation Group of the calling application. If system triggers run in a separate Activation Group (ACTGRP(*NEW)), then those system triggers will not participate in the unit of the work for the calling application, nor in the unit of work for any SQL triggers. System triggers that run in a separate Activation Group are responsible for committing or rolling back any database operations they perform under commitment control. Note that SQL triggers defined by the CREATE TRIGGER statement always run in the caller's Activation Group.

If the triggering application is running with commitment control, the operations of an SQL trigger, and any cascaded SQL triggers, will be captured into a sub-unit of work. If the operations of the trigger and any cascaded triggers are successful, the operations captured in the sub-unit of work will be committed or rolled back when the triggering application commits or rolls back its current unit of work. Any system triggers that run in the same Activation Group as the caller, and perform a SET TRANSACTION to the isolation level of the caller, will also participate in the sub-unit of work. If the triggering application is running without commit control, then the operations of the SQL triggers will also be run without commitment control.

If an application that causes a trigger to be activated, is running with an isolation level of No Commit (COMMIT(*NONE) or COMMIT(*NC)), and it issues an INSERT, UPDATE, or DELETE statement that encounters an error during the

execution of the statement, no other the system and SQL triggers will still be activated following the error for that operation. However, some number of changes will already have been performed. If the triggering application is running with commitment control, the operations of any triggers that are captured in a sub-unit of work will be rolled back when the first error is encountered, and no additional triggers will be activated for the current INSERT, UPDATE, or DELETE statement.

Performance considerations: Create the trigger under the isolation level that will most often by used by the application programs that cause the trigger to fire. The SET OPTION statement can be used to explicitly choose the isolation level.

ROW triggers (especially MODE DB2ROW triggers) perform much better than TABLE level triggers.

Considerations for implicitly hidden columns: A transition variable will exist for any column defined as explicitly hidden. In the body of a trigger, a transition variable that corresponds to an implicitly hidden column can be referenced.

Triggered actions in the catalog: At the time the trigger is created, the *triggered-action* is modified as a result of the CREATE TRIGGER statement:

- Naming mode is switched to SQL naming.
- All unqualified object references are explicitly qualified
- All implicit column lists (for example, SELECT *, INSERT with no column list, UPDATE SET ROW) are expanded to be the list of actual column names.

The modified *triggered-action* is stored in the catalog.

Renaming or moving a table referenced in the triggered action: Any table (including the subject table) referenced in a triggered-action can be moved or renamed. However, the triggered-action will continue to reference the old name or schema. An error will occur if the referenced table is not found when the triggered-action is executed. Hence, you should drop the trigger and then re-create the trigger so that it refers to the renamed or moved table.

Datetime considerations: If OLD ROW or NEW ROW is specified, the date or time constants and the string representation of dates and times in variables that are used in SQL statements in the triggered-action must have a format of ISO, EUR, JIS, USA, or must match the date and time formats specified when the table was created if it was created using DDS and the CRTPF CL command. If the DDS specifications contain multiple different date or time formats, the trigger cannot be created.

Operations that invalidate triggers: An *inoperative trigger* is a trigger that is no longer available to be activated. If a trigger becomes invalid, no INSERT, UPDATE, or DELETE operations will be allowed on the subject table or view. A trigger becomes invalid if:

- The SQL statements in the triggered-action reference the subject table or view, the trigger is a self-referencing trigger, and the table or view is duplicated using the system CRTDUPOBJ CL command, or
- The SQL statements in the *triggered-action* reference tables or views in the from library and the objects are not found in the new library when the table or view is duplicated using the system CRTDUPOBJ CL command, or

 The table or view is restored to a new library using the system RSTOBJ or RSTLIB CL commands, and the *triggered-action* references the subject table or subject view, the trigger is a self-referencing trigger.

An invalid trigger must first be dropped before it can be recreated by issuing a CREATE TRIGGER statement. Note that dropping and recreating a trigger will affect the activation order of a trigger if multiple triggers for the same triggering operation and activation time are defined for the subject table.

Trigger program object: When a trigger is created, SQL creates a temporary source file that will contain C source code with embedded SQL statements. A program object is then created using the CRTPGM command. The SQL options used to create the program are the options that are in effect at the time the CREATE TRIGGER statement is executed. The program is created with ACTGRP(*CALLER).

The program is created with STGMDL(*SNGLVL). If the trigger runs on behalf of an application that uses STGMDL(*TERASPACE) and also uses commitment control, the entire application will need to run under a job scoped commitment definition (STRCMTCTL CMTSCOPE(*JOB)).

The trigger will execute with the adopted authority of the *owner* of the trigger.

Examples

Example 1: Create two triggers that track the number of employees that a company manages. The triggering table is the EMPLOYEE table, and the triggers increment and decrement a column with the total number of employees in the COMPANY_STATS table. The COMPANY_STATS table has the following properties:

```
CREATE TABLE COMPANY_STATS
  (NBEMP INTEGER,
   NBPRODUCT INTEGER,
   REVENUE DECIMAL(15,0))
```

This example uses row triggers to maintain summary data in another table.

Create the first trigger, NEW_HIRE, so that it increments the number of employees each time a new person is hired; that is, each time a new row is inserted into the EMPLOYEE table, increase the value of column NBEMP in table COMPANY_STATS by 1.

```
CREATE TRIGGER NEW_HIRE

AFTER INSERT ON EMPLOYEE

FOR EACH ROW MODE DB2SQL

UPDATE COMPANY_STATS SET NBEMP = NBEMP + 1
```

Create the second trigger, FORM_EMP, so that it decrements the number of employees each time an employee leaves the company; that is, each time a row is deleted from the table EMPLOYEE, decrease the value of column NBEMP in table COMPANY_STATS by 1.

```
CREATE TRIGGER FORM_EMP

AFTER DELETE ON EMPLOYEE

FOR EACH ROW MODE DB2SQL

BEGIN ATOMIC

UPDATE COMPANY_STATS SET NBEMP = NBEMP - 1;

END
```

CREATE TRIGGER

Example 2: Create a trigger, REORDER, that invokes user-defined function ISSUE_SHIP_REQUEST to issue a shipping request whenever a parts record is updated and the on-hand quantity for the affected part is less than 10% of its maximum stocked quantity. User-defined function ISSUE_SHIP_REQUEST orders a quantity of the part that is equal to the part's maximum stocked quantity minus its on-hand quantity. The function eliminates any duplicate requests to order the same PARTNO and sends the unique order to the appropriate supplier.

This example also shows how to define the trigger as a statement trigger instead of a row trigger. For each row in the transition table that evaluates to true for the WHERE clause, a shipping request is issued for the part.

```
CREATE TRIGGER REORDER

AFTER UPDATE OF ON_HAND, MAX_STOCKED ON PARTS

REFERENCING NEW_TABLE AS NTABLE

FOR EACH STATEMENT MODE DB2SQL

BEGIN ATOMIC

SELECT ISSUE_SHIP_REQUEST(MAX_STOCKED - ON_HAND, PARTNO)

FROM NTABLE

WHERE ON_HAND < 0.10 * MAX_STOCKED;
END
```

Example 3: Assume that table EMPLOYEE contains column SALARY. Create a trigger, SAL_ADJ, that prevents an update to an employee's salary that exceeds 20% and signals such an error. Have the error that is returned with an SQLSTATE of 75001 and a description. This example shows that the SIGNAL SQLSTATE statement is useful for restricting changes that violate business rules.

```
CREATE TRIGGER SAL_ADJ

AFTER UPDATE OF SALARY ON EMPLOYEE

REFERENCING OLD AS OLD_EMP

NEW AS NEW_EMP

FOR EACH ROW MODE DB2SQL

WHEN (NEW_EMP.SALARY > (OLD_EMP.SALARY *1.20))

BEGIN ATOMIC

SIGNAL SQLSTATE '75001'('Invalid Salary Increase - Exceeds 20%');
END
```

CREATE TYPE

The CREATE TYPE statement defines a distinct type at the current server. A distinct type is always sourced on one of the built-in data types.

Successful execution of the statement also generates:

- A function to cast from the distinct type to its source type
- A function to cast from the source type to its distinct type
- As appropriate, support for the use of comparison operators with the distinct type.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSTYPES catalog table:
 - The INSERT privilege on the table, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

If SQL names are specified and a user profile exists that has the same name as the library into which the distinct type is created, and that name is different from the authorization ID of the statement, then the privileges held by the authorization ID of the statement must include at least one of the following:

- The system authority *ADD to the user profile with that name
- Administrative authority

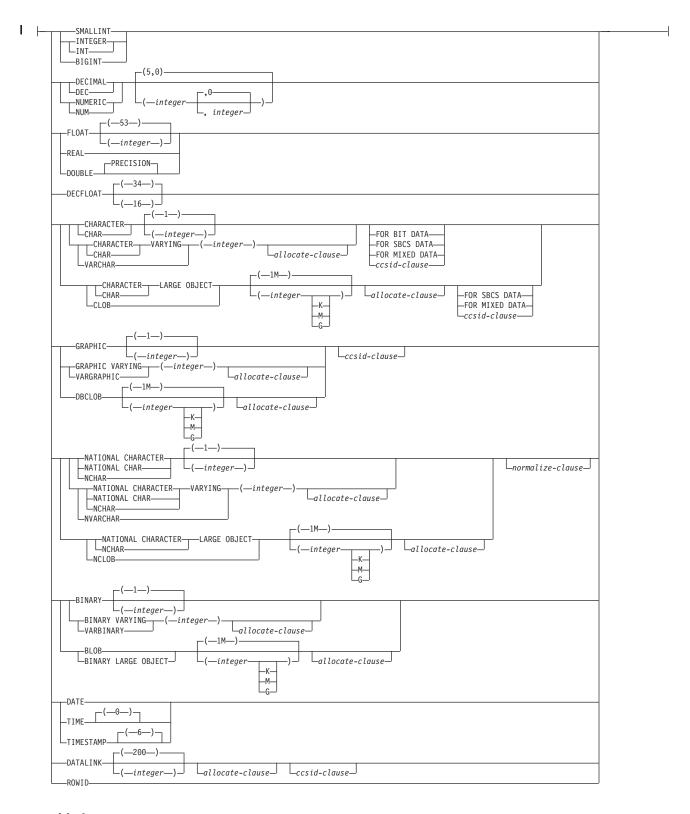
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax

►► CREATE—TYPE—distinct-type-name—AS—built-in-type—————WITH COMPARISONS—

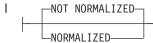
built-in-type:

CREATE TYPE



ccsid-clause:

normalize-clause:



Description

distinct-type-name

Names the distinct type. The name, including the implicit or explicit qualifier, must not be the same as a distinct type that already exists at the current server.

If SQL names were specified, the distinct type will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the distinct type will be created in the schema that is specified by the qualifier. If not qualified:

- If the value of the CURRENT SCHEMA special register is *LIBL, the distinct type will be created in the current library (*CURLIB).
- Otherwise, the distinct type will be created in the current schema.

If the distinct type name is not a valid system name, DB2 for i will generate a system name. For information about the rules for generating a name, see "Rules for Table Name Generation" on page 810.

distinct-type-name must not be the name of a built-in data type, or any of the following system-reserved keywords even if you specify them as delimited identifiers.

=	<	>	>=
<=	<>	7=	¬<
¬<	!=	!<	!>
ALL	DISTINCT	NODENUMBER	SIMILAR
AND	EXCEPT	NODENAME	SOME
ANY	EXISTS	NOT	STRIP
ARRAY	EXTRACT	NULL	SUBSTRING
BETWEEN	FALSE	ONLY	TABLE
BOOLEAN	FOR	OR	THEN
CASE	FROM	OVERLAPS	TRIM
CAST	HASHED_VALUE	PARTITION	TRUE
CHECK	IN	POSITION	TYPE
DATAPARTITIONNAME	INTERVAL	RID	UNIQUE
DATAPARTITIONNUM	IS	RRN	UNKNOWN
DBPARTITIONNAME	LIKE	SELECT	WHEN
DBPARTITIONNUM	MATCH		

If a qualified *distinct-type-name* is specified, the schema name cannot be QSYS, QSYS2, QTEMP, or SYSIBM.

built-in-type

Specifies the built-in data type used as the basis for the internal representation of the distinct type. See "CREATE TABLE" on page 768 for a more complete description of each built-in data type.

For portability of applications across platforms, use the following recommended data type names:

DOUBLE or REAL instead of FLOAT.

If a specific value is not specified for the data types that have length, precision, or scale attributes, the default attributes of the data type as shown in the syntax diagram are implied.

If the distinct type is sourced on a string data type, a CCSID is associated with the distinct data type at the time the distinct type is created. For more information about data types, see "CREATE TABLE" on page 768.

WITH COMPARISONS

Specifies that system-generated comparison functions are to be created for comparing two instances of the distinct type. WITH COMPARISONS is the default. Comparison functions will be generated for all source types with the exception of a DATALINK whether WITH COMPARISONS is specified.83 For compatibility with other DB2 products, WITH COMPARISONS should be specified.

The comparison functions do not support the LIKE predicate. In order to use the LIKE predicate on a distinct type, it must be cast to a built-in type.

Notes

Additional generated functions: Besides the system-generated comparison operators described above, the following functions become available to convert to and from the source type:

- The distinct type to the source type
- The source type to the distinct type
- INTEGER to the distinct type if the source type is SMALLINT
- DOUBLE to the distinct type if the source type is REAL
- VARCHAR to the distinct type if the source type is CHAR
- VARGRAPHIC to the distinct type if the source type is GRAPHIC

These functions are created as if the following statements were executed (except that the service programs are not created, so you cannot grant or revoke privileges to these functions):

```
CREATE FUNCTION source-type-name (distinct-type-name)
 RETURNS source-type-name
```

```
CREATE FUNCTION distinct-type-name (source-type-name)
 RETURNS distinct-type-name
```

Names of the generated cast functions: Table 58 on page 831 contains details about the generated cast functions. The unqualfied name of the cast function that converts from the distinct type to the source type is the name of the source data type.

In cases in which a length, precision, or scale is specified for the source data type in the CREATE TYPE statement, the unqualified name of the cast function that converts from the distinct type to the source type is simply the name of the source data type. The data type of the value that the cast function returns includes any length, precision, or scale values that were specified for the source data type on the CREATE TYPE statement.

^{83.} Service programs are not created for these comparison functions. These comparison functions are not registered in the SYSROUTINES catalog table.

The name of the cast function that converts from the source type to the distinct type is the name of the distinct type. The input parameter of the cast function has the same data type as the source data type, including the length, precision, and scale.

The cast functions that are generated are created in the same schema as that of the distinct type. A function with the same name and same function signature must not already exist in the current server.

For example, assume that a distinct type named T_SHOESIZE is created with the following statement:

CREATE TYPE CLAIRE.T_SHOESIZE AS VARCHAR(2) WITH COMPARISONS

When the statement is executed, the database manager also generates the following cast functions. VARCHAR converts from the distinct type to the source type, and T_SHOESIZE converts from the source type to the distinct type.

FUNCTION CLAIRE. VARCHAR (CLAIRE.T SHOESIZE) RETURNS VARCHAR(2)

FUNCTION CLAIRE.T_SHOESIZE (VARCHAR(2) RETURNS CLAIRE.T_SHOESIZE

Notice that function VARCHAR returns a value with a data type of VARCHAR(2) and that function T_SHOESIZE has an input parameter with a data type of VARCHAR(2).

A generated cast function cannot be explicitly dropped. The cast functions that are generated for a distinct type are implicitly dropped when the distinct type is dropped with the DROP statement.

For each built-in data type that can be the source data type for a distinct type, the following table gives the names of the generated cast functions, the data types of the input parameters, and the data types of the values that the functions returns.

Table 58. CAST Functions on Distinct Types

Source Type Name	Function Name	Parameter Type	Return Type
SMALLINT	distinct-type-name	SMALLINT	distinct-type-name
	distinct-type-name	INTEGER	distinct-type-name
	SMALLINT	distinct-type-name	SMALLINT
INTEGER	distinct-type-name	INTEGER	distinct-type-name
	INTEGER	distinct-type-name	INTEGER
BIGINT	distinct-type-name	BIGINT	distinct-type-name
	BIGINT	distinct-type-name	BIGINT
DECIMAL	distinct-type-name	DECIMAL(p,s)	distinct-type-name
	DECIMAL	distinct-type-name	DECIMAL(p,s)
NUMERIC	distinct-type-name	NUMERIC(p,s)	distinct-type-name
	NUMERIC	distinct-type-name	NUMERIC(p,s)
REAL or FLOAT(n) where n <= 24	distinct-type-name	REAL	distinct-type-name
	distinct-type-name	DOUBLE	distinct-type-name
	REAL	distinct-type-name	REAL

Table 58. CAST Functions on Distinct Types (continued)

Source Type Name	Function Name	Parameter Type	Return Type
DOUBLE or DOUBLE PRECISION or FLOAT(n) where n > 24	distinct-type-name	DOUBLE	distinct-type-name
	DOUBLE	distinct-type-name	DOUBLE
DECFLOAT	distinct-type-name	DECFLOAT(n)	distinct-type-name
	DECFLOAT	distinct-type-name	DECFLOAT(n)
CHAR	distinct-type-name	CHAR(n)	distinct-type-name
	CHAR	distinct-type-name	CHAR(n)
	distinct-type-name	VARCHAR(n)	distinct-type-name
VARCHAR	distinct-type-name	VARCHAR(n)	distinct-type-name
	VARCHAR	distinct-type-name	VARCHAR(n)
CLOB	distinct-type-name	CLOB(n)	distinct-type-name
	CLOB	distinct-type-name	CLOB(n)
GRAPHIC	distinct-type-name	GRAPHIC(n)	distinct-type-name
	GRAPHIC	distinct-type-name	GRAPHIC(n)
	distinct-type-name	VARGRAPHIC(n)	distinct-type-name
VARGRAPHIC	distinct-type-name	VARGRAPHIC(n)	distinct-type-name
	VARGRAPHIC	distinct-type-name	VARGRAPHIC(n)
DBCLOB	distinct-type-name	DBCLOB(n)	distinct-type-name
	DBCLOB	distinct-type-name	DBCLOB(n)
BINARY	distinct-type-name	BINARY(n)	distinct-type-name
	BINARY	distinct-type-name	BINARY(n)
	distinct-type-name	VARBINARY(n)	distinct-type-name
VARBINARY	distinct-type-name	VARBINARY(n)	distinct-type-name
	VARBINARY	distinct-type-name	VARBINARY(n)
BLOB	distinct-type-name	BLOB(n)	distinct-type-name
	BLOB	distinct-type-name	BLOB(n)
DATE	distinct-type-name	DATE	distinct-type-name
	DATE	distinct-type-name	DATE
TIME	distinct-type-name	TIME	distinct-type-name
	TIME	distinct-type-name	TIME
TIMESTAMP	distinct-type-name	TIMESTAMP	distinct-type-name
	TIMESTAMP	distinct-type-name	TIMESTAMP
DATALINK	distinct-type-name	DATALINK	distinct-type-name
	DATALINK	distinct-type-name	DATALINK
ROWID	distinct-type-name	ROWID	distinct-type-name
	ROWID	distinct-type-name	ROWID

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NUMERIC and FLOAT are not recommended when creating a distinct type for a portable application. DECIMAL and DOUBLE should be used instead.

Built-in functions: The functions described in the above table are the only functions that are generated automatically when distinct types are defined. Consequently, none of the built-in functions (AVG, MAX, LENGTH, and so on) are automatically supported for the distinct type. A built-in function can be used on a distinct type only after a sourced user-defined function, which is based on the built-in function, has been created for the distinct type. See "Extending or overriding a built-in function:" on page 657.

The schema name of the distinct type must be included in the distinct type for successful use of these operators and cast functions in SQL statements.

Distinct type attributes: A distinct type is created as a *SQLUDT object.

Distinct type ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the distinct type is created exists, the *owner* of the distinct type is that user profile.
- Otherwise, the *owner* of the distinct type is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the distinct type is the user profile or group user profile of the job executing the statement.

Distinct type authority: If SQL names are used, distinct types are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, distinct types are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the distinct type is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the distinct type.

Syntax alternatives: For compatibility with previous versions of DB2:

CREATE DISTINCT TYPE can be specified in place of CREATE TYPE.

Examples

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Example 1: Create a distinct type named SHOESIZE that is sourced on the built-in INTEGER data type.

CREATE TYPE SHOESIZE AS INTEGER WITH COMPARISONS

The successful execution of this statement also generates two cast functions. Function INTEGER(SHOESIZE) returns a value with data type INTEGER, and function SHOESIZE(INTEGER) returns a value with distinct type SHOESIZE.

Example 2: Create a distinct type named MILES that is sourced on the built-in DOUBLE data type.

CREATE TYPE MILES

AS DOUBLE WITH COMPARISONS

The successful execution of this statement also generates two cast functions. Function DOUBLE(MILES) returns a value with data type DOUBLE, and function MILES(DOUBLE) returns a value with distinct type MILES.

CREATE TYPE

Example 3: Create a distinct type T_DEPARTMENT that is sourced on the built-in CHAR data type.

CREATE TYPE CLAIRE.T_DEPARTMENT AS CHAR(3) WITH COMPARISONS

The successful execution of this statement also generates three cast functions:

- Function CLAIRE.CHAR takes a T_DEPARTMENT as input and returns a value with data type CHAR(3).
- Function CLAIRE.T_DEPARTMENT takes a CHAR(3) as input and returns a value with distinct type T_DEPARTMENT.
- Function CLAIRE.T_DEPARTMENT takes a VARCHAR(3) as input and returns a value with distinct type T_DEPARTMENT.

CREATE VIEW

The CREATE VIEW statement creates a view on one or more tables or views at the current server.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The privilege to create in the schema. For more information, see Privileges necessary to create in a schema.
- Administrative authority

The privileges held by the authorization ID of the statement must include at least one of the following:

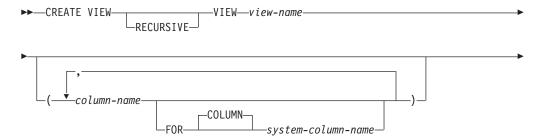
- · The following system authorities:
 - *USE to the Create Logical File (CRTLF) CL command
 - *CHANGE to the data dictionary if the library into which the view is created is an SQL schema with a data dictionary
- Administrative authority

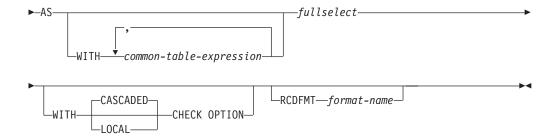
The privileges held by the authorization ID of the statement must also include at least one of the following:

- For each table and view referenced directly through the fullselect, or indirectly through views referenced in the fullselect:
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- · Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax





Description

RECURSIVE

Indicates that the view is potentially recursive.

If a *fullselect* of the view contains a reference to the view itself in a FROM clause, the view is a *recursive view*. Views using recursion are useful in supporting applications such as bill of materials (BOM), reservation systems, and network planning.

The restrictions that apply to a recursive *view* are similar to those for a recursive common table expression:

- A list of *column-names* must be specified following the *view-name* unless the result columns of the fullselect are already named.
- The UNION ALL set operator must be specified.
- The first fullselect of the first union (the initialization fullselect) must not include a reference to the *view* itself in any FROM clause.
- Each fullselect that is part of the recursion cycle must not include any aggregate functions, GROUP BY clauses, or HAVING clauses.
- The FROM clauses of each fullselect can include at most one reference to the view that is part of a recursion cycle.
- The table being defined in the *common-table-expression* cannot be referenced in a subquery of a fullselect that defines the *common-table-expression*.
- LEFT OUTER JOIN and FULL OUTER JOIN are not allowed if the *common-table-expression* is the right operand. RIGHT OUTER JOIN and FULL OUTER JOIN are not allowed if the *common-table-expression* is the left operand.

If a column name of the view is referred to in the iterative fullselect, the attributes of the result columns are determined using the rules for result columns. For more information see "Rules for result data types" on page 105.

Recursive views are not allowed if the query specifies:

- · a distributed table,
- a table with a read trigger,
- a table referenced directly or indirectly in the fullselect must not be a DDS-created logical file, or
- a logical file built over multiple physical file members.

view-name

Names the view. The name, including the implicit or explicit qualifier, must not be the same as an alias, file, index, table, or view that already exists at the current server.

If SQL names were specified, the view will be created in the schema specified by the implicit or explicit qualifier.

If system names were specified, the view will be created in the schema that is specified by the qualifier. If not qualified and there is no default schema, the view name will be created in the same schema as the first table specified on the first FROM clause (including FROM clauses in any common table expressions or nested table expression). If no tables are referenced in the fullselect, the view will be created in the same schema as the first user defined table function. If no table or user defined table function is referenced in the fullselect, the current library (*CURLIB) will be used.

If a view name is not a valid system name, DB2 for i SQL will generate a system name. For information about the rules for generating the name, see "Rules for Table Name Generation" on page 810.

(column-name, ...)

Names the columns in the view. If a list of column names is specified, it must consist of as many names as there are columns in the result table of the fullselect. Each *column-name* and *system-column-name* must be unique and unqualified. If a list of column names is not specified, the columns of the view inherit the names of the columns and system names of the columns of the result table of the *fullselect*.

A list of column names (and system column names) must be specified if the result table of the subselect has duplicate column names, duplicate system column names, or an unnamed column. For more information about unnamed columns, see "Names of result columns" on page 473.

FOR COLUMN system-column-name

Provides an IBM i name for the column. Do not use the same name for more than one column of the view or for a column-name of the view.

If the system-column-name is not specified, and the column-name is not a valid system-column-name, a system column name is generated. For more information about how system column names are generated, see "Rules for Column Name Generation" on page 809.

AS

Defines the view.

WITH *common-table-expression*

Defines a common table expression for use with the fullselect that follows. For an explanation of common table expression, see "common-table-expression" on page 513.

fullselect

Defines the view. At any time, the view consists of the rows that would result if the fullselect were executed.

fullselect must not reference variables.

The maximum number of columns allowed in a view is 8000. The column name lengths and the length of the WHERE clause also reduce this number. The maximum number of base tables allowed in the view is 256.

For an explanation of *fullselect*, see "fullselect" on page 506.

common-table-expression defines a common table expression for use with the *fullselect* that follows. For more information see "common-table-expression" on page 513.

A declared temporary table must not be referenced in the *fullselect* unless the view is created in schema QTEMP.

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The ORDER BY and FETCH FIRST clauses may not be specified except within a *common-table-expression*.

WITH CASCADED CHECK OPTION or WITH LOCAL CHECK OPTION

Specifies that every row that is inserted or updated through the view must conform to the definition of the view. A row that does not conform to the definition of the view is a row that cannot be retrieved using that view.

CHECK OPTION must not be specified if:

- the view is read-only
- the definition of the view includes a subquery other than a scalar fullselect in the outer select list of the view
- the definition of the view contains a non-deterministic, MODIFIES SQL DATA, or EXTERNAL ACTION function in other than the outer select list of the view
- the definition of the view contains a special register in other than the outer select list of the view
- · the view references another view and that view has an INSTEAD OF trigger
- the view is recursive

If CHECK OPTION is specified for an updatable view that does not allow inserts, then the check option applies to updates only.

If CHECK OPTION is omitted, the definition of the view is not used in the checking of any insert or update operations that use the view. Some checking might still occur during insert or update operations if the view is directly or indirectly dependent on another view that includes a CHECK OPTION. Because the definition of the view is not used, rows that do not conform to the definition of the view might be inserted or updated through the view.

The difference between the two forms of the CHECK OPTION clause, CASCADED and LOCAL, is meaningful only when a view is dependent on another view. The default is CASCADED. The view upon which another view is directly or indirectly defined is an *underlying view*.

CASCADED

The WITH CASCADED CHECK OPTION on a view V is inherited by any updatable view that is directly or indirectly dependent on V. Thus, if an updatable view is defined on V, the check option on V also applies to that view, even if WITH CHECK OPTION is not specified on that view. For example, consider the following updatable views:

CREATE VIEW V1 AS SELECT COL1 FROM T1 WHERE COL1 > 10

CREATE VIEW V2 AS SELECT COL1 FROM V1 WITH CHECK OPTION

CREATE VIEW V3 AS SELECT COL1 FROM V2 WHERE COL1 < 100

SQL statement	Description of result		
INSERT INTO V1 VALUES(5)	Succeeds because V1 does not have a CHECK OPTION clause and it is not dependent on any other view that has a CHECK OPTION clause.		
INSERT INTO V2 VALUES(5)	Results in an error because the inserted row does not conform to the search condition of V1 which is implicitly part of the definition of V2.		
INSERT INTO V3 VALUES(5)	Results in an error because V3 is dependent on V2 which has a CHECK OPTION clause and the inserted row does not conform to the definition of V2.		

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SQL statement	Description of result
INSERT INTO V3 VALUES(200)	Succeeds even though it does not conform to the definition of V3 (V3 does not have the view CHECK OPTION clause specified); it does conform to the definition of V2 (which does have the view CHECK OPTION clause specified).

LOCAL

WITH LOCAL CHECK OPTION is identical to WITH CASCADED CHECK OPTION except that it is still possible to update a row so that it no longer conforms to the definition of the view when the view is defined with the WITH LOCAL CHECK OPTION. This can only happen when the view is directly or indirectly dependent on a view that was defined without either WITH CASCADED CHECK OPTION or WITH LOCAL CHECK OPTION clauses.

WITH LOCAL CHECK OPTION specifies that the search conditions of the following underlying views are checked when a row is inserted or updated:

- · views that specify WITH LOCAL CHECK OPTION
- views that specify WITH CASCADED CHECK OPTION
- all underlying views of a view that specifies WITH CASCADED CHECK OPTION

In contrast, WITH CASCADED CHECK OPTION specifies that the search conditions of all underlying views are checked when a row is inserted or updated.

The difference between CASCADED and LOCAL is best shown by example. Consider the following updatable views where x and y represent either LOCAL or CASCADED:

```
V1 defined on table T0
V2 defined on V1 WITH x CHECK OPTION
V3 defined on V2
V4 defined on V3 WITH y CHECK OPTION
V5 defined on V4
```

The following table describes which views search conditions are checked during an INSERT or UPDATE operation:

Table 59. Views whose search conditions are checked during INSERT and UPDATE

T. 1 .	x = LOCAL	x = CASCADED	x = LOCAL	x = CASCADED
View used in INSERT or UPDATE	y = LOCAL	y = CASCADED	y = CASCADED	y = LOCAL
V1	none	none	none	none
V2	V2	V2 V1	V2	V2 V1
V3	V2	V2 V1	V2	V2 V1
V4	V4 V2	V4 V3 V2 V1	V4 V3 V2 V1	V4 V2 V1
V5	V4 V2	V4 V3 V2 V1	V4 V3 V2 V1	V4 V2 V1

RCDFMT format-name

An unqualified name that designates the IBM i record format name of the view. A *format-name* is a system identifier.

If a record format name is not specified, the *format-name* is the same as the *system-object-name* of the view.

Notes

View ownership: If SQL names were specified:

- If a user profile with the same name as the schema into which the view is created exists, the *owner* of the view is that user profile.
- Otherwise, the *owner* of the view is the user profile or group user profile of the job executing the statement.

If system names were specified, the *owner* of the view is the user profile or group user profile of the job executing the statement.

View authority: If SQL names are used, views are created with the system authority of *EXCLUDE on *PUBLIC. If system names are used, views are created with the authority to *PUBLIC as determined by the create authority (CRTAUT) parameter of the schema.

If the owner of the view is a member of a group profile (GRPPRF keyword) and group authority is specified (GRPAUT keyword), that group profile will also have authority to the view.

The owner always acquires the SELECT privilege WITH GRANT OPTION on the view and the authorization to drop the view.

The owner can also acquire the INSERT, UPDATE, and DELETE privileges on the view. If the view is not read-only, then the same privileges will be acquired on the new view as the owner has on the table or view identified in the first FROM clause of the fullselect. These privileges can be granted only if the privileges from which they are derived can also be granted.

Deletable views: A view is *deletable* if an INSTEAD OF trigger for the delete operation has been defined for the view, or if all of the following are true:

- The outer fullselect identifies only one base table or deletable view that is not a catalog table or view and is not in a nested table expression.
- The outer fullselect does not include a VALUES clause.
- The outer fullselect does not include a GROUP BY clause or HAVING clause.
- The outer fullselect does not include aggregate functions in the select list.
- The outer fullselect does not include a UNION, UNION ALL, EXCEPT, or INTERSECT operator.
- The outer fullselect does not include the DISTINCT clause.

Updatable views: A view is *updatable* if an INSTEAD OF trigger for the update operation has been defined for the view, or if all of the following are true:

- independent of an INSTEAD OF trigger for delete, the view is deletable
- at least one column of the view is updatable.

A column of a view is *updatable* if an INSTEAD OF trigger for the update operation has been defined for the view, or if the corresponding result column of the *subselect* is derived solely from a column of a table or an updatable column of another view (that is, it is not derived from an expression that contains an operator, scalar function, constant, or a column that itself is derived from such expressions).

Insertable views: A view is *insertable* if an INSTEAD OF trigger has been defined for the view, or if at least one column of the view is updatable.

Read-only views: A view is *read-only* if it is not deletable.

A read-only view cannot be the object of an INSERT, UPDATE, or DELETE statement.

Unqualified table names: If the CREATE VIEW statement refers to an unqualified table name, the following rules are applied to determine which table is actually being referenced:

- If the unqualified name corresponds to one or more common table expression *table-identifiers* that are specified in the *fullselect*, the name identifies the common table expression that is in the innermost scope.
- Otherwise, the name identifies a persistent table, a temporary table, or a view that is present in the default schema.

Collating sequence: The view is created with the collating sequence in effect at the time the CREATE VIEW statement is executed. The collating sequence of the view applies to all comparisons involving SBCS data and mixed data in the view fullselect. When the view is included in a query, an intermediate result table is generated from the view fullselect. The collating sequence in effect when the query is executed applies to any selection specified in the query.

View attributes: Views are created as nonkeyed logical files. When a view is created, the file wait time and record wait time attributes are set to the default that is specified on the WAITFILE and WAITRCD keywords of the Create Logical File (CRTLF) command.

The date and time format used for date and time result columns is ISO.

A view created over a distributed table is created on all of the systems across which the table is distributed. If a view is created over more than one distributed table, and those tables are not distributed using the same nodegroup, then the view is created only on the system that performs the CREATE VIEW statement. For more information about distributed tables, see the DB2 Multisystem topic collection.

Identity columns: A column of a view is considered an identity column if the element of the corresponding column in the fullselect of the view definition is the name of an identity column of a table, or the name of a column of a view which directly or indirectly maps to the name of an identity column of a base table. In all other cases, the columns of a view will not get the identity property. For example:

- the select-list of the view definition includes multiple instances of the name of an identity column (that is, selecting the same column more than once)
- · the view definition involves a join
- a column in the view definition includes an expression that refers to an identity column
- the view definition includes a UNION or INTERSECT

Considerations for implicitly hidden columns: It is possible that the result table of the *fullselect* will include a column of a base table that is defined as implicitly hidden. This can occur when the implicitly hidden column is explicitly referenced

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in the fullselect of the view definition. However, the corresponding column of the view does not inherit the implicitly hidden attribute. Columns of a view cannot be defined as implicitly hidden.

Examples

Example 1: Create a view named MA_PROJ over the PROJECT table that contains only those rows with a project number (PROJNO) starting with the letters 'MA'.

```
CREATE VIEW MA PROJ
 AS SELECT * FROM PROJECT
       WHERE SUBSTR(PROJNO, 1, 2) = 'MA'
```

Example 2: Create a view as in example 1, but select only the columns for project number (PROJNO), project name (PROJNAME) and employee in charge of the project (RESPEMP).

```
CREATE VIEW MA PROJ
 AS SELECT PROJNO, PROJNAME, RESPEMP FROM PROJECT
      WHERE SUBSTR(PROJNO, 1, 2) = 'MA'
```

Example 3: Create a view as in example 2, but, in the view, call the column for the employee in charge of the project IN_CHARGE.

```
CREATE VIEW MA PROJ (PROJNO, PROJNAME, IN CHARGE)
 AS SELECT PROJNO, PROJNAME, RESPEMP FROM PROJECT
      WHERE SUBSTR(PROJNO, 1, 2) = 'MA'
```

Note: Even though you are changing only one of the column names, the names of all three columns in the view must be listed in the parentheses that follow MA PROJ.

Example 4: Create a view named PRJ_LEADER that contains the first four columns (PROJNO, PROJNAME, DEPTNO, RESPEMP) from the PROJECT table together with the last name (LASTNAME) of the person who is responsible for the project (RESPEMP). Obtain the name from the EMPLOYEE table by matching EMPNO in EMPLOYEE to RESEMP in PROJECT.

```
CREATE VIEW PRJ LEADER
 AS SELECT PROJNO, PROJNAME, DEPTNO, RESPEMP, LASTNAME
      FROM PROJECT, EMPLOYEE
      WHERE RESPEMP = EMPNO
```

Example 5: Create a view as in example 4, but in addition to the columns PROJNO, PROJNAME, DEPTNO, RESEMP and LASTNAME, show the total pay (SALARY + BONUS +COMM) of the employee who is responsible. Also select only those projects with mean staffing (PRSTAFF) greater than one.

```
CREATE VIEW PRJ LEADER (PROJNO, PROJNAME, DEPTNO, RESPEMP, LASTNAME, TOTAL PAY)
 AS SELECT PROJNO, PROJNAME, DEPTNO, RESPEMP, LASTNAME, SALARY+BONUS+COMM
      FROM PROJECT, EMPLOYEE
      WHERE RESPEMP = EMPNO AND PRSTAFF > 1
```

Example 6: Create a recursive view that returns a similar result as a common table expression, see "Example 1: Single level explosion" on page 517.

```
CREATE RECURSIVE VIEW RPL (PART, SUBPART, QUANTITY) AS
       SELECT ROOT.PART, ROOT.SUBPART, ROOT.QUANTITY
           FROM PARTLIST ROOT
           WHERE ROOT.PART = '01'
       UNION ALL
       SELECT CHILD.PART, CHILD.SUBPART, CHILD.QUANTITY
           FROM RPL PARENT, PARTLIST CHILD
           WHERE PARENT.SUBPART = CHILD.PART
```

CREATE VIEW

SELECT DISTINCT * **FROM**RPL ORDER BY PART, SUBPART, QUANTITY

DEALLOCATE DESCRIPTOR

The DEALLOCATE DESCRIPTOR statement deallocates an SQL descriptor.

Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It cannot be issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

Authorization

None required.

Syntax



Description

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation. The descriptor known in this local scope is deallocated.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session. The descriptor known to any program that executes using the same database connection is deallocated.

SQL-descriptor-name

Names the descriptor to deallocate. The name must identify a descriptor that already exists with the specified scope.

Notes

Descriptor persistence: Local and global descriptors are also implicitly deallocated. For more information, see Descriptor persistence

Examples

Deallocate a descriptor called 'NEWDA'.

EXEC SOL DEALLOCATE DESCRIPTOR 'NEWDA'

DECLARE CURSOR

The DECLARE CURSOR statement defines a cursor.

Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in Java.

Authorization

No authorization is required to use this statement. However to use OPEN or FETCH for the cursor, the privileges held by the authorization ID of the statement must include at least one of the following:

- For each table or view identified in the SELECT statement of the cursor:
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

The SELECT statement of the cursor is one of the following:

- The prepared *select-statement* identified by the *statement-name*.
- The specified *select-statement*.

If *statement-name* is specified:

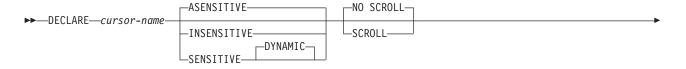
- The authorization ID of the statement is the run-time authorization ID unless DYNUSRPRF(*OWNER) was specified on the CRTSQLxxx command when the program was created. For more information, see "Authorization IDs and authorization names" on page 64.
- The authorization check is performed when the *select-statement* is prepared unless DLYPRP(*YES) is specified on the CRTSQLxxx command.
- The authorization check is performed when the cursor is opened for programs compiled with the DLYPRP(*YES) parameter.

If the *select-statement* is specified:

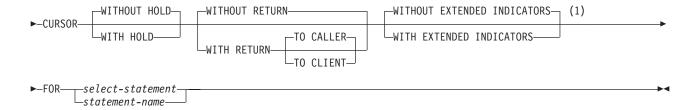
- If USRPRF(*OWNER) or USRPRF(*NAMING) with SQL naming was specified
 on the CRTSQLxxx command, the authorization ID of the statement is the owner
 of the SQL program or package.
- If USRPRF(*USER) or USRPRF(*NAMING) with system naming was specified on the CRTSQLxxx command, the authorization ID of the statement is the run-time authorization ID.
- In REXX, the authorization ID of the statement is the run-time authorization ID.
- The authorization check is performed when the cursor is opened.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax



DECLARE CURSOR



Notes:

1 The HOLD, RETURN, and EXTENDED INDICATORS clauses can be specified in any order.

Description

cursor-name

Names a cursor. The name must not be the same as the name of another cursor declared in your source program.

ASENSITIVE, SENSITIVE, or INSENSITIVE

Specifies whether the cursor is asensitive, sensitive, or insensitive to changes.

ASENSITIVE

Specifies that the cursor may behave as SENSITIVE or INSENSITIVE depending on how the *select-statement* is optimized. If *statement-name* is specified, the default is the corresponding prepare attribute of the statement. Otherwise, this is the default.

SENSITIVE

Specifies that changes made to the database after the cursor is opened are visible in the result table. The cursor has some level of sensitivity to any updates or deletes made to the rows underlying its result table after the cursor is opened. The cursor is always sensitive to positioned updates or deletes using the same cursor. Additionally, the cursor can have sensitivity to changes made outside this cursor. If the database manager cannot make changes visible to the cursor, then an error is returned. The database manager cannot make changes visible to the cursor when the cursor implicitly becomes read-only. (See Result table of a cursor.) If SENSITIVE is specified, the SELECT statement cannot contain a *data-change-table-reference*.

INSENSITIVE

Specifies that once the cursor is opened, it does not have sensitivity to inserts, updates, or deletes performed by this or any other activation group. If INSENSITIVE is specified, the cursor is read-only and a temporary result is created when the cursor is opened. In addition, the SELECT statement cannot contain a UPDATE clause and the application must allow a copy of the data (ALWCPYDTA(*OPTIMIZE) or ALWCPYDTA(*YES)).

NO SCROLL or SCROLL

Specifies whether the cursor is scrollable or not scrollable.

NO SCROLL

Specifies that the cursor is not scrollable. If *statement-name* is specified, the default is the corresponding prepare attribute of the statement. Otherwise, this is the default.

SCROLL

Specifies that the cursor is scrollable. The cursor may or may not have immediate sensitivity to inserts, updates, and deletes done by other activation groups.

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WITHOUT HOLD

Does not prevent the cursor from being closed as a consequence of a commit operation. If *statement-name* is specified, the default is the corresponding prepare attribute of the statement. Otherwise, this is the default.

WITH HOLD

Prevents the cursor from being closed as a consequence of a commit operation. A cursor declared using the WITH HOLD clause is implicitly closed at commit time only if the connection associated with the cursor is ended during the commit operation.

When WITH HOLD is specified, a commit operation commits all the changes in the current unit of work, and releases all locks except those that are required to maintain the cursor position. Afterward, a FETCH statement is required before a Positioned UPDATE or DELETE statement can be executed.

All cursors are implicitly closed by a CONNECT (Type 1) or rollback operation. All cursors associated with a connection are implicitly closed by a disconnect of the connection. A cursor is also implicitly closed by a commit operation if WITH HOLD is not specified, or if the connection associated with the cursor is in the release-pending state.

If a cursor is closed before the commit operation, the effect is the same as if the cursor was declared without the WITH HOLD option.

WITHOUT RETURN or WITH RETURN

Specifies whether the result table of the cursor is intended to be used as a result set that will be returned from a procedure.

WITHOUT RETURN

Specifies that the result table of the cursor is not intended to be used as a result set that will be returned from a procedure. If *statement-name* is specified, the default is the corresponding prepare attribute of the statement. Otherwise, this is the default.

WITH RETURN

Specifies that the result table of the cursor is intended to be used as a result set that will be returned from a procedure. WITH RETURN is relevant only if the DECLARE CURSOR statement is contained within the source code for a procedure. In other cases, the precompiler may accept the clause, but it has no effect.

For SQL procedures, result sets are only returned if a DYNAMIC RESULT SETS clause with a nonzero maximum number of result sets is specified on the procedure definition.

- Cursors defined by using the WITH RETURN clause that are still open when the procedure ends define the result sets for the procedure. All other open cursors are closed when the procedure ends, provided the procedure was not created with CLOSQLCSR(*ENDACTGRP).
- If no cursors in the stored procedure are defined by using the WITH RETURN or WITHOUT RETURN clause, then any cursor that is open when the stored procedure ends potentially becomes a result set cursor.

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DECLARE CURSOR

 See the DYNAMIC RESULT SETS clause in "CREATE PROCEDURE (SQL)" on page 745 for further considerations that determine a procedure's result sets.

For external procedures:

- Any cursors that are defined by using the WITH RETURN clause (or identified as a result set cursor in a SET RESULT SETS statement) and that are still open when the procedure ends define the potential result sets for the procedure, provided the procedure was not created with CLOSQLCSR(*ENDACTGRP). All other open cursors remain open.
- If no cursors in the stored procedure are defined by using the WITH RETURN or WITHOUT RETURN clause, and no cursors are identified as a result set cursor in a SET RESULT SETS statement, then any cursor that is open when the stored procedure ends potentially becomes a result set cursor.
- See the DYNAMIC RESULT SETS clause in "CREATE PROCEDURE (External)" on page 731 for further considerations that determine a procedure's result sets.

For non-scrollable cursors, the result set consists of all rows from the current cursor position to the end of the result table. For scrollable cursors, the result set consists of all rows of the result table.

TO CALLER

Specifies that the cursor can return a result set to the caller of the procedure. For example, if the caller is a client application, the result set is returned to the client application.

TO CLIENT

Specifies that the cursor can return a result set to the client application. This cursor is invisible to any intermediate nested procedures. If a function or trigger called the procedure either directly or indirectly, result sets cannot be returned to the client and the cursor will be closed after the procedure finishes.

TO CLIENT may be necessary if the result set is returned from an ILE program with multiple modules.

WITHOUT EXTENDED INDICATORS or WITH EXTENDED INDICATORS Specifies whether extended indicators are enabled.

WITHOUT EXTENDED INDICATORS

Specifies that extended indicator variables are not enabled, and only updatable columns are allowed in the implicit or explicit UPDATE clause or the *select-statement*. If *statement-name* is specified, the default is the corresponding prepare attribute of the statement. Otherwise, the default is the attribute specified on the containing program or service program.

WITH EXTENDED INDICATORS

Specifies that extended indicator variables are enabled, and non-updatable columns are allowed in the implicit or explicit UPDATE clause of the *select-statement*.

select-statement

Specifies the SELECT statement of the cursor. See "select-statement" on page 512 for more information.

The *select-statement* must not include parameter markers (except for REXX), but can include references to variables. In host languages, other than REXX, the declarations of the host variables must precede the DECLARE CURSOR

statement in the source program. In REXX, parameter markers must be used in place of variables and the statement must be prepared.

statement-name

The SELECT statement of the cursor is the prepared *select-statement* identified by the *statement-name* when the cursor is opened. The *statement-name* must not be identical to a *statement-name* specified in another DECLARE CURSOR statement of the source program. See "PREPARE" on page 1020 for an explanation of prepared statements.

Notes

Placement of DECLARE CURSOR: The DECLARE CURSOR statement must precede all statements that explicitly reference the cursor by name, except in C and PL/I.

Result table of a cursor: A cursor in the open state designates a *result table* and a position relative to the rows of that table. The table is the result table specified by the SELECT statement of the cursor.

A cursor is *deletable* if all of the following are true:

- The outer fullselect identifies only one base table or deletable view that is not a catalog table or view and is not in a nested table expression.
- The outer fullselect does not include a VALUES clause.
- The outer fullselect does not include a GROUP BY clause or HAVING clause.
- The outer fullselect does not include aggregate functions in the select list.
- The outer fullselect does not include a UNION, UNION ALL, EXCEPT, or INTERSECT operator.
- The select-clause of the outer fullselect does not include the DISTINCT clause.
- The outer fullselect does not include a *data-change-table-reference* in the FROM clause
- The select-statement does not contain an ORDER BY clause and does not contain the UPDATE clause and SENSITIVE is not specified in the DECLARE CURSOR statement
- The select-statement does not include a FOR READ ONLY clause.
- The select-statement does not include a FETCH FIRST n ROWS ONLY clause.
- The result of the outer fullselect does not make use of a temporary table.
- The *select-statement* does not include the SCROLL keyword, or the SENSITIVE keyword or UPDATE clause is also specified.
- The select list does not include a DATALINK column unless a UPDATE clause is specified.

A result column in the select list of the outer fullselect associated with a cursor is *updatable* if all of the following are true:

- The cursor is deletable.
- The result column is derived solely from a column of a table or an updatable column of a view. That is, at least one result column must not be derived from an expression that contains an operator, scalar function, constant, or a column that itself is derived from such expressions.

A cursor is read-only if it is not deletable.

If the UPDATE clause is omitted, only the columns in the SELECT clause of the subselect that can be updated can be changed.

If UPDATE is specified without a list of column names, then the list of columns that can appear as targets in the assignment clause of subsequent positioned UPDATE statements identifying this cursor is determined as follows:

- If WITH EXTENDED INDICATORS is specified, all the columns of the table or view identified in the first FROM clause of the fullselect.
- Otherwise, only the updatable columns of the table or view identified in the first FROM clause of the fullselect.

If UPDATE is specified with a list of column names, only the columns specified in the list of column names can be appear as targets in the assignment clause in subsequent positioned UPDATE statements identifying this cursor.

If the EXTENDED INDICATORS clause is specified on the DECLARE CURSOR statement, that value takes precedence over any value specified on the PREPARE statement or during precompile. If a DECLARE CURSOR does not specify the EXTENDED INDICATORS clause, a value specified on the PREPARE takes precedence over a value from the precompile.

Scope of a cursor: The scope of *cursor-name* is the source program in which it is defined; that is, the program submitted to the precompiler. Thus, a cursor can only be referenced by statements that are precompiled with the cursor declaration. For example, a program called from another separately compiled program cannot use a cursor that was opened by the calling program.

The scope of cursor-name is also limited to the thread in which the program that contains the cursor is running. For example, if the same program is running in two separate threads in the same job, the second thread cannot use a cursor that was opened by the first thread.

A cursor can only be referred to in the same instance of the program in the program stack unless CLOSQLCSR(*ENDJOB), CLOSQLCSR(*ENDSQL), or CLOSQLCSR(*ENDACTGRP) is specified on the CRTSQLxxx commands.

- If CLOSQLCSR(*ENDJOB) is specified, the cursor can be referred to by any instance of the program on the program stack.
- If CLOSQLCSR(*ENDSQL) is specified, the cursor can be referred to by any instance of the program on the program stack until the last SQL program on the program stack ends.
- If CLOSQLCSR(*ENDACTGRP) is specified, the cursor can be referred to by all instances of the module in the activation group until the activation group ends.

Although the scope of a cursor is the program in which it is declared, each package created from the program includes a separate instance of the cursor and more than one cursor can exist at run time. For example, assume a program using CONNECT (Type 2) statements connects to location X and location Y in the following sequence:

```
EXEC SQL DECLARE C CURSOR FOR...
EXEC SQL CONNECT TO X;
EXEC SQL OPEN C;
EXEC SQL FETCH C INTO...
EXEC SQL CONNECT TO Y;
EXEC SQL OPEN C;
EXEC SQL FETCH C INTO...
```

The second OPEN C statement does not cause an error because it refers to a different instance of cursor C.

A SELECT statement is evaluated at the time the cursor is opened. If the same cursor is opened, closed, and then opened again, the results may be different. If the SELECT statement of a cursor contains CURRENT DATE, CURRENT TIME, or CURRENT TIMESTAMP, all references to these special registers will yield the same respective datetime value on each FETCH. The value is determined when the cursor is opened. Multiple cursors using the same SELECT statement can be opened concurrently. They are each considered independent activities.

Using sequence expressions: For information regarding using NEXT VALUE and PREVIOUS VALUE expressions with a cursor, see Using sequence expressions with a cursor.

Blocking of data: For more efficient processing of data, the database manager can block data for read-only cursors. If a cursor is not going to be used in a Positioned UPDATE or DELETE statement, it should be declared as FOR READ ONLY.

Usage in REXX: If variables are used on the DECLARE CURSOR statement within a REXX procedure, then the DECLARE CURSOR must be the object of a PREPARE and EXECUTE.

Temporary results: Certain *select-statements* may be implemented as temporary result tables.

- A temporary result table is created when:
 - INSENSITIVE is specified
 - The ORDER BY and GROUP BY clauses specify different columns or columns in a different order.
 - The ORDER BY and GROUP BY clauses include a user-defined function or one of the following scalar functions: DLVALUE, DLURLPATH, DLURLPATHONLY, DLURLSERVER, DLURLSCHEME, or DLURLCOMPLETE for DataLinks with an attribute of FILE LINK CONTROL and READ PERMISSION DB.
 - The UNION, EXCEPT, INTERSECT, or DISTINCT clauses are specified.
 - The ORDER BY or GROUP BY clauses specify columns which are not all from the same table.
 - A logical file defined by the JOINDFT data definition specifications (DDS) keyword is joined to another file.
 - A logical file that is based on multiple database file members is specified.
 - The CURRENT or RELATIVE scroll options are specified on the FETCH statement when the select statement of the DECLARE CURSOR contains a GROUP BY clause.
 - The FETCH FIRST n ROWS ONLY clause is specified.
- Queries that include a subquery where:
 - The outermost query does not provide correlated values to any inner subselects.
 - No IN, = ANY, = SOME, or <> ALL subqueries are referenced by the outermost query.

Cursor sensitivity: The ALWCPYDTA precompile option is ignored for DYNAMIC SCROLL cursors. If sensitivity to inserts, updates, and deletes must be maintained, a temporary copy of the data is never made unless a temporary result is required to implement the query.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

DYNAMIC SCROLL is a synonym for SENSITIVE DYNAMIC SCROLL

Examples

Example 1: Declare C1 as the cursor of a query to retrieve data from the table DEPARTMENT. The query itself appears in the DECLARE CURSOR statement.

```
EXEC SQL DECLARE C1 CURSOR FOR

SELECT DEPTNO, DEPTNAME, MGRNO
FROM DEPARTMENT
WHERE ADMRDEPT = 'A00';
```

Example 2: Declare C1 as the cursor of a query to retrieve data from the table DEPARTMENT. Assume that the data will be updated later with a searched update and should be locked when the query executes. The query itself appears in the DECLARE CURSOR statement.

```
EXEC SQL DECLARE C1 CURSOR FOR

SELECT DEPTNO, DEPTNAME, MGRNO
FROM DEPARTMENT
WHERE ADMRDEPT = 'A00'
FOR READ ONLY WITH RS USE AND KEEP EXCLUSIVE LOCKS;
```

Example 3: Declare C2 as the cursor for a statement named STMT2.

```
EXEC SQL DECLARE C2 CURSOR FOR STMT2;
```

Example 4: Declare C3 as the cursor for a query to be used in positioned updates of the table EMPLOYEE. Allow the completed updates to be committed from time to time without closing the cursor.

```
EXEC SQL DECLARE C3 CURSOR WITH HOLD FOR

SELECT *

FROM EMPLOYEE

FOR UPDATE OF WORKDEPT, PHONENO, JOB, EDLEVEL, SALARY;
```

Instead of explicitly specifying the columns to be updated, an UPDATE clause could have been used without naming the columns. This would allow all the updatable columns of the table to be updated. Since this cursor is updatable, it can also be used to delete rows from the table.

Example 5: In a C program, use the cursor C1 to fetch the values for a given project (PROJNO) from the first four columns of the EMPPROJACT table a row at a time and put them into the following host variables: EMP(CHAR(6)), PRJ(CHAR(6)), ACT(SMALLINT) and TIM(DECIMAL(5,2)). Obtain the value of the project to search for from the host variable SEARCH_PRJ (CHAR(6)). Dynamically prepare the *select-statement* to allow the project to search by to be specified when the program is executed.

```
void main ()
{
    EXEC SQL BEGIN DECLARE SECTION;
    char EMP[7];
    char PRJ[7];
```

```
SEARCH_PRJ[7];
    char
    short
                   ACT;
    double
                   TIM;
                   SELECT_STMT[201];
   char
   EXEC SQL END DECLARE SECTION;
    EXEC SQL INCLUDE SQLCA;
    strcpy(SELECT_STMT, "SELECT EMPNO, PROJNO, ACTNO, EMPTIME \
                   FROM EMPPROJACT \
                   WHERE PROJNO = ?");
    EXEC SQL PREPARE SELECT_PRJ FROM :SELECT_STMT;
    EXEC SQL DECLARE C1 CURSOR FOR SELECT PRJ;
/* Obtain the value for SEARCH PRJ from the user.
                                                       */
   EXEC SQL OPEN C1 USING : SEARCH PRJ;
   EXEC SQL FETCH C1 INTO : EMP, : PRJ, : ACT, :TIM;
    if (strcmp(SQLSTATE, "02000", 5) )
        data not found();
    else
       while (strcmp(SQLSTATE, "00", 2) || strcmp(SQLSTATE, "01", 2) )
            EXEC SQL FETCH C1 INTO : EMP, : PRJ, : ACT, :TIM;
   EXEC SQL CLOSE C1;
  }
```

Example 6: The DECLARE CURSOR statement associates the cursor name C1 with the results of the SELECT. C1 is an updatable, scrollable cursor.

```
EXEC SQL DECLARE C1 SENSITIVE SCROLL CURSOR FOR SELECT DEPTNO, DEPTNAME, MGRNO FROM TDEPT WHERE ADMRDEPT = 'A00';
```

Example 7: Declare a cursor in order to fetch values from four columns and assign the values to variables using the Serializable (RR) isolation level:

```
DECLARE CURSOR1 CURSOR FOR
SELECT COL1, COL2, COL3, COL4
FROM TBLNAME WHERE COL1 = :varname
WITH RR
```

Example 8: Assume that the EMPLOYEE table has been altered to add a generated column, WEEKLYPAY, that calculates the weekly pay based on the yearly salary. Declare a cursor to retrieve the system generated column value from a row to be inserted.

```
DECLARE C2 CURSOR FOR
SELECT E.WEEKLYPAY
FROM FINAL TABLE
```

DECLARE CURSOR

(INSERT INTO EMPLOYEE (EMPNO, FIRSTNME, MIDINIT, LASTNAME, EDLEVEL, SALARY) VALUES('000420', 'Peter', 'U', 'Bender', 16, 31842)) AS E;

DECLARE GLOBAL TEMPORARY TABLE

The DECLARE GLOBAL TEMPORARY TABLE statement defines a declared temporary table for the current application process. The declared temporary table description does not appear in the system catalog. It is not persistent and cannot be shared with other application processes. Each application process that defines a declared temporary table of the same name has its own unique description of the temporary table. When the application process ends, the temporary table is dropped.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

If the LIKE or AS *select-statement* clause is specified, the privileges held by the authorization ID of the statement must include at least one of the following on any table or view specified in the LIKE clause or *as-result-table* clause:

- · The SELECT privilege for the table or view
- Ownership of the table or view
- · Administrative authority

If a distinct type is referenced, the privileges held by the authorization ID of the statement must include at least one of the following:

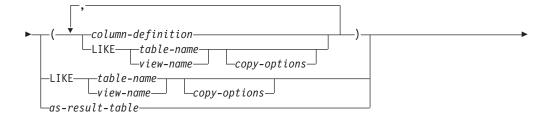
- For each distinct type identified in the statement:
 - The USAGE privilege on the distinct type, and
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View and Corresponding System Authorities When Checking Privileges to a Distinct Type.

Syntax

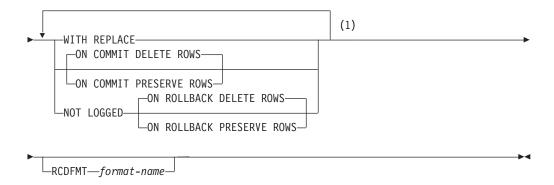
I

▶►—DECLARE GLOBAL TEMPORARY TABLE—table-name—

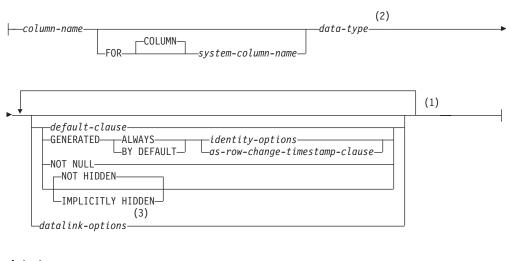


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DECLARE GLOBAL TEMPORARY TABLE



column-definition:



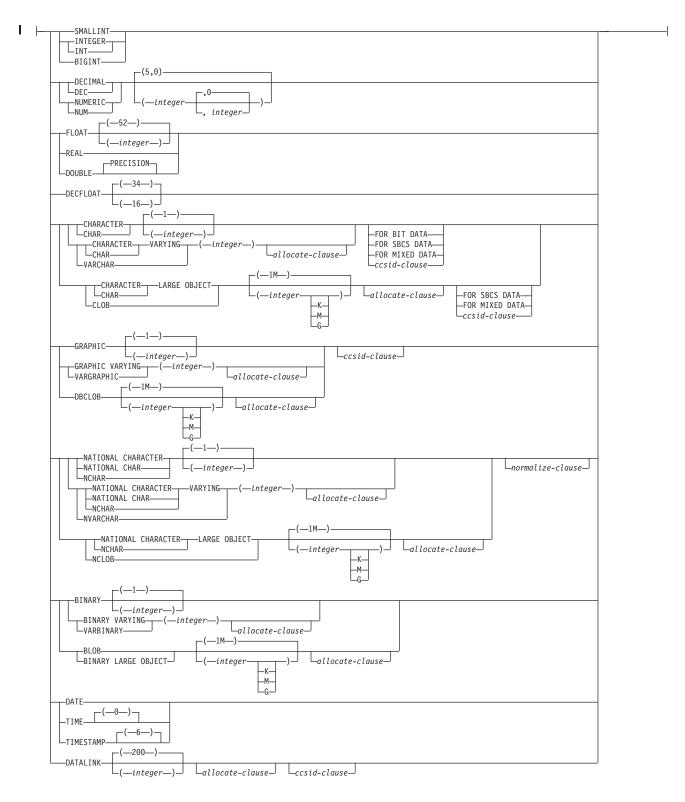
data-type:

```
-__built-in-type-
distinct-type-name-
```

Notes:

- 1 The same clause must not be specified more than once.
- 2 data-type is optional for row change timestamp columns
- 3 The datalink-options can only be specified for DATALINKs and distinct-types sourced on DATALINKs.

built-in-type:



ccsid-clause:

DECLARE GLOBAL TEMPORARY TABLE

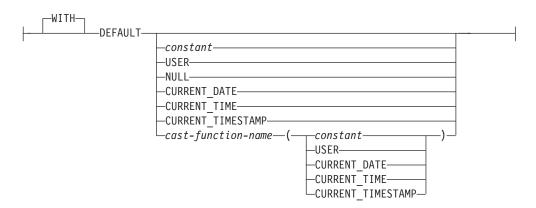
normalize-clause:

```
NOT NORMALIZED—
NORMALIZED—
NORMALIZED—
```

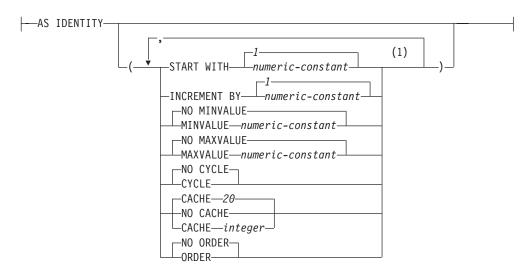
allocate-clause:

```
---ALLOCATE--(integer)----
```

default-clause:



identity-options:



Notes:

1 The same clause must not be specified more than once.

as-row-change-timestamp-clause:

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP—

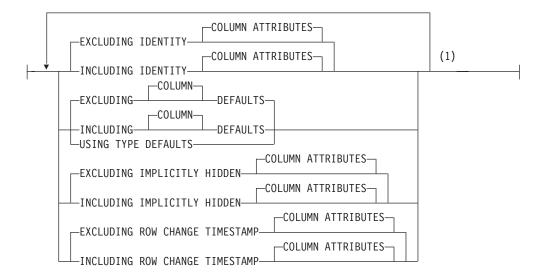
DECLARE GLOBAL TEMPORARY TABLE

datalink-options:

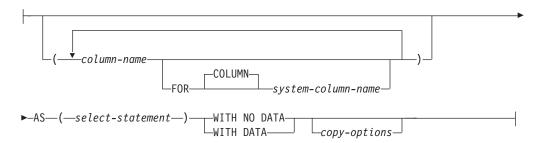


copy-options:

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as-result-table:



Notes:

1 The clauses can be specified in any order.

Description

table-name

Names the temporary table. The qualifier, if specified explicitly, must be SESSION, otherwise an error is returned. If the qualifier is not specified, it is implicitly defined to be SESSION. If a declared temporary table, or an index or view that is dependent on a declared temporary table already exists with the same name, an error is returned.

If a persistent table, view, index, or alias already exists with the same name and the schema name SESSION:

• The declared temporary table is still defined with SESSION. *table-name*. An error is not issued because the resolution of a declared temporary table name does not include a permanent library.

• Any references to SESSION. *table-name* will resolve to the declared temporary table rather than to a permanent table, view, index, or alias with a name of SESSION. *table-name*.

The table will be created in library QTEMP.

column-definition

Defines the attributes of a column. There must be at least one column definition and no more than 8000 column definitions.

The sum of the row buffer byte counts of the columns must not be greater than 32766 or, if a VARCHAR or VARGRAPHIC column is specified, 32740. Additionally, if a LOB is specified, the sum of the row data byte counts of the columns must not be greater than 3.5 gigabytes. For information about the byte counts of columns according to data type, see "Maximum row sizes" on page 807.

column-name

Names a column of the table. Do not qualify *column-name* and do not use the same name for more than one column of the table or for a system-column-name of the table.

FOR COLUMN system-column-name

Provides an IBM i name for the column. Do not use the same name for more than one column of the table or for a column-name of the table.

If the system-column-name is not specified, and the column-name is not a valid system-column-name, a system column name is generated. For more information about how system column names are generated, see "Rules for Column Name Generation" on page 809.

data-type

Specifies the data type of the column.

built-in-type

Specifies a built-in data type. See "CREATE TABLE" on page 768 for a description of *built-in-type*.

A ROWID column or a DATALINK column with FILE LINK CONTROL cannot be specified for a declared temporary table.

distinct-type-name

Specifies that the data type of the column is a distinct type (a user-defined data type). The length, precision, and scale of the column are respectively the length, precision, and scale of the source type of the distinct type. If a distinct type name is specified without a schema name, the distinct type name is resolved by searching the schemas on the SQL path.

DEFAULT

Specifies a default value for the column. This clause cannot be specified more than once in a *column-definition*. DEFAULT cannot be specified for an identity column (a column that is defined AS IDENTITY) or a row change timestamp column. The database manager generates default values for identity columns and row change timestamp columns. If a value is not specified following the DEFAULT keyword, then:

- if the column is nullable, the default value is the null value.
- if the column is not nullable, the default depends on the data type of the column:

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Data type	Default value
Numeric	0
Fixed-length character or graphic string	Blanks
Fixed-length binary string	Hexadecimal zeros
Varying-length string	A string length of 0
Date	The current date at the time of INSERT
Time	The current time at the time of INSERT
Timestamp	The current timestamp at the time of INSERT
Datalink	A value corresponding to DLVALUE(",'URL',")
distinct-type	The default value of the corresponding source type of the distinct type.

Omission of NOT NULL and DEFAULT from a *column-definition* is an implicit specification of DEFAULT NULL.

constant

Specifies the constant as the default for the column. The specified constant must represent a value that could be assigned to the column in accordance with the rules of assignment as described in "Assignments and comparisons" on page 89. A floating-point constant or decimal floating-point constant must not be used for a SMALLINT, INTEGER, DECIMAL, or NUMERIC column. A decimal constant must not contain more digits to the right of the decimal point than the specified scale of the column.

USER

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value of the column. The data type of the column must be CHAR or VARCHAR with a length attribute greater than or equal to the length attribute of the USER special register.

NULL

Specifies null as the default for the column. If NOT NULL is specified, DEFAULT NULL must not be specified within the same *column-definition*.

CURRENT_DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the column must be DATE or a distinct type based on a DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the column must be TIME or a distinct type based on a TIME.

CURRENT TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the column must be TIMESTAMP or a distinct type based on a TIMESTAMP.

cast-function-name

This form of a default value can only be used with columns defined as a distinct type, BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME or TIMESTAMP data types. The following table describes the allowed uses of these *cast-functions*.

DECLARE CLORAL TEMPORARY TARLE

DECLARE GLOBA	L TEMPORARY TABLE	
İ	Data Type	Cast Function Name
] 	Distinct type N based on a BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
 	Distinct type N based on a DATE, TIME, or TIMESTAMP	N (the user-defined cast function that was generated when N was created) **
[[or DATE, TIME, or TIMESTAMP *
 	Distinct type N based on other data types	N (the user-defined cast function that was generated when N was created) **
I I	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
 	DATE, TIME, or TIMESTAMP Notes:	DATE, TIME, or TIMESTAMP *
I I	* The name of the function must match the the distinct type) with an implicit or explicit	e name of the data type (or the source type of cit schema name of QSYS2.
 	qualified with a schema name, it must be t	the name of the distinct type for the column. If the same as the schema name for the distinct m function resolution must be the same as the
 	rules of a constant for the s data type if not a distinct t	argument. The constant must conform to the source type of the distinct type or for the ype. For BINARY, VARBINARY, BLOB, ME, and TIMESTAMP functions, the onstant.
I	USER	

USER

Specifies the value of the USER special register at the time of INSERT or UPDATE as the default value for the column. The data type of the source type of the distinct type of the column must be CHAR or VARCHAR with a length attribute greater than or equal to the length attribute of the USER special register.

CURRENT_DATE

Specifies the current date as the default for the column. If CURRENT_DATE is specified, the data type of the source type of the distinct type of the column must be DATE.

CURRENT_TIME

Specifies the current time as the default for the column. If CURRENT_TIME is specified, the data type of the source type of the distinct type of the column must be TIME.

CURRENT_TIMESTAMP

Specifies the current timestamp as the default for the column. If CURRENT_TIMESTAMP is specified, the data type of the source type of the distinct type of the column must be TIMESTAMP.

If the value specified is not valid, an error is returned.

GENERATED

Specifies that the database manager generates values for the column. GENERATED may be specified if the column is to be considered an identity column or a row change timestamp column.

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ALWAYS

Specifies that the database manager will always generate a value for the column when a row is inserted into the table. ALWAYS is the recommended value.

BY DEFAULT

Specifies that the database manager will generate a value for the column when a row is inserted only if a value is not specified for the column. If a value is specified, the database manager uses that value.

For an identity column or row change timestamp column, the database manager inserts a specified value but does not verify that it is a unique value for the column unless the identity column or row change timestamp column has a unique constraint or a unique index that solely specifies the identity column or row change timestamp column.

AS IDENTITY

Specifies that the column is an identity column for the table. A table can have only one identity column. AS IDENTITY can be specified only if the data type for the column is an exact numeric type with a scale of zero (SMALLINT, INTEGER, BIGINT, DECIMAL or NUMERIC with a scale of zero, or a distinct type based on one of these data types). If a DECIMAL or NUMERIC data type is specified, the precision must not be greater than 31.

An identity column is implicitly NOT NULL. An identity column cannot have a DEFAULT clause. See the AS IDENTITY clause in "CREATE TABLE" on page 768 for the descriptions of the identity attributes.

FOR EACH ROW ON UPDATE AS ROW CHANGE TIMESTAMP

Specifies that the column is a timestamp and the values will be generated by the database manager. The database manager generates a value for the column for each row as a row is inserted, and for every row in which any column is updated. The value generated for a row change timestamp column is a timestamp corresponding to the time of the insert or update of the row. If multiple rows are inserted with a single SQL statement, the value for the row change timestamp column may be different for each row to reflect when each row was inserted. The generated value is not guaranteed to be unique.

A table can have only one row change timestamp column. If *data-type* is specified, it must be a TIMESTAMP or a distinct type based on a TIMESTAMP. A row change timestamp column cannot have a DEFAULT clause and must be NOT NULL.

NOT NULL

Prevents the column from containing null values. Omission of NOT NULL implies that the column can be null. NOT NULL is required for a row change timestamp column.

NOT HIDDEN

Indicates the column is included in implicit references to the table in SQL statements. This is the default.

IMPLICITLY HIDDEN

Indicates the column is not visible in SQL statements unless it is referred to explicitly by name. For example, SELECT * does not include any hidden columns in the result. A table must contain at least one column that is not IMPLICITLY HIDDEN.

datalink-options

Specifies the options associated with a DATALINK data type.

LINKTYPE URL

Defines the type of link as a Uniform Resource Locator (URL).

NO LINK CONTROL

Specifies that there will not be any check made to determine that the linked files exist. Only the syntax of the URL will be checked. There is no database manager control over the linked files.

LIKE

table-name or view-name

Specifies that the columns defined in the specified table or view are included in this table. The *table-name* or *view-name* specified in a LIKE clause must identify the table or view that already exists at the application server.

The use of LIKE is an implicit definition of n columns, where n is the number of columns in the identified table or view. The implicit definition includes the following attributes of the n columns (if applicable to the data type):

- Column name (and system column name)
- · Data type, length, precision, and scale
- CCSID

If the LIKE clause is specified immediately following the *table-name* and not enclosed in parenthesis, the following column attributes are also included, otherwise they are not included (the default value, identity, row change timestamp, and hidden attributes can also be controlled by using the *copy-options*):

- Default value, if a *table-name* is specified (*view-name* is not specified)
- Identity attributes
- Nullability
- · Hidden attributes
- Row change timestamp attribute
- Column heading and text (see "LABEL" on page 1005)

If the specified table or view is a non-SQL created physical file or logical file, any non-SQL attributes are removed. For example, the date and time format will be changed to ISO.

The implicit definition does not include any other optional attributes of the identified table or view. For example, the new table does not automatically include a primary key or foreign key from a table. The new table has these and other optional attributes only if the optional clauses are explicitly specified.

as-result-table

column-name

Names a column of the table. Do not qualify *column-name* and do not use the same name for more than one column of the table or for a system-column-name of the table.

FOR COLUMN system-column-name

Provides an IBM i name for the column. Do not use the same name for more than one column of the table or for a column-name of the table.

If the system-column-name is not specified, and the column-name is not a valid system-column-name, a system column name is generated. For more information about how system column names are generated, see "Rules for Column Name Generation" on page 809.

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select-statement

Specifies that the columns of the table are to have the same name and description as the columns that would appear in the derived result table of the *select-statement* if the *select-statement* were to be executed. The use of AS *select-statement* is an implicit definition of n columns for the table, where n is the number of columns that would result from the *select-statement*. The implicit definition includes the following attributes of the n columns (if applicable to the data type):

- Column name (and system column name)
- Data type, length, precision, and scale
- CCSID
- Nullability
- Column heading and text (see "LABEL" on page 1005)

The following attributes are not included (the default value, identity, row change timestamp, and hidden attributes may be included by using the *copy-options*):

- Default value
- · Hidden attribute
- Identity attributes
- · Row change timestamp attribute

The implicit definition does not include any other optional attributes of the tables or views referenced in the *select-statement*.

The implicitly defined columns of the table inherit the names of the columns from the result table of the *select-statement*. Therefore, a column name must be specified in the *select-statement* or in the column name list for all result columns. For result columns that are derived from expressions, constants, and functions, the *select-statement* must include the AS column-name clause immediately after the result column or a name must be specified in the column list preceding the *select-statement*.

The *select-statement* must not refer to variables or include parameter markers (question marks). The *select-statement* must not contain a PREVIOUS VALUE or a NEXT VALUE expression. The UPDATE, SKIP LOCKED DATA, and USE AND KEEP EXCLUSIVE LOCKS clauses may not be specified.

WITH DATA

Specifies that the *select-statement* is executed. After the table is created, the result table rows of the *select-statement* are automatically inserted into the table.

WITH NO DATA

Specifies that the *select-statement* is not executed. Therefore, there is no result table with a set of rows with which to automatically populate the table.

copy-options

INCLUDING IDENTITY COLUMN ATTRIBUTES or EXCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies whether identity column attributes are inherited.

INCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies that the table inherits the identity attribute, if any, of the columns resulting from *select-statement*, *table-name*, or *view-name*. In general, the identity attribute is copied if the element of the corresponding column in the table, view, or *select-statement* is the name of a table column or the name of a view column that directly or indirectly maps to the name of a

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DECLARE GLOBAL TEMPORARY TABLE

base table column with the identity attribute. If the INCLUDING IDENTITY COLUMN ATTRIBUTES clause is specified with the AS *select-statement* clause, the columns of the new table do not inherit the identity attribute in the following cases:

- The select list of the *select-statement* includes multiple instances of an identity column name (that is, selecting the same column more than once).
- The select list of the *select-statement* includes multiple identity columns (that is, it involves a join).
- The identity column is included in an expression in the select list.
- The select-statement includes a set operation (UNION or INTERSECT).

If INCLUDING IDENTITY is not specified, the table will not have an identity column.

EXCLUDING IDENTITY COLUMN ATTRIBUTES

Specifies that the table does not inherit the identity attribute, if any, of the columns resulting from the *fullselect*, *table-name*, or *view-name*.

EXCLUDING COLUMN DEFAULTS or INCLUDING COLUMN DEFAULTS or USING TYPE DEFAULTS

Specifies whether column defaults are inherited.

EXCLUDING COLUMN DEFAULTS

Specifies that the column defaults are not inherited from the definition of the source table. The default values of the column of the new table are either null or there are no default values. If the column can be null, the default is the null value. If the column cannot be null, there is no default value, and an error occurs if a value is not provided for a column on INSERT for the new table.

INCLUDING COLUMN DEFAULTS

Specifies that the table inherits the default values of the columns resulting from the *select-statement*, *table-name*, or *view-name*. A default value is the value assigned to a column when a value is not specified on an INSERT.

Do not specify INCLUDING COLUMN DEFAULTS, if you specify USING TYPE DEFAULTS.

If INCLUDING COLUMN DEFAULTS is not specified, the default values are not inherited.

USING TYPE DEFAULTS

Specifies that the default values for the table depend on the data type of the columns that result from the *select-statement*, *table-name*, or *view-name*. If the column is nullable, then the default value is the null value. Otherwise, the default value is as follows:

Data type	Default value
Numeric	0
Fixed-length character or graphic string	Blanks
Fixed-length binary string	Hexadecimal zeros
Varying-length string	A string length of 0
Date	The current date at the time of INSERT
Time	The current time at the time of INSERT
Timestamp	The current timestamp at the time of INSERT

Data type	Default value
Datalink	A value corresponding to DLVALUE(",'URL',")
	The default value of the corresponding source type of the distinct type.

Do not specify USING TYPE DEFAULTS if INCLUDING COLUMN DEFAULTS is specified.

INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES or EXCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies whether implicitly hidden columns are inherited.

INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies that the table inherits implicitly hidden columns from *select-statement, table-name*, or *view-name* and those columns will be defined with the implicitly hidden attribute in the new table.

If INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES is not specified, the table will not have any implicitly hidden columns.

EXCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES

Specifies that the table does not inherit implicitly hidden columns from the *fullselect*, *table-name*, or *view-name*.

INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES or EXCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies whether the row change timestamp attribute is inherited.

INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies that the table inherits the row change timestamp attribute, if any, of the columns resulting from *select-statement*, *table-name*, or *view-name*. In general, the row change timestamp attribute is copied if the element of the corresponding column in the table, view, or *select-statement* is the name of a table column or the name of a view column that directly or indirectly maps to the name of a base table column with the row change timestamp attribute. If the INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES clause is specified with the AS *select-statement* clause, the columns of the new table do not inherit the row change timestamp in the following cases:

- The select list of the *select-statement* includes multiple instances of a row change timestamp column name (that is, selecting the same column more than once).
- The select list of the *select-statement* includes multiple row change timestamp columns (that is, it involves a join).
- The row change timestamp column is included in an expression in the select list.
- The *select-statement* includes a set operation (UNION or INTERSECT).

If INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES is not specified, the table will not have a row change timestamp column.

EXCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES

Specifies that the table does not inherit the row change timestamp attribute, if any, of the columns resulting from the *fullselect*, *table-name*, or *view-name*.

WITH REPLACE

Specifies that, in the case that a declared temporary table already exists with

DECLARE GLOBAL TEMPORARY TABLE

the specified name, the existing table is replaced with the temporary table defined by this statement (and all rows of the existing table are deleted).

When WITH REPLACE is not specified, then the name specified must not identify a declared temporary table that already exists in the current session.

ON COMMIT

Specifies the action taken on the declared temporary table when a COMMIT operation is performed. The default is DELETE ROWS.

The ON COMMIT clause does not apply if the declared temporary table is opened under isolation level No Commit (NC) or if a COMMIT HOLD operation is performed.

DELETE ROWS

All rows of the table will be deleted if no WITH HOLD cursor is open on the table.

PRESERVE ROWS

Rows of the table will be preserved.

NOT LOGGED

Changes to the table are not logged, including creation of the table. When a ROLLBACK (or ROLLBACK TO SAVEPOINT) operation is performed and the table was changed in the unit of work (or savepoint), the changes are not rolled back. If the table was created in the unit of work (or savepoint), then that table will be dropped. If the table was dropped in the unit of work (or savepoint) then the table will be restored, but with no rows.

ON ROLLBACK

Specifies the action taken on the declared temporary table when a ROLLBACK operation is performed.

The ON ROLLBACK clause does not apply if the declared temporary table was opened under isolation level No Commit (NC) or if a ROLLBACK HOLD operation is performed.

DELETE ROWS

All rows of the table will be deleted. This is the default.

PRESERVE ROWS

Rows of the table will be preserved.

RCDFMT *format-name*

An unqualified name that designates the IBM i record format name of the table. A *format-name* is a system identifier.

If a record format name is not specified, the *format-name* is the same as the *system-object-name* of the table.

Notes

Instantiation, scope, and termination: Let P denote an application process and let T be a declared temporary table in an application program in P:

- When a program in P issues a DECLARE GLOBAL TEMPORARY TABLE statement, an empty instance of T is created.
- Any program in P can reference T, and any of those references is a reference to that same instance of T. (If a DECLARE GLOBAL TEMPORARY statement is specified within a compound statement of an SQL function, SQL procedure, or trigger; the scope of the declared temporary table is the application process and not the compound statement.)

If T was declared at a remote server, the reference to T must use the same connection that was used to declare T and that connection must not have been terminated after T was declared. When the connection to the database server at which T was declared terminates, T is dropped.

- If T is defined with the ON COMMIT DELETE ROWS clause, when a commit operation terminates a unit of work in P and no program in P has a WITH HOLD cursor open that is dependent on T, all rows are deleted.
- If T is defined with the ON ROLLBACK DELETE ROWS clause, when a rollback operation terminates a unit of work in P, all rows are deleted.
- When the application process that declared T terminates, T is dropped.

Temporary table ownership: The *owner* of the table is the user profile of the job executing the statement.

Temporary table authority: When a declared temporary table is defined, PUBLIC implicitly is granted all table privileges on the table and authority to drop the table.

Referring to a declared temporary table in other SQL statements: Many SQL statements support declared temporary tables. To refer to a declared temporary table in an SQL statement other than DECLARE GLOBAL TEMPORARY TABLE, the table must be implicitly or explicitly qualified with SESSION.

If you use SESSION as the qualifier for a table name but the application process does not include a DECLARE GLOBAL TEMPORARY TABLE statement for the table name, the database manager assumes that you are not referring to a declared temporary table. The database manager resolves such table references to a permanent table.

Restrictions on the use of declared temporary tables:

- Declared temporary tables cannot be specified in an ALTER TABLE, COMMENT, CREATE ALIAS, GRANT, LABEL, LOCK, RENAME, or REVOKE statement.
- Declared temporary tables cannot be specified as the parent table in referential constraints
- If a declared temporary table is referenced in a CREATE INDEX or CREATE VIEW statement, the index or view must be created in SESSION (or library OTEMP).

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

DEFINITION ONLY is a synonym for WITH NO DATA

Examples

Example 1: Define a declared temporary table with column definitions for an employee number, salary, commission, and bonus.

```
DECLARE GLOBAL TEMPORARY TABLE SESSION.TEMP_EMP
(EMPNO CHAR(6) NOT NULL,
SALARY DECIMAL(9, 2),
BONUS DECIMAL(9, 2),
COMM DECIMAL(9, 2))
ON COMMIT PRESERVE ROWS
```

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DECLARE GLOBAL TEMPORARY TABLE

Example 2: Assume that base table USER1.EMPTAB exists and that it contains three columns, one of which is an identity column. Declare a temporary table that has the same column names and attributes (including identity attributes) as the base table.

DECLARE GLOBAL TEMPORARY TABLE TEMPTAB1 LIKE USER1.EMPTAB **INCLUDING IDENTITY** ON COMMIT PRESERVE ROWS

In the above example, the database manager uses SESSION as the implicit qualifier for TEMPTAB1.

DECLARE PROCEDURE

The DECLARE PROCEDURE statement defines an external procedure.

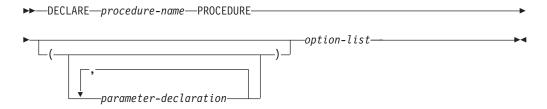
Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in REXX.

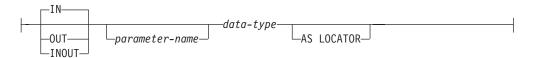
Authorization

None.

Syntax

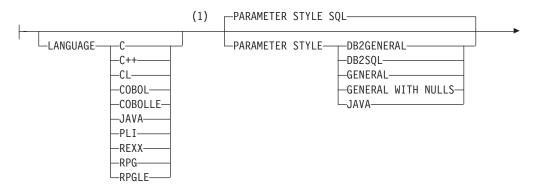


parameter-declaration:

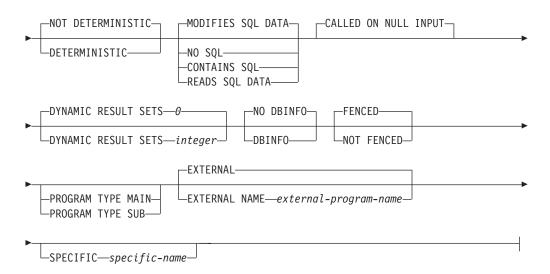


data-type:

option-list:



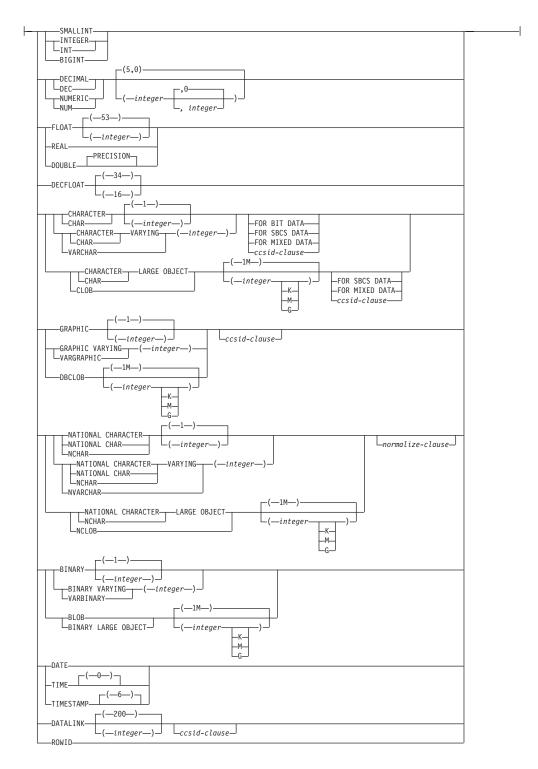
DECLARE PROCEDURE



Notes:

The optional clauses can be specified in a different order.

built-in-type:



ccsid-clause:

I

normalize-clause:

DECLARE PROCEDURE

-NOT NORMALIZED-NORMALIZED-

Description

procedure-name

Names the procedure. The name must not be the same as the name of another procedure declared in your source program.

(parameter-declaration,...)

Specifies the number of parameters of the procedure and the data type of each parameter. A parameter for a procedure can be used only for input, only for output, or for both input and output. Although not required, you can give each parameter a name.

The maximum number of parameters allowed in DECLARE PROCEDURE depends on the language and the parameter style:

- If PARAMETER STYLE GENERAL is specified, in C and C++, the maximum is 1024. Otherwise, the maximum is 255.
- If PARAMETER STYLE GENERAL WITH NULLS is specified, in C and C++, the maximum is 1023. Otherwise, the maximum is 254.
- If PARAMETER STYLE SQL or PARAMETER STYLE DB2SQL is specified, in C and C++, the maximum is 508. Otherwise, the maximum is 90.
- If PARAMETER STYLE JAVA or PARAMETER STYLE DB2GENERAL is specified, the maximum is 90.

The maximum number of parameters is also limited by the maximum number of parameters allowed by the licensed program used to compile the external program or service program.

IN

Identifies the parameter as an input parameter to the procedure. Any changes made to the parameter within the procedure are not available to the calling SQL application when control is returned.⁸⁴

OUT

Identifies the parameter as an output parameter that is returned by the procedure.

A DataLink or a distinct type based on a DataLink may not be specified as an output parameter.

INOUT

Identifies the parameter as both an input and output parameter for the

A DataLink or a distinct type based on a DataLink may not be specified as an input and output parameter.

parameter-name

Names the parameter. The name cannot be the same as any other parameter-name for the procedure.

data-type

Specifies the data type of the parameter.

^{84.} When the language type is REXX, all parameters must be input parameters.

DECLARE PROCEDURE

The data type must be valid for the language specified in the language clause. All data types are valid for SQL procedures. DataLinks are not valid for external procedures. For more information about data types, see "CREATE TABLE" on page 768, and the SQL Programming topic collection.

If a CCSID is specified, the parameter will be converted to that CCSID prior to passing it to the procedure. If a CCSID is not specified, the CCSID is determined by the default CCSID at the current server at the time the procedure is called.

AS LOCATOR

Specifies that the parameter is a locator to the value rather than the actual value. You can specify AS LOCATOR only if the parameter has a LOB data type or a distinct type based on a LOB data type. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

DYNAMIC RESULT SETS integer

Specifies the maximum number of result sets that can be returned from the procedure. *integer* must be greater than or equal to zero and less than 32768. If zero is specified, no result sets are returned. If the SET RESULT SETS statement is issued, the number of results returned is the minimum of the number of result sets specified on this keyword and the SET RESULT SETS statement.

Result sets are only returned if the procedure is directly called or if the procedure is a RETURN TO CLIENT procedure and is indirectly called from ODBC, JDBC, OLE DB, .NET, the SQL Call Level Interface, or the System i Access Family Optimized SQL API. For more information about result sets, see "SET RESULT SETS" on page 1106.

LANGUAGE

Specifies the language that the external program is written in. The language clause is required if the external program is a REXX procedure.

If LANGUAGE is not specified, the LANGUAGE is determined from the program attribute information associated with the external program. If the program attribute information associated with the program does not identify a recognizable language, then the language is assumed to be C.

C

The external program is written in C.

C++

The external program is written in C++.

CL

The external program is written in CL.

COBOL

The external program is written in COBOL.

COBOLLE

The external program is written in ILE COBOL.

JAVA

The external program is written in JAVA.

PLI

The external program is written in PL/I.

REXX

The external program is a REXX procedure.

RPG

The external program is written in RPG.

RPGLE

The external program is written in ILE RPG.

PARAMETER STYLE

Specifies the conventions used for passing parameters to and returning the values from procedures:

SQL

Specifies that in addition to the parameters on the CALL statement, several additional parameters are passed to the procedure. The parameters are defined to be in the following order:

- The first N parameters are the parameters that are specified on the DECLARE PROCEDURE statement.
- N parameters for indicator variables for the parameters.
- A CHAR(5) output parameter for SQLSTATE. The SQLSTATE returned indicates the success or failure of the procedure. The SQLSTATE returned is assigned by the external program.

The user may set the SQLSTATE to any valid value in the external program to return an error or warning from the function.

- A VARCHAR(517) input parameter for the fully qualified procedure name.
- A VARCHAR(128) input parameter for the specific name.
- A VARCHAR(1000) output parameter for the message text.

These parameters are passed according to the specified LANGUAGE. For example, if the language is C or C++, the VARCHAR parameters are passed as NUL-terminated strings. For more information about the parameters passed, see the include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

PARAMETER STYLE SQL cannot be used with LANGUAGE JAVA.

DB2GENERAL

Specifies that the procedure will use a parameter passing convention that is defined for use with Java methods.

PARAMETER STYLE DB2GENERAL can only be specified with LANGUAGE JAVA. For details on passing parameters in JAVA, see the IBM Developer Kit for Java topic collection.

DB2SOL

Specifies that in addition to the parameters on the CALL statement, several additional parameters are passed to the procedure. DB2SQL is identical to the SQL parameter style, except that the following additional parameter may be passed as the last parameter:

• A parameter for the dbinfo structure, if DBINFO was specified on the DECLARE PROCEDURE statement.

For more information about the parameters passed, see the include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

PARAMETER STYLE DB2SQL cannot be used with LANGUAGE JAVA.

GENERAL

Specifies that the procedure will use a parameter passing mechanism where the procedure receives the parameters specified on the CALL. Additional arguments are not passed for indicator variables.

PARAMETER STYLE GENERAL cannot be used with LANGUAGE JAVA.

GENERAL WITH NULLS

Specifies that in addition to the parameters on the CALL statement as specified in GENERAL, another argument is passed to the procedure. This additional argument contains an indicator array with an element for each of the parameters of the CALL statement. In C, this would be an array of short INTs. For more information about how the indicators are handled, see the SQL Programming topic collection.

PARAMETER STYLE GENERAL WITH NULLS cannot be used with LANGUAGE JAVA.

JAVA

Specifies that the procedure will use a parameter passing convention that conforms to the Java language and SQLJ Routines specification. INOUT and OUT parameters will be passed as single entry arrays to facilitate returning values. For increased portability, you should write Java procedures that use the PARAMETER STYLE JAVA conventions.

PARAMETER STYLE JAVA can only be specified with LANGUAGE JAVA. For details on passing parameters in JAVA, see the IBM Developer Kit for Java topic collection.

Note that the language of the external function determines how the parameters are passed. For example, in C, any VARCHAR or CHAR parameters are passed as NUL-terminated strings. For more information, see SQL Programming. For Java routines, see IBM Developer Kit for Java.

SPECIFIC *specific-name*

Specifies a qualified or unqualified name that uniquely identifies the procedure. The specific-name, including the implicit or explicit qualifier, must be the same as the *procedure-name*.

If no qualifier is specified, the implicit or explicit qualifier of the procedure-name is used. If a qualifier is specified, the qualifier must be the same as the explicit or implicit qualifier of the procedure-name.

If *specific-name* is not specified, it is the same as the procedure name.

DETERMINISTIC or NOT DETERMINISTIC

Specifies whether the procedure returns the same results each time the procedure is called with the same IN and INOUT arguments.

NOT DETERMINISTIC

The procedure may not return the same result each time the procedure is called with the same IN and INOUT arguments, even when the referenced data in the database has not changed.

DETERMINISTIC

The procedure always returns the same results each time the procedure is called with the same IN and INOUT arguments, provided the referenced data in the database has not changed.

CONTAINS SQL, READS SQL DATA, MODIFIES SQL DATA, or NO SQL

Specifies which SQL statements, if any, may be executed in the procedure or any routine called from this procedure. See Appendix B, "Characteristics of

DECLARE PROCEDURE

SQL statements," on page 1213 for a detailed list of the SQL statements that can be executed under each data access indication.

CONTAINS SQL

Specifies that SQL statements that neither read nor modify SQL data can be executed by the procedure.

NO SOL

Specifies that the procedure cannot execute any SQL statements.

READS SQL DATA

Specifies that SQL statements that do not modify SQL data can be included in the procedure.

MODIFIES SQL DATA

Specifies that the procedure can execute any SQL statement except statements that are not supported in procedures.

CALLED ON NULL INPUT

Specifies that the function is to be invoked, if any, or all, argument values are null, making the function responsible for testing for null argument values. The function can return a null or nonnull value.

FENCED or NOT FENCED

This parameter is allowed for compatibility with other products and is not used by DB2 for i.

PROGRAM TYPE MAIN or PROGRAM TYPE SUB

This parameter is allowed for compatibility with other products. It indicates whether the routine's external program is a program (*PGM) or a procedure in a service program (*SRVPGM).

PROGRAM TYPE MAIN

Specifies that the routine executes as the main entry point in a program. The external program must be a *PGM object.

PROGRAM TYPE SUB

Specifies that the procedure executes as a procedure in a service program. The external program must be a *SRVPGM object.

DBINFO

Specifies that the database manager should pass a structure containing status information to the procedure. Table 60 contains a description of the DBINFO structure. Detailed information about the DBINFO structure can be found in include sqludf in the appropriate source file in library QSYSINC. For example, for C, sqludf can be found in QSYSINC/H.

DBINFO is only allowed with PARAMETER STYLE DB2SQL.

Table 60. DBINFO fields

Field	Data Type	Description
Relational database	VARCHAR(128)	The name of the current server.
Authorization ID	VARCHAR(128)	The run-time authorization ID.

Table 60. DBINFO fields (continued)

Field	Data Type	Description
CCSID Information	INTEGER INTEGER	The CCSID information of the job. Three sets of three CCSIDs are returned. The following information identifies the three CCSIDs in each set:
	INTEGER	SBCS CCSID
		DBCS CCSID
		Mixed CCSID
	INTEGER INTEGER INTEGER	Following the three sets of CCSIDs is an integer that indicates which set of three sets of CCSIDs is applicable and eight bytes of reserved space.
		Each set of CCSIDs is for a different encoding scheme (EBCDIC, ASCII, and Unicode).
	INTEGER INTEGER INTEGER	If a CCSID is not explicitly specified for a parameter on the CREATE PROCEDURE statement, the input string is assumed to be encoded in the CCSID of the job at the time the procedure is executed. If the CCSID of the input string is not the same as the CCSID of the parameter, the input string passed to the external procedure will be
	INTEGER	converted before calling the external program.
	CHAR(8)	
Target Column	VARCHAR(128)	Not applicable for a call to a procedure.
	VARCHAR(128)	
	VARCHAR(128)	
Version and release	CHAR(8)	The version, release, and modification level of the database manager.
Platform	INTEGER	The server's platform type.

EXTERNAL NAME *external-program-name*

Specifies the program that will be executed when the procedure is called by the CALL statement. The program name must identify a program that exists at the application server. The program cannot be an ILE service program.

The validity of the name is checked at the application server. If the format of the name is not correct, an error is returned.

If external-program-name is not specified, the external program name is assumed to be the same as the procedure name.

Notes

DECLARE PROCEDURE scope: The scope of the *procedure-name* is the source program in which it is defined; that is, the program submitted to the precompiler. Thus, a program called from another separately compiled program or module will not use the attributes from a DECLARE PROCEDURE statement in the calling program.

DECLARE PROCEDURE rules: The DECLARE PROCEDURE statement should precede all CALL statements that reference that procedure.

DECLARE PROCEDURE

The DECLARE PROCEDURE statement only applies to static CALL statements. It does not apply to any dynamically prepared CALL statements or a CALL statement where the procedure name is identified by a variable.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords VARIANT and NOT VARIANT can be used as synonyms for NOT DETERMINISTIC and DETERMINISTIC.
- The keywords NULL CALL can be used as synonyms for CALLED ON NULL INPUT.
- The keywords SIMPLE CALL can be used as a synonym for GENERAL.
- The value DB2GENRL may be used as a synonym for DB2GENERAL.
- The keywords PARAMETER STYLE in the PARAMETER STYLE clause are optional.

Example

Declare an external procedure PROC1 in a C program. When the procedure is called using the CALL statement, a COBOL program named PGM1 in library LIB1 will be called.

```
EXEC SQL

DECLARE PROC1 PROCEDURE

(CHAR(10), CHAR(10))

EXTERNAL NAME LIB1.PGM1

LANGUAGE COBOL GENERAL;

EXEC SQL

CALL PROC1 ('FIRSTNAME ','LASTNAME ');
```

DECLARE STATEMENT

The DECLARE STATEMENT statement is used for program documentation. It declares names that are used to identify prepared SQL statements.

Invocation

This statement can only be embedded in an application program. It is not an executable statement. This statement is not allowed in Java or REXX.

Authorization

None required.

Syntax



Description

statement-name

Lists one or more names that are used in your program to identify prepared SQL statements.

Example

This example shows the use of the DECLARE STATEMENT statement in a C program.

```
EXEC SQL INCLUDE SQLDA;
void main ()
  EXEC SQL BEGIN DECLARE SECTION;
   char src stmt[32000];
   char sq1da[32000]
   EXEC SQL END DECLARE SECTION;
   EXEC SQL INCLUDE SQLCA;
   strcpy(src_stmt,"SELECT DEPTNO, DEPTNAME, MGRNO \
     FROM DEPARTMENT \
     WHERE ADMRDEPT = 'A00'");
   EXEC SQL DECLARE OBJ_STMT STATEMENT;
   (Allocate storage from SQLDA)
   EXEC SQL DECLARE C1 CURSOR FOR OBJ STMT;
   EXEC SQL PREPARE OBJ_STMT FROM :src_stmt;
   EXEC SQL DESCRIBE OBJ_STMT INTO :sqlda;
   (Examine SQLDA) (Set SQLDATA pointer addresses)
   EXEC SQL OPEN C1;
   while (strncmp(SQLSTATE, "00000", 5))
     EXEC SQL FETCH C1 USING DESCRIPTOR :sqlda;
```

DECLARE STATEMENT

```
(Print results)
EXEC SQL CLOSE C1;
return;
```

DECLARE VARIABLE

The DECLARE VARIABLE statement is used to assign a subtype or CCSID other than the default to a host variable.

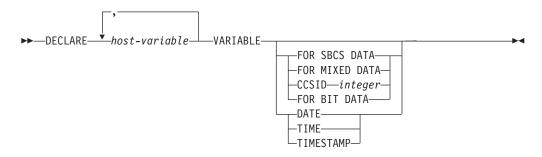
Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in Java or REXX.

Authorization

None required.

Syntax



Description

host-variable

Names a character or graphic-string host variable defined in the program. An indicator variable cannot be specified for the host-variable. The host-variable definition may either precede or follow a DECLARE VARIABLE statement that refers to that variable.

FOR BIT DATA

Specifies that the values of the host-variable are not associated with a coded character set and, therefore, are never converted. The CCSID of a FOR BIT DATA host variable is 65535. FOR BIT DATA cannot be specified for graphic host-variables.

FOR SBCS DATA

Specifies that the values of the host variable contain SBCS (single-byte character set) data. FOR SBCS DATA is the default if the CCSID attribute of the job at the application requester is not DBCS-capable or if the length of the host variable is less than 4. The CCSID of FOR SBCS DATA is determined by the CCSID attribute of the job at the application requester. FOR SBCS DATA cannot be specified for graphic host-variables.

FOR MIXED DATA

Specifies that the values of the host variable contain both SBCS data and DBCS data. FOR MIXED DATA is the default if the CCSID attribute of the job at the application requester is DBCS-capable and the length of the host variable is greater than 3. The CCSID of FOR DBCS DATA is determined by the CCSID attribute of the job at the application requester. FOR MIXED DATA cannot be specified for graphic host-variables.

CCSID integer

Specifies that the values of the host variable contain data of CCSID integer. If the integer is an SBCS CCSID, the host variable is SBCS data. If the integer is a mixed data CCSID, the host variable is mixed data. For character host variables, the CCSID specified must be an SBCS or mixed CCSID.

If the variable has a graphic string data type, the CCSID specified must be a DBCS, UTF-16, or UCS-2 CCSID. For a list of valid CCSIDs, see Appendix E, "CCSID values," on page 1251. Consider specifying CCSID 1200 or 13488 to indicate UTF-16 or UCS-2 data. If a CCSID is not specified, the CCSID of the graphic string variable will be the associated DBCS CCSID for the job.

For file reference variables, the CCSID specifies the CCSID of the path and file name, not the data within the file.

DATE

Specifies that the values of the host variable contain data that is a date.

TIME

Specifies that the values of the host variable contain data that is a time.

TIMESTAMP

Specifies that the values of the host variable contain data that is a timestamp.

Notes

Placement restrictions: The DECLARE VARIABLE statement can be specified anywhere in an application program that SQL statements are valid with the following exceptions:

- If the host language is COBOL or RPG, the DECLARE VARIABLE statement must occur before an SQL statement that refers to a host variable specified in the DECLARE VARIABLE statement.
- If DATE, TIME, or TIMESTAMP is specified for a NUL-terminated character string in C, the length of the C declaration will be reduced by one.

Precompiler rules: The following situations result in an error message during precompile:

- A reference is made to a variable that does not exist.
- A reference is made to a numeric variable.
- A reference is made to a variable that has been referred to already.
- A reference is made to a variable that is not unique.
- A reference is made to an ILE RPG variable that is defined as UCS-2.
- A reference is made to an ILE COBOL variable that is defined as NATIONAL.
- The DECLARE VARIABLE statement occurs after an SQL statement where the SQL statement and the DECLARE VARIABLE statement refer to the same variable.
- The FOR BIT DATA, FOR SBCS DATA, or FOR MIXED DATA clause is specified for a graphic host variable.
- A SBCS or mixed CCSID is specified for a graphic host variable.
- A DBCS, UTF-16, or UCS-2 CCSID is specified for a character host variable.
- DATE, TIME, or TIMESTAMP is specified for a host variable that is not character
- The length of a host variable used for DATE, TIME, or TIMESTAMP is not long enough for the minimum date, time, or timestamp value.

Example

In this example, declare C program variables *fred* and *pete* as mixed data, and *jean* and *dave* as SBCS data with CCSID 37.

```
void main ()
{
    EXEC SQL BEGIN DECLARE SECTION;
    char fred[10];
    EXEC SQL DECLARE :fred VARIABLE FOR MIXED DATA;

    decimal(6,0) mary;
    char pete[4];
    EXEC SQL DECLARE :pete VARIABLE FOR MIXED DATA;

    char jean[30];
    char dave[9];
    EXEC SQL DECLARE :jean, :dave VARIABLE CCSID 37;
    EXEC SQL END DECLARE SECTION;
    EXEC SQL INCLUDE SQLCA;
    ...
}
```

The DELETE statement deletes rows from a table or view. Deleting a row from a view deletes the row from the table on which the view is based if no INSTEAD OF DELETE trigger is defined for this view. If such a trigger is defined, the trigger will be activated instead.

There are two forms of this statement:

- The *Searched* DELETE form is used to delete one or more rows (optionally determined by a search condition).
- The *Positioned* DELETE form is used to delete exactly one row (as determined by the current position of a cursor).

Invocation

A Searched DELETE statement can be embedded in an application program or issued interactively. A Positioned DELETE must be embedded in an application program. Both forms are executable statements that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the table or view identified in the statement:
 - The DELETE privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

If the *search-condition* in a Searched DELETE contains a reference to a column of the table or view, then the privileges held by the authorization ID of the statement must also include one of the following:

- The SELECT privilege on the table or view
- · Administrative authority

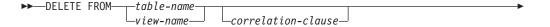
If *search-condition* includes a subquery, the privileges held by the authorization ID of the statement must also include at least one of the following:

- For each table or view identified in the subquery:
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- · Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax

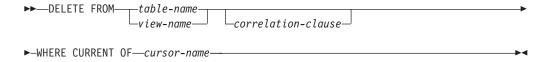
Searched DELETE:



Notes:

1 The same clause must not be specified more than once.

Positioned DELETE:



isolation-clause:



skip-locked-data-clause:



Description

FROM table-name or view-name

Identifies the table or view from which rows are to be deleted. The name must identify a table or view that exists at the current server, but it must not identify a catalog table, a view of a catalog table, or a view that is not deletable. For an explanation of deletable views, see "CREATE VIEW" on page 835.

correlation-clause

Specifies an alternate name that can be used within the *search-condition* to designate the table or view. For an explanation of *correlation-clause*, see Chapter 4, "Queries," on page 469. For an explanation of *correlation-name*, see "Correlation names" on page 129.

WHERE

Specifies the rows to be deleted. The clause can be omitted, or a *search-condition* or *cursor-name* can be specified. If the clause is omitted, all rows of the table or view are deleted.

search-condition

Is any search condition as described in "Search conditions" on page 201. Each *column-name* in the *search-condition*, other than in a subquery, must identify a column of the table or view.

The *search-condition* is applied to each row of the table or view and the deleted rows are those for which the result of the *search-condition* is true.

If the *search-condition* contains a subquery, the subquery can be thought of as being executed each time the *search condition* is applied to a row, and the results used in applying the *search condition*. In actuality, a subquery with no correlated references may be executed only once, whereas a subquery with a correlated reference may have to be executed once for each row.

If a subquery refers to the object table of the DELETE statement or a dependent table with a delete rule of CASCADE, SET NULL, or SET DEFAULT, the subquery is completely evaluated before any rows are deleted.

CURRENT OF cursor-name

Identifies the cursor to be used in the delete operation. The *cursor-name* must identify a declared cursor as explained in the Notes[®] for the DECLARE CURSOR statement.

The table or view identified must also be specified in the FROM clause of the *select-statement* of the cursor and the cursor must be deletable. For an explanation of deletable cursors, see "DECLARE CURSOR" on page 845.

When the DELETE statement is executed, the cursor must be positioned on a row; that row is the one deleted. After the deletion, the cursor is positioned before the next row of its result table. If there is no next row, the cursor is positioned after the last row.

isolation-clause

Specifies the isolation level to be used for this statement.

WITH

Introduces the isolation level, which may be one of:

- RR Repeatable read
- RS Read stability
- CS Cursor stability
- UR Uncommitted read
- NC No commit

If *isolation-clause* is not specified the default isolation is used. For more information on the default isolation, see "isolation-clause" on page 523.

skip-locked-data-clause

Specifies to skip rows on which incompatible locks are held by other transactions.

DELETE Rules

Triggers: If the identified table or the base table of the identified view has a delete trigger, the trigger is activated. A trigger might cause other statements to be executed or return error conditions based on the deleted values.

Referential Integrity: If the identified table or the base table of the identified table is a parent table, the rows selected must not have any dependents in a relationship with a delete rule of RESTRICT or NO ACTION, and the DELETE must not cascade to descendent rows that have dependents in a relationship with a delete rule of RESTRICT or NO ACTION.

If the delete operation is not prevented by a RESTRICT or NO ACTION delete rule, the selected rows are deleted. Any rows that are dependents of the selected rows are also affected:

I

- The nullable columns of the foreign keys of any rows that are their dependents in a relationship with a delete rule of SET NULL are set to the null value.
- Any rows that are their dependents in a relationship with a delete rule of CASCADE are also deleted, and the above rules apply, in turn to those rows.
- The columns of the foreign keys of any rows that are their dependents in a relationship with a delete rule of SET DEFAULT are set to the corresponding default value.

The referential constraints (other than a referential constraint with a RESTRICT delete rule), are effectively checked at the end of the statement. In the case of a multiple-row delete, this would occur after all rows were deleted and any associated triggers were activated.

Check Constraints: A check constraint can prevent the deletion of a row in a parent table when there are dependents in a relationship with a delete rule of SET NULL or SET DEFAULT. If deleting a row in the parent table would cause a column in a dependent table to be set to null or a default value and the null or default value would cause a search condition of a check constraint to evaluate to false, the row is not deleted.

Notes

Delete operation errors: If an error occurs while executing any delete operation, changes from this statement, referential constraints, and any triggered SQL statements are rolled back (unless the isolation level is NC for this statement or any other triggered SQL statements).

Locking: Unless appropriate locks already exist, one or more exclusive locks are acquired during the execution of a successful DELETE statement. Until the locks are released by a commit or rollback operation, the effect of the DELETE operation can only be perceived by:

- The application process that performed the deletion
- Another application process using isolation level UR or NC

The locks can prevent other application processes from performing operations on the table. For further information about locking, see the description of the COMMIT, ROLLBACK, and LOCK TABLE statements, and "Isolation level" on page 26.

If an application process deletes a row on which any of its non-updatable cursors are positioned, those cursors are positioned before the next row of their result table. Let C be a cursor that is positioned before the next row R (as the result of an OPEN, a DELETE through C, a DELETE through some other cursor, or a Searched DELETE). In the presence of INSERT, UPDATE, and DELETE operations that affect the base table from which R is derived, the next FETCH operation referencing C does not necessarily position C on R. For example, the operation can position C on R' where R' is a new row that is now the next row of the result table.

A maximum of 4000000 rows can be deleted or changed in any single DELETE statement when COMMIT(*RR), COMMIT(*ALL), COMMIT(*CS), or COMMIT(*CHG) was specified. The number of rows changed includes any rows inserted, updated, or deleted under the same commitment definition as a result of a trigger, a CASCADE, SET NULL, or SET DEFAULT referential integrity delete rule.

DELETE

Position of cursor: If an application process deletes a row on which any of its cursors are positioned, those cursors are positioned before the next row of their result table. Let C be a cursor that is positioned before row R (as a result of an OPEN, a DELETE through C, a DELETE through some other cursor, or a Searched DELETE). In the presence of INSERT, UPDATE, and DELETE operations that affect the base table from which R is derived, the next FETCH operation referencing C does not necessarily position C on R. For example, the operation can position C on R', where R' is a new row that is now the next row of the result table.

Number of rows deleted: When a DELETE statement is completed, the number of rows deleted is returned in the ROW_COUNT condition area item in the SQL Diagnostics Area (or SQLERRD(3) in the SQLCA). The value in the ROW_COUNT item does not include the number of rows that were deleted as a result of a CASCADE delete rule or a trigger.

For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

DELETE Performance: An SQL DELETE statement that does not contain a WHERE clause will delete all rows of a table. In this case, the rows may be deleted using either a clear operation (if not running under commitment control) or a change file operation (if running under commitment control). If running under commitment control, the deletes can still be committed or rolled back. This implementation will be much faster than individually deleting each row, but individual journal entries for each row will not be recorded in the journal. This technique will only be used if all the following are true:

- The target table is not a view.
- A significant number of rows are being deleted.
- The job issuing the DELETE statement does not have an open cursor on the file (not including pseudo-closed SQL cursors).
- · No other job has a lock on the table.
- The table does not have an active delete trigger.
- The table is not the parent in a referential constraint with a CASCADE, SET NULL, or SET DEFAULT delete rule.
- The user issuing the DELETE statement has *OBJMGT or *OBJALTER system authority on the table in addition to the DELETE privilege.

If this technique is successful, the number of increments (see the SIZE keyword on the CHGPF CL command) is set to zero.

Referential integrity considerations: The DB2_ROW_COUNT_SECONDARY condition information item in the SQL Diagnostics Area (or SQLERRD(5) in the SQLCA) shows the number of rows affected by referential constraints. It includes rows that were deleted as the result of a CASCADE delete rule and rows in which foreign keys were set to NULL or the default value as the result of a SET NULL or SET DEFAULT delete rule.

For a description of DB2_ROW_COUNT_SECONDARY, see "GET DIAGNOSTICS" on page 943. For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

REXX: Variables cannot be used in the DELETE statement within a REXX procedure. Instead, the DELETE must be the object of a PREPARE and EXECUTE using parameter markers.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword NONE can be used as a synonym for NC.
- The keyword CHG can be used as a synonym for UR.
- The keyword ALL can be used as a synonym for RS.

Examples

Example 1: Delete department (DEPTNO) 'D11' from the DEPARTMENT table.

```
DELETE FROM DEPARTMENT
WHERE DEPTNO = 'D11'
```

Example 2: Delete all the departments from the DEPARTMENT table (that is, empty the table).

```
DELETE FROM DEPARTMENT
```

Example 3: Use a Java program statement to delete all the subprojects (MAJPROJ is NULL) from the PROJECT table on the connection context 'ctx', for a department (DEPTNO) equal to that in the host variable HOSTDEPT (java.lang.String).

Example 4: Code a portion of a Java program that will be used to display retired employees (JOB) and then, if requested to do so, remove certain employees from the EMPLOYEE table on the connection context 'ctx'.

DESCRIBE

The DESCRIBE statement obtains information about a prepared statement.

For an explanation of prepared statements, see "PREPARE" on page 1020.

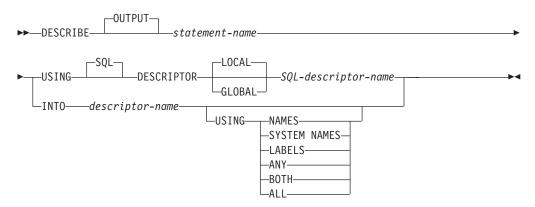
Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

None required. See "PREPARE" on page 1020 for the authorization required to create a prepared statement.

Syntax 1 4 1



Description

statement-name

Identifies the prepared statement. When the DESCRIBE statement is executed, the name must identify a prepared statement at the application server.

If the prepared statement is a SELECT or VALUES INTO statement, the information returned describes the columns in its result table. If the prepared statement is a CALL statement, the information returned describes the OUT and INOUT parameters of the procedure.

USING

Identifies an SQL descriptor.

Specifies the scope of the name of the descriptor to be local to program invocation.

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

INTO *descriptor-name*

Identifies an SQL descriptor area (SQLDA), which is described in Appendix D, "SQLDA (SQL descriptor area)," on page 1235. Before the DESCRIBE statement is executed, the following variable in the SQLDA must be set.

SQLN Indicates the number of SQLVAR entries provided in the SQLDA. SQLN must be set to a value greater than or equal to zero before the DESCRIBE statement is executed. For information about techniques to determine the number of occurrences requires, see "Determining how many SQLVAR occurrences are needed" on page 1238.

The rules for REXX are different. For more information, see the Embedded SQL Programming topic collection.

When the DESCRIBE statement is executed, the database manager assigns values to the variables of the SQLDA as follows:

SQLDAID

The first 6 bytes are set to 'SQLDA' (that is, 5 letters followed by the space character).

The seventh byte is set based on the result columns described:

- If the SQLDA contains two, three, or four SQLVAR entries for every select list item (or, column of the result table), the seventh byte is set to '2', '3', or '4'. This technique is used in order to accommodate LOB or distinct type result columns, labels, and system names.
- Otherwise, the seventh byte is set to the space character.

The seventh byte is set to the space character if there is not enough room in the SQLDA to contain the description of all result columns.

The eighth byte is set to the space character.

SQLDABC

Length of the SQLDA in bytes.

SQLD If the prepared statement is a SELECT, SQLD is set to the number of columns in its result table plus the number of extended SQLVAR entries. For information about extended SQLVAR entries see, "Field descriptions in an occurrence of SQLVAR" on page 1240. If the prepared statement is a CALL statement, SQLD is set to the number of OUT and INOUT parameters of the procedure. Otherwise, SQLD is set to 0.

SQLVAR

If the value of SQLD is 0, or greater than the value of SQLN, no values are assigned to occurrences of SQLVAR.

If the value of SQLD is n, where n is greater than 0 but less than or equal to the value of SQLN, values are assigned to the first n occurrences of SQLVAR so that the first occurrence of SQLVAR contains a description of the first column of the result table (or parameter), the second occurrence of SQLVAR contains a description of the second column of the result table (or parameter), and so on. For information about the values assigned to SQLVAR occurrences, see "Field descriptions in an occurrence of SQLVAR" on page 1240.

USING

Specifies what value to assign to each SQLNAME variable in the SQLDA. If the requested value does not exist or if the length of a name is greater than 30, SQLNAME is set to a length of 0.

NAMES

Assigns the name of the column (or parameter). This is the default. For the DESCRIBE of a prepared statement where the name is explicitly listed in the select-list, the name specified is returned. The column name returned is case sensitive and without delimiters.

SYSTEM NAMES

Assigns the system column name of the column.

LABELS

Assigns the label of the column. (Column labels are defined by the LABEL statement.) Only the first 20 bytes of the label are returned.

ANY

Assigns the column label. If the column has no label, the column name is used instead.

BOTH

Assigns both the label and name of the column. In this case, two or three occurrences of SQLVAR per column, depending on whether the result set contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 2*n or 3*n(where n is the number of columns in the table or view). The first n occurrences of SQLVAR contain the column names. Either the second or third n occurrences contain the column labels. If there are no distinct types, the labels are returned in the second set of SQLVAR entries. Otherwise, the labels are returned in the third set of SQLVAR entries.

ALL

Assigns the label, column name, and system column name. In this case three or four occurrences of SQLVAR per column, depending on whether the result set contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 3*n or 4*n (where n is the number of columns in the result table). The first n occurrences of SQLVAR contain the system column names. The second or third n occurrences contain the column labels. The third or fourth n occurrences contain the column names if they are different from the system column name. Otherwise the SQLNAME field is set to a length of zero. If there are no distinct types, the labels are returned in the second set of SQLVAR entries and the column names are returned in the third set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries.

Notes

PREPARE INTO: Information about a prepared statement can also be obtained by using the INTO clause of the PREPARE statement.

Allocating the SQL descriptor: Before the DESCRIBE statement is executed, the SQL descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. If the number of descriptor items allocated is less than the number of result columns, a warning (SQLSTATE 01005) is returned.

Allocating the SQLDA: In C, COBOL, PL/I, and RPG, before the DESCRIBE or PREPARE INTO statement is executed, enough storage must be allocated for some number of SQLVAR occurrences. SQLN must then be set to the number of SQLVAR occurrences that were allocated. To obtain the description of the columns of the

First technique

Allocate an SQLDA with enough occurrences of SQLVAR entries to accommodate any select list that the application will have to process. At the extreme, the number of SQLVARs could equal two times the maximum number of columns allowed in a result table. Having done the allocation, the application can use this SQLDA repeatedly.

This technique uses a large amount of storage that is never deallocated, even when most of this storage is not used for a particular select list.

Second technique

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Repeat the following three steps for every processed select list:

- 1. Execute a DESCRIBE statement with an SQLDA that has no occurrences of SQLVAR entries; that is, an SQLDA for which SQLN is zero. The value returned for SQLD is either the required number of occurrences of SQLVAR entries or the number of result columns. Because there were no SQLVAR entries, a warning will be issued.⁸⁵
- 2. If the seventh byte of SQLDAID field is not a blank, then allocate an SQLDA with (the value in the seventh byte of SQLDAID) * SQLD occurrences and set SQLN in the new SQLDA to (the value in the seventh byte of SQLDAID) * SQLD. Otherwise, allocate an SQLDA with SQLD occurrences and set SQLN in the new SQLDA to the value of SQLD.
- 3. Execute the DESCRIBE statement again, using this new SQLDA.

This technique allows better storage management than the first technique, but it doubles the number of DESCRIBE statements.

Third technique

Allocate an SQLDA that is large enough to handle most, and perhaps all, select lists but is also reasonably small. If an execution of DESCRIBE fails because the SQLDA is too small, allocate a larger SQLDA and execute DESCRIBE again. For the new SQLDA, use the value of SQLD (or double the value of SQLD) returned from the first execution of DESCRIBE for the number of occurrences of SQLVAR entries.

This technique is a compromise between the first two techniques. Its effectiveness depends on a good choice of size for the original SQLDA.

Example

In a C program, execute a DESCRIBE statement with an SQLDA that has no occurrences of SQLVAR entries. If SQLD is greater than zero, use the value to allocate an SQLDA with the necessary number of occurrences of SQLVAR entries and then execute a DESCRIBE statement using that SQLDA.

```
EXEC SQL BEGIN DECLARE SECTION;
char stmt1 str [200];
EXEC SQL END DECLARE SECTION;
```

^{85.} If LOBs or UDTs are not in the result set, the warning is only returned if the standards option is specified. For information about the standards option, see "Standards compliance" on page ix.

DESCRIBE

```
EXEC SQL INCLUDE SQLDA;
struct sqlda initialsqlda;
struct sqlda *sqldaPtr;
EXEC SQL DECLARE DYN_CURSOR CURSOR FOR STMT1_NAME;
\dots /* code to prompt user for a query, then to generate
   /\ast a select-statement in the stmt1_str
EXEC SQL PREPARE STMT1_NAME FROM :stmt1_str;
\dots /* code to set SQLN to zero and to allocate the SQLDA
EXEC SQL DESCRIBE STMT1 NAME INTO :initialsqlda;
if (initialsqlda.sqld == 0); /* statement is a select-statement */
   ... /* Code to allocate correct size SQLDA (sets sqldaPtr) */
   if (strcmp(SQLSTATE, "01005") == 0)
      sqldaPtr->sqln = 2*initialsqlda.sqld;
      SETSQLDOUBLED(sqldaPtr, SQLDOUBLED);
   else
      sqldaPtr->sqln = initialsqlda.sqld;
      SETSQLDOUBLED(sqldaPtr, SQLSINGLED);
   EXEC SQL DESCRIBE STMT1_NAME INTO :*sqldaPtr;
   \dots /* code to prepare for the use of the SQLDA
   EXEC SQL OPEN DYN_CURSOR;
   ... /* loop to fetch rows from result table
                                                               */
   EXEC SQL FETCH DYN CURSOR USING DESCRIPTOR :*sqldaPtr;
  }
```

DESCRIBE INPUT

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The DESCRIBE INPUT statement obtains information about the IN and INOUT parameter markers of a prepared statement.

For an explanation of prepared statements, see "PREPARE" on page 1020.

Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

Authorization

None required. See "PREPARE" on page 1020 for the authorization required to create a prepared statement.

Syntax





Description

statement-name

Identifies the prepared statement. When the DESCRIBE INPUT statement is executed, the name must identify a prepared statement at the current server.

USING

Identifies an SQL descriptor.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

INTO *descriptor-name*

Identifies an SQL descriptor area (SQLDA), which is described in Appendix D, "SQLDA (SQL descriptor area)," on page 1235. Before the DESCRIBE INPUT statement is executed, the following variable in the SQLDA must be set.

SQLN Specifies the number of SQLVAR occurrences provided in the SQLDA. SQLN must be set to a value greater than or equal to zero before the DESCRIBE INPUT statement is executed. For information about

techniques to determine the number of occurrences requires, see "Determining how many SQLVAR occurrences are needed" on page 1238.

When the DESCRIBE INPUT statement is executed, the database manager assigns values to the variables of the SQLDA as follows:

SQLDAID

The first 6 bytes are set to 'SQLDA' (that is, 5 letters followed by the space character).

The seventh byte is set based on the parameter markers described:

- If the SQLDA contains two SQLVAR entries for every input parameter marker, the seventh byte is set to '2'. This technique is used in order to accommodate LOB input parameters.
- Otherwise, the seventh byte is set to the space character.

The seventh byte is set to the space character if there is not enough room in the SQLDA to contain the description of all input parameter markers.

The eighth byte is set to the space character.

SQLDABC

Length of the SQLDA in bytes.

SQLD The number of input parameter markers in the prepared statement.

SQLVAR

If the value of SQLD is 0, or greater than the value of SQLN, no values are assigned to occurrences of SQLVAR.

If the value of SQLD is n, where n is greater than 0 but less than or equal to the value of SQLN, values are assigned to the first n occurrences of SQLVAR so that the first occurrence of SQLVAR contains a description of the first input parameter marker, the second occurrence of SQLVAR contains a description of the second input parameter marker, and so on. For information about the values assigned to SQLVAR occurrences, see "Field descriptions in an occurrence of SQLVAR" on page 1240.

Notes

Allocating the SQL descriptor: Before the DESCRIBE INPUT statement is executed, the SQL descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. The number of descriptor items allocated must not be less than the number of input parameter markers or an error is returned.

Allocating the SQLDA: Before the DESCRIBE INPUT statement is executed, enough storage must be allocated for some number of SQLVAR occurrences. SQLN must then be set to the number of SQLVAR occurrences that were allocated. To obtain the description of the input parameter markers in the prepared statement, the number of occurrences of SQLVAR must not be less than the number of input parameter markers. Furthermore, if the input parameter markers include LOBs or distinct types, the number of occurrences of SQLVAR should be two times the number of input parameter markers. See "Determining how many SQLVAR occurrences are needed" on page 1238 for more information.

If not enough occurrences are provided to return all sets of occurrences, SQLN is set to the total number of occurrences necessary to return all information. Otherwise, SQLN is set to the number of input parameter markers.

Among the possible ways to allocate the SQLDA are the three described below:

First technique

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Allocate an SQLDA with enough occurrences of SQLVAR entries to accommodate any number of input parameter markers that the application will have to process. At the extreme, the number of SQLVARs could equal two times the maximum number of parameter markers allowed in a prepared statement. Having done the allocation, the application can use this SQLDA repeatedly.

This technique uses a large amount of storage that is never deallocated, even when most of this storage is not used for a particular prepared statement.

Second technique

Repeat the following three steps for every processed prepared statement:

- 1. Execute a DESCRIBE INPUT statement with an SQLDA that has no occurrences of SQLVAR entries, that is, an SQLDA for which SQLN is zero. The value returned for SQLD is the number of input parameter markers in the prepared statement. This value is either the required number of occurrences of SQLVAR entries or half the required number. Because there were no SQLVAR entries, a warning will be issued. ⁸⁶
- 2. If the SQLSTATE accompanying that warning is equal to 01005, allocate an SQLDA with 2 * SQLD occurrences and set SQLN in the new SQLDA to 2 * SQLD. Otherwise, allocate an SQLDA with SQLD occurrences and set SQLN in the new SQLDA to the value of SQLD.
- 3. Execute the DESCRIBE INPUT statement again, using this new SQLDA.

This technique allows better storage management than the first technique, but it doubles the number of DESCRIBE INPUT statements.

Third technique

Allocate an SQLDA that is large enough to handle most, and perhaps all, parameter markers in prepared statements but is also reasonably small. If an execution of DESCRIBE INPUT fails because the SQLDA is too small, allocate a larger SQLDA and execute DESCRIBE INPUT again. For the new SQLDA, use the value of SQLD (or double the value of SQLD) returned from the first execution of DESCRIBE INPUT for the number of occurrences of SQLVAR entries.

This technique is a compromise between the first two techniques. Its effectiveness depends on a good choice of size for the original SQLDA.

Examples

Example 1: In a C program, execute a DESCRIBE INPUT statement with an SQLDA that has enough to describe any number of input parameter markers a prepared statement might have. Assume that five parameter markers at most will need to be described and that the input data does not contain LOBs.

^{86.} If LOBs or UDTs are not in the result set, the warning is only returned if the standards option is specified. For information about the standards option, see "Standards compliance" on page ix.

DESCRIBE INPUT

```
EXEC SQL BEGIN DECLARE SECTION;
   char stmt1 str [200];
 EXEC SQL END DECLARE SECTION;
 EXEC SQL INCLUDE SQLDA;
 struct sqlda initialsqlda;
 struct sqlda *sqldaPtr;
  \dots /* stmt1 str contains INSERT statement with VALUES
                                                            */
     /* clause
                                                            */
 EXEC SQL PREPARE STMT1_NAME FROM :stmt1_str;
  \dots /* code to set SQLN to five and to allocate the SQLDA */
 EXEC SQL DESCRIBE INPUT STMT1_NAME INTO :SQLDA;
Example 2: Allocate a descriptor called 'NEWDA' large enough to hold 20 item
descriptor areas and use it on DESCRIBE INPUT.
 EXEC SQL ALLOCATE DESCRIPTOR 'NEWDA'
   WITH MAX 20;
 EXEC SQL DESCRIBE INPUT STMT1
   USING SQL DESCRIPTOR 'NEWDA';
```

DESCRIBE TABLE

The DESCRIBE TABLE statement obtains information about a table or view.

Invocation

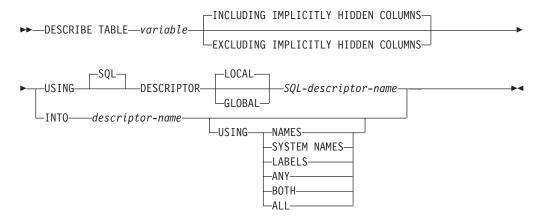
This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the table or view identified in the statement:
 - The system authority of *OBJOPR on the table or view
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

Syntax



Description

variable

Identifies the table or view to describe. When the DESCRIBE TABLE statement is executed:

- The name must identify a table or view that exists at the application server.
- The *variable* must be a character-string or Unicode graphic-string variable and must not include an indicator variable.
- The table name that is contained within the *variable* must be left-justified and must be padded on the right with blanks if its length is less than that of the *variable*.
- The name of the table must be in uppercase unless it is a delimited name.

INCLUDING IMPLICITLY HIDDEN COLUMNS or EXCLUDING IMPLICITLY HIDDEN COLUMNS

Specifies whether information should be returned for implicitly hidden column in a table.

INCLUDING IMPLICITLY HIDDEN COLUMNS

Specifies that information is returned for columns defined as implicitly hidden. This is the default.

EXCLUDING IMPLICITLY HIDDEN COLUMNS

Specifies that information is not returned for columns defined as implicitly hidden.

When the DESCRIBE TABLE statement is executed, the database manager assigns values to the variables of the SQL descriptor or SQLDA as follows:

Identifies an SQL descriptor.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

INTO *descriptor-name*

Identifies an SQL descriptor area (SQLDA), which is described in Appendix D, "SQLDA (SQL descriptor area)," on page 1235. Before the DESCRIBE TABLE statement is executed, the following variable in the SQLDA must be set.

SQLN Specifies the number of SQLVAR occurrences provided in the SQLDA. SQLN must be set to a value greater than or equal to zero before the DESCRIBE TABLE statement is executed. For information about techniques to determine the number of occurrences requires, see "Determining how many SQLVAR occurrences are needed" on page 1238.

The rules for REXX are different. For more information, see the Embedded SQL Programming topic collection.

When the DESCRIBE statement is executed, the database manager assigns values to the variables of the SQLDA as follows:

SQLDAID

The first 6 bytes are set to 'SQLDA' (that is, 5 letters followed by the space character).

The seventh byte is set based on the column described:

- If the SQLDA contains two, three, or four SQLVAR entries for every column of the table, the seventh byte is set to '2', '3', or '4'. This technique is used in order to accommodate LOB or distinct type result columns, labels, and system names.
- Otherwise, the seventh byte is set to the space character.

The seventh byte is set to the space character if there is not enough room in the SQLDA to contain the description of all columns.

The eighth byte is set to the space character.

SQLDABC

Length of the SQLDA in bytes.

SQLD The number of columns in the table plus the number of extended SQLVAR entries. For information about extended SQLVAR entries see, "Field descriptions in an occurrence of SQLVAR" on page 1240.

SQLVAR

If the value of SQLD is 0, or greater than the value of SQLN, no values are assigned to occurrences of SQLVAR.

If the value of SQLD is n, where n is greater than 0 but less than or equal to the value of SQLN, values are assigned to the first n occurrences of SQLVAR so that the first occurrence of SQLVAR contains a description of the first column of the table, the second occurrence of SQLVAR contains a description of the second column of the table, and so on. For information about the values assigned to SQLVAR occurrences, see "Field descriptions in an occurrence of SQLVAR" on page 1240.

USING

Specifies what value to assign to each SQLNAME variable in the SQLDA. If the requested value does not exist or if the length of a name is greater than 30, SQLNAME is set to a length of 0.

NAMES

Assigns the name of the column. The column name returned is case sensitive and without delimiters. This is the default.

SYSTEM NAMES

Assigns the system column name of the column.

LABELS

Assigns the label of the column. (Column labels are defined by the LABEL statement.) Only the first 20 bytes of the label are returned.

ANY

Assigns the column label. If the column has no label, the column name is used instead.

BOTH

Assigns both the label and name of the column. In this case, two or three occurrences of SQLVAR per column, depending on whether the table contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 2*n or 3*n(where n is the number of columns in the table or view). The first n occurrences of SQLVAR contain the column names if they are different from the system column name. Either the second or third n occurrences contain the column labels. If there are no distinct types, the labels are returned in the second set of SQLVAR entries. Otherwise, the labels are returned in the third set of SQLVAR entries.

ALL

Assigns the label, column name, and system column name. In this case three or four occurrences of SQLVAR per column, depending on whether the table contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 3*n or 4*n (where n is the number of columns in the table). The first n occurrences of SQLVAR contain the system column names. The second or third n occurrences contain the column labels. The third or fourth n occurrences contain the column names. If there

are no distinct types, the labels are returned in the second set of SQLVAR entries and the column names are returned in the third set of SQLVAR entries. Otherwise, the labels are returned in the third set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries.

Notes

Allocating the SQL descriptor: Before the DESCRIBE TABLE statement is executed, the SQL descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. If the number of descriptor items allocated is less than the number of columns in the table or view, a warning (SQLSTATE 01005) is returned.

Allocating the SQLDA: Before the DESCRIBE TABLE statement is executed, the value of SQLN must be set to a value greater than or equal to zero to indicate how many occurrences of SQLVAR are provided in the SQLDA and enough storage must be allocated to contain SQLN occurrences. To obtain the description of the columns of the table or view, the number of occurrences of SQLVAR must not be less than the number of columns. Furthermore, if USING BOTH or USING ALL is specified, or if the columns include LOBs or distinct types, the number of occurrences of SQLVAR should be two, three, or four times the number of columns. See "Determining how many SQLVAR occurrences are needed" on page 1238 for more information.

If not enough occurrences are provided to return all sets of occurrences, SQLN is set to the total number of occurrences necessary to return all information. Otherwise, SQLN is set to the number of columns.

For a description of techniques that can be used to allocate the SQLDA, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.

Example

In a C program, execute a DESCRIBE statement with an SQLDA that has no occurrences of SQLVAR. If SQLD is greater than zero, use the value to allocate an SQLDA with the necessary number of occurrences of SQLVAR and then execute a DESCRIBE statement using that SQLDA.

```
EXEC SQL BEGIN DECLARE SECTION;
  char table_name[201];
EXEC SQL END DECLARE SECTION;
EXEC SQL INCLUDE SQLDA;
EXEC SQL DECLARE DYN_CURSOR CURSOR FOR STMT1_NAME;
.../*code to prompt user for a table or view */
.../*code to set SQLN to zero and to allocate the SQLDA */
EXEC SQL DESCRIBE TABLE :table name INTO :sqlda;
\dots /* code to check that SQLD is greater than zero, to set */
    /* SQLN to SQLD, then to re-allocate the SQLDA
EXEC SQL DESCRIBE TABLE :table name INTO :sqlda;
```

DISCONNECT

The DISCONNECT statement ends one or more connections for unprotected conversations.

Invocation

This statement can only be embedded in an application program or issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

DISCONNECT is not allowed in a trigger. DISCONNECT is not allowed in an external procedure if the external procedure is called on a remote application server.

Authorization

None required.

Syntax



Description

server-name or variable

Identifies the application server by the specified server name or the server name contained in the variable. If a variable is specified:

- It must be a character-string variable.
- It must not be followed by an indicator variable
- The server name must be left-justified within the variable and must conform to the rules for forming an ordinary identifier
- If the length of the server name is less than the length of the variable, it must be padded on the right with blanks.

When the DISCONNECT statement is executed, the specified server name or server name contained in the variable must identify an existing dormant or current connection of the activation group. The identified connection cannot use a protected conversation.

CURRENT

Identifies the current connection of the activation group. The activation group must be in the connected state. The current connection must not use a protected conversation.

ALL or ALL SQL

Identifies all existing connections of the activation group (local as well as remote connections). An error or warning does not occur if no connections exist when the statement is executed. None of the connections can use protected conversations.

Notes

DISCONNECT and CONNECT (Type 1): Using CONNECT (Type 1) semantics does not prevent using DISCONNECT.

Connection restrictions: An identified connection must not be a connection that was used to execute SQL statements during the current unit of work and must not be a connection for a protected conversation. To end connections on protected conversations, use the RELEASE statement. Local connections are never considered to be protected conversations.

The DISCONNECT statement should be executed immediately after a commit operation. If DISCONNECT is used to end the current connection, the next executed SQL statement must be CONNECT or SET CONNECTION.

ROLLBACK does not reconnect a connection that has been ended by DISCONNECT.

Successful disconnect: If the DISCONNECT statement is successful, each identified connection is ended. If the current connection is destroyed, the activation group is placed in the unconnected state.

DISCONNECT closes cursors, releases resources, and prevents further use of the connection.

DISCONNECT ALL ends the connection to the local application server. A connection is ended even though it has an open cursor defined with the WITH HOLD clause.

Unsuccessful disconnect: If the DISCONNECT statement is unsuccessful, the connection state of the activation group and the states of its connections are unchanged.

Resource considerations for remote connections: Resources are required to create and maintain remote connections. Thus, a remote connection that is not going to be reused should be ended as soon as possible and a remote connection that is going to be reused should not be destroyed.

Examples

Example 1: The connection to TOROLAB1 is no longer needed. The following statement is executed after a commit operation.

EXEC SQL DISCONNECT TOROLAB1;

Example 2: The current connection is no longer needed. The following statement is executed after a commit operation.

EXEC SQL DISCONNECT CURRENT;

Example 3: The existing connections are no longer needed. The following statement is executed after a commit operation.

EXEC SQL DISCONNECT ALL;

DROP

The DROP statement drops an object. Objects that are directly or indirectly dependent on that object may also be dropped.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

To drop a table, view, index, alias, or package, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - The system authorities of *OBJOPR and *OBJEXIST on the object to be dropped
 - If the object is a table or view, the system authorities of *OBJOPR and *OBJEXIST on any views, indexes, and logical files that are dependent on that table or view
 - The system authority *EXECUTE on the library that contains the object to be dropped
- Administrative authority

To drop a schema, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - The system authorities of *OBJEXIST, *OBJOPR, *EXECUTE, and *READ on the library to be dropped.
 - The system authorities of *OBJOPR and *OBJEXIST on all objects in the schema and *OBJOPR and *OBJEXIST on any views, indexes and logical files that are dependent on tables and views in the schema.
 - Any additional authorities required to delete other object types that exist in the schema. For example, *OBJMGT to the data dictionary if the schema contains a data dictionary, and some system data authority to the journal receiver. For more information, see Security Reference.
- Administrative authority

To drop a distinct type, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - The system authorities of *OBJOPR and *OBJEXIST on the distinct type to be dropped
 - The system authority *EXECUTE on the library that contains the distinct type to be dropped
 - The DELETE privilege on the SYSTYPES, SYSPARMS, and SYSROUTINES catalog tables, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To drop a function, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - For SQL functions, the system authority *OBJEXIST on the service program object associated with the function, and
 - The DELETE privilege on the SYSFUNCS, SYSPARMS, and SYSROUTINEDEP catalog tables, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To drop a procedure, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - For SQL procedures, the system authority *OBJEXIST on the program object associated with the procedure, and
 - The DELETE privilege on the SYSPROCS, SYSPARMS, and SYSROUTINEDEP catalog tables, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To drop a sequence, the privileges held by the authorization ID of the statement must include at least one of the following:

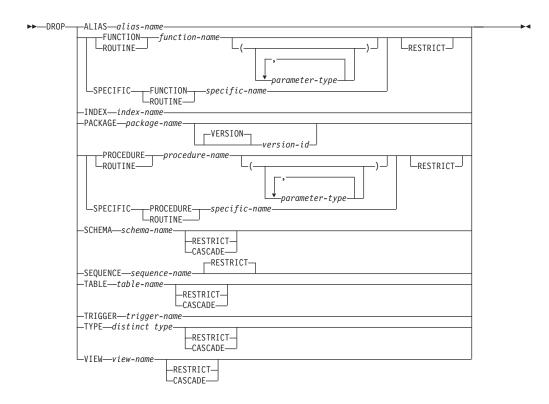
- The following system authorities:
 - The system authority *OBJEXIST on the data area associated with the sequence, and
 - The system authority *EXECUTE on the library that contains the sequence to be dropped
 - The DELETE privilege on the SYSSEQOBJECTS catalog table, and
 - The system authority *EXECUTE on library QSYS2, and
 - *USE to the Delete Data Area (DLTDTAARA) command
- Administrative authority

To drop a trigger, the privileges held by the authorization ID of the statement must include at least one of the following:

- The following privileges:
 - The system authority *USE to the Remove Physical File Trigger (RMVPFTRG) command, and
 - For the subject table or view of the trigger:
 - The ALTER privilege to the subject table or view, and
 - The system authority *EXECUTE on the library containing the subject table or view,
 - If the trigger being dropped is an SQL trigger:
 - The system authority *OBJEXIST on the trigger program object, and
 - The system authority *EXECUTE on the library containing the trigger.
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax



parameter-type:

```
-data-type -AS LOCATOR-
```

data-type:

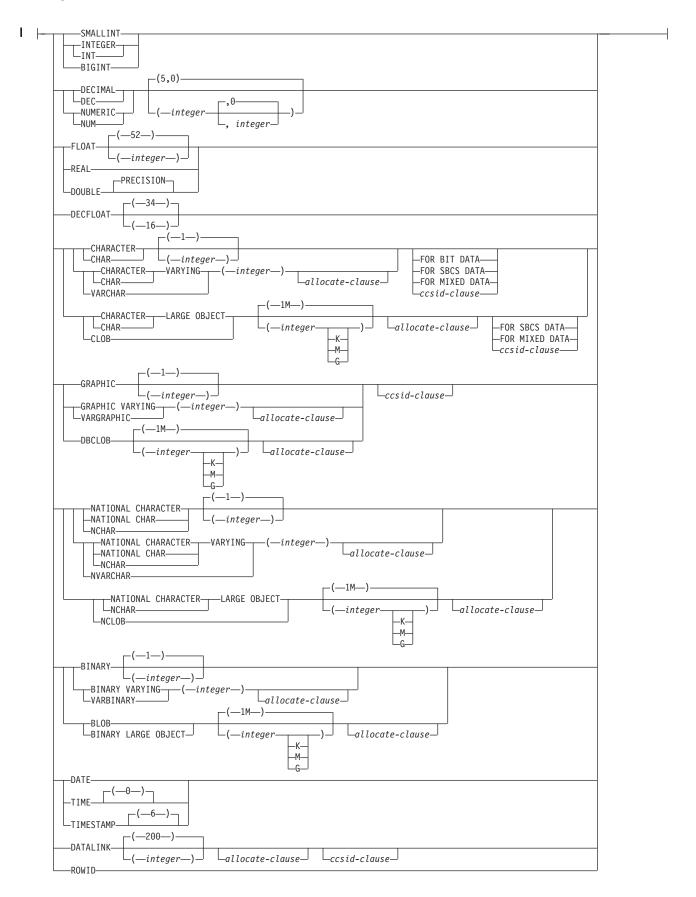
```
___built-in-type______
```

data-type:

```
-__built-in-type-
distinct-type-name-
```

built-in-type:

DROP



Description

ALIAS alias-name

Identifies the alias that is to be dropped. The *alias-name* must identify an alias that exists at the current server.

The specified alias is deleted from the schema. Dropping an alias has no effect on any constraint, view, or materialized query that was defined using the alias. An alias can be dropped whether it is referenced in a function, package, procedure, program, or trigger.

FUNCTION or SPECIFIC FUNCTION

Identifies the function that is to be dropped. The function must exist at the current server and it must be a function that was defined with the CREATE FUNCTION statement. The particular function can be identified by its name, function signature, or specific name.

Functions implicitly generated by the CREATE TYPE statement cannot be dropped using the DROP statement. They are implicitly dropped when the distinct type is dropped.

The function cannot be dropped if another function is dependent on it. A function is dependent on another function if it was identified in the SOURCE clause of the CREATE FUNCTION statement. A function can be dropped whether it is referenced in a function, package, procedure, program, trigger, or view unless RESTRICT is specified

The specified function is dropped from the schema. All privileges on the user-defined function are also dropped. If this is an SQL function or sourced function, the service program (*SRVPGM) associated with the function is also dropped. If this is an external function, the information that was saved in the program or service program specified on the CREATE FUNCTION statement is removed from the object.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type, ...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type*, ...) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance which is to be dropped. Synonyms for data types are considered a match.

If *function-name* () is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type, ...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC FUNCTION specific-name

Identifies the function by its specific name. The *specific-name* must identify a specific function that exists at the current server.

RESTRICT

Specifies that the function cannot be dropped if it is referenced in an SQL function, SQL procedure, table, SQL trigger, or view.

INDEX *index-name*

Identifies the index that is to be dropped. The *index-name* must identify an index that exists at the current server.

The specified index is dropped from the schema. An index can be dropped whether it is referenced in a function, package, procedure, program, or trigger.

PACKAGE package-name

Identifies the package that is to be dropped. The *package-name* must identify a package that exists at the current server.

The specified package is dropped from the schema. All privileges on the package are also dropped.

A package can be dropped whether it is referenced in a function, package, procedure, program, or trigger.

VERSION version-id

version-id is the version identifier that was assigned to the package when it was created. If *version-id* is not specified, a null string is used as the version identifier.

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure that is to be dropped. The *procedure-name* must identify a procedure that exists at the current server.

The specified procedure is dropped from the schema. All privileges on the procedure are also dropped. If this is an SQL procedure, the program (*PGM) associated with the procedure is also dropped. If this is an external procedure, the information that was saved in the program specified on the CREATE PROCEDURE statement is removed from the object.

A procedure can be dropped whether it is referenced in a function, package, procedure, program, trigger, or view.

PROCEDURE *procedure-name*

Identifies the procedure by its name. The *procedure-name* must identify exactly one procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE procedure-name (parameter-type, ...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The *procedure-name* (*parameter-type*, ...) must identify a procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types, and the logical concatenation of the data types is used to identify the specific procedure instance which is to be dropped. Synonyms for data types are considered a match.

If *procedure-name* () is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type, ...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the
 attribute when determining whether the data types match. For
 example, DEC() will be considered a match for a parameter of a
 procedure defined with a data type of DEC(7,2). However, FLOAT
 cannot be specified with empty parenthesis because its parameter
 value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC PROCEDURE specific-name

Identifies the procedure by its specific name. The specific-name must identify a specific procedure that exists at the current server.

RESTRICT

Specifies that the procedure cannot be dropped if it is referenced in an SQL function, SQL procedure, or SQL trigger.

SCHEMA *schema-name*

Identifies the schema that is to be dropped. The schema-name must identify a schema that exists at the current server.

The specified schema is dropped. Each object in the schema is dropped as if the appropriate DROP statement was executed with the specified drop option (CASCADE, RESTRICT, or neither). See the DROP description of these object types for information about the handling of objects dependent on these objects.

DROP SCHEMA is only valid when the commit level is *NONE.

Neither CASCADE nor RESTRICT

Specifies that the schema will be dropped even if it is referenced in a function, package, procedure, program, table, or trigger in another schema.

CASCADE

Specifies that any objects in the schema and any triggers that reference the schema will be dropped.

RESTRICT

Specifies that the schema cannot be dropped if it is referenced in an SQL trigger in another schema or if the schema contains any SQL objects other than catalog views, the journal, and journal receiver.

SEQUENCE *sequence-name*

Identifies the sequence that is to be dropped. The sequence-name must identify a sequence that exists at the current server.

RESTRICT

Specifies that the sequence cannot be dropped if it is referenced in an SQL trigger, function, or procedure.

TABLE table-name

Identifies the table that is to be dropped. The table-name must identify a base table that exists at the current server, but must not identify a catalog table.

The specified table is dropped from the schema. All privileges, constraints, indexes, and triggers on the table are also dropped.

Any aliases that reference the specified table are not dropped.

Neither CASCADE nor RESTRICT

Specifies that the table will be dropped even if it is referenced in a constraint, index, trigger, view, or materialized query table. All indexes, views, and materialized query tables that reference the table are dropped even if the authorization ID of the statement does not explicitly have privileges to those objects.

CASCADE

Specifies that the table will be dropped even if it is referenced in a constraint, index, trigger, view, or materialized query table. All constraints, indexes, triggers, views, and materialized query tables that reference the table are dropped even if the authorization ID of the statement does not explicitly have privileges to those objects.

RESTRICT

Specifies that the table cannot be dropped if it is referenced in a constraint, index, trigger, view, or materialized query table.

TRIGGER trigger-name

Identifies the trigger that is to be dropped. The trigger-name must identify a trigger that exists at the current server.

The specified trigger is dropped from the schema. If the trigger is an SQL trigger, the program object associated with the trigger is also deleted from the

If trigger-name specifies an INSTEAD OF trigger on a view, another trigger may depend on that trigger through an update against the view.

TYPE distinct type

Identifies the distinct type that is to be dropped. The distinct type must identify a distinct type that exists at the current server. The specified type is deleted from the schema.

Neither CASCADE nor RESTRICT

Specifies that the type cannot be dropped if any constraints, indexes, sequences, tables, and views reference the type.

For every procedure or function R that has parameters or a return value of the type being dropped, or a reference to the type being dropped, the following DROP statement is effectively executed:

DROP ROUTINE R

For every trigger T that references the type being dropped, the following DROP statement is effectively executed:

DROP TRIGGER T

It is possible that this statement would cascade to drop dependent functions or procedures. If all of these functions or procedures are in the list to be dropped because of a dependency on the distinct type, the drop of the distinct type will succeed.

CASCADE

Specifies that the type will be dropped even if it is referenced in a constraint, function, index, procedure, sequence, table, trigger, or view. All constraints, functions, indexes, procedures, sequences, tables, triggers, and views that reference the type are dropped.

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RESTRICT

Specifies that the type cannot be dropped if it is referenced in a constraint, function (other than a function that was created when the type was created), index, procedure, sequence, table, trigger, or view.

VIEW view-name

Identifies the view that is to be dropped. The *view-name* must identify a view that exists at the current server, but must not identify a catalog view.

The specified view is dropped from the schema. When a view is dropped, all privileges and triggers on that view are dropped.

Neither CASCADE nor RESTRICT

Specifies that the view will be dropped even if it is referenced in a trigger, materialized query table, or another view. All views and materialized query tables that reference the view are dropped.

CASCADE

Specifies that the view will be dropped even if it is referenced in a trigger, materialized query table, or another view. All triggers, materialized query tables, and views that reference the view are dropped.

RESTRICT

Specifies that the view cannot be dropped if it is referenced in a trigger, materialized query table, or another view.

Notes

Drop effects: Whenever an object is dropped, its description is dropped from the catalog. If the object is referenced in a function, package, procedure, program, or trigger; any access plans that reference the object are implicitly prepared again when the access plan is next used. If the object does not exist at that time, an error is returned.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword SYNONYM can be used as a synonym for ALIAS.
- The keywords DATA TYPE or DISTINCT TYPE can be used as a synonym for TYPE.
- The keyword PROGRAM can be used as a synonym for PACKAGE.
- The keyword COLLECTION can be used as a synonym for SCHEMA.

Examples

Example 1: Drop your table named MY_IN_TRAY. Do not allow the drop if any views or indexes are created over this table.

DROP TABLE MY IN TRAY RESTRICT

Example 2: Drop your view named MA_PROJ.

DROP VIEW MA PROJ

Example 3: Drop the package named PERS.PACKA.

DROP PACKAGE PERS.PACKA

Example 4: Drop the distinct type DOCUMENT, if it is not currently in use:

DROP DISTINCT TYPE DOCUMENT RESTRICT

Example 5: Assume that you are SMITH and that ATOMIC_WEIGHT is the only

function with that name in schema CHEM. Drop ATOMIC_WEIGHT.

END DECLARE SECTION

The END DECLARE SECTION statement marks the end of an SQL declare section.

Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in RPG, Java, or REXX.

Authorization

None required.

Syntax

►► END DECLARE SECTION

Description

The END DECLARE SECTION statement can be coded in the application program wherever declarations can appear in accordance with the rules of the host language. It is used to indicate the end of an SQL declare section. An SQL declare section starts with a BEGIN DECLARE SECTION statement. For more information about the BEGIN DECLARE SECTION statement, see "BEGIN DECLARE SECTION" on page 618.

The BEGIN DECLARE SECTION and the END DECLARE SECTION statements must be paired and cannot be nested.

Examples

See "BEGIN DECLARE SECTION" on page 618 for examples using the END DECLARE SECTION statement.

EXECUTE

The EXECUTE statement executes a prepared SQL statement.

Invocation

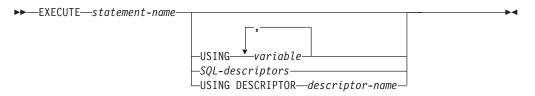
This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

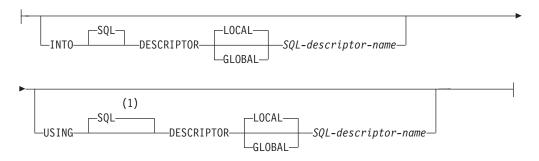
The authorization rules are those defined for the SQL statement specified by EXECUTE. For example, see the description of INSERT for the authorization rules that apply when an INSERT statement is executed using EXECUTE.

The authorization ID of the statement is the run-time authorization ID unless DYNUSRPRF(*OWNER) was specified on the CRTSQLxxx command when the program was created. For more information, see "Authorization IDs and authorization names" on page 64.

Syntax



SQL-descriptors:



Notes:

If an SQL descriptor is specified in the USING clause and the INTO clause is not specified, USING DESCRIPTOR is not allowed and USING SQL DESCRIPTOR must be specified.

Description

statement-name

Identifies the prepared statement to be executed. When the EXECUTE statement is executed, the name must identify a prepared statement at the current server. The prepared statement cannot be a SELECT statement.

USING

Introduces a list of variables whose values are substituted for the parameter markers (question marks) in the prepared statement. For an explanation of parameter markers, see "PREPARE" on page 1020. If the prepared statement includes parameter markers, the USING clause must be used. USING is ignored if there are no parameter markers.

variable,...

Identifies one of more host structures or variables that must be declared in the program in accordance with the rules for declaring host structures and variables. A reference to a host structure is replaced by a reference to each of its variables. The number of variables must be the same as the number of parameter markers in the prepared statement. The *n*th variable corresponds to the *n*th parameter marker in the prepared statement.

SQL-descriptors

INTO

Identifies an SQL descriptor which contains valid descriptions of the output variables to be used with the EXECUTE statement. This clause is only valid for a CALL or VALUES INTO statement. Before the EXECUTE statement is executed, a descriptor must be allocated using the ALLOCATE DESCRIPTOR statement.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

USING

Identifies an SQL descriptor which contains valid descriptions of the input variables to be used with the EXECUTE statement. Before the EXECUTE statement is executed, a descriptor must be allocated using the ALLOCATE DESCRIPTOR statement.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation. The information is returned from the descriptor known in this local scope.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session. The information is returned from the descriptor known to any program that executes using the same database connection.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

DESCRIPTOR descriptor-name

Identifies an SQLDA that must contain a valid description of variables.

Before the EXECUTE statement is processed, the user must set the following fields in the SQLDA. (The rules for REXX are different. For more information, see the Embedded SQL Programming topic collection.)

- SQLN to indicate the number of SQLVAR occurrences provided in the SQLDA.
- SQLDABC to indicate the number of bytes of storage allocated for the SQLDA.
- SQLD to indicate the number of variables used in the SQLDA when processing the statement.
- SQLVAR occurrences to indicate the attributes of the variables.

The SQLDA must have enough storage to contain all SQLVAR occurrences. If LOBs or distinct types are present in the results, there must be additional SQLVAR entries for each parameter. For more information about the SQLDA, which includes a description of the SQLVAR and an explanation on how to determine the number of SQLVAR occurrences, see "Determining how many SQLVAR occurrences are needed" on page 1238.

SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN. It must be the same as the number of parameter markers in the prepared statement. The *n*th variable described by the SQLDA corresponds to the *n*th parameter marker in the prepared statement.

Note that RPG/400 does not provide the function for setting pointers. Because the SQLDA uses pointers to locate the appropriate variables, you have to set these pointers outside your RPG/400 application.

Notes

Parameter marker replacement: Before the prepared statement is executed, each parameter marker in the statement is effectively replaced by its corresponding variable. The replacement of a parameter marker is an assignment operation in which the source is the value of the variable, and the target is a variable within the database manager. For a typed parameter marker, the attributes of the target variable are those specified by the CAST specification. For an untyped parameter marker, the attributes of the target variable are determined according to the context of the parameter marker. For the rules that affect parameter markers, see Table 80 on page 1027.

Let V denote a variable that corresponds to parameter marker P. The value of V is assigned to the target variable for P using storage assignment rules as described in "Assignments and comparisons" on page 89. Thus:

- V must be compatible with the target.
- If V is a number, the absolute value of its integral part must not be greater than the maximum absolute value of the integral part of the target.
- If the attributes of V are not identical to the attributes of the target, the value is converted to conform to the attributes of the target.
- If the target cannot contain nulls, the value of V must not be null.

However, unlike the storage assignment rules:

• If V is a string, the value will be truncated (without an error), if its length is greater than the length attribute of the target.

When the prepared statement is executed, the value used in place of P is the value of the target variable for P. For example, if V is CHAR(6) and the target is CHAR(8), the value used in place of P is the value of V padded with two blanks.

Example

This example of portions of a COBOL program shows how an INSERT statement with parameter markers is prepared and executed.

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
 77 EMP
                     PIC X(6).
  77 PRJ
                     PIC X(6).
  77 ACT
                     PIC S9(4) COMP-4.
                     PIC S9(3)V9(2).
  77 TIM
  01 HOLDER.
     49 HOLDER-LENGTH
                          PIC S9(4) COMP-4.
     49 HOLDER-VALUE PIC X(80).
EXEC SQL END DECLARE SECTION END-EXEC.
MOVE 70 TO HOLDER-LENGTH.
MOVE "INSERT INTO EMPPROJACT (EMPNO, PROJNO, ACTNO, EMPTIME)
             "VALUES (?, ?, ?, ?)" TO HOLDER-VALUE.
EXEC SQL PREPARE MYINSERT FROM : HOLDER END-EXEC.
IF SQLCODE = 0
  PERFORM DO-INSERT THRU END-DO-INSERT
ELSE
  PERFORM ERROR-CONDITION.
DO-INSERT.
  MOVE "000010" TO EMP.
  MOVE "AD3100" TO PRJ.
  MOVE 160
               TO ACT.
  MOVE .50
               TO TIM.
  EXEC SQL EXECUTE MYINSERT USING : EMP, : PRJ, : ACT, : TIM END-EXEC.
END-DO-INSERT.
```

EXECUTE IMMEDIATE

EXECUTE IMMEDIATE combines the basic functions of the PREPARE and EXECUTE statements. It can be used to prepare and execute SQL statements that contain neither variables nor parameter markers.

The EXECUTE IMMEDIATE statement:

- Prepares an executable form of an SQL statement from a character string form of the statement
- Executes the SQL statement

Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

The authorization rules are those defined for the SQL statement specified by EXECUTE IMMEDIATE. For example, see "INSERT" on page 994 for the authorization rules that apply when an INSERT statement is executed using EXECUTE IMMEDIATE.

The authorization ID of the statement is the run-time authorization ID unless DYNUSRPRF(*OWNER) was specified on the CRTSQLxxx command when the program was created. For more information, see "Authorization IDs and authorization names" on page 64.

Syntax



Description

variable

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Identifies a variable that must be declared in accordance with the rules for declaring character-string or Unicode graphic variables. An indicator variable must not be specified.

string-expression

A *string-expression* is any PL/I *string-expression* that yields a character string. SQL expressions that yield a character string are not allowed. A *string-expression* is only allowed in PL/I.

The value of the identified variable or string expression is called a *statement string*.

The statement string must be one of the following SQL statements:⁸⁷

ALTER INSERT SET CURRENT DEBUG MODE

^{87.} A select-statement is not allowed. To dynamically process a select-statement, use the PREPARE, DECLARE CURSOR, and OPEN statements.

EXECUTE IMMEDIATE

CALL	LABEL	SET CURRENT DECFLOAT ROUNDING MODE
COMMENT	LOCK TABLE	SET CURRENT DEGREE
COMMIT	REFRESH TABLE	SET ENCRYPTION PASSWORD
CREATE	RELEASE SAVEPOINT	SET PATH
DECLARE GLOBAL TEMPORARY TABLE	RENAME	SET SCHEMA
DELETE	REVOKE	SET SESSION AUTHORIZATION
DROP	ROLLBACK	SET TRANSACTION
GRANT	SAVEPOINT	UPDATE

The statement string must not:

- Begin with EXEC SQL.
- · End with END-EXEC or a semicolon.
- Include references to variables.
- · Include parameter markers.

When an EXECUTE IMMEDIATE statement is executed, the specified statement string is parsed and checked for errors. If the SQL statement is not valid, it is not executed and the error condition that prevents its execution is reported in the stand-alone SQLSTATE and SQLCODE. If the SQL statement is valid, but an error occurs during its execution, that error condition is reported in the stand-alone SQLSTATE and SQLCODE. Additional information about the error can be retrieved from the SQL Diagnostics Area (or the SQLCA).

Note

Performance considerations: If the same SQL statement is to be executed more than once, it is more efficient to use the PREPARE and EXECUTE statements rather than the EXECUTE IMMEDIATE statement.

Example

```
Use C to execute the SQL statement in the variable Qstring.
void main ()
    EXEC SQL BEGIN DECLARE SECTION END-EXEC.
    char Qstring[100] = "INSERT INTO WORK TABLE SELECT * FROM EMPPROJACT
    WHERE ACTNO >= 100";
   EXEC SQL END DECLARE SECTION END-EXEC.
   EXEC SQL INCLUDE SQLCA;
    EXEC SQL EXECUTE IMMEDIATE : Qstring;
    return;
```

FETCH

The FETCH statement positions a cursor on a row of the result table. It can return zero, one, or multiple rows, and it assigns the values of the rows returned to variables.

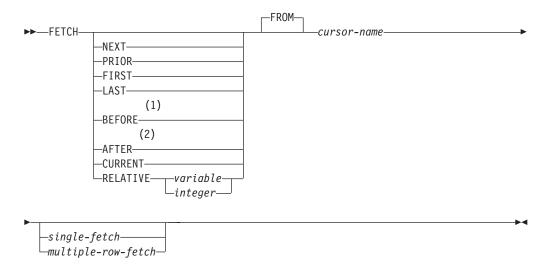
Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. Multiple row fetch is not allowed in a REXX procedure.

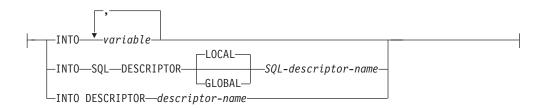
Authorization

See "DECLARE CURSOR" on page 845 for an explanation of the authorization required to use a cursor.

Syntax



single-fetch:



multiple-row-fetch:

```
├─FOR──variable──ROWS──
```



row-storage-area:



Notes:

- 1 If BEFORE is specified, a *single-fetch* or *multiple-row-fetch* must not be specified.
- 2 If AFTER is specified, a *single-fetch* or *multiple-row-fetch* must not be specified.

Description

The following keywords specify a new position for the cursor: NEXT, PRIOR, FIRST, LAST, BEFORE, AFTER, CURRENT, and RELATIVE. Of those keywords, only NEXT may be used for cursors that have not been declared SCROLL.

NEXT

Positions the cursor on the next row of the result table relative to the current cursor position. NEXT is the default if no other cursor orientation is specified.

PRIOR

Positions the cursor on the previous row of the result table relative to the current cursor position.

FIRST

Positions the cursor on the first row of the result table.

LAST

Positions the cursor on the last row of the result table.

BEFORE

Positions the cursor before the first row of the result table.

AFTER

Positions the cursor after the last row of the result table.

CURRENT

Does not reposition the cursor, but maintains the current cursor position. If the cursor has been declared as DYNAMIC SCROLL and the current row has been updated so its place within the sort order of the result table is changed, an error is returned.

RELATIVE

Variable or *integer* is assigned to an integer value k. RELATIVE positions the cursor to the row in the result table that is either k rows after the current row if k>0, or k rows before the current row if k<0. If a *variable* is specified, it must be a numeric variable with zero scale and it must not include an indicator variable.

Table 61. Synonymous Scroll Specifications

Specification	Alternative
RELATIVE +1	NEXT

Table 61. Synonymous Scroll Specifications (continued)

Specification	Alternative
RELATIVE -1	PRIOR
RELATIVE 0	CURRENT

FROM

This keyword is provided for clarity only. If a scroll position option is specified, then this keyword is required. If no scrolling option is specified, then the FROM keyword is optional.

cursor-name

Identifies the cursor to be used in the fetch operation. The *cursor-name* must identify a declared cursor as explained in "Description" on page 846 for the DECLARE CURSOR statement or when used in Java, an instance of an SQLJ iterator. When the FETCH statement is executed, the cursor must be in the open state.

If a *single-fetch* or *multiple-row-fetch* clause is not specified, no data is returned to the user. However, the cursor is positioned and a row lock may be acquired. For more information about locking, see "Isolation level" on page 26.

single-fetch

INTO variable,...

Identifies one or more host structures or variables that must be declared in accordance with the rules for declaring host structures and variables. In the operational form of INTO, a host structure is replaced by a reference to each of its variables. The first value in the result row is assigned to the first variable in the list, the second value to the second variable, and so on.

INTO SQL DESCRIPTOR *SQL-descriptor-name*

Identifies an SQL descriptor which contains valid descriptions of the output variables to be used with the FETCH statement. Before the FETCH statement is executed, a descriptor must be allocated using the ALLOCATE DESCRIPTOR statement.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

INTO DESCRIPTOR descriptor-name

Identifies an SQLDA that must contain a valid description of zero or more variables.

Before the FETCH statement is processed, the user must set the following fields in the SQLDA. (The rules for REXX are different. For more information see the Embedded SQL Programming topic collection.)

- SQLN to indicate the number of SQLVAR occurrences provided in the SQLDA

- SQLDABC to indicate the number of bytes of storage allocated for the SQLDA
- SQLD to indicate the number of variables used in the SQLDA when processing the statement
- SQLVAR occurrences to indicate the attributes of the variables

The SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(80), where 80 is the length of an SQLVAR occurrence. If LOBs are specified, there must be two SQLVAR entries for each parameter marker and SQLN must be set to two times the number of parameter markers.

SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN. For more information, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.

The USING DESCRIPTOR clause is not supported for a FETCH statement within a Java program.

multiple-row-fetch

FOR variable or integer ROWS

Evaluates *variable* or *integer* to an integral value that represents the number of rows to fetch. If a *variable* is specified, it must be a numeric variable with zero scale and it must not include an indicator variable. The value must be in the range of 1 to 32767. The cursor is positioned on the row specified by the orientation keyword (for example, NEXT), and that row is fetched. Then the next rows are fetched (moving forward in the table), until either the specified number of rows have been fetched or the end of the cursor is reached. After the fetch operation, the cursor is positioned on the last row fetched.

For example, FETCH PRIOR FROM C1 FOR 3 ROWS causes the previous row, the current row, and the next row to be returned, in that order. The cursor is positioned on the next row. FETCH RELATIVE -1 FROM C1 FOR 3 ROWS returns the same result. FETCH FIRST FROM C1 FOR :x ROWS returns the first x rows, and leaves the cursor positioned on row number x.

When a *multiple-row-fetch* is successfully executed, three statement information items are available in the SQL Diagnostics Area (or the SQLCA):

- ROW_COUNT (or SQLERRD(3) of the SQLCA) shows the number of rows retrieved.
- DB2_ROW_LENGTH (or SQLERRD(4) of the SQLCA) contains the length of the row retrieved.
- DB2_LAST_ROW (or SQLERRD(5) of the SQLCA) contains +100 if the last row was fetched. ⁸⁸

INTO *host-structure-array*

host-structure-array identifies an array of host structures defined in accordance with the rules for declaring host structures.

The first structure in the array corresponds to the first row, the second structure in the array corresponds to the second row, and so on. In addition, the first value in the row corresponds to the first item in the structure, the

^{88.} If the number of rows returned is equal to the number of rows requested, then an end of data warning may not occur and DB2_LAST_ROW (or SQLERRD(5) of the SQLCA) may not contain +100.

second value in the row corresponds to the second item in the structure, and so on. The number of rows to be fetched must be less than or equal to the dimension of the host structure array.

USING SQL DESCRIPTOR SQL-descriptor-name

Identifies an SQL descriptor.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

The COUNT field in the descriptor header must be set to reflect the number of columns in the result set. The TYPE and DATETIME_INTERVAL_CODE (if applicable) must be set for each column in the result set.

USING DESCRIPTOR descriptor-name

Identifies an SQLDA that must contain a valid description of zero or more variables that describe the format of a row in the *row-storage-area*.

Before the FETCH statement is processed, the user must set the following fields in the SQLDA:

- SQLN to indicate the number of SQLVAR occurrences provided in the SQLDA.
- SQLDABC to indicate the number of bytes of storage allocated for the SQLDA.
- SQLD to indicate the number of variables used in the SQLDA when processing the statement.
- SQLVAR occurrences to indicate the attributes of the variables.

The values of the other fields of the SQLDA (such as SQLNAME) may not be defined after the FETCH statement is executed and should not be used.

The SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(80), where 80 is the length of an SQLVAR occurrence. If LOBs or distinct types are specified, there must be two SQLVAR entries for each parameter marker and SQLN must be set to two times the number of parameter markers.

SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN. For more information, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.

On completion of the FETCH, the SQLDATA pointer in the first SQLVAR entry addresses the returned value for the first column in the allocated storage in the first row, the SQLDATA pointer in the second SQLVAR entry addresses the returned value for the second column in the allocated storage in the first row, and so on. The SQLIND pointer in the first nullable SQLVAR entry addresses the first indicator value, the SQLIND pointer in the second nullable SQLVAR entry addresses the second indicator value, and so on. The SQLDA must be allocated on a 16-byte boundary.

INTO row-storage-area

host-identifier-1 specified with a variable identifies an allocation of storage in which to return the rows. The rows are returned into the storage area in the format described by the SQLDA or SQL descriptor. host-identifier-1 must be large enough to hold all the rows requested.

host-identifier-2 identifies the optional indicator area. It should be specified if any of the data types returned are nullable. The indicators are returned as small integers. host-identifier-2 must be large enough to contain an indicator for each nullable value for each row to be returned.

The GET DIAGNOSTICS statement can be used to return the DB2_ROW_LENGTH which indicates the length of each row returned into the *row-storage-area*.

The *nth* variable identified by the INTO clause or described in the SQLDA corresponds to the *nth* column of the result table of the cursor. The data type of each variable must be compatible with its corresponding column.

Each assignment to a variable is made according to the retrieval assignment rules described in "Retrieval assignment" on page 93.89 If the number of variables is less than the number of values in the row, the SQLSTATE is set to '01503' (or the SQLWARN3 field of the SQLCA is set to 'W'). Note that there is no warning if there are more variables than the number of result columns. If the value is null, an indicator variable must be provided. If an assignment error occurs, the value is not assigned to the variable, and no more values are assigned to variables. Any values that have already been assigned to variables remain assigned.

If an error occurs as the result of an arithmetic expression in the SELECT list of an outer SELECT statement (division by zero, overflow, etc.) or a character conversion error occurs, the result is the null value. As in any other case of a null value, an indicator variable must be provided. The value of the variable is undefined. In this case, however, the indicator variable is set to -2. Processing of the statement continues as if the error had not occurred. (However, a warning is returned.) If you do not provide an indicator variable, an error is returned. It is possible that some values have already been assigned to variables and will remain assigned when the error occurs.

multiple-row-fetch is not allowed if any of the result columns are LOBs or if the current connection is to a remote server.

Notes

Cursor position: An open cursor has three possible positions:

- Before a row
- · On a row
- · After the last row

If a cursor is positioned on a row, that row is called the current row of the cursor. A cursor referenced in an UPDATE or DELETE statement must be positioned on a row. A cursor can only be positioned on a row as a result of a FETCH statement.

It is possible for an error to occur that makes the state of the cursor unpredictable.

^{89.} If assigning to an SQL-variable or SQL-parameter and the standards option is specified, storage assignment rules apply. For information on the standards option, see "Standards compliance" on page ix.

 Variable assignment: The *n*th variable identified by the INTO clause or described in the SQLDA corresponds to the *n*th column of the result table of the cursor. The data type of each variable must be compatible with its corresponding column.

Each assignment to a variable is made according to the Retrieval Assignment rules described in "Assignments and comparisons" on page 89. If the number of variables is less than the number of values in the row, the SQLWARN3 field of the SQLCA is set to 'W'. Note that there is no warning if there are more variables than the number of result columns. If the value is null, an indicator variable must be provided. If an assignment error occurs, the values in the variables are unpredictable.

If the specified variable is a string and is not large enough to contain the result, a warning (SQLSTATE 01004) is returned (and 'W' is assigned to SQLWARN1 in the SQLCA). The actual length of the result is returned in the indicator variable associated with the *variable*, if an indicator variable is provided.

If the specified variable is a C NUL-terminated variable and is not large enough to contain the result and the NUL-terminator:

- If the *CNULRQD option is specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*YES) on the SET OPTION statement), the following occurs:
 - The result is truncated.
 - The last character is the NUL-terminator.
 - A warning (SQLSTATE 01004) is returned (and 'W' is assigned to SQLWARN1 in the SQLCA).
- If the *NOCNULRQD option on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement) is specified, the following occurs:
 - The NUL-terminator is not returned.
 - A warning (SQLSTATE 01004) is returned (and 'N' is assigned to SQLWARN1 in the SQLCA).

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

 USING DESCRIPTOR may be used as a synonym for INTO DESCRIPTOR in the single-fetch-clause.

Example

Example 1: In this C example, the FETCH statement fetches the results of the SELECT statement into the program variables dnum, dname, and mnum. When no more rows remain to be fetched, the not found condition is returned.

```
EXEC SQL DECLARE C1 CURSOR FOR
SELECT DEPTNO, DEPTNAME, MGRNO FROM TDEPT
WHERE ADMRDEPT = 'A00';
EXEC SQL OPEN C1;
while (SQLCODE==0) {
   EXEC SQL FETCH C1 INTO :dnum, :dname, :mnum;
}
EXEC SQL CLOSE C1;
```

Example 2: This FETCH statement uses an SQLDA.

```
FETCH CURS USING DESCRIPTOR :sqlda3
```

FREE LOCATOR

The FREE LOCATOR statement removes the association between a locator variable and its value.

Invocation

This statement can only be embedded in an application program. It cannot be issued interactively. It is an executable statement that can be dynamically prepared. However, the EXECUTE statement with the USING clause must be used to execute the prepared statement. FREE LOCATOR cannot be used with the EXECUTE IMMEDIATE statement. It must not be specified in Java or REXX.

Authorization

None required.

Syntax



Description

variable,...

Identifies one or more locator variables that must be declared in accordance with the rules for declaring locator variables. The locator variable type must be a binary large object locator, a character large object locator, or a double-byte character large object locator.

The variable must currently have a locator assigned to it. That is, a locator must have been assigned during this unit of work (by a CALL, FETCH, SELECT INTO, assignment statement, SET variable, or VALUES INTO statement) and must not subsequently have been freed (by a FREE LOCATOR statement); otherwise, an error is returned.

If more than one locator variable is specified and an error occurs on one of the locators, no locators will be freed.

Example

Assume that the employee table contains columns RESUME, HISTORY, and PICTURE and that locators have been established in a program to represent the column values. In a COBOL program, free the CLOB locator variables LOCRES and LOCHIST, and the BLOB locator variable LOCPIC.

```
EXEC SQL
FREE LOCATOR : LOCRES, : LOCHIST, : LOCPIC
END-EXEC.
```

GET DESCRIPTOR

The GET DESCRIPTOR statement gets information from an SQL descriptor.

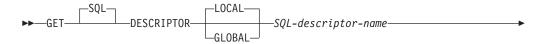
Invocation

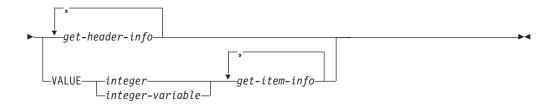
This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It cannot be issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

Authorization

None required.

Syntax





get-header-info:

get-item-info:

—variable**-**2— = — -DATA--DATETIME INTERVAL CODE--DB2_BASE_CATALOG_NAME--DB2 BASE COLUMN NAME--DB2_BASE_SCHEMA_NAME--DB2 BASE TABLE NAME--DB2 CCSID--DB2 COLUMN CATALOG NAME--DB2 COLUMN GENERATED--DB2 COLUMN GENERATION TYPE -DB2 COLUMN HIDDEN--DB2 COLUMN NAME--DB2 COLUMN ROW CHANGE--DB2 COLUMN SCHEMA NAME--DB2 COLUMN TABLE NAME--DB2 COLUMN UPDATABILITY--DB2 CORRELATION NAME--DB2 LABEL--DB2 PARAMETER NAME--DB2 SYSTEM COLUMN NAME--INDICATOR--KEY MEMBER -LENGTH--LEVEL -NAME--NULLABLE -OCTET LENGTH--PARAMETER MODE--PARAMETER ORDINAL POSITION--PARAMETER SPECIFIC CATALOG--PARAMETER SPECIFIC NAME--PARAMETER SPECIFIC SCHEMA--PRECISION--RETURNED LENGTH--RETURNED OCTET LENGTH--SCALE--TYPE--UNNAMED--USER DEFINED TYPE CATALOG--USER DEFINED TYPE CODE--USER_DEFINED_TYPE_NAME--USER DEFINED TYPE SCHEMA-

Description

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation. The information is returned from the descriptor known in this local scope.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session. The information is returned from the descriptor known to any program that executes using the same database connection.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

get-header-info

Returns information about the prepared SQL statement and SQL descriptor.

VALUE

Identifies the item number for which the specified information is retrieved. If the value is greater than the value of COUNT (from the header information), then no result is returned. If the item number is greater than the maximum number of items allocated for the descriptor or the item number is less than 1, an error is returned.

integer

An integer constant in the range of 1 to the number of items in the SQL descriptor.

integer-variable

Identifies a variable declared in the program in accordance with the rules for declaring variables. The data type of the variable must be SMALLINT, INTEGER, BIGINT, or DECIMAL or NUMERIC with a scale of zero. The value of *integer-variable* must be in the range of 1 to the maximum number of items in the SQL descriptor.

get-item-info

Returns information about a specific item in the SQL descriptor.

get-header-info

variable-1

Identifies a variable declared in the program in accordance with the rules for declaring variables, but must not be a file reference variable. The data type of the variable must be compatible with the descriptor information item as specified in Table 62 on page 940. The variable is assigned (using storage assignment rules) to the corresponding descriptor item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

COUNT

A count of the number of items in the descriptor.

DYNAMIC_FUNCTION

The type of the prepared SQL statement as a character string. For information on statement type, see Table 65 on page 963.

DYNAMIC_FUNCTION_CODE

The statement code representing the type of the prepared SQL statement. For information on statement codes, see Table 65 on page 963.

KEY TYPE

The type of key included in the select list. The possible values are:

- The descriptor is not describing the columns of a query or there are no key columns referenced in the query, or there is no unique key.
- The select list includes all the columns of the primary key of the base table referenced by the query.
- The table referenced by the query does not have a primary key but the select list includes a set of columns that are defined as the preferred candidate key. If there is more than one such preferred candidate key included in the select list, the left-most preferred candidate key is used.

DB2_MAX_ITEMS

Represents the value specified as the allocated maximum number of item descriptors on the ALLOCATE DESCRIPTOR statement. If the WITH MAX clause was not specified, the value is the default number of maximum items for the ALLOCATE DESCRIPTOR statement.

get-item-info

variable-2

Identifies a variable declared in the program in accordance with the rules for declaring variables, but must not be a file reference variable. The data type of the variable must be compatible with the descriptor information item as specified in Table 62 on page 940. The variable is assigned (using storage assignment rules) to the corresponding descriptor item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

When getting the DATA item, in general the variable must have the same data type, length, precision, scale, and CCSID as specified in Table 62 on page 940. For variable-length types, the variable length must not be less than the LENGTH in the descriptor. For C nul-terminated types, the variable length must be at least one greater than the LENGTH in the descriptor.

DB2_BASE_CATALOG_NAME

The server name of the base table for the column represented by the item descriptor.

DB2 BASE COLUMN NAME

The name of the column as defined in the base table referenced in the described query, possibly indirectly through a view. If a column name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2 BASE SCHEMA NAME

The schema name of the base table for the column represented by the item descriptor. If a schema name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2_BASE_TABLE_NAME

The table name of the underlying base table for the column represented by the item descriptor. If a table name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2_CCSID

The CCSID of character or graphic data. Value is zero for all types that are not based on character or graphic string types. Value is 65535 for binary types or character types with the FOR BIT DATA attribute.

DB2_COLUMN_CATALOG_NAME

The server name of the referenced table or view for the column represented by the item descriptor. If a column catalog name cannot be defined or is not applicable, this item will contain the empty string.

DB2_COLUMN_GENERATED

Indicates whether a column is generated. Possible values are:

- 0 Not generated
- 1 GENERATED ALWAYS
- 2 GENERATED BY DEFAULT

DB2 COLUMN GENERATION TYPE

Indicates how the column is generated. Possible values are:

- 0 Not generated
- 1 IDENTITY column
- 2 ROWID column
- 4 Row change timestamp column

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DB2_COLUMN_HIDDEN

Indicates whether the column represented by the item descriptor is hidden. Possible values are:

- 0 Not hidden
- 1 Implicitly hidden
- 3 Implicitly hidden for optimistic locking

DB2_COLUMN_NAME

The name of the column as defined in the table or view referenced in the described query. If a column name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2_COLUMN_ROW_CHANGE

Indicates whether the column represented by the item descriptor was added as a result of using the WITH ROW CHANGE COLUMNS prepare attribute. Possible values are:

- -1 ROW CHANGE TOKEN (distinct)
- -2 ROW CHANGE TOKEN (not distinct)
- -3 RID (only valid from a remote relational database)
- -4 RID_BIT (only valid from a remote relational database)

DB2 COLUMN SCHEMA NAME

The schema name of the referenced table or view for the column represented by the item descriptor. If a column schema name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2 COLUMN TABLE NAME

The table or view name of the referenced table or view for the column represented by the item descriptor. If a column table name cannot be defined or is not applicable, this item will contain the empty string. The name is returned as case sensitive and without delimiters.

DB2_COLUMN_UPDATABILITY

Indicates whether the column represented by the item descriptor is updatable. Possible values are:

- 0 Not updatable
- 1 Updatable

DB2_CORRELATION_NAME

The empty string is always returned.

DB2 LABEL

The label defined for the column. If there is no label for the column, this item will contain the empty string.

DB2_PARAMETER_NAME

The name of the parameter for the stored procedure. Only returned for a CALL statement. The name is returned as case sensitive and without delimiters.

DB2_SYSTEM_COLUMN_NAME

The system name of the column. If a system name cannot be defined or is not applicable, this item will contain blanks.

DATA

The value for the data described by the item descriptor. If the value of INDICATOR is negative, then the value of DATA is undefined and the INDICATOR *get-item-info* must also be specified in the same statement.

DATETIME_INTERVAL_CODE

Codes that define the specific datetime data type.

- **0** Descriptor item does not have TYPE value of 9.
- 1 DATE
- 2 TIME
- 3 TIMESTAMP

INDICATOR

The value for the indicator. A non-negative value is used when the value returned in this descriptor item is given in the DATA field. When extended indicator variables are not enabled, a negative value is used when the value returned in this descriptor item is the null value. When extended indicators are enabled:

- -1, -2, -3, -4, or -6 indicates the value returned in this descriptor is the null value.
- -5 indicates the value returned in this descriptor item is DEFAULT.
- -7 indicates the value returned in this descriptor item is UNASSIGNED.

KEY MEMBER

An indication of whether this column is part of a key.

- **0** This column is not part of a key.
- 1 This column is part of a unique key.
- 2 This column by itself is a unique key.

LENGTH

Returns the maximum length of the data. If the data type is a character or graphic string type or a datetime type, the length represents the number of characters (not bytes). If the data type is a binary string or any other type, the length represents the number of bytes. For a description of data type codes and lengths, see Table 63 on page 941.

LEVEL

The level of the item descriptor. The value is 0.

NAME

The name associated with the select list column described by the item descriptor. The name is returned as case sensitive and without delimiters.

NULLABLE

Indicates whether the column or parameter marker is nullable.

- The select list column or parameter marker cannot have a null value.
- 1 The select list column or parameter marker can have a null value.

OCTET LENGTH

Returns the maximum length of the data in bytes for all types. For a description of data type codes and lengths, see Table 63 on page 941.

PARAMETER_MODE

The mode of the parameter marker in a CALL statement.

- The descriptor is not associated with a CALL statement.
- 1 Input only parameter.
- 2 Input and output parameter.
- 4 Output only parameter.

PARAMETER_ORDINAL_POSITION

The ordinal position of the parameter marker in a CALL statement. The value is 0 if the descriptor is not associated with a CALL statement.

PARAMETER SPECIFIC CATALOG

The server name of the procedure containing the parameter marker.

PARAMETER_SPECIFIC_NAME

The specific name of the procedure containing the parameter marker. The name is returned as case sensitive and without delimiters.

PARAMETER_SPECIFIC_SCHEMA

The schema name of the procedure containing the parameter marker. The name is returned as case sensitive and without delimiters.

PRECISION

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Returns the precision for the data:

SMALLINT

5

INTEGER

10

BIGINT

10

NUMERIC and DECIMAL

Defined precision

REAL 24

DOUBLE

53

DECFLOAT(7)

7

DECFLOAT(16)

16

DECFLOAT(34)

34

TIME 0

TIMESTAMP

6

Other data types

0

RETURNED_LENGTH

The returned length in characters for character string and graphic string data types. The returned length in bytes for binary string data types.

RETURNED_OCTET_LENGTH

The returned length in bytes for all string data types.

SCALE

Returns the defined scale if the data type is DECIMAL or NUMERIC. The scale is 0 for all other data types.

TYPE

Returns a data type code representing the data type of the item. For a description of the data type codes and lengths, see Table 63 on page 941.

UNNAMED

A value of 1 indicates that the NAME value is generated by the database manager. Otherwise, the value is zero and NAME is the derived name of the column in the select list.

USER DEFINED TYPE CATALOG

The server name of the user-defined type. If the type is not a user-defined data type, this item contains the empty string.

USER_DEFINED_TYPE_CODE

Indicates whether the type of the descriptor item is a user-defined type.

The descriptor item is not a user-defined type.

1 The descriptor item is a user-defined type.

USER_DEFINED_TYPE_NAME

The name of the user-defined data type. If the type is not a user-defined data type, this item contains the empty string. The name is returned as case sensitive and without delimiters.

USER_DEFINED_TYPE_SCHEMA

The schema name of the user-defined data type. If the type is not a user-defined data type, this item contains the empty string. The name is returned as case sensitive and without delimiters.

Notes

Data types for items: The following table shows, the SQL data type for each descriptor item. When a descriptor item is assigned to a variable, the variable must be compatible with the data type of the diagnostic item.

Table 62. Data Types for GET DESCRIPTOR Items

Item Name	Data Type
Header Infor	mation
COUNT	INTEGER
DYNAMIC_FUNCTION	VARCHAR(128)
DYNAMIC_FUNCTION_CODE	INTEGER
KEY_TYPE	INTEGER
DB2_MAX_ITEMS	INTEGER
Item Inform	ation
DATA	Matches the data type specified by TYPE
DATETIME_INTERVAL_CODE	INTEGER
DB2_BASE_CATALOG_NAME	VARCHAR(128)
DB2_BASE_COLUMN_NAME	VARCHAR(128)
DB2_BASE_SCHEMA_NAME	VARCHAR(128)
DB2_BASE_TABLE_NAME	VARCHAR(128)
DB2_CCSID	INTEGER
DB2_COLUMN_CATALOG_NAME	VARCHAR(128)
DB2_COLUMN_GENERATED	INTEGER
DB2_COLUMN_GENERATION_TYPE	INTEGER
DB2_COLUMN_HIDDEN	INTEGER
DB2_COLUMN_NAME	VARCHAR(128)
DB2_COLUMN_ROW_CHANGE	INTEGER
DB2_COLUMN_SCHEMA_NAME	VARCHAR(128)
DB2_COLUMN_TABLE_NAME	VARCHAR(128)
DB2_COLUMN_UPDATABILITY	INTEGER
DB2_CORRELATION_NAME	VARCHAR(128)
DB2_LABEL	VARCHAR(60)
DB2_PARAMETER_NAME	VARCHAR(128)
DB2_SYSTEM_COLUMN_NAME	CHAR(10)

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Table 62. Data Types for GET DESCRIPTOR Items (continued)

Item Name	Data Type
INDICATOR	INTEGER
KEY_MEMBER	INTEGER
LENGTH	INTEGER
LEVEL	INTEGER
NAME	VARCHAR(128)
NULLABLE	INTEGER
OCTET_LENGTH	INTEGER
PARAMETER_MODE	INTEGER
PARAMETER_ORDINAL_POSITION	INTEGER
PARAMETER_SPECIFIC_CATALOG	VARCHAR(128)
PARAMETER_SPECIFIC_NAME	VARCHAR(128)
PARAMETER_SPECIFIC_SCHEMA	VARCHAR(128)
PRECISION	INTEGER
RETURNED_LENGTH	INTEGER
RETURNED_OCTET_LENGTH	INTEGER
SCALE	INTEGER
TYPE	INTEGER
UNNAMED	INTEGER
USER_DEFINED_TYPE_CATALOG	VARCHAR(128)
USER_DEFINED_TYPE_NAME	VARCHAR(128)
USER_DEFINED_TYPE_SCHEMA	VARCHAR(128)
USER_DEFINED_TYPE_CODE	VARCHAR(128)

SQL data type codes and lengths: The following table represents the possible values for TYPE, LENGTH, OCTET_LENGTH, and DATETIME_INTERVAL_CODE descriptor items.

The values in the following table are assigned by the ISO and ANSI SQL Standard and may change as the standard evolves. Include *sqlscds* in the include source files in library QSYSINC should be used when referencing these values.

Table 63. SQL Data Type Codes and Lengths

Data Type	Data Type Code	Length	Octet Length
SMALLINT	5	2	2
INTEGER	4	4	4
BIGINT	25	8	8
DECIMAL	3	(precision/2)+1	(precision/2)+1
NUMERIC(n)	2	n	n
REAL	7	4	4
FLOAT	6	8	8
DOUBLE PRECISION	8	8	8

Table 63. SQL Data Type Codes and Lengths (continued)

	Data Type		
Data Type	Code	Length	Octet Length
DECFLOAT(7)	-360	4	4
DECFLOAT(16)	-360	8	8
DECFLOAT(34)	-360	16	16
CHARACTER(n)	1	n	n
VARCHAR(n)	12	<=n	n
CLOB(n)	40	<=n	n
GRAPHIC(n)	-95	n	2*n
VARGRAPHIC(n)	-96	<=n	2*n
DBCLOB(n)	-350	<=n	2*n
BINARY(n)	-2	n	n
VARBINARY(n)	-3	<=n	n
BLOB(n)	30	n	n
DATE (DATETIME_INTERVAL_CODE = 1)	9	Length depends on date format	Based on CCSID
TIME (DATETIME_INTERVAL_CODE = 2)	9	Length depends on time format	Based on CCSID
TIMESTAMP (DATETIME_INTERVAL_CODE = 3)	9	26	26 or 52 (based on CCSID)
DATALINK(n)	70	<=n	n
ROWID	-904	40	40
C nul terminated CHARACTER(n)	1	<=n	n
C nul terminated GRAPHIC(n)	-400	<=n	2*n
BLOB File Reference Variable	-916	267	267
CLOB File Reference Variable	-920	267	267
DBCLOB File Reference Variable	-924	267	267

Example

Example 1: Retrieve from the descriptor 'NEWDA' the number of descriptor items.

```
EXEC SQL GET DESCRIPTOR 'NEWDA'
  :numitems = COUNT;
```

Example 2: Retrieve from the first item descriptor of descriptor 'NEWDA' the data type and the octet length.

```
GET DESCRIPTOR 'NEWDA'
 VALUE 1 :dtype = TYPE,
         :olength = OCTET_LENGTH;
```

GET DIAGNOSTICS

The GET DIAGNOSTICS statement obtains information about the previous SQL statement that was executed.

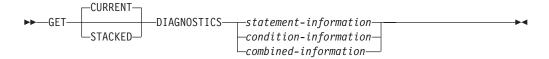
Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It cannot be issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

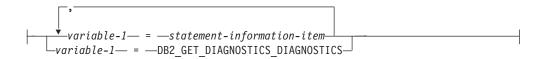
Authorization

None required.

Syntax

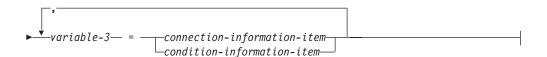


statement-information:

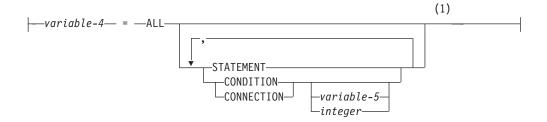


condition-information:





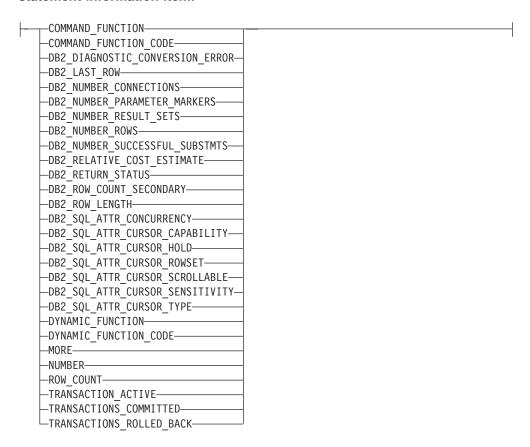
combined-information:



Notes:

STATEMENT can only be specified once. If variable-5 or integer is not specified, CONDITION and CONNECTION can only be specified once.

statement-information-item:



connection-information-item:

```
-CONNECTION NAME-
-DB2 AUTHENTICATION TYPE-
-DB2 AUTHORIZATION ID-
-DB2 CONNECTION METHOD-
-DB2 CONNECTION NUMBER-
-DB2_CONNECTION_STATE-
-DB2 CONNECTION STATUS-
-DB2 CONNECTION TYPE-
-DB2_DYN_QUERY_MGMT-
-DB2 ENCRYPTION TYPE-
-DB2 PRODUCT ID-
-DB2 SERVER CLASS NAME-
-DB2 SERVER NAME-
```

condition-information-item:

CATALOG_NAME
-CLASS ORIGIN-
-COLUMN_NAME-
-CONDITION_IDENTIFIER-
-CONDITION_NUMBER-
CONSTRAINT_CATALOG
CONCEDITATINE COLUMN
—CONSTRAINT_SCHEMA————————————————————————————————————
-CURSOR_NAME-
-DB2_ERROR_CODE1-
-DB2_ERROR_CODE2-
DB2_ERROR_CODE3
-DB2_ERROR_CODE4
-DB2_INTERNAL_ERROR_POINTER
-DB2_LINE_NUMBER-
-DB2_MESSAGE_ID-
-DB2_MESSAGE_ID1
DB2_MESSAGE_ID2
-DB2_MESSAGE_KEY
DB2_MODULE_DETECTING_ERROR
-DB2_NUMBER_FAILING_STATEMENTS-
-DB2_OFFSET-
-DB2_ORDINAL_TOKEN_n-
—DB2_PARTITION_NUMBER—
DB2_REASON_CODE
-DB2_RETURNED_SQLCODE-
DB2_ROW_NUMBER
-DB2 SQLERRD SET-
-DB2_SQLERRD1-
—DB2_SQLERRD2———————————————————————————————————
DB2_SQLERRD2
-DB2_SQLERRD4-
-DB2_SQLERRD5-
-DB2_SQLERRD6-
DD2_SQLERKUO
—DB2_TOKEN_COUNT————————————————————————————————————
DB2_TOKEN_STRING
MESSAGE OCTET LENGTH
-MESSAGE_OCTET_LENGTH
-MESSAGE_TEXT-
PARAMETER_NAME
PARAMETER_ORDINAL_POSITION
-RETURNED_SQLSTATE
-ROUTINE_CATALOG-
-ROUTINE_NAME
-ROUTINE_SCHEMA-
-SCHEMA_NAME
-SERVER NAME-
-SPECIFIC_NAME-
-SUBCLASS_ORIGIN
-TABLE_NAME
TRIGGER_CATALOG
TRIGGER NAME

Description

CURRENT or STACKED

Specifies which diagnostics area to access.

CURRENT

Specifies to access the first diagnostics area. It corresponds to the previous SQL statement that was executed and that was not a GET DIAGNOSTICS statement. This is the default.

STACKED

Specifies to access the second diagnostics area. The second diagnostics area is only available within a handler. It corresponds to the previous SQL statement that was executed before the handler was entered and that was not a GET DIAGNOSTICS statement. If the GET DIAGNOSTICS statement is the first statement within a handler, then the first diagnostics area and the second diagnostics area contain the same diagnostics information.

statement-information

Returns information about the last SQL statement executed.

variable-1

Identifies a variable declared in the program in accordance with the rules for declaring variables. The data type of the variable must be compatible with the data type as specified in Table 64 on page 960 for the specified condition information item. The variable is assigned the value of the specified statement information item according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the value is truncated when assigning it to the variable, a warning (SQLSTATE 01004) is returned and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

If a specified diagnostic item does not contain diagnostic information, then the variable is set to a default value based on its data type:

- 0 for an exact numeric diagnostic item,
- · an empty string for a VARCHAR diagnostic item,
- · and blanks for a CHAR diagnostic item.

condition-information

Returns information about the condition or conditions that occurred when the last SQL statement was executed.

CONDITION *variable–2* **or** *integer*

Identifies the diagnostic for which information is requested. Each diagnostic that occurs while executing an SQL statement is assigned an integer. The value 1 indicates the first diagnostic, 2 indicates the second diagnostic and so on. If the value is 1, then the diagnostic information retrieved corresponds to the condition indicated by the SQLSTATE value actually returned by the execution of the previous SQL statement (other than a GET DIAGNOSTICS statement). The variable specified must be declared in the program in accordance with the rules for declaring numeric variables. The value specified must not be less than one or greater than the number of available diagnostics.

variable-3

Identifies a variable declared in the program in accordance with the rules for declaring variables. The data type of the variable must be compatible with the data type as specified in Table 64 on page 960 for the specified condition information item. The variable is assigned the value of the specified condition information item according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the value is truncated when assigning it to the variable, an error is returned and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

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If a specified diagnostic item does not contain diagnostic information , then the variable is set to a default value based on its data type:

- 0 for an exact numeric diagnostic item,
- · an empty string for a VARCHAR diagnostic item,
- · and blanks for a CHAR diagnostic item.

combined-information

Returns multiple information items combined into one string.

variable-4

Identifies a variable declared in the program in accordance with the rules for declaring variables. The data type of the variable must be VARCHAR. The variable is assigned according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the length of *variable-4* is not sufficient to hold the full returned diagnostic string, the string is truncated, an error is returned and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

ALL

I

Indicates that all diagnostic items that are set for the last SQL statement executed should be combined into one string. The format of the string is a semicolon separated list of all of the available diagnostic information in the form:

item-name=character-form-of-the-item-value;

The character form of a positive numeric value will not contain a leading plus sign (+) unless the item is DB2_RETURNED_SQLCODE. In this case, a leading plus sign (+) is added. For example:

NUMBER=1;RETURNED SQLSTATE=02000;DB2 RETURNED SQLCODE=+100;

Only items that contain diagnostic information are included in the string.

STATEMENT

Indicates that all *statement-information-item* diagnostic items that contain diagnostic information for the last SQL statement executed should be combined into one string. The format is the same as described above for ALL.

CONDITION

Indicates that *condition-information-item* diagnostic items that contain diagnostic information for the last SQL statement executed should be combined into one string. If *variable*–5 or *integer* is specified, then the format is the same as described above for the ALL option. If *variable*–5 or *integer* is not specified, then the format includes a condition number entry at the beginning of the information for that condition in the form:

CONDITION NUMBER=X; item-name=character-form-of-the-item-value;

where X is the number of the condition. For example: CONDITION_NUMBER=1; RETURNED_SQLSTATE=02000; DB2_RETURNED_SQLCODE=+100; CONDITION_NUMBER=2; RETURNED_SQLSTATE=01004;

CONNECTION

Indicates that *connection-information-item* diagnostic items that contain diagnostic information for the last SQL statement executed should be combined into one string. If *variable–5* or *integer* is specified, then the

format is the same as described above for ALL. If *variable*–5 or *integer* is not specified, then the format includes a connection number entry at the beginning of the information for that condition in the form:

DB2 CONNECTION NUMBER=X; *item-name=character-form-of-the-item-value*;

where X is the number of the condition. For example: DB2_CONNECTION_NUMBER=1;CONNECTION_NAME=SVL1;DB2_PRODUCT_ID=DSN07010;

variable-5 or integer

Identifies the diagnostic for which ALL CONDITION or ALL CONNECTION information is requested. The variable specified must be declared in the program in accordance with the rules for declaring numeric variables. The value specified must not be less than one or greater than the number of available diagnostics.

statement-information-item

COMMAND_FUNCTION

Returns the name of the previous SQL statement. For information about the statement string values, see Table 65 on page 963.

COMMAND_FUNCTION_CODE

Returns an integer that identifies the previous SQL statement. For information about the statement code values, see Table 65 on page 963.

DB2 DIAGNOSTIC_CONVERSION_ERROR

Returns the value 1 if there was a conversion error when converting a character data value for one of the GET DIAGNOSTICS statement values. Otherwise, the value zero is returned.

DB2 GET DIAGNOSTICS DIAGNOSTICS

After a GET DIAGNOSTICS statement, if any errors or warnings occurred during the execution of the GET DIAGNOSTICS statement, DB2_GET_DIAGNOSTICS_DIAGNOSTICS returns textual information about these errors or warnings. The format of the information is similar to what would be returned by a GET DIAGNOSTICS: hv = ALL statement.

If a request was made for an information item that the server does not understand, for example, if the server was at a lower DRDA level than the requesting client, DB2_GET_DIAGNOSTICS_DIAGNOSTICS returns the text 'Item not supported:' followed by a comma separated list of item names that were requested but that the server does not support.

DB2 LAST ROW

For a *multiple-row-fetch* statement, a value of +100 may be returned if the set of rows that have been fetched contains the last row currently in the table for cursors that are fetching forward, or contains the first row currently in the table for cursors that are fetching backward. For cursors that are not sensitive to updates, there would be no need to do a subsequent FETCH since the result would be an end of data indication (SQLSTATE 02000). For cursors that are sensitive to updates, a subsequent FETCH may return more data if a row had been inserted before the FETCH was executed. Otherwise, the value zero is returned.

If the number of rows returned is equal to the number of rows requested, then an end of data warning may not occur and DB2_LAST_ROW may not contain +100.

DB2 NUMBER CONNECTIONS

Returns the number of connections that were made in order to get to the

server that fulfilled the request from the client. Each such connection may generate a connection information item area which would be available for the single condition.

DB2_NUMBER_PARAMETER_MARKERS

For a PREPARE statement, returns the number of parameter markers in the prepared statement. Otherwise, the value zero is returned.

DB2_NUMBER_RESULT_SETS

For a CALL statement, returns the actual number of result sets returned by the procedure. Otherwise, the value zero is returned.

DB2 NUMBER ROWS

If the previous SQL statement was an OPEN or a FETCH which caused the size of the result table to be known, returns the number of rows in the result table. For SENSITIVE cursors, this value can be thought of as an approximation since rows inserted and deleted will affect the next retrieval of this value. If the previous statement was a PREPARE statement, returns the estimated number of rows in the result table for the prepared statement. Otherwise, the value zero is returned.

DB2_NUMBER_SUCCESSFUL_SUBSTMTS

For embedded compound SQL statements, returns a count of the number of successful sub-statements. Otherwise, the value zero is returned.

DB2_RELATIVE_COST_ESTIMATE

For a PREPARE statement, returns a relative cost estimate of the resources required for every execution. It does not reflect an estimate of the time required. When preparing a dynamically defined statement, this value can be used as an indicator of the relative cost of the prepared statement. The value varies depending on changes to statistics and can vary between releases of the product. It is an estimated cost for the access plan chosen by the optimizer. The value zero is returned if the statement is not a PREPARE statement.

DB2_RETURN_STATUS

Identifies the status value returned from the previous SQL CALL statement. If the previous statement is not a CALL statement, the value returned has no meaning and is unpredictable. For more information, see "RETURN statement" on page 1196. Otherwise, the value zero is returned.

For external procedures, if the returned SQLCODE < 0, the SQL_ERROR_CODE1 and DB2_RETURN_STATUS will be set to -1, otherwise SQL_ERROR_CODE1 and DB2_RETURN_STATUS are set to 0.

DB2_ROW_COUNT_SECONDARY

Identifies the number of rows associated with secondary actions from the previous SQL statement that was executed. If the previous SQL statement is a DELETE, the value is the total number of rows affected by referential constraints, including cascaded actions and the processing of triggered SQL statements from activated triggers. If the previous SQL statement is an INSERT or an UPDATE, the value is the total number of rows affected as the result of the processing of triggered SQL statements from activated triggers. Otherwise, the value zero is returned.

If the SQL statement is run using isolation level No Commit, this value may be zero.

DB2 ROW LENGTH

For a FETCH statement, returns the length of the row retrieved. Otherwise, the value zero is returned.

DB2_SQL_ATTR_CONCURRENCY

For an OPEN statement, indicates the concurrency control option of read-only, locking, optimistic using timestamps, or optimistic using values.

- R indicates read-only.
- L indicates locking.
- T indicates comparing row versions using timestamps or ROWIDs.
- V indicates comparing values.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_CAPABILITY

For an OPEN statement, indicates the capability of the cursor, whether a cursor is read-only, deletable, or updatable.

- R indicates that this cursor can only be used to read.
- D indicates that this cursor can be used to read as well as delete.
- U indicates that this cursor can be used to read, delete as well as update.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_HOLD

For an OPEN statement, indicates whether a cursor can be held open across multiple units of work or not.

- N indicates that this cursor will not remain open across multiple units of work.
- Y indicates that this cursor will remain open across multiple units of work.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_ROWSET

For an OPEN statement, whether a cursor can be accessed using rowset positioning or not.

- N indicates that this cursor only supports row positioned operations.
- Y indicates that this cursor supports rowset positioned operations.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_SCROLLABLE

For an OPEN statement, indicates whether a cursor can be scrolled forward and backward or not.

- N indicates that this cursor is not scrollable.
- Y indicates that this cursor is scrollable.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_SENSITIVITY

For an OPEN statement, indicates whether a cursor does or does not show updates to cursor rows made by other connections.

- · I indicates insensitive.
- · P indicates partial sensitivity.
- S indicates sensitive.
- U indicates unspecified.

Otherwise, a blank is returned.

DB2_SQL_ATTR_CURSOR_TYPE

For an OPEN statement, indicates whether a cursor type is dynamic, forward-only, or static.

- D indicates a dynamic cursor.
- F indicates a forward-only cursor.
- S indicates a static cursor.

Otherwise, a blank is returned.

DYNAMIC_FUNCTION

Returns a character string that identifies the type of the SQL-statement being prepared or executed dynamically. For information about the statement string values, see Table 65 on page 963.

DYNAMIC_FUNCTION_CODE

Returns a number that identifies the type of the SQL-statement being prepared or executed dynamically. For information about the statement code values, see Table 65 on page 963.

MORE

Indicates whether more errors were raised than could be handled.

- N indicates that all the errors and warnings from the previous SQL statement were stored in the diagnostics area.
- Y indicates that more errors and warnings were raised from the previous SQL statement than there are condition areas in the diagnostics area.

NUMBER

Returns the number of errors and warnings detected by the execution of the previous SQL statement, other than a GET DIAGNOSTICS statement, that have been stored in the diagnostics area. If the previous SQL statement returned success (SQLSTATE 00000), or no previous SQL statement has been executed, the number returned is one. The GET DIAGNOSTICS statement itself may return information via the SQLSTATE parameter, but does not modify the previous contents of the diagnostics area, except for the DB2_GET_DIAGNOSTICS_DIAGNOSTICS item.

ROW COUNT

Identifies the number of rows associated with the previous SQL statement that was executed. If the previous SQL statement is a DELETE, INSERT, REFRESH, or UPDATE statement, ROW_COUNT identifies the number of rows deleted, inserted, or updated by that statement, excluding rows affected by either triggers or referential integrity constraints. If the previous statement is a PREPARE statement, ROW_COUNT identifies the estimated number of result rows in the prepared statement. If the previous SQL statement is a *multiple-row-fetch*, ROW_COUNT identifies the number of rows fetched. Otherwise, the value zero is returned.

TRANSACTION_ACTIVE

Returns the value 1 if an SQL transaction is currently active, and 0 if an SQL transaction is not currently active.

TRANSACTIONS_COMMITTED

If the previous statement was a CALL, returns the number of transactions that were committed during the execution of the SQL or external procedure. Otherwise, the value zero is returned.

TRANSACTIONS ROLLED BACK

If the previous statement was a CALL, returns the number of transactions that were rolled back during the execution of the SQL or external procedure. Otherwise, the value zero is returned.

connection-information-item

CONNECTION_NAME

If the previous SQL statement is a CONNECT, DISCONNECT, or SET CONNECTION, returns the name of the server specified in the previous statement. Otherwise, the name of the current connection.

DB2_AUTHENTICATION_TYPE

Indicates the authentication type, whether server or client.

- C for client authentication.
- E for DCE security services authentication.
- S for server authentication.

Otherwise, a blank is returned.

DB2_AUTHORIZATION_ID

Returns the authorization id used by connected server. Because of userid translation and authorization exits, the local userid may not be the authid used by the server.

DB2 CONNECTION METHOD

For a CONNECT or SET CONNECTION statement, returns the connection method.

- D indicates *DUW (Distributed Unit of Work).
- R indicates *RUW (Remote Unit of Work).

DB2 CONNECTION NUMBER

Returns the number of the connections.

DB2 CONNECTION STATE

Indicates the connection state, whether connected or not.

- -1 indicates the connection is unconnected.
- 1 indicates the connection is connected.

Otherwise, the value zero is returned.

DB2_CONNECTION_STATUS

Indicates whether commitable update can be performed or not.

- 1 indicates commitable updates can be performed on the connection for this unit of work.
- · 2 indicates no commitable updates can be performed on the connection for this unit of work.

Otherwise, the value zero is returned.

DB2_CONNECTION_TYPE

Indicated the connection type (either local, remote, or to a driver program) and whether the conversation is protected or not.

- 1 indicates a connection to a local relational database.
- 2 indicates a connection to a remote relational database with the conversation unprotected.
- 3 indicates a connection to a remote relational database with the conversation protected.
- 4 indicates a connection to an application requester driver program.

Otherwise, the value zero is returned.

DB2_DYN_QUERY_MGMT

Returns a value of 1 if DYN_QUERY_MGMT database configuration parameter is enabled. Otherwise, the value zero is returned.

DB2_ENCRYPTION_TYPE

Returns the level of encryption.

- A indicates only the authentication tokens (authid and password) are encrypted.
- D indicates all data is encrypted for the connection.

Otherwise, a blank is returned.

DB2_PRODUCT_ID

Returns a product signature. If the application server is an IBM relational database product, the form is pppvvrrm, where:

- ppp identifies the product as follows: ARI for DB2 for VM and VSE, DSN for DB2 for z/OS, QSQ for DB2 for i, and SQL for all other DB2 products
- vv is a two-digit version identifier such as '04'
- rr is a two-digit release identifier such as '01'
- m is a one-digit modification level such as '0'

For example, if the application server is Version 7 of DB2 for z/OS, the value would be 'DSN07010'. Otherwise, the empty string is returned.

DB2_SERVER_CLASS_NAME

Returns the server class name. For example, DB2 for z/OS, DB2 for AIX, DB2 for Windows, and DB2 for i.

DB2 SERVER NAME

For a CONNECT or SET CONNECTION statement, returns the relational database name. Otherwise, the empty string is returned.

condition-information-item

CATALOG_NAME

If the returned SQLSTATE is:

- class 09 (Triggered Action Exception), or
- · class 23 (Integrity Constraint Violation), or
- · class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

and the constraint that caused the error is a referential, check, or unique constraint, the server name of the table that owns the constraint is returned.

If the returned SQLSTATE is class 42 (Syntax Error or Access Rule Violation), the server name of the table that caused the error is returned.

If the returned SQLSTATE is class 44 (WITH CHECK OPTION Violation), the server name of the view that caused the error is returned. Otherwise, the empty string is returned.

CLASS ORIGIN

Returns 'ISO 9075' for those SQLSTATEs whose class is defined by ISO 9075. Returns 'ISO/IEC 13249' for those SQLSTATEs whose class is defined by SQL/MM. Returns 'DB2 SQL' for those SQLSTATEs whose class is defined by IBM DB2 SQL. Returns the value set by user written code if available. Otherwise, the empty string is returned.

| |

COLUMN_NAME

If the returned SQLSTATE is class 42 (Syntax Error or Access Rule Violation) and the error was caused by an inaccessible column, the name of the column that caused the error is returned. Otherwise, the empty string is returned.

CONDITION IDENTIFIER

If the value of the RETURNED_SQLSTATE corresponds to an unhandled user-defined exception (SQLSTATE 45000), then the condition name of the user-defined exception is returned.

CONDITION_NUMBER

Returns the number of the conditions.

CONSTRAINT_CATALOG

If the returned SQLSTATE is:

- class 23 (Integrity Constraint Violation), or
- class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

the name of the server that contains the table that contains the constraint that caused the error is returned. Otherwise, the empty string is returned.

CONSTRAINT NAME

If the returned SQLSTATE is:

- class 23 (Integrity Constraint Violation), or
- class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

the name of the constraint that caused the error is returned. Otherwise, the empty string is returned.

CONSTRAINT SCHEMA

If the returned SQLSTATE is:

- class 23 (Integrity Constraint Violation), or
- class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

the name of the schema of the constraint that caused the error is returned. Otherwise, the empty string is returned.

CURSOR_NAME

If the returned SQLSTATE is class 24 (Invalid Cursor State), the name of the cursor is returned. Otherwise, the empty string is returned.

DB2 ERROR CODE1

Returns an internal error code. Otherwise, the value zero is returned.

DB2 ERROR CODE2

Returns an internal error code. Otherwise, the value zero is returned.

DB2 ERROR CODE3

Returns an internal error code. Otherwise, the value zero is returned.

DB2 ERROR CODE4

Returns an internal error code. Otherwise, the value zero is returned.

DB2 INTERNAL ERROR POINTER

For some errors, this will be a negative value that is an internal error pointer. Otherwise, the value zero is returned.

DB2_LINE_NUMBER

For a CREATE PROCEDURE for an SQL function, SQL procedure, or SQL trigger where an error is encountered parsing the SQL procedure body, returns the line number where the error possibly occurred. Otherwise, the value zero is returned.

DB2 MESSAGE ID

Returns the message ID corresponding to the MESSAGE_TEXT.

DB2_MESSAGE_ID1

Returns the underlying IBM i CPF escape message that originally caused this error. Otherwise, the empty string is returned.

DB2_MESSAGE_ID2

Returns the underlying i CPD diagnostic message that originally caused this error. Otherwise, the empty string is returned.

DB2 MESSAGE KEY

For a CALL statement, returns the i message key of the error that caused the procedure to fail. For a trigger error in a DELETE, INSERT, or UPDATE statement, returns the message key of the error that was signaled from the trigger program. The i QMHRCVPM API can be used to return the message description and message data for the message key. Otherwise, the value zero is returned.

DB2 MODULE DETECTING ERROR

Returns an identifier indicating which module detected the error. For a SIGNAL statement issued from a routine, the value 'ROUTINE' is returned. For other SIGNAL statements, the value 'PROGRAM' is returned.

DB2 NUMBER FAILING STATEMENTS

For a NOT ATOMIC embedded compound SQL statement, returns the number of statements that failed. Otherwise, the value zero is returned.

DB2 OFFSET

For a CREATE PROCEDURE for an SQL procedure where an error is encountered parsing the SQL procedure body, returns the offset into the line number where the error possibly occurred, if available. For an EXECUTE IMMEDIATE or a PREPARE statement where an error is encountered parsing the source statement, returns the offset into the source statement where the error possibly occurred. Otherwise, the value zero is returned.

DB2_ORDINAL_TOKEN_n

Returns the nth token. n must be a value from 1 to 100. For example, DB2_ORDINAL_TOKEN_1 would return the value of the first token, DB2_ORDINAL_TOKEN_2 the second token. A numeric value for a token is converted to character before being returned. If there is no value for the token, the empty string is returned.

DB2 PARTITION NUMBER

For a partitioned database, returns the partition number of the database partition that encountered the error or warning. If no errors or warnings were encountered, returns the partition number of the current node. Otherwise, the value zero is returned.

DB2_REASON_CODE

Returns the reason code for errors that have a reason code token in the message text. Otherwise, the value zero is returned.

DB2 RETURNED SQLCODE

Returns the SQLCODE for the specified diagnostic.

DB2_ROW_NUMBER

If the previous SQL statement is a multiple row insert or a multiple row fetch, returns the number of the row where the condition was encountered, when such a value is available and applicable. Otherwise, the value zero is returned.

DB2 SOLERRD SET

Returns Y to indicate that the DB2_SQLERRD1 through DB2_SQLERRD6 items may be set. Otherwise, a blank is returned.

DB2_SQLERRD1

Returns the value of SQLERRD(1) from the SQLCA returned by the server.

DB2 SOLERRD2

Returns the value of SQLERRD(2) from the SQLCA returned by the server.

DB2 SOLERRD3

Returns the value of SQLERRD(3) from the SQLCA returned by the server.

DB2 SQLERRD4

Returns the value of SQLERRD(4) from the SQLCA returned by the server.

DB2_SQLERRD5

Returns the value of SQLERRD(5) from the SQLCA returned by the server.

DB2 SQLERRD6

Returns the value of SQLERRD(6) from the SQLCA returned by the server.

DB2 TOKEN COUNT

Returns the number of tokens available for the specified diagnostic.

DB2 TOKEN STRING

Returns a X'FF' delimited string of the tokens for the specified diagnostic.

MESSAGE_LENGTH

Identifies the length (in characters) of the message text of the error, warning, or successful completion returned from the previous SQL statement that was executed.

MESSAGE OCTET LENGTH

Identifies the length (in bytes) of the message text of the error, warning, or successful completion returned from the previous SQL statement that was executed.

MESSAGE_TEXT

Identifies the message text of the error, warning, or successful completion returned from the previous SQL statement that was executed.

When the SQLCODE is 0, the empty string is returned, even if the RETURNED_SQLSTATE value indicates a warning condition.

PARAMETER_MODE

If the returned SQLSTATE is:

- class 39 (External Routine Invocation Exception), or
- class 38 (External Routine Exception), or
- class 2F (SQL Routine Exception), or
- class 22 (Data Exception), or
- class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

and the condition is related to the *i*th parameter of the routine, the parameter mode of the *i*th parameter is returned. Otherwise, the empty string is returned.

PARAMETER NAME

If the returned SQLSTATE is:

- · class 39 (External Routine Invocation Exception), or
- · class 38 (External Routine Exception), or
- class 2F (SQL Routine Exception), or
- · class 22 (Data Exception), or
- class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

the condition is related to the *i*th parameter of the routine, and a parameter name was specified for the parameter when the routine was created, the parameter name of the *i*th parameter is returned. Otherwise, the empty string is returned.

PARAMETER_ORDINAL_POSITION

If the returned SQLSTATE is:

- class 39 (External Routine Invocation Exception), or
- · class 38 (External Routine Exception), or
- class 2F (SQL Routine Exception), or
- class 22 (Data Exception), or
- · class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

and the condition is related to the *i*th parameter of the routine, the value of *i* is returned. Otherwise, the empty string is returned.

RETURNED_SQLSTATE

Returns the SQLSTATE for the specified diagnostic.

ROUTINE CATALOG

If the returned SQLSTATE is:

- class 39 (External Routine Invocation Exception), or
- class 38 (External Routine Exception), or
- class 2F (SQL Routine Exception), or

and the condition is related to the *i*th parameter of the routine, or if the returned SQLSTATE is:

- class 22 (Data Exception), or
- · class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

and the condition was raised as the result of an assignment to an SQL parameter during an routine invocation, the server name of the routine is returned. Otherwise, the empty string is returned.

ROUTINE NAME

If the returned SQLSTATE is:

- class 39 (External Routine Invocation Exception), or
- class 38 (External Routine Exception), or
- · class 2F (SQL Routine Exception), or

and the condition is related to the *i*th parameter of the routine, or if the returned SQLSTATE is:

- class 22 (Data Exception), or
- class 23 (Integrity Constraint Violation), or

• class 01 (Warning)

and the condition was raised as the result of an assignment to an SQL parameter during an routine invocation, the name of the routine is returned. Otherwise, the empty string is returned.

ROUTINE SCHEMA

If the returned SQLSTATE is:

- · class 39 (External Routine Invocation Exception), or
- class 38 (External Routine Exception), or
- · class 2F (SQL Routine Exception), or

and the condition is related to the *i*th parameter of the routine, or if the returned SOLSTATE is:

- class 22 (Data Exception), or
- · class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

and the condition was raised as the result of an assignment to an SQL parameter during an routine invocation, the schema name of the routine is returned. Otherwise, the empty string is returned.

SCHEMA NAME

If the returned SQLSTATE is:

- · class 09 (Triggered Action Exception), or
- class 23 (Integrity Constraint Violation), or
- · class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

and the constraint that caused the error is a referential, check, or unique constraint, the schema name of the table that owns the constraint is returned.

If the returned SQLSTATE is class 42 (Syntax Error or Access Rule Violation), the schema name of the table that caused the error is returned.

If the returned SQLSTATE is class 44 (WITH CHECK OPTION Violation), the schema name of the view that caused the error is returned. Otherwise, the empty string is returned.

SERVER_NAME

If the previous SQL statement is a CONNECT, DISCONNECT, or SET CONNECTION, the name of the server specified in the previous statement is returned. Otherwise, the name of the server where the statement executed is returned.

SPECIFIC_NAME

If the returned SQLSTATE is:

- class 39 (External Routine Invocation Exception), or
- class 38 (External Routine Exception), or
- class 2F (SQL Routine Exception), or

and the condition is related to the *i*th parameter of the routine, or if the returned SQLSTATE is:

- class 22 (Data Exception), or
- class 23 (Integrity Constraint Violation), or
- class 01 (Warning)

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and the condition was raised as the result of an assignment to an SQL parameter during an routine invocation, the specific name of the procedure or function is returned. Otherwise, the empty string is returned.

SUBCLASS ORIGIN

Returns 'ISO 9075' for those SQLSTATEs whose subclass is defined by ISO 9075. Returns 'ISO/IEC 9579' for those SQLSTATEs whose subclass is defined by RDA. Returns 'ISO/IEC 13249-1', 'ISO/IEC 13249-2', 'ISO/IEC 13249-3', 'ISO/IEC 13249-4', or 'ISO/IEC 13249-5' for those SQLSTATEs whose subclass is defined SQL/MM. Returns 'DB2 SQL' for those SQLSTATEs whose subclass is defined by IBM DB2 SQL. Returns the value set by user written code if available. Otherwise, the empty string is returned.

TABLE NAME

If the returned SQLSTATE is:

- class 09 (Triggered Action Exception), or
- · class 23 (Integrity Constraint Violation), or
- class 27 (Triggered Data Change Violation), or
- 40002 (Transaction Rollback Integrity Constraint Violation),

and the constraint that caused the error is a referential, check, or unique constraint, the table name that owns the constraint is returned.

If the returned SQLSTATE is class 42 (Syntax Error or Access Rule Violation), the table name that caused the error is returned.

If the returned SQLSTATE is class 44 (WITH CHECK OPTION Violation), the table name that caused the error is returned. Otherwise, the empty string is returned.

TRIGGER_CATALOG

If the returned SQLSTATE is:

- · class 09 (Triggered Action Exception), or
- class 27 (Triggered Data Change Violation),

the name of the trigger is returned. Otherwise, the empty string is returned.

TRIGGER NAME

If the returned SQLSTATE is:

- class 09 (Triggered Action Exception), or
- class 27 (Triggered Data Change Violation),

the name of the trigger is returned. Otherwise, the empty string is returned.

TRIGGER SCHEMA

If the returned SQLSTATE is:

- class 09 (Triggered Action Exception), or
- class 27 (Triggered Data Change Violation),

the schema name of the trigger is returned. Otherwise, the empty string is returned.

Notes

Considerations for the diagnostics area: The GET DIAGNOSTICS statement does not change the contents of the diagnostics area except for DB2_GET_DIAGNOSTICS_DIAGNOSTICS.

If the GET DIAGNOSTICS statement is specified in an SQL function, SQL procedure, or trigger, the GET DIAGNOSTICS statement must be the first executable statement specified in the handler that will handle the error.

If information is wanted about a warning,

- If a handler will get control for the warning condition, the GET DIAGNOSTICS statement must be the first statement specified in that handler.
- If a handler will not get control for the warning condition, the GET DIAGNOSTICS statement must be the next statement executed after that previous statement.

Considerations for the SQLCODE and SQLSTATE SQL variables: The GET DIAGNOSTICS statement does not change the value of the SQLSTATE and SQLCODE SQL variables.

Case of return values: Values for identifiers in returned diagnostic items are not delimited and are case sensitive. For example, a table name of "abc" would be returned, simply as abc.

Data types for items: The following table shows, the SQL data type for each diagnostic item. When a diagnostic item is assigned to a variable, the variable must be compatible with the data type of the diagnostic item.

Table 64. Data Types for GET DIAGNOSTICS Items

Item Name	Data Type
Statement Information Item	
COMMAND_FUNCTION	VARCHAR(128)
COMMAND_FUNCTION_CODE	INTEGER
DB2_DIAGNOSTIC_CONVERSION_ERROR	INTEGER
DB2_GET_DIAGNOSTICS_DIAGNOSTICS	VARCHAR(32740)
DB2_LAST_ROW	INTEGER
DB2_NUMBER_CONNECTIONS	INTEGER
DB2_NUMBER_PARAMETER_MARKERS	INTEGER
DB2_NUMBER_RESULT_SETS	INTEGER
DB2_NUMBER_ROWS	DECIMAL(31,0)
DB2_NUMBER_SUCCESSFUL_SUBSTMTS	INTEGER
DB2_RELATIVE_COST_ESTIMATE	INTEGER
DB2_RETURN_STATUS	INTEGER
DB2_ROW_COUNT_SECONDARY	DECIMAL(31,0)
DB2_ROW_LENGTH	INTEGER
DB2_SQL_ATTR_CONCURRENCY	CHAR(1)
DB2_SQL_ATTR_CURSOR_CAPABILITY	CHAR(1)
DB2_SQL_ATTR_CURSOR_HOLD	CHAR(1)
DB2_SQL_ATTR_CURSOR_ROWSET	CHAR(1)
DB2_SQL_ATTR_CURSOR_SCROLLABLE	CHAR(1)
DB2_SQL_ATTR_CURSOR_SENSITIVITY	CHAR(1)
DB2_SQL_ATTR_CURSOR_TYPE	CHAR(1)

Table 64. Data Types for GET DIAGNOSTICS Items (continued)

Item Name	Data Type
DYNAMIC_FUNCTION	VARCHAR(128)
DYNAMIC_FUNCTION_CODE	INTEGER
MORE	CHAR(1)
NUMBER	INTEGER
ROW_COUNT	DECIMAL(31,0)
TRANSACTION_ACTIVE	INTEGER
TRANSACTIONS_COMMITTED	INTEGER
TRANSACTIONS_ROLLED_BACK	INTEGER
Connection Infor	mation Item
CONNECTION_NAME	VARCHAR(128)
DB2_AUTHENTICATION_TYPE	CHAR(1)
DB2_AUTHORIZATION_ID	VARCHAR(128)
DB2_CONNECTION_METHOD	CHAR(1)
DB2_CONNECTION_NUMBER	INTEGER
DB2_CONNECTION_STATE	INTEGER
DB2_CONNECTION_STATUS	INTEGER
DB2_CONNECTION_TYPE	SMALLINT
DB2_DYN_QUERY_MGMT	INTEGER
DB2_ENCRYPTION_TYPE	CHAR(1)
DB2_PRODUCT_ID	VARCHAR(8)
DB2_SERVER_CLASS_NAME	VARCHAR(128)
DB2_SERVER_NAME	VARCHAR(128)
Condition Inform	nation Item
CATALOG_NAME	VARCHAR(128)
CLASS_ORIGIN	VARCHAR(128)
COLUMN_NAME	VARCHAR(128)
CONDITION_IDENTIFIER	VARCHAR(128)
CONDITION_NUMBER	INTEGER
CONSTRAINT_CATALOG	VARCHAR(128)
CONSTRAINT_NAME	VARCHAR(128)
CONSTRAINT_SCHEMA	VARCHAR(128)
CURSOR_NAME	VARCHAR(128)
DB2_ERROR_CODE1	INTEGER
DB2_ERROR_CODE2	INTEGER
DB2_ERROR_CODE3	INTEGER
DB2_ERROR_CODE4	INTEGER
DB2_INTERNAL_ERROR_POINTER	INTEGER
DB2_LINE_NUMBER	INTEGER
DB2_MESSAGE_ID	CHAR(10)
DB2_MESSAGE_ID1	VARCHAR(7)

GET DIAGNOSTICS

Table 64. Data Types for GET DIAGNOSTICS Items (continued)

	· · ·
Item Name	Data Type
DB2_MESSAGE_ID2	VARCHAR(7)
DB2_MESSAGE_KEY	INTEGER
DB2_MODULE_DETECTING_ERROR	VARCHAR(128)
DB2_NUMBER_FAILING_STATEMENTS	INTEGER
DB2_OFFSET	INTEGER
DB2_ORDINAL_TOKEN_n	VARCHAR(32740)
DB2_PARTITION_NUMBER	INTEGER
DB2_REASON_CODE	INTEGER
DB2_RETURNED_SQLCODE	INTEGER
DB2_ROW_NUMBER	INTEGER
DB2_SQLERRD_SET	CHAR(1)
DB2_SQLERRD1	INTEGER
DB2_SQLERRD2	INTEGER
DB2_SQLERRD3	INTEGER
DB2_SQLERRD4	INTEGER
DB2_SQLERRD5	INTEGER
DB2_SQLERRD6	INTEGER
DB2_TOKEN_COUNT	INTEGER
DB2_TOKEN_STRING	VARCHAR(1000)
MESSAGE_LENGTH	INTEGER
MESSAGE_OCTET_LENGTH	INTEGER
MESSAGE_TEXT	VARCHAR(32740)
PARAMETER_MODE	VARCHAR(5)
PARAMETER_NAME	VARCHAR(128)
PARAMETER_ORDINAL_POSITION	INTEGER
RETURNED_SQLSTATE	CHAR(5)
ROUTINE_CATALOG	VARCHAR(128)
ROUTINE_NAME	VARCHAR(128)
ROUTINE_SCHEMA	VARCHAR(128)
SCHEMA_NAME	VARCHAR(128)
SERVER_NAME	VARCHAR(128)
SPECIFIC_NAME	VARCHAR(128)
SUBCLASS_ORIGIN	VARCHAR(128)
TABLE_NAME	VARCHAR(128)
TRIGGER_CATALOG	VARCHAR(128)
TRIGGER_NAME	VARCHAR(128)
TRIGGER_SCHEMA	VARCHAR(128)

SQL statement codes and strings: The following table represents the possible values for COMMAND_FUNCTION, COMMAND_FUNCTION_CODE, DYNAMIC_FUNCTION, and DYNAMIC_FUNCTION_CODE diagnostic items.

The values in the following table are assigned by the ISO and ANSI SQL Standard and may change as the standard evolves. Include *sqlscds* in the include source files in library QSYSINC should be used when referencing these values.

Table 65. SQL Statement Codes and Strings

Type of statement	Statement string	Statement code
ALLOCATE DESCRIPTOR	ALLOCATE DESCRIPTOR	2
ALTER FUNCTION	ALTER ROUTINE	17
ALTER PROCEDURE	ALTER ROUTINE	17
ALTER SEQUENCE	ALTER SEQUENCE	134
ALTER TABLE	ALTER TABLE	4
assignment-statement	ASSIGNMENT	5
CALL	CALL	7
CASE	CASE	86
CLOSE (static SQL)	CLOSE CURSOR	9
CLOSE (dynamic SQL)	DYNAMIC CLOSE CURSOR	37
COMMENT	COMMENT	-7
COMMIT	COMMIT WORK	11
compound-statement	BEGIN END	12
CONNECT	CONNECT	13
CREATE ALIAS	CREATE ALIAS	-8
CREATE FUNCTION	CREATE ROUTINE	14
CREATE INDEX	CREATE INDEX	-14
CREATE PROCEDURE	CREATE ROUTINE	14
CREATE SCHEMA	CREATE SCHEMA	64
CREATE SEQUENCE	CREATE SEQUENCE	133
CREATE TABLE	CREATE TABLE	77
CREATE TRIGGER	CREATE TRIGGER	80
CREATE TYPE	CREATE TYPE	83
CREATE VIEW	CREATE VIEW	84
DEALLOCATE DESCRIPTOR	DEALLOCATE DESCRIPTOR	15
DECLARE GLOBAL TEMPORARY TABLE	DECLARE GLOBAL TEMPORARY TABLE	-21
DELETE Positioned (static SQL)	DELETE CURSOR	18
DELETE Positioned (dynamic SQL)	DYNAMIC DELETE CURSOR	38
DELETE Searched	DELETE WHERE	19
DESCRIBE	DESCRIBE	20
DESCRIBE TABLE	DESCRIBE TABLE	-24
DISCONNECT	DISCONNECT	22
DROP ALIAS	DROP ALIAS	-25

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Table 65. SQL Statement Codes and Strings (continued)

Type of statement	Statement string	Statement code
DROP FUNCTION	DROP ROUTINE	30
DROP INDEX	DROP INDEX	-30
DROP PACKAGE	DROP PACKAGE	-32
DROP PROCEDURE	DROP ROUTINE	30
DROP SCHEMA	DROP SCHEMA	31
DROP SEQUENCE	DROP SEQUENCE	135
DROP TABLE	DROP TABLE	32
DROP TRIGGER	DROP TRIGGER	34
DROP TYPE	DROP TYPE	35
DROP VIEW	DROP VIEW	36
EXECUTE	EXECUTE	44
EXECUTE IMMEDIATE	EXECUTE IMMEDIATE	43
FETCH (static SQL)	FETCH	45
FETCH (dynamic SQL)	DYNAMIC FETCH	39
FOR	FOR	46
FREE LOCATOR	FREE LOCATOR	98
GET DESCRIPTOR	GET DESCRIPTOR	47
GOTO	GOTO	-37
GRANT (any type)	GRANT	48
HOLD LOCATOR	HOLD LOCATOR	99
IF	IF	88
INSERT	INSERT	50
ITERATE	ITERATE	102
LABEL	LABEL	-39
LEAVE	LEAVE	89
LOCK TABLE	LOCK TABLE	-40
LOOP	LOOP	90
OPEN (static SQL)	OPEN	53
OPEN (dynamic SQL)	DYNAMIC OPEN	40
PREPARE	PREPARE	56
Prepared DELETE Positioned (dynamic SQL)	PREPARABLE DYNAMIC DELETE CURSOR	54
Prepared UPDATE Positioned (dynamic SQL)	PREPARABLE DYNAMIC UPDATE CURSOR	55
REFRESH TABLE	REFRESH TABLE	-41
RELEASE (connection)	RELEASE CONNECTION	-42
RELEASE SAVEPOINT	RELEASE SAVEPOINT	57
RENAME INDEX	RENAME INDEX	-43
RENAME TABLE	RENAME TABLE	-44
REPEAT	REPEAT	95

Table 65. SQL Statement Codes and Strings (continued)

RESIGNAL RETURN RETURN REVOKE (any type) REVOKE REVOKE (any type) ROLLBACK ROLLBACK ROLLBACK WORK 62 SAVEPOINT SAVEPOINT SAVEPOINT 63 SELECT INTO SELECT 65 Select-statement (dynamic SQL) SELECT CURSOR 85 SET CONNECTION SET CONNECTION SET CURRENT DEBUG MODE SET CURRENT DECFLOAT ROUNDING MODE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE -47 SET DESCRIPTOR SET ENCRYPTION PASSWORD -48 SET PATH SET PATH SET PATH SET RESULT SETS -64 SET SCHEMA 58	
REVOKE (any type) ROLLBACK ROLLBACK ROLLBACK WORK 62 SAVEPOINT SAVEPOINT 63 SELECT INTO SELECT SELECT CURSOR 85 SET CONNECTION SET CONNECTION SET CURRENT DEBUG MODE SET CURRENT DECFLOAT ROUNDING MODE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE -47 SET DESCRIPTOR SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD SET RESULT SETS -64	ı
ROLLBACK ROLLBACK WORK 62 SAVEPOINT SAVEPOINT 63 SELECT INTO SELECT 65 select-statement (dynamic SQL) SELECT CURSOR 85 SET CONNECTION SET CONNECTION 67 SET CURRENT DEBUG MODE SET CURRENT DEBUG MODE -75 SET CURRENT DECFLOAT SET CURRENT DECFLOAT ROUNDING MODE ROUNDING MODE SET CURRENT DEGREE -47 SET CURRENT DEGREE SET CURRENT DEGREE -47 SET DESCRIPTOR SET DESCRIPTOR 70 SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD -48 SET PATH SET PATH 69 SET RESULT SETS SET RESULT SETS -64	
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select-statement(dynamic SQL)SELECT CURSOR85SET CONNECTIONSET CONNECTION67SET CURRENT DEBUG MODESET CURRENT DEBUG MODE-75SET CURRENT DECFLOAT ROUNDING MODESET CURRENT DECFLOAT ROUNDING MODE-82SET CURRENT DEGREESET CURRENT DEGREE-47SET DESCRIPTORSET DESCRIPTOR70SET ENCRYPTION PASSWORDSET ENCRYPTION PASSWORD-48SET PATHSET PATH69SET RESULT SETS-64	
SET CONNECTION SET CURRENT DEBUG MODE SET CURRENT DEBUG MODE SET CURRENT DECFLOAT ROUNDING MODE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE -47 SET DESCRIPTOR SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD SET PATH SET PATH SET RESULT SETS -64	
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SET CURRENT DECFLOAT ROUNDING MODE SET CURRENT DEGREE SET CURRENT DEGREE SET CURRENT DEGREE -47 SET DESCRIPTOR SET ENCRYPTION PASSWORD SET PATH SET PATH SET RESULT SETS -64	
ROUNDING MODE SET CURRENT DEGREE SET CURRENT DEGREE SET DESCRIPTOR SET DESCRIPTOR SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD SET PATH SET PATH SET RESULT SETS SET RESULT SETS ROUNDING MODE -47 70 70 SET ENCRYPTION PASSWORD -48 SET PATH 69	5
SET DESCRIPTOR SET DESCRIPTOR 70 SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD -48 SET PATH SET PATH 69 SET RESULT SETS SET RESULT SETS -64	2
SET ENCRYPTION PASSWORD SET ENCRYPTION PASSWORD -48 SET PATH SET PATH 69 SET RESULT SETS SET RESULT SETS -64	7
SET PATH SET PATH 69 SET RESULT SETS SET RESULT SETS -64	
SET RESULT SETS SET RESULT SETS -64	8
SET SCHEMA SET SCHEMA 74	4
SET SESSION AUTHORIZATION SET SESSION AUTHORIZATION 76	
SET TRANSACTION SET TRANSACTION 75	
SET transition-variable ASSIGNMENT 5	
SET variable ASSIGNMENT 5	
SIGNAL SIGNAL 92	
UPDATE Positioned (static SQL) UPDATE CURSOR 81	
UPDATE Positioned (dynamic SQL) DYNAMIC UPDATE CURSOR 42	
UPDATE Searched UPDATE WHERE 82	
VALUES STANDALONE FULLSELECT –69	9
VALUES INTO VALUES INTO -66	6
WHILE WHILE 97	
Unrecognized statement a zero length string 0	

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword EXCEPTION can be used as a synonym for CONDITION.
- The keyword RETURN_STATUS can be used as a synonym for DB2_RETURN_STATUS.

Example

In an SQL procedure, execute a GET DIAGNOSTICS statement to determine how many rows were updated.

```
CREATE PROCEDURE sqlprocg (IN deptnbr VARCHAR(3))
LANGUAGE SQL
BEGIN
    DECLARE SQLSTATE CHAR(5);
    DECLARE rount INTEGER;
    UPDATE CORPDATA.PROJECT
    SET PRSTAFF = PRSTAFF + 1.5
    WHERE DEPTNO = deptnbr;
    GET DIAGNOSTICS rount = ROW_COUNT;
    /* At this point, rount contains the number of rows that were updated. */
END
```

Within an SQL procedure, handle the returned status value from the invocation of a stored procedure called TRYIT. TRYIT could use the RETURN statement to explicitly return a status value or a status value could be implicitly returned by the database manager. If the procedure is successful, it returns a value of zero.

```
CREATE PROCEDURE TESTIT ()

LANGUAGE SQL
A1: BEGIN

DECLARE RETVAL INTEGER DEFAULT 0;

...

CALL TRYIT

GET DIAGNOSTICS RETVAL = RETURN_STATUS;

IF RETVAL <> 0 THEN

...

LEAVE A1;

ELSE

...

END IF;

END A1
```

In an SQL procedure, execute a GET DIAGNOSTICS statement to retrieve the message text for an error.

This form of the GRANT statement grants privileges on a function or procedure.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

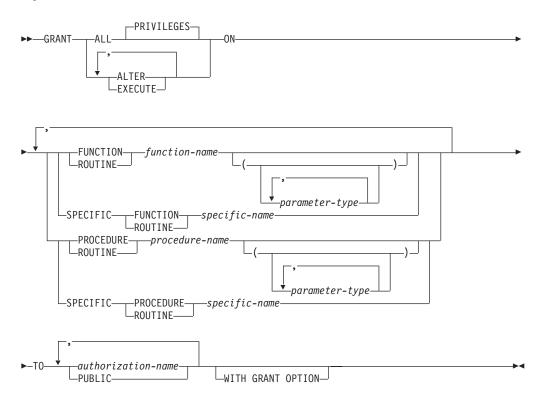
The privileges held by the authorization ID of the statement must include at least one of the following:

- For each function or procedure identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the function or procedure
 - The system authority *EXECUTE on the library (or directory if this is a Java routine) containing the function or procedure
- · Administrative authority

If WITH GRANT OPTION is specified, the privileges held by the authorization ID of the statement must include at least one of the following:

- · Ownership of the function or procedure
- Administrative authority

Syntax



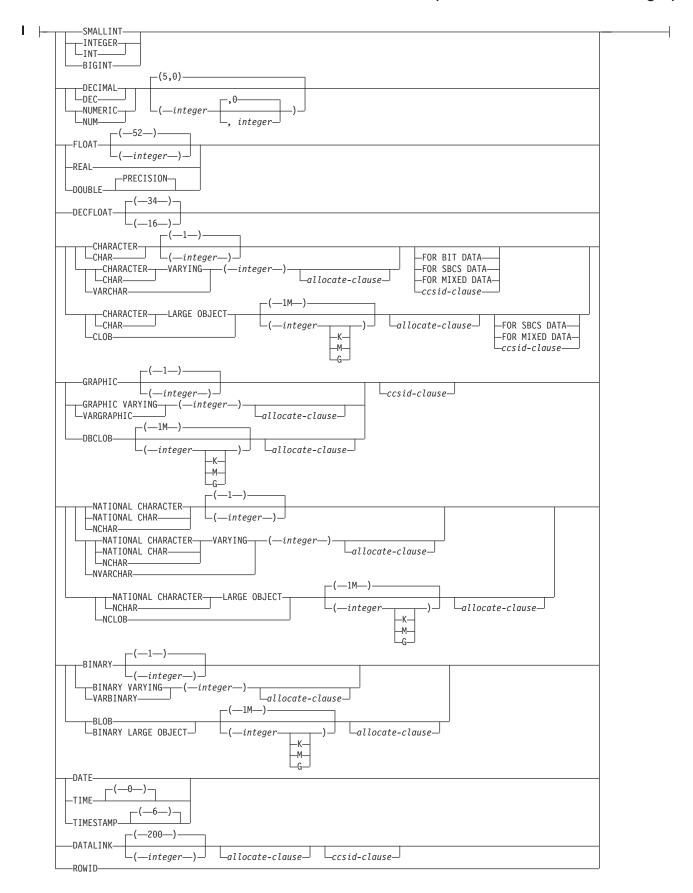
parameter-type:

-data-type-AS LOCATOR

data-type:

built-in-type—distinct-type-name—

built-in-type:



ccsid-clause:

---CCSID--integer-

Description

ALL or ALL PRIVILEGES

Grants one or more privileges. The privileges granted are all those grantable privileges that the authorization ID of the statement has on the specified functions or procedures. Note that granting ALL PRIVILEGES on a function or procedure is not the same as granting the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword grants the privilege described.

ALTER

Grants the privilege to use the ALTER FUNCTION, ALTER PROCEDURE, or COMMENT statement.

EXECUTE

Grants the privilege to execute the function or procedure.

FUNCTION or SPECIFIC FUNCTION

Identifies the function on which the privilege is granted. The function must exist at the current server and it must be a user-defined function, but not a function that was implicitly generated with the creation of a distinct type. The function can be identified by its name, function signature, or specific name.

FUNCTION function-name

Identifies the function by its name. The *function-name* must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type, ...)

Identifies the function by its function signature, which uniquely identifies the function. The *function-name* (*parameter-type*, ...) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance on which the privilege is to be granted. Synonyms for data types are considered a match.

If *function-name* () is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type, ...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

• Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a

function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).

- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty
 parentheses are not specified, the default attributes of the data type
 are implied. The implicit length must exactly match the value that
 was specified (implicitly or explicitly) in the CREATE FUNCTION
 statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC FUNCTION specific-name

Identifies the function by its specific name. The *specific-name* must identify a specific function that exists at the current server.

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure on which the privilege is granted. The *procedure-name* must identify a procedure that exists at the current server.

PROCEDURE *procedure-name*

Identifies the procedure by its name. The *procedure-name* must identify exactly one procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE procedure-name (parameter-type, ...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The *procedure-name* (*parameter-type*, ...) must identify a procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types, and the logical concatenation of the data types is used to identify the specific procedure instance which is to be granted. Synonyms for data types are considered a match.

If *procedure-name* () is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type, ...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a procedure defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC PROCEDURE *specific-name*

Identifies the procedure by its specific name. The specific-name must identify a specific procedure that exists at the current server.

TO

Indicates to whom the privileges are granted.

authorization-name,...

Lists one or more authorization IDs.

Grants the privileges to a set of users (authorization IDs). For more information, see "Authorization, privileges and object ownership" on page

WITH GRANT OPTION

Allows the specified *authorization-names* to grant privileges on the functions or procedures specified in the ON clause to other users.

If WITH GRANT OPTION is omitted, the specified authorization-names cannot grant privileges on the functions or procedures specified in the ON clause to another user unless they have received that authority from some other source (for example, from a grant of the system authority *OBJMGT).

Notes

Corresponding System Authorities: Privileges granted to either an SQL or external function or procedure are granted to its associated program (*PGM) or service program (*SRVPGM) object. Privileges granted to a Java external function or procedure are granted to the associated class file or jar file. If the associated program, service program, class file, or jar file is not found when the grant is executed, an error is returned.

GRANT and REVOKE statements assign and remove system authorities for SQL objects. The following table describes the system authorities that correspond to the SQL privileges:

Table 66. Privileges Granted to or Revoked from Non-Java Functions or Procedures

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Function or Procedure
ALL (Grant or revoke of ALL grants or revokes only those privileges the authorization ID of the statement has)	*OBJALTER *OBJOPR *EXECUTE *OBJMGT (Revoke only)
ALTER	*OBJALTER
EXECUTE	*EXECUTE *OBJOPR
WITH GRANT OPTION	*OBJMGT

Table 67. Privileges Granted to or Revoked from Java Functions or Procedures

SQL Privilege	Corresponding Data Authorities when Granting to or Revoking from a Java Function or Procedure	Corresponding Object Authorities when Granting to or Revoking from a Java Function or Procedure
ALL (Grant or revoke of ALL grants or revokes only those privileges the authorization ID of the statement has)	*RWX	*OBJEXIST *OBJALTER *OBJMGT (Revoke only)
ALTER	*R	*OBJALTER
EXECUTE	*RX	*EXECUTE
WITH GRANT OPTION	*RWX	*OBJMGT

Corresponding System Authorities When Checking Privileges to a Function or Procedure: The following table describes the system authorities that correspond to the SQL privileges when checking privileges to a function or procedure. The left column lists the SQL privilege. The right column lists the equivalent system authorities.

Table 68. Corresponding System Authorities When Checking Privileges to a Non-Java Function or Procedure

SQL Privilege	Corresponding System Authorities
ALTER	*OBJALTER

Table 68. Corresponding System Authorities When Checking Privileges to a Non-Java Function or Procedure (continued)

SQL Privilege	Corresponding System Authorities
EXECUTE	
	*EXECUTE and *OBJOPR

Table 69. Corresponding System Authorities When Checking Privileges to a Java Function or Procedure

SQL Privilege		Corresponding Object Authorities when Checking Privileges to a Java Function or Procedure
ALTER	*R	*OBJALTER
EXECUTE	*RX	*EXECUTE

Built-in functions: Privileges cannot be granted on built-in functions.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

• The keyword RUN can be used as a synonym for EXECUTE.

Example

Grant the EXECUTE privilege on procedure PROCA to PUBLIC.

GRANT EXECUTE ON PROCEDURE PROCA TO PUBLIC

GRANT (Package Privileges)

This form of the GRANT statement grants privileges on a package.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

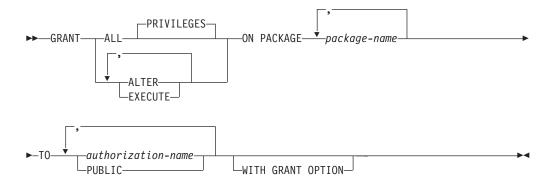
The privileges held by the authorization ID of the statement must include at least one of the following:

- For each package identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the package
 - The system authority *EXECUTE on the library containing the package
- Administrative authority

If WITH GRANT OPTION is specified, the privileges held by the authorization ID of the statement must include at least one of the following:

- Ownership of the package
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Grants one or more privileges. The privileges granted are all those grantable privileges that the authorization ID of the statement has on the specified packages. Note that granting ALL PRIVILEGES on a package is not the same as granting the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword grants the privilege described.

ALTER

Grants the privilege to use the COMMENT and LABEL statements.

EXECUTE

Grants the privilege to execute statements in a package.

GRANT (Package Privileges)

ON PACKAGE package-name

Identifies the packages on which you are granting the privilege. The *package-name* must identify a package that exists at the current server.

TO

Indicates to whom the privileges are granted.

authorization-name,...

Lists one or more authorization IDs.

PUBLIC

Grants the privileges to a set of users (authorization IDs). For more information, see "Authorization, privileges and object ownership" on page 18.

WITH GRANT OPTION

Allows the specified *authorization-names* to grant privileges on the packages specified in the ON clause to other users.

If WITH GRANT OPTION is omitted, the specified *authorization-names* cannot grant privileges on the packages specified in the ON clause to another user unless they have received that authority from some other source (for example, from a grant of the system authority *OBJMGT).

Notes

Corresponding System Authorities: GRANT and REVOKE statements assign and remove system authorities for SQL objects. The following table describes the system authorities that correspond to the SQL privileges:

Table 70. Privileges Granted to or Revoked from Packages

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Package
ALL (Grant or revoke of ALL grants or revokes only those privileges the authorization ID of the statement has)	*OBJALTER *OBJOPR *EXECUTE *OBJMGT (Revoke only)
ALTER	*OBJALTER
EXECUTE	*EXECUTE *OBJOPR
WITH GRANT OPTION	*OBJMGT

Corresponding System Authorities When Checking Privileges to a Package: The following table describes the system authorities that correspond to the SQL privileges when checking privileges to a package. The left column lists the SQL privilege. The right column lists the equivalent system authorities.

Table 71. Corresponding System Authorities When Checking Privileges to a Package

SQL Privilege	Corresponding System Authorities When Checking Privileges to a Package
ALTER	*OBJALTER
EXECUTE	
	*EXECUTE and *OBJOPR

GRANT (Package Privileges)

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword RUN can be used as a synonym for EXECUTE.
- The keyword PROGRAM can be used as a synonym for PACKAGE.

Example

Grant the EXECUTE privilege on package PKGA to PUBLIC.

GRANT EXECUTE
ON PACKAGE PKGA
TO PUBLIC

GRANT (Sequence Privileges)

This form of the GRANT statement grants privileges on a sequence.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

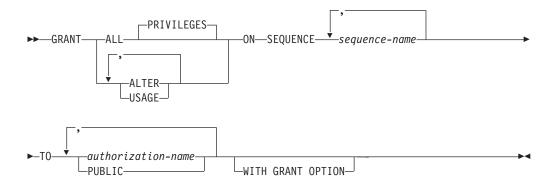
The privileges held by the authorization ID of the statement must include at least one of the following:

- For each sequence identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the sequence
 - The system authority *EXECUTE on the library containing the sequence
- Administrative authority

If WITH GRANT OPTION is specified, the privileges held by the authorization ID of the statement must include at least one of the following:

- Ownership of the sequence
- · Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Grants one or more privileges. The privileges granted are all those grantable privileges that the authorization ID of the statement has on the specified sequences. Note that granting ALL PRIVILEGES on a sequence is not the same as granting the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword grants the privilege described.

ALTER

Grants the privilege to use the ALTER SEQUENCE, COMMENT, and LABEL statements on a sequence.

USAGE

Grants the privilege to use the sequence in NEXT VALUE or PREVIOUS VALUE expressions.

ON SEQUENCE sequence-name

Identifies the sequences on which the privilege is granted. The *sequence-name* must identify a sequence that exists at the current server.

TO

Indicates to whom the privileges are granted.

authorization-name,...

Lists one or more authorization IDs.

PUBLIC

Grants the privileges to a set of users (authorization IDs). For more information, see "Authorization, privileges and object ownership" on page 18.

WITH GRANT OPTION

Allows the specified *authorization-names* to grant privileges on the sequences specified in the ON clause to other users.

If WITH GRANT OPTION is omitted, the specified *authorization-names* cannot grant the USAGE privilege to others unless they have received that authority from some other source (for example, from a grant of the system authority *OBJMGT).

Notes

Corresponding System Authorities: GRANT and REVOKE statements assign and remove system authorities for SQL objects. The following table describes the system authorities that correspond to the SQL privileges:

Table 72. Privileges Granted to or Revoked from Sequences

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Sequence
ALL (Grant or revoke of ALL grants or revokes only those privileges the	*OBJALTER
authorization ID of the statement has)	*OBJOPR *EXECUTE
	*READ
	*ADD *DLT
	*UPD
	*OBJMGT (Revoke only)
ALTER	*OBJALTER
USAGE	
	*OBJOPR
	*EXECUTE
	*READ
	*ADD *DLT
	*UPD
WITH GRANT OPTION	*OBJMGT

Corresponding System Authorities When Checking Privileges to a Sequence: The following table describes the system authorities that correspond to the SQL

GRANT (Sequence Privileges)

privileges when checking privileges to a sequence. The left column lists the SQL privilege. The right column lists the equivalent system authorities.

Table 73. Corresponding System Authorities When Checking Privileges to a Sequence

SQL Privilege	Corresponding System Authorities
ALTER	*OBJALTER
USAGE	*OBJOPR and *EXECUTE and *READ and *ADD and *DLT and *UPD

Example

Grant any user the USAGE privilege on a sequence called ORG_SEQ.

GRANT USAGE
ON SEQUENCE ORG_SEQ
TO PUBLIC

GRANT (Table or View Privileges)

This form of the GRANT statement grants privileges on tables or views.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

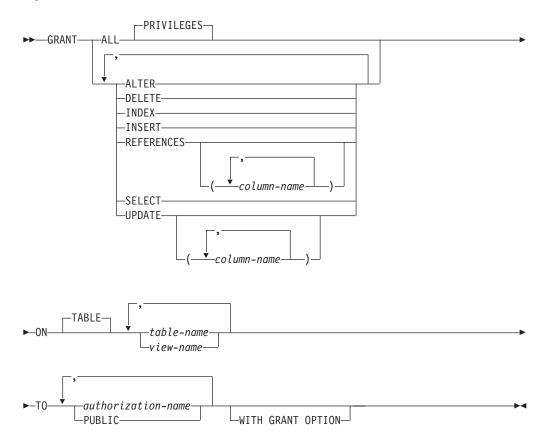
The privileges held by the authorization ID of the statement must include at least one of the following:

- For each table or view identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the table or view
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

If WITH GRANT OPTION is specified, the privileges held by the authorization ID of the statement must include at least one of the following:

- Ownership of the table
- · Administrative authority

Syntax



GRANT (Table or View Privileges)

Description

ALL or ALL PRIVILEGES

Grants one or more privileges. The privileges granted are all those grantable privileges that the authorization ID of the statement has on the specified tables or views.

Note that granting ALL PRIVILEGES on a table or view is not the same as granting the system authority of *ALL.

ALTER

Grants the privilege to alter the specified table or create or drop a trigger on the specified table. Grants the privilege to use the COMMENT and LABEL statements on tables and views.

DELETE

Grants the privilege to delete rows from the specified table or view. If a view is specified, it must be a deletable view.

Grants the privilege to create an index on the specified table. This privilege cannot be granted on a view.

INSERT

Grants the privilege to insert rows into the specified table or view. If a view is specified, it must be an insertable view.

REFERENCES

Grants the privilege to add a referential constraint in which each specified table is a parent. If a list of columns is not specified or if REFERENCES is granted to all columns of the table or view via the specification of ALL PRIVILEGES, the grantee(s) can add referential constraints using all columns of each table specified in the ON clause as a parent key, even those added later via the ALTER TABLE statement. This privilege can be granted on a view, but the privilege is not used for a view.

REFERENCES (column-name,...)

Grants the privilege to add a referential constraint in which each specified table is a parent using only those columns specified in the column list as a parent key. Each column-name must be an unqualified name that identifies a column of each table specified in the ON clause. This privilege can be granted on the columns of a view, but the privilege is not used for a view.

SELECT

Grants the privilege to create a view or read data from the specified table or view. For example, the SELECT privilege is required if a table or view is specified in a query.

Grants the privilege to update rows in the specified table or view. If a list of columns is not specified or if UPDATE is granted to all columns of the table or view via the specification of ALL PRIVILEGES, the grantee(s) can update all updatable columns on each table specified in the ON clause, even those added later via the ALTER TABLE statement. If a view is specified, it must be an updatable view.

UPDATE (column-name,...)

Grants the privilege to use the UPDATE statement to update only those columns that are identified in the column list. Each column-name must be an unqualified name that identifies a column of each table and view specified in the ON clause. If a view is specified, it must be an updatable view and the specified columns must be updatable columns.

ON table-name **or** view-name,...

Identifies the tables or views on which the privileges are granted. The *table-name* or *view-name* must identify a table or view that exists at the current server, but must not identify a declared temporary table.

TO

Indicates to whom the privileges are granted.

authorization-name,...

Lists one or more authorization IDs.

PUBLIC

Grants the privileges to a set of users (authorization IDs). For more information, see "Authorization, privileges and object ownership" on page 18.

WITH GRANT OPTION

Allows the specified *authorization-names* to grant privileges on the tables and views specified in the ON clause to other users.

If WITH GRANT OPTION is omitted, the specified *authorization-names* cannot grant privileges on the tables and views specified in the ON clause unless they have received that authority from some other source (for example, from a grant of the system authority *OBJMGT).

Notes

Corresponding system authorities: The GRANT and REVOKE statements assign and remove system authorities for SQL objects. The following table describes the system authorities that correspond to the SQL privileges when granting to a table. The left column lists the SQL privilege. The right column lists the equivalent system authorities that are granted or revoked.

Table 74. Privileges Granted to or Revoked from Tables

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Table
ALL (GRANT or revoke of ALL only grants or revokes those privileges the authorization ID of the statement has)	*OBJALTER 90 *OBJMGT (Revoke only) *OBJOPR *OBJREF *ADD *DLT *READ *UPD
ALTER	*OBJALTER ⁹¹
DELETE	*OBJOPR *DLT
INDEX	*OBJALTER ⁹¹
INSERT	*OBJOPR *ADD
REFERENCES	*OBJREF ⁹¹

GRANT (Table or View Privileges)

Table 74. Privileges Granted to or Revoked from Tables (continued)

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Table
SELECT	
	*OBJOPR
	*READ
UPDATE	
	*OBJOPR
	*UPD
WITH GRANT OPTION	*OBJMGT

The following table describes the system authorities that correspond to the SQL privileges when granting to a view. The left column lists the SQL privilege. The middle column lists the equivalent system authorities that are granted to or revoked from the view itself. The right column lists the system authorities that are granted to all tables and views referenced in the view's definition, and if a view is referenced, all tables and views referenced in its definition, and so on. ⁹²

If a view references more than one table or view, the *DLT, *ADD, and *UPD system authorities are only granted to the first table or view in the fullselect of the view definition. The *READ system authority is granted to all tables and views referenced in the view definition.

If more than one system authority will be granted with an SQL privilege, and any one of the authorities cannot be granted, then a warning occurs and no authorities will be granted for that privilege. Unlike GRANT, REVOKE only revokes system authorities to the view. No system authorities are revoked from the referenced tables and views.

Table 75. Privileges Granted to or Revoked from Views

SQL Privilege	Corresponding System Authorities Granted to or Revoked from View	Corresponding System Authorities Granted to or Revoked from Referenced Tables and Views
ALL (GRANT or REVOKE of		
ALL only grants or revokes	*OBJALTER	*ADD
those privileges the	*OBJMGT (Revoke only)	*DLT
authorization ID of the	*OBJOPR	*READ
statement has)	*OBJREF	*UPD
	*ADD	
	*DLT	
	*READ	
	*UPD	
ALTER	*OBJALTER 91	None

^{90.} The SQL INDEX and ALTER privilege correspond to the same system authority of *OBJALTER. Granting both INDEX and ALTER will not provide the user with any additional authorities.

^{91.} If the WITH GRANT OPTION is given to a user, the user will also be able to perform the functions given by ALTER and REFERENCES authority.

^{92.} The specified rights are only granted to the tables and views referenced in the view definition if the user to whom the rights are being granted doesn't already have the rights from another authority source, for example public authority.

Table 75. Privileges Granted to or Revoked from Views (continued)

SQL Privilege	Corresponding System Authorities Granted to or Revoked from View	Corresponding System Authorities Granted to or Revoked from Referenced Tables and Views
DELETE	*OBJOPR *DLT	*DLT
INDEX	Not Applicable	Not Applicable
INSERT	*OBJOPR *ADD	*ADD
REFERENCES	*OBJREF 91	None
SELECT	*OBJOPR *READ	*READ
UPDATE	*OBJOPR *UPD	*UPD
WITH GRANT OPTION	*OBJMGT	None

Corresponding system authorities when checking privileges to a table or view: The following table describes the system authorities that correspond to the SQL privileges when checking privileges to a table. The left column lists the SQL privilege. The right column lists the equivalent system authorities.

Table 76. Corresponding System Authorities when Checking Privileges to a Table

SQL Privilege	Corresponding System Authorities when Checking Privileges to a Table
ALTER	*OBJALTER or *OBJMGT
DELETE	*OBJOPR and *DLT
INDEX	*OBJALTER or *OBJMGT
INSERT	*OBJOPR and *ADD
REFERENCES	*OBJREF or *OBJMGT
SELECT	*OBJOPR and *READ
UPDATE	*OBJOPR and *UPD

The following table describes the system authorities that correspond to the SQL privileges when checking privileges to a view. The left column lists the SQL privilege. The middle column lists the equivalent system authorities that are checked on the view itself. The right column lists the system authorities that are checked on all tables and views referenced in the view's definition, and if a view is referenced, all tables and views referenced in its definition, and so on.

Table 77. Corresponding System Authorities when Checking Privileges to a View

SQL Privilege	Corresponding System Authorities to the View	Corresponding System Authorities to the Referenced Tables and Views
ALTER	*OBJALTER and *OBJMGT	None
DELETE ⁹³	*OBJOPR and *DLT	*DLT
INDEX	Not Applicable	Not Applicable
INSERT ⁹⁴	*OBJOPR and *ADD	*ADD
REFERENCES	*OBJREF or *OBJMGT	None
SELECT	*OBJOPR and *READ	*READ
UPDATE ⁹⁵	*OBJOPR and *UPD	*UPD

GRANT rules: The GRANT statement will grant only those privileges that the authorization ID of the statement is allowed to grant. If no privileges were granted, an error is returned.

Examples

Example 1: Grant all privileges on the table WESTERN_CR to PUBLIC.

GRANT ALL PRIVILEGES ON WESTERN_CR TO PUBLIC

Example 2: Grant the appropriate privileges on the CALENDAR table so that PHIL and CLAIRE can read it and insert new entries into it. Do not allow them to change or remove any existing entries.

GRANT SELECT, INSERT ON CALENDAR TO PHIL, CLAIRE

Example 3: Grant column privileges on TABLE1 and VIEW1 to FRED. Note that both columns specified in this GRANT statement must be found in both TABLE1 and VIEW1.

GRANT UPDATE(column_1, column_2)
ON TABLE1, VIEW1
TO FRED WITH GRANT OPTION

^{93.} When a view is created, the owner does not necessarily acquire the DELETE privilege on the view. The owner only acquires the DELETE privilege if the view allows deletes and the owner also has the DELETE privilege on the first table referenced in the subselect

^{94.} When a view is created, the owner does not necessarily acquire the INSERT privilege on the view. The owner only acquires the INSERT privilege if the view allows inserts and the owner also has the INSERT privilege on the first table referenced in the subselect.

^{95.} When a view is created, the owner does not necessarily acquire the UPDATE privilege on the view. The owner only acquires the UPDATE privilege if the view allows updates and the owner also has the UPDATE privilege on the first table referenced in the subselect.

GRANT (Type Privileges)

This form of the GRANT statement grants privileges on a type.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

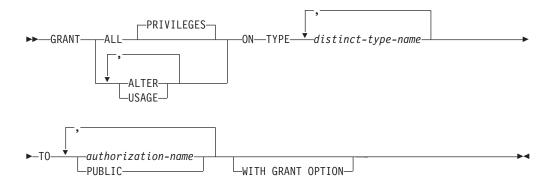
The privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the distinct type
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

If WITH GRANT OPTION is specified, the privileges held by the authorization ID of the statement must include at least one of the following:

- · Ownership of the distinct type
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Grants one or more privileges. The privileges granted are all those grantable privileges that the authorization ID of the statement has on the specified distinct types. Note that granting ALL PRIVILEGES on a distinct type is not the same as granting the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword grants the privilege described.

ALTER

Grants the privilege to use the COMMENT statement.

USAGE

1

Grants the privilege to use the distinct type in tables, functions, procedures, or CAST expressions.

ON TYPE distinct-type-name

Identifies the distinct types on which the privilege is granted. The *distinct-type-name* must identify a distinct type that exists at the current server.

TO

Indicates to whom the privileges are granted.

authorization-name,...

Lists one or more authorization IDs.

PUBLIC

Grants the privileges to a set of users (authorization IDs). For more information, see "Authorization, privileges and object ownership" on page 18.

WITH GRANT OPTION

Allows the specified *authorization-names* to grant privileges on the distinct types specified in the ON clause to other users.

If WITH GRANT OPTION is omitted, the specified *authorization-names* cannot grant the USAGE privilege to others unless they have received that authority from some other source (for example, from a grant of the system authority *OBJMGT).

Notes

Corresponding System Authorities: GRANT and REVOKE statements assign and remove system authorities for SQL objects. The following table describes the system authorities that correspond to the SQL privileges:

Table 78. Privileges Granted to or Revoked from Distinct Types

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Distinct Type
ALL (Grant or revoke of ALL grants or revokes only those privileges the authorization ID of the statement has)	*OBJALTER *OBJOPR *EXECUTE *OBJMGT (Revoke only)
ALTER	*OBJALTER
USAGE	*EXECUTE *OBJOPR
WITH GRANT OPTION	*OBJMGT

Corresponding System Authorities When Checking Privileges to a Distinct Type: The following table describes the system authorities that correspond to the SQL privileges when checking privileges to a distinct type. The left column lists the SQL privilege. The right column lists the equivalent system authorities.

Table 79. Corresponding System Authorities When Checking Privileges to a Distinct Type

	Corresponding System Authorities when Granting to or Revoking from a Distinct
SQL Privilege	Type
ALTER	*OBJALTER

Table 79. Corresponding System Authorities When Checking Privileges to a Distinct Type (continued)

SQL Privilege	Corresponding System Authorities when Granting to or Revoking from a Distinct Type
USAGE	
	*EXECUTE and *OBJOPR

When USAGE privilege is required: USAGE privilege is required when a distinct type is explicitly referenced in an SQL statement. For example, in a statement that contains a CAST specification or in a CREATE TABLE statement. The USAGE privilege is not required when a distinct type is indirectly referenced. For example, when a view references a column of a table that has a distinct data type.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

 The keywords DATA TYPE or DISTINCT TYPE can be used as a synonym for TYPE

Example

Grant the USAGE privilege on distinct type SHOE_SIZE to user JONES. This GRANT statement does not give JONES the privilege to execute the cast functions that are associated with the distinct type SHOE_SIZE.

```
GRANT USAGE
ON DISTINCT TYPE SHOE_SIZE
TO JONES
```

HOLD LOCATOR

The HOLD LOCATOR statement allows a LOB locator variable to retain its association with a value beyond a unit of work.

Invocation

This statement can only be embedded in an application program. It cannot be issued interactively. It is an executable statement that can be dynamically prepared. However, the EXECUTE statement with the USING clause must be used to execute the prepared statement. HOLD LOCATOR cannot be used with the EXECUTE IMMEDIATE statement. It must not be specified in REXX.

Authorization

None required.

Syntax



Description

variable,...

Identifies a variable that must be declared in accordance with the rules for declaring variable locator variables. An indicator variable must not be specified. The locator variable type must be a binary large object locator, a character large object locator, or a double-byte character large object locator.

After the HOLD LOCATOR statement is executed, each locator variable in the *variable* list has the hold property.

The variable must currently have a locator assigned to it. That is, a locator must have been assigned during this unit of work (by a CALL, FETCH, SELECT INTO, SET variable, or VALUES INTO statement) and must not subsequently have been freed (by a FREE LOCATOR statement); otherwise, an error is raised.

If more than one variable is specified in the HOLD LOCATOR statement and an error occurs on one of the locators, no locators will be held.

Note

A LOB locator variable that has the hold property is freed (has its association between it and its value removed) when:

- The SQL FREE LOCATOR statement is executed for the locator variable.
- The SQL ROLLBACK statement without a HOLD option is executed.
- The SQL session is terminated.

Example

Assume that the employee table contains columns RESUME, HISTORY, and PICTURE and that locators have been established in a program to represent the values represented by the columns. Give the CLOB locator variables LOCRES and

HOLD LOCATOR

LOCHIST, and the BLOB locator variable LOCPIC the hold property. **HOLD LOCATOR** :LOCRES,:LOCHIST,:LOCPIC

INCLUDE

The INCLUDE statement inserts application code, including declarations and statements, into a source program.

Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in Java or REXX.

Authorization

The authorization ID of the statement must have the system authorities *OBJOPR and *READ on the file that contains the member.

Syntax



Description

SQLCA

Indicates the description of an SQL communication area (SQLCA) is to be included. Include SQLCA must not be specified if the program includes a stand-alone SQLCODE or a stand-alone SQLSTATE. An SQLCA can be specified for C, C++, COBOL, and PL/I. If the SQLCA is not specified, the variable SQLCODE or SQLSTATE must appear in the program.

INCLUDE SQLCA must not be specified more than once in the same program. For more information, see "SQL diagnostic information" on page 537.

The SQLCA should not be specified for RPG programs. In an RPG program, the precompiler automatically includes the SQLCA.

For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

SOLDA

Specifies the description of an SQL descriptor area (SQLDA) is to be included. INCLUDE SQLDA can be specified in C, C++, COBOL, PL/I, and ILE RPG.

For a description of the SQLDA, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.

name

Identifies a member or source stream file to be included in the source program.

If precompiling using the SRCFILE parameter, it identifies a member to be included from the file specified on the INCFILE parameter of the CRTSQLxxx command.

If precompiling using the SRCSTMF parameter, it identifies a file to be included using the path from the INCDIR parameter of the CRTSQLxxx command. No suffix will be appended to the name.

The source can contain any host language statements and any SQL statements other than an INCLUDE statement. In COBOL, INCLUDE *member-name* must not be specified in other than the DATA DIVISION or PROCEDURE DIVISION.

'string'

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Identifies a file to be included using the path from the INCDIR parameter of the CRTSQLxxx command. The string will be handled as a normal SQL string literal; the source stream file rules for escaping characters will not be followed. No suffix will be appended to the string.

The source can contain any host language statements and any SQL statements other than an INCLUDE statement.

When your program is precompiled, the INCLUDE statement is replaced by source statements.

The INCLUDE statement must be specified at a point in your program where the resulting source statements are acceptable to the compiler.

Notes

CCSID considerations: If the CCSID of the file specified on the SRCFILE or SRCSTMF parameter is different from the CCSID of the source for the INCLUDE statement, the INCLUDE source is converted to the CCSID of the source file.

Example

Include an SQL descriptor area in a C program.

```
EXEC SQL INCLUDE SQLDA;

EXEC SQL DECLARE C1 CURSOR FOR
   SELECT DEPTNO, DEPTNAME, MGRNO FROM TDEPT
   WHERE ADMRDEPT = 'A00';

EXEC SQL OPEN C1;

while (SQLCODE==0) {
   EXEC SQL FETCH C1 INTO :dnum, :dname, :mnum;

/* Print results */
}

EXEC SQL CLOSE C1;
```

INSERT

The INSERT statement inserts rows into a table or view. Inserting a row into a view also inserts the row into the table on which the view is based if no INSTEAD OF INSERT trigger is defined on this view. If such a trigger is defined, the trigger will be activated instead.

There are three forms of this statement:

- The *INSERT using VALUES* form is used to insert one or more rows into the table or view using the values provided or referenced.
- The *INSERT using fullselect* form is used to insert one or more rows into the table or view using values from other tables or views.
- The *INSERT using n ROWS* form is used to insert multiple rows into the table or view using the values provided in a host-structure-array.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared with the exception of the n ROWS form, which must be a static statement embedded in an application program. The n ROWS form is not allowed in a REXX procedure.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

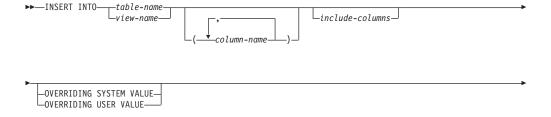
- For the table or view identified in the statement:
 - The INSERT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

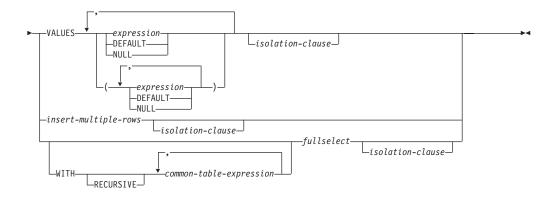
If a *fullselect* is specified, the privileges held by the authorization ID of the statement must also include one of the following:

- For each table or view identified in the *fullselect*:
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

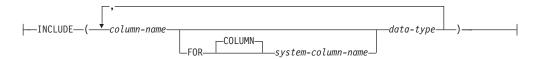
For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax



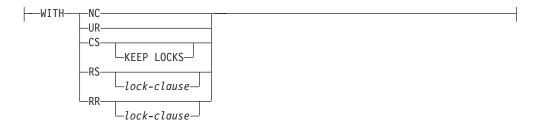


include-columns:



insert-multiple-rows:

isolation-clause:



lock-clause:

```
---USE AND KEEP EXCLUSIVE LOCKS---
```

data-type:

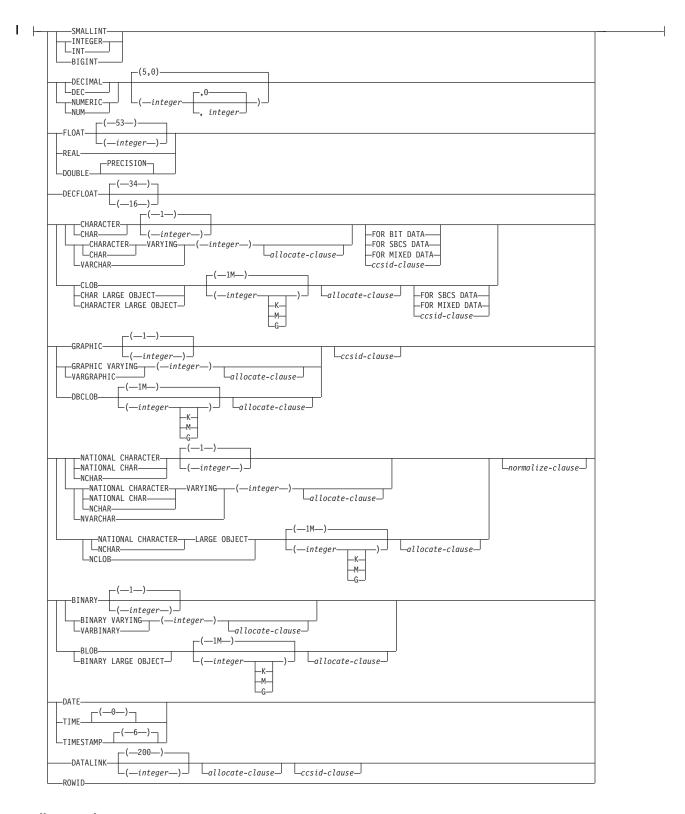
```
-__built-in-type-___distinct-type-__
```

built-in-type:

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INSERT



allocate-clause:

—ALLOCATE—(—integer—)-

ccsid-clause:



normalize-clause:



Description

INTO table-name or view-name

Identifies the object of the insert operation. The name must identify a table or view that exists at the current server, but it must not identify a catalog table, a view of a catalog table, or a view that is not insertable. For an explanation of insertable views, see "CREATE VIEW" on page 835.

(column-name,...)

Specifies the columns for which insert values are provided. Each name must be a name that identifies a column of the table or view. The same column must not be identified more than once. If extended indicator variables are not enabled, a view column that is not updatable must not be identified. If extended indicator variables are not enabled and the object of the insert operation is a view with such columns, a list of column names must be specified and the list must not identify those columns. For an explanation of updatable columns in views, see "CREATE VIEW" on page 835.

Omission of the column list is an implicit specification of a list in which every column of the table or view is identified in left-to-right order. Any columns defined with the hidden attribute are omitted. This list is established when the statement is prepared and, therefore, does not include columns that were added to a table after the statement was prepared.

If the INSERT statement is embedded in an application and the referenced table or view exists at create program time, the statement is prepared at create program time. Otherwise, the statement is prepared at the first successful execute of the INSERT statement.

include-columns

Specifies a set of columns that are included, along with the columns of *table-name* or *view-name*, in the intermediate result table of the INSERT statement when it is nested in the FROM clause of a fullselect. The *include-columns* are appended to the end of the list of columns specified by *table-name* or *view-name*.

INCLUDE

Specifies a list of columns to be included in the intermediate result table of the INSERT statement. This clause can only be specified if the INSERT statement is nested in the FROM clause of a fullselect.

column-name

Specifies a column of the intermediate result table of the INSERT statement. The name cannot be the same as the name of another include column or a column in *table-name* or *view-name*.

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INSERT

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FOR COLUMN *system-column-name*

Provides an IBM i name for the column. The name must not be the same as any *column-name* or *system-column-name* in the INCLUDE column list or in *table-name* or *view-name*.

data-type

Specifies the data type of the include column. For a description of *data-type*, see "CREATE TABLE" on page 768. If a DATALINK data-type is used, FILE LINK CONTROL is not allowed.

OVERRIDING SYSTEM VALUE or OVERRIDING USER VALUE

Specifies whether system generated values or user-specified values for a ROWID, identity, or row change timestamp column are used. If OVERRIDING SYSTEM VALUE is specified, the implicit or explicit list of columns for the INSERT statement must contain a column defined as GENERATED ALWAYS. If OVERRIDING USER VALUE is specified, the implicit or explicit list of columns for the INSERT statement must contain a column defined as either GENERATED ALWAYS or GENERATED BY DEFAULT.

OVERRIDING SYSTEM VALUE

Specifies that the value specified in the VALUES clause or produced by a fullselect for a column that is defined as GENERATED ALWAYS is used. A system-generated value is not inserted.

OVERRIDING USER VALUE

Specifies that the value specified in the VALUES clause or produced by a fullselect for a column that is defined as either GENERATED ALWAYS or GENERATED BY DEFAULT is ignored. Instead, a system-generated value is inserted, overriding the user-specified value.

If neither OVERRIDING SYSTEM VALUE nor OVERRIDING USER VALUE is specified:

- A value cannot be specified for a ROWID, identity, or row change timestamp column that is defined as GENERATED ALWAYS.
- A value can be specified for a ROWID, identity, or row change timestamp column that is defined as GENERATED BY DEFAULT. If a value is specified that value is assigned to the column. However, a value can be inserted into a ROWID column defined BY DEFAULT only if the specified value is a valid row ID value that was previously generated by DB2 for z/OS or DB2 for i. When a value is inserted into an identity or row change timestamp column defined BY DEFAULT, the database manager does not verify that the specified value is a unique value for the column unless the identity or row change timestamp column is the sole key in a unique constraint or unique index. Without a unique constraint or unique index, the database manager can guarantee unique values only among the set of system-generated values as long as NO CYCLE is in effect.

If a value is not specified the database manager generates a new value.

VALUES

Specifies one or more new rows to be inserted.

Each variable in the clause must identify a host structure or variable that is declared in accordance with the rules for declaring host structures and variables. In the operational form of the statement, a reference to a host structure is replaced by a reference to each of its variables. For further information about variables and structures, see "References to host variables" on page 136 and "Host structures" on page 142.

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The number of values for each row in the VALUES clause must equal the number of names in the implicit or explicit column list and the columns identified in the INCLUDE clause. The first value is inserted in the first column in the list, the second value in the second column, and so on.

An expression of the type described in "Expressions" on page 152, that does not include an aggregate function or column name. If expression is a variable, the variable can identify a structure. If extended indicator variables are enabled and the expression is not a single variable, the extended indicator variable values of DEFAULT and UNASSIGNED must not be used for that expression.

DEFAULT

Specifies that the default value is assigned to a column. The value that is inserted depends on how the column was defined, as follows:

- If the WITH DEFAULT clause is used, the default inserted is as defined for the column (see default-clause in column-definition in "CREATE TABLE" on page 768).
- If the WITH DEFAULT clause or the NOT NULL clause is not used, the value inserted is NULL.
- If the NOT NULL clause is used and the WITH DEFAULT clause is not used or DEFAULT NULL is used, the DEFAULT keyword cannot be specified for that column.
- If the column is a ROWID or identity column, the database manager will generate a new value.
- If the column is defined as a row change timestamp column, a new row change timestamp value is assigned to the column.

DEFAULT must be specified for a ROWID or an identity column that was defined as GENERATED ALWAYS unless OVERRIDING USER VALUE is specified to indicate that any user-specified value will be ignored and a unique system-generated value will be inserted.

NULL

Specifies the value for a column is the null value. NULL should only be specified for nullable columns.

WITH *common-table-expression*

Specifies a common table expression. For an explanation of common table expression, see "common-table-expression" on page 513.

fullselect

Specifies a set of new rows in the form of the result table of a fullselect. If the result table is empty, SQLSTATE is set to '02000'.

For an explanation of *fullselect*, see "fullselect" on page 506.

When the base object of the INSERT and a base object of any subselect in the fullselect are the same table, the select statement is completely evaluated before any rows are inserted.

The number of columns in the result table must equal the number of names implicitly or explicitly specified in the column-name list. The value of the first column of the result is inserted in the first column in the list, the second value in the second column, and so on.

isolation-clause

Specifies the isolation level to be used for this statement.

WITH

Introduces the isolation level, which may be one of:

- RR Repeatable read
- RS Read stability
- CS Cursor stability
- UR Uncommitted read
- NC No commit

If isolation-clause is not specified the default isolation is used. See "isolation-clause" on page 523 for a description of how the default is determined.

insert-multiple-rows

integer or variable ROWS

Specifies the number of rows to be inserted. If a variable is specified, it must be numeric with zero scale and cannot include an indicator variable.

VALUES (host-structure-array)

Specifies a set of new rows in the form of an array of host structures. The host-structure-array must be declared in the program in accordance with the rules for declaring host structure arrays. A parameter marker may not be used in place of the host-structure-array name.

The number of variables in the host structure must equal the number of names in the implicit or explicit column list and the columns identified in the INCLUDE clause. The first host structure in the array corresponds to the first row, the second host structure in the array corresponds to the second row, and so on. In addition, the first variable in the host structure corresponds with the first column of the row, the second variable in the host structure corresponds with the second column of the row, and so on.

For an explanation of arrays of host structures see "Host structure arrays" on page 143.

insert-multiple-rows is not allowed if the current connection is to a non-DB2 for i remote server. insert-multiple-rows is not allowed in a data change reference in an RPG/400 or PL/I program.

INSERT Rules

Default Values: The value inserted in any column that is not in the column list is the default value of the column. Columns without a default value must be included in the column list. Similarly, if you insert into a view without an INSTEAD OF INSERT trigger, the default value is inserted into any column of the base table that is not included in the view. Hence, all columns of the base table that are not in the view must have a default value.

Assignment: Insert values are assigned to columns in accordance with the storage assignment rules described in Chapter 2, "Language elements," on page 47.

Validity: Insert operations must obey the following rules. If they do not, or if any other errors occur during the execution of the INSERT statement, no rows are inserted unless COMMIT(*NONE) was specified.

• Unique constraints and unique indexes: If the identified table, or the base table of the identified view, has one or more unique indexes or unique constraints, each

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row inserted into the table must conform to the limitations imposed by those indexes and constraints (SQLSTATE 23505).

All uniqueness checks are effectively made at the end of the statement unless COMMIT(*NONE) was specified. In the case of a multiple-row INSERT statement, this would occur after all rows were inserted. If COMMIT(*NONE) is specified, checking is performed as each row is inserted.

- Check constraints: If the identified table, or the base table of the identified view, has one or more check constraints, each check constraint must be true or unknown for each row inserted into the table (SQLSTATE 23513).
 - The check constraints are effectively checked at the end of the statement. In the case of a multiple-row INSERT statement, this would occur after all rows were inserted.
- Views and the CHECK OPTION clause: If a view is identified, the inserted rows must conform to any applicable CHECK OPTION clause (SQLSTATE 44000). For more information, see "CREATE VIEW" on page 835.

Triggers: If the identified table or the base table of the identified view has an insert trigger, the trigger is activated. A trigger might cause other statements to be executed or raise error conditions based on the insert values. If the INSERT statement is used as a data-change-table-reference, an AFTER INSERT trigger that attempts to modify the inserted rows will cause an error.

Referential Integrity: Each nonnull insert value of a foreign key must equal some value of the parent key of the parent table in the relationship.

The referential constraints (other than a referential constraint with a RESTRICT delete rule) are effectively checked at the end of the statement. In the case of a multiple-row INSERT statement, this would occur after all rows were inserted and any associated triggers were activated.

If the INSERT statement is used as a data-change-table-reference, any referential constraint that attempts to modify the inserted rows will cause an error.

Extended indicator variable usage: If enabled, indicator variable values other than positive values and 0 (zero) through -7 must not be set. The DEFAULT and UNASSIGNED extended indicator variable values must not appear in contexts where they are not supported.

Extended indicator variables: Extended indicator variables can only be enabled for INSERT with VALUES; they are not allowed with insert with fullselect or a multiple-row insert. In an INSERT statement, the extended indicator value of UNASSIGNED has the effect of setting the column to its default value.

If a target column is not updatable, it must be assigned the extended indicator variable value of UNASSIGNED, unless it is an identity column defined as GENERATED ALWAYS. If the target column is an identity column defined as GENERATED ALWAYS; then it must be assigned the DEFAULT keyword or the extended indicator variable values of DEFAULT or UNASSIGNED.

Extended indicator variables and insert triggers: No change in the activation of insert triggers results from the presence of extended indicator variables. If all columns in the implicit or explicit column list have been assigned to an extended indicator variable-based value of UNASSIGNED, or DEFAULT, an insert where all columns have their respective DEFAULT values is attempted, and if successful, the insert trigger is activated.

INSERT

Extended indicator variables and deferred error checks: When extended indicator variables are enabled, validation that would normally be done during statement preparation to recognize an insert into a non-updatable column is deferred until the statement is executed.

Notes

Insert operation errors: If an insert value violates any constraints, or if any other error occurs during the execution of an INSERT statement and COMMIT(*NONE) was not specified, all changes from this statement and any triggered SQL statements are rolled back. However, other changes in the unit of work made prior to the error are not rolled back. If COMMIT(*NONE) is specified, changes are not rolled back.

Number of rows inserted: After executing an INSERT statement, the ROW_COUNT statement information item in the SQL Diagnostics Area (or SQLERRD(3) of the SQLCA) is the number of rows that the database manager inserted. The ROW_COUNT item does not include the number of rows that were inserted as a result of a trigger.

For a description of ROW_COUNT, see "GET DIAGNOSTICS" on page 943. For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

Locking: If COMMIT(*RR), COMMIT(*ALL), COMMIT(*CS), or COMMIT(*CHG) is specified, one or more exclusive locks are acquired during the execution of a successful INSERT statement. Until the locks are released by a commit or rollback operation, an inserted row can only be accessed by:

- The application process that performed the insert
- Another application process using COMMIT(*NONE) or COMMIT(*CHG) through a read-only operation

The locks can prevent other application processes from performing operations on the table. For further information about locking, see the description of the "COMMIT" on page 639, "ROLLBACK" on page 1058, and "LOCK TABLE" on page 1013 statements. Also, see "Isolation level" on page 26 and Database Programming.

If the INSERT is used as a data-change-table-reference where FINAL TABLE is specified, locks are placed on inserted rows until the SELECT is complete. These locks may prevent indirect changes to the inserted rows from within the same job, such as an AFTER TRIGGER attempting to change an inserted row. These locks are acquired for all isolation levels, including COMMIT(*NONE).

A maximum of 500 000 000 rows can be inserted or changed in any single INSERT statement when COMMIT(*RR), COMMIT(*ALL), COMMIT(*CS), or COMMIT(*CHG) was specified. The number of rows changed includes any rows inserted, updated, or deleted under the same commitment definition as a result of a trigger.

Row change timestamp columns: A row change timestamp column that is defined as GENERATED ALWAYS should not be specified in the column-list unless the corresponding entry in the VALUES list is DEFAULT. The user can specify the

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OVERRIDING USER VALUE clause to indicate that any user-specified value will be ignored and the timestamp value associated with the INSERT will be inserted into this column.

REXX: Variables cannot be used in the INSERT statement within a REXX procedure. Instead, the INSERT must be the object of a PREPARE and EXECUTE using parameter markers.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword NONE can be used as a synonym for NC.
- The keyword CHG can be used as a synonym for UR.
- The keyword ALL can be used as a synonym for RS.

Examples

Example 1: Insert a new department with the following specifications into the **DEPARTMENT** table:

- Department number (DEPTNO) is 'E31'
- Department name (DEPTNAME) is 'ARCHITECTURE'
- Managed by (MGRNO) a person with number '00390'
- Reports to (ADMRDEPT) department 'E01'.

```
INSERT INTO DEPARTMENT
 VALUES ('E31', 'ARCHITECTURE', '00390', 'E01')
```

Example 2: Insert a new department into the DEPARTMENT table as in example 1, but do not assign a manager to the new department.

```
INSERT INTO DEPARTMENT (DEPTNO, DEPTNAME, ADMRDEPT)
  VALUES ('E31', 'ARCHITECTURE', 'E01')
```

Example 3: Create a table MA_EMPPROJACT with the same columns as the EMPPROJACT table. Populate MA_EMPPROJACT with the rows from the EMPPROJACT table with a project number (PROJNO) starting with the letters 'MA'.

```
CREATE TABLE MA_EMPPROJACT LIKE EMPPROJACT
INSERT INTO MA EMPPROJACT
  SELECT * FROM EMPPROJACT
    WHERE SUBSTR(PROJNO, 1, 2) = 'MA'
```

Example 4: Use a Java program statement to add a skeleton project to the PROJECT table on the connection context 'ctx'. Obtain the project number (PROJNO), project name (PROJNAME), department number (DEPTNO), and responsible employee (RESPEMP) from host variables. Use the current date as the project start date (PRSTDATE). Assign a NULL value to the remaining columns in the table.

```
#sql [ctx] { INSERT INTO PROJECT (PROJNO, PROJNAME, DEPTNO, RESPEMP, PRSTDATE)
            VALUES (:PRJNO, :PRJNM, :DPTNO, :REMP, CURRENT DATE) };
```

Example 5: Insert two new departments using one statement into the DEPARTMENT table as in example 2, but do not assign a manager to the new departments.

```
INSERT INTO DEPARTMENT (DEPTNO, DEPTNAME, ADMRDEPT)
 VALUES ('B11', 'PURCHASING', 'B01'),
         ('E41', 'DATABASE ADMINISTRATION', 'E01')
```

Example 6: In a PL/I program, use a multiple-row INSERT to add 10 rows to table DEPARTMENT. The host structure array DEPT contains the data to be inserted.

```
DCL 1 DEPT(10),
        3 DEPT CHAR(3),
        3 LASTNAME CHAR(29) VARYING,
3 WORKDEPT CHAR(6),
        3 JOB CHAR(3);
EXEC SQL INSERT INTO DEPARTMENT 10 ROWS VALUES (:DEPT);
```

Example 7: Insert a new project into the EMPPROJACT table using the Read Uncommitted (UR, CHG) option:

```
INSERT INTO EMPPROJACT
 VALUES ('000140', 'PL2100', 30)
 WITH CHG
```

Example 8: Specify an INSERT statement as the data-change-table-reference within a SELECT statement. Define an extra include column whose values are specified in the VALUES clause, which is then used as an ordering column for the inserted rows.

```
SELECT inorder, ordernum
  FROM FINAL TABLE (INSERT INTO ORDERS (CUSTNO)
                                INCLUDE(INSERTNUM INTEGER)
                      VALUES (:cnum1, 1),
                             (:cnum2, 2)) InsertedOrders
  ORDER BY insertnum
```

LABEL

The LABEL statement adds or replaces labels in the catalog descriptions of various database objects.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

To label a table, view, alias, column, distinct type, package, or sequence, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the table, view, alias, distinct type, package, sequence, function or procedure identified in the statement,
 - The ALTER privilege on the table, view, alias, distinct type, package, sequence, function or procedure, and
 - The system authority *EXECUTE on the library containing the table, view, alias, distinct type, package, sequence, function or procedure
- Administrative authority

To label a constraint or trigger, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the subject table of the constraint or trigger in the statement:
 - The ALTER privilege on the subject table, and
 - The system authority *EXECUTE on the library that contains the subject table
- · Administrative authority

To label an index, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the index identified in the statement,
 - The system authority *OBJALTER on the index, and
 - The system authority *EXECUTE on the library containing the index.
- Administrative authority

To label a function, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSFUNCS and SYSROUTINES catalog view and table:
 - The UPDATE privilege on SYSROUTINES,
 - The system authority *OBJOPR on SYSFUNCS, and
 - The system authority *EXECUTE on library QSYS2
- Administrative authority

To label a procedure, the privileges held by the authorization ID of the statement must include at least one of the following:

- For the SYSPROCS and SYSROUTINES catalog view and table:
 - The UPDATE privilege on SYSROUTINES,
 - The system authority *OBJOPR on SYSPROCS, and
 - The system authority *EXECUTE on library QSYS2

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Administrative authority

To label a sequence, the privileges held by the authorization ID of the statement must also include at least one of the following:

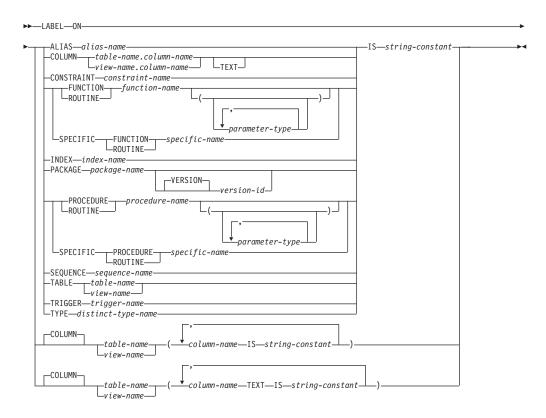
- *USE authority to the Change Data Area (CHGDTAARA) CL command
- Administrative authority

The authorization ID of the statement has the ALTER privilege on an alias when:

- It is the owner of the alias, or
- It has been granted the system authorities of either *OBJALTER or *OBJMGT to the alias

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View, Corresponding System Authorities When Checking Privileges to a Sequence, and Corresponding System Authorities When Checking Privileges to a Package.

Syntax



parameter-type:

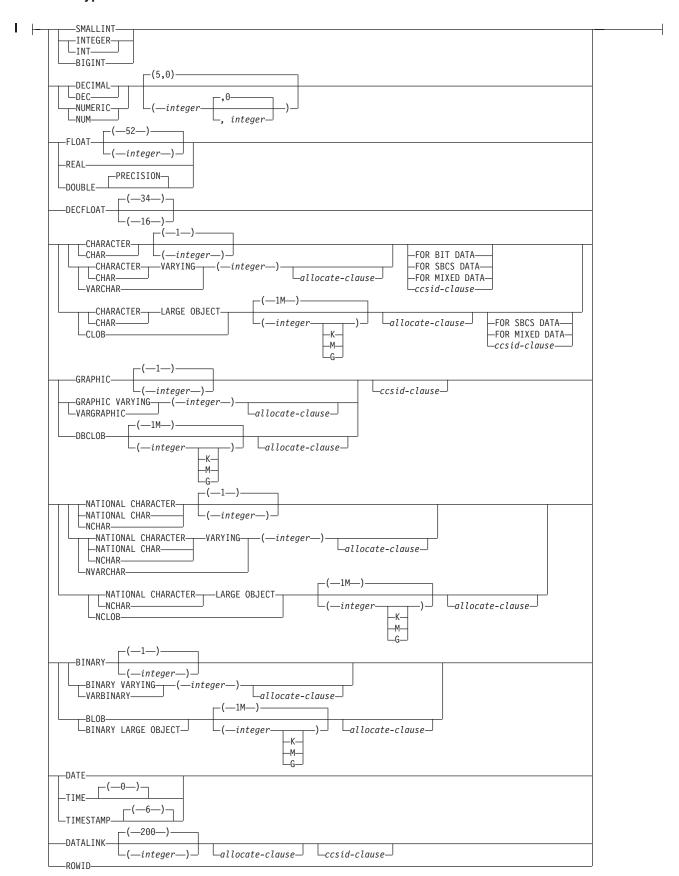
```
-data-type-
              -AS LOCATOR-
```

data-type:

```
-built-in-type-
-distinct-type-name—
```

I

built-in-type:



ccsid-clause:

---CCSID--integer-

Description

ALIAS

Specifies that the label is for an alias. Labels on aliases are implemented as system object text.

alias-name

Identifies the alias to which the label applies. The name must identify an alias that exists at the current server.

COLUMN

Specifies that the label is for a column. Labels on columns are implemented as system column headings or column text. Column headings are used when displaying or printing query results.

table-name.column-name or view-name.column-name

Identifies the column to which the label applies. The table-name or view-name must identify a table or view that exists at the current server, but must not identify a declared temporary table. The column-name must identify a column of that table or view.

TEXT

Specifies that IBM i column text is specified. If TEXT is omitted, a column heading is specified.

CONSTRAINT

Specifies that the label is for a constraint.

constraint-name

Identifies the constraint to which the label applies. The constraint-name must identify a constraint that exists at the current server.

FUNCTION or SPECIFIC FUNCTION

Identifies the function on which the label applies. The function must exist at the current server and it must be a user-defined function. The function can be identified by its name, function signature, or specific name.

FUNCTION *function-name*

Identifies the function by its name. The function-name must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (*parameter-type*, ...)

Identifies the function by its function signature, which uniquely identifies the function. The function-name (parameter-type, ...) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance on which to label. Synonyms for data types are considered a match.

If function-name () is specified, the function identified must have zero parameters.

I

function-name

Identifies the name of the function.

(parameter-type, ...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

SPECIFIC FUNCTION specific-name

Identifies the function by its specific name. The specific-name must identify a specific function that exists at the current server.

INDEX

Specifies that the label is for an index. Labels on indexes are implemented as system object text.

index-name

Identifies the index to which the label applies. The name must identify an index that exists at the current server.

PACKAGE

Specifies that the label is for a package. Labels on packages are implemented as system object text.

package-name

Identifies the package to which the label applies. The name must identify a package that exists at the current server.

VERSION version-id

version-id is the version identifier that was assigned to the package when it was created. If version-id is not specified, a null string is used as the version identifier.

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure to which the label applies. The procedure-name must identify a procedure that exists at the current server.

PROCEDURE *procedure-name*

Identifies the procedure by its name. The procedure-name must identify exactly one procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE *procedure-name* (*parameter-type*, ...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The procedure-name (parameter-type, ...) must identify a procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types, and the logical concatenation of the data types is used to identify the specific procedure instance which is to be labeled on. Synonyms for data types are considered a match.

If procedure-name () is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type, ...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a procedure defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either

1 1 I clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB. If AS LOCATOR is specified, FOR SBCS DATA or FOR MIXED DATA must not be specified.

SPECIFIC PROCEDURE *specific-name*

Identifies the procedure by its specific name. The specific-name must identify a specific procedure that exists at the current server.

SEOUENCE

Specifies that the label is for a sequence. Labels on sequences are implemented as system object text.

sequence-name

Identifies the sequence on which you want to add a label. The sequence-name must identify a sequence that exists at the current server.

TABLE

Specifies that the label is for a table or a view. Labels on tables or views are implemented as system object text.

table-name **or** view-name

Identifies the table or view on which you want to add a label. The table-name or view-name must identify a table or view that exists at the current server, but must not identify a declared temporary table.

TRIGGER

Specifies that the label is for a trigger.

trigger-name

Identifies the trigger on which you want to add a label. The trigger-name must identify a trigger that exists at the current server.

TYPE distinct-type-name

Identifies the distinct type to which the label applies. The distinct-type-name must identify a distinct type that exists at the current server.

IS

Introduces the label you want to provide.

string-constant

Can be any SQL character-string constant of up to either 50 bytes in length for tables, views, aliases, SQL packages, sequences, or column text, or 60 bytes in length for column headings. The constant may contain single-byte and double-byte characters.

The label for a column heading consists of three 20-byte segments. Interactive SQL, the Query /400 program, IBM DB2 Query Manager and SQL Development Kit for i5/OS, and other products can display or print each 20-byte segment on a separate line. If the label for a column contains mixed data, each 20-byte segment must be a valid mixed data character string. The shift characters must be paired within each 20-byte segment.

Notes

Column headings: Column headings are used when displaying or printing query results. The first column heading is displayed or printed on the first line, the second column heading is displayed or printed on the second line, and the third

LABEL

column heading is displayed or printed on the third line. The column headings can be up to 60 bytes in length, where the first 20 bytes is the first column heading, the second 20 bytes is the second column heading, and the third 20 bytes is the third column heading. Blanks are trimmed from the end of each 20-byte column heading.

All 60 bytes of column heading information are available in the catalog view SYSCOLUMNS; however, only the first column heading is returned in an SQLDA on a DESCRIBE or DESCRIBE TABLE statement.

Column text is not returned on a DESCRIBE or DESCRIBE TABLE statement. When the database manager changes the column heading information in a record format description that is shared, the change is reflected in all files sharing the format description. To find out if a file shares a format with another file, use the RCDFMT parameter on the CL command, Display Database Relations (DSPDBR).

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword PROGRAM can be used as a synonym for PACKAGE.
- The keywords DATA TYPE or DISTINCT TYPE can be used as a synonym for TYPE.

Examples

Example 1: Enter a label on the DEPTNO column of table DEPARTMENT.

LABEL ON COLUMN DEPARTMENT. DEPTNO IS 'DEPARTMENT NUMBER'

Example 2: Enter a label on the DEPTNO column of table DEPARTMENT where the column heading is shown on two separate lines.

LABEL ON COLUMN DEPARTMENT.DEPTNO IS 'Department Number'

Example 3: Enter a label on the PAYROLL package.

LABEL ON PACKAGE PAYROLL IS 'Payroll Package'

LOCK TABLE

The LOCK TABLE statement either prevents concurrent application processes from changing a table or prevents concurrent application processes from using a table.

Invocation

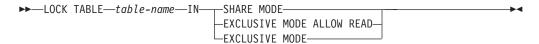
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- · For the table identified in the statement,
 - The system authority of *OBJOPR on the table, and
 - The system authority *EXECUTE on the library containing the table
- Administrative authority

Syntax 1 4 1



Description

table-name

Identifies the table to be locked. The table-name must identify a base table that exists at the current server, but must not identify a catalog table or a declared temporary table.

IN SHARE MODE

Prevents concurrent application processes from executing any but read-only operations on the table.

A shared lock (*SHRNUP) is acquired for the application process in which the statement is executed. Other application processes may also acquire a shared lock (*SHRNUP) and prevent this application process from executing any but read-only operations.

IN EXCLUSIVE MODE ALLOW READ

Prevents concurrent application processes from executing any but read-only operations on the table.

An exclusive allow read lock (*EXCLRD) is acquired for the application process in which the statement is executed. Other application processes may not acquire a shared lock (*SHRNUP) and cannot prevent this application process from executing updates, deletes, and inserts on the table.

IN EXCLUSIVE MODE

Prevents concurrent application processes from executing any operations at all on the table.

An exclusive lock (*EXCL) is acquired for the application process in which the statement is executed.

Notes

Locks obtained: Locking is used to prevent concurrent operations.

The lock is released:

- · When the unit of work ends, unless the unit of work is ended by a COMMIT HOLD or ROLLBACK HOLD
- When the first SQL program in the program stack ends, unless CLOSQLCSR(*ENDJOB) or CLOSQLCSR(*ENDACTGRP) was specified on the CRTSQLxxx command
- When the activation group ends
- When the connection is changed using a CONNECT (Type 1) statement
- · When the connection associated with the lock is disconnected using the DISCONNECT statement
- When the connection is in the release-pending state and a successful COMMIT

You may also issue the Deallocate Object (DLCOBJ) command to unlock the table.

Lock wait time: Conflicting locks already held by other application processes will cause your application to wait up to the default wait time of the job.

Example

Obtain a lock on the DEPARTMENT table.

LOCK TABLE DEPARTMENT IN EXCLUSIVE MODE

OPEN

The OPEN statement opens a cursor so that it can be used to fetch rows from its result table.

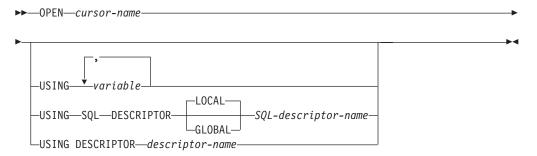
Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

See "DECLARE CURSOR" on page 845 for the authorization required to use a cursor.

Syntax



Description

cursor-name

Identifies the cursor to be opened. The cursor-name must identify a declared cursor as explained in the Notes for the DECLARE CURSOR statement. When the OPEN statement is executed, the cursor must be in the closed state.

The SELECT statement associated with the cursor is either:

- The select-statement specified in the DECLARE CURSOR statement, or
- The prepared select-statement identified by the statement-name specified in the DECLARE CURSOR statement. If the statement has not been successfully prepared, or is not a select-statement, the cursor cannot be successfully opened.

The result table of the cursor is derived by evaluating the SELECT statement. The evaluation uses the current values of any special registers specified in the SELECT statement and the current values of any variables specified in the SELECT statement or the USING clause of the OPEN statement. The rows of the result table can be derived during the execution of the OPEN statement and a temporary table can be created to hold them; or they can be derived during the execution of subsequent FETCH statements. In either case, the cursor is placed in the open state and positioned before the first row of its result table. If the table is empty the position of the cursor is effectively "after the last row."

USING

Introduces a list of variables whose values are substituted for the parameter

markers (question marks) of a prepared statement. For an explanation of parameter markers, see "PREPARE" on page 1020.

- If a statement-name is specified in the DECLARE CURSOR statement that includes parameter markers, USING must be used. If the prepared statement does not include parameter markers, USING is ignored.
- If a select-statement is specified in the DECLARE CURSOR statement, USING may be used to override the variable values. For more information, see Variable value override.

If the DECLARE CURSOR statement names a prepared statement that includes parameter markers, you must use USING. If the prepared statement does not include parameter markers, USING is ignored.

variable,...

Identifies host structures or variables that must be declared in the program in accordance with the rules for declaring host structures and variables. A reference to a host structure is replaced by a reference to each of its variables. The resulting number of variables must be the same as the number of parameter markers in the prepared statement. The *n*th variable corresponds to the nth parameter marker in the prepared statement.

USING SQL DESCRIPTOR *SQL-descriptor-name*

Identifies an SQL descriptor.

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

USING DESCRIPTOR descriptor-name

Identifies an SQLDA that must contain a valid description of input variables.

Before the OPEN statement is processed, the user must set the following fields in the SQLDA. (The rules for REXX are different. For more information see Embedded SQL Programming.)

- SQLN to indicate the number of SQLVAR occurrences provided in the **SQLDA**
- SQLDABC to indicate the number of bytes of storage allocated for the **SQLDA**
- SQLD to indicate the number of variables used in the SQLDA when processing the statement
- SQLVAR occurrences to indicate the attributes of the variables

The SQLDA must have enough storage to contain all SQLVAR occurrences. If LOBs or distinct types are present in the results, there must be additional SQLVAR entries for each parameter. For more information about the SQLDA, which includes a description of the SQLVAR and an explanation on how to determine the number of SQLVAR occurrences, see Appendix D, "SQLDA (SQL descriptor area)," on page 1235.

SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN. It must be the same as the number of parameter markers in the prepared statement. The *n*th variable described by the SQLDA corresponds to the *n*th parameter marker in the prepared statement.

Note that because RPG/400 does not provide the facility for setting pointers and the SQLDA uses pointers to locate the appropriate variables, you will have to set these pointers outside your RPG/400 application.

Notes

Closed state of cursors: All cursors in a program are in the closed state when:

- The program is called:
 - If CLOSQLCSR(*ENDPGM) is specified, all cursors are in the closed state each time the program is called.
 - If CLOSQLCSR(*ENDSQL) is specified, all cursors are in the closed state only the first time the program is called as long as one SQL program remains on the call stack.
 - If CLOSQLCSR(*ENDJOB) is specified, all cursors are in the closed state only the first time the program is called as long as the job remains active.
 - If CLOSQLCSR(*ENDMOD) is specified, all cursors are in the closed state each time the module is initiated.
 - If CLOSQLCSR(*ENDACTGRP) is specified, all cursors are in the closed state only the first time the module in the program is initiated in the activation group.
- A program starts a new unit of work by executing a COMMIT statement without a HOLD option. Cursors declared with the HOLD option are not closed by a COMMIT statement without a HOLD option. A COMMIT HOLD statement does not close cursors whether they are declared with a HOLD option or not.
- A program starts a new unit of work by executing a ROLLBACK statement without a HOLD option. A ROLLBACK HOLD statement does not close cursors whether they are declared with a HOLD option or not.
- A CONNECT (Type 1) statement was executed.

A cursor can also be in the closed state because:

- · A CLOSE statement was executed.
- A DISCONNECT statement disconnected the connection with which the cursor was associated.
- The connection with which the cursor was associated was in the release-pending state and a successful COMMIT occurred.
- A CONNECT (Type 1) statement was executed.

To retrieve rows from the result table of a cursor, the FETCH statement must be executed when the cursor is open. The only way to change the state of a cursor from closed to open is to execute an OPEN statement.

Effect of temporary tables: If the result table of a cursor is not read-only, its rows are derived during the execution of subsequent FETCH statements. The same method may be used for a read-only result table. However, if a result table is read-only, DB2 for i may choose to use the temporary table method instead. With this method the entire result table is inserted into a temporary table during the execution of the OPEN statement. When a temporary table is used, the results of a program can differ in several ways:

- An error can occur during OPEN that would otherwise not occur until some later FETCH statement.
- The INSERT, UPDATE, and DELETE statements that are executed while the cursor is open cannot affect the result table.
- Any NEXT VALUE expressions in the SELECT statement are evaluated for every row of the result table during OPEN. Thus, sequence values are generated, for every row of the result table during OPEN.
- Any functions are evaluated for every row of the result table during OPEN. Thus, any external actions and SQL statements that modify SQL data within the functions are performed for every row of the result table during OPEN.

Conversely, if a temporary table is not used, INSERT, UPDATE, and DELETE statements executed while the cursor is open can affect the result table, and any NEXT VALUE expressions and functions in the SELECT statement are evaluated as each row is fetched. The effect of such operations is not always predictable. For example, if cursor CUR is positioned on a row of its result table defined as SELECT * FROM T, and a row is inserted into T, the effect of that insert on the result table is not predictable because its rows are not ordered. A subsequent FETCH CUR might or might not retrieve the new row of T.

Parameter marker replacement: When the SELECT statement of the cursor is evaluated, each parameter marker in the statement is effectively replaced by its corresponding variable. The replacement of a parameter marker is an assignment operation in which the source is the value of the variable, and the target is a variable within the database manager. For a typed parameter marker, the attributes of the target variable are those specified by the CAST specification. For an untyped parameter marker, the attributes of the target variable are determined according to the context of the parameter marker. For the rules that affect parameter markers, see Table 80 on page 1027.

Let V denote a variable that corresponds to parameter marker P. The value of V is assigned to the target variable for P in accordance with the rules for assigning a value to a column. Thus:

- V must be compatible with the target.
- If V is a number, the absolute value of its integral part must not be greater than the maximum absolute value of the integral part of the target.
- If the attributes of V are not identical to the attributes of the target, the value is converted to conform to the attributes of the target.
- If the target cannot contain nulls, the value of V must not be null.

However, unlike the rules for assigning a value to a column:

• If V is a string, the value will be truncated (without an error), if its length is greater than the length attribute of the target.

When the SELECT statement of the cursor is evaluated, the value used in place of P is the value of the target variable for P. For example, if V is CHAR(6), and the target is CHAR(8), the value used in place of P is the value of V padded with two blanks.

The USING clause is intended for a prepared SELECT statement that contains parameter markers. However, it can also be used when the SELECT statement of the cursor is part of the DECLARE CURSOR statement. In this case the OPEN statement is executed as if each variable in the SELECT statement were a parameter marker, except that the attributes of the target variables are the same as the attributes of the variables in the SELECT statement. The effect is to override the values of the variables in the SELECT statement of the cursor with the values of the variables specified in the USING clause.

Variable value override: The USING clause is intended for a prepared SELECT statement that contains parameter markers. However, it can also be used when the SELECT statement of the cursor is part of the DECLARE CURSOR statement. In this case, the OPEN statement is executed as if each variable in the SELECT statement were a parameter marker, except that the attributes of the target variables are the same as the attributes of the variables in the SELECT statement. The effect is to override the values of the variables in the SELECT statement of the cursor with the values of the variables specified in the USING clause.

Examples

Example 1: Write the embedded statements in a COBOL program that will:

- 1. Define a cursor C1 that is to be used to retrieve all rows from the DEPARTMENT table for departments that are administered by (ADMRDEPT) department 'A00'
- 2. Place the cursor C1 before the first row to be fetched.

```
EXEC SQL DECLARE C1 CURSOR FOR
SELECT DEPTNO, DEPTNAME, MGRNO FROM DEPARTMENT
WHERE ADMRDEPT = 'A00' END-EXEC.

EXEC SQL OPEN C1 END-EXEC.
```

Example 2: Code an OPEN statement to associate a cursor DYN_CURSOR with a dynamically defined *select-statement* in a C program. Assume each prepared *select-statement* always defines two items in its select list with the first item having a data type of integer and the second item having a data type of VARCHAR(64). (The related host variable definitions, PREPARE statement, and DECLARE CURSOR statement are also shown in the example below.)

```
EXEC SQL BEGIN DECLARE SECTION;
static short hv_int;
char hv_vchar64[64];
char stmt1_str[200];
EXEC SQL END DECLARE SECTION;

EXEC SQL PREPARE STMT1_NAME FROM :stmt1_str;

EXEC SQL DECLARE DYN_CURSOR CURSOR FOR STMT1_NAME;

EXEC SQL OPEN DYN_CURSOR USING :hv_int, :hv_vchar64;
```

Example 3: Code an OPEN statement as in example 3, but in this case the number and data types of the items in the select statement are not known.

```
EXEC SQL BEGIN DECLARE SECTION;
char stmt1_str[200];
EXEC SQL END DECLARE SECTION;
EXEC SQL INCLUDE SQLDA;

EXEC SQL PREPARE STMT1_NAME FROM :stmt1_str;
EXEC SQL DECLARE DYN_CURSOR CURSOR FOR STMT1_NAME;

EXEC SQL OPEN DYN CURSOR USING DESCRIPTOR :sqlda;
```

The PREPARE statement creates an executable form of an SQL statement from a character-string form of the statement. The character-string form is called a statement string, and the executable form is called a prepared statement.

Invocation

This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java.

Authorization

The authorization rules are the same as those defined for the SOL statement specified by the PREPARE statement. For example, see "select-statement" on page 512 for the authorization rules that apply when a SELECT statement is prepared.

If DLYPRP(*NO) is specified on the CRTSQLxxx command, the authorization checking is performed when the statement is prepared, except:

- If a DROP SCHEMA statement is prepared, privileges on all objects in the schema are not checked until the statement is executed.
- If a DROP TABLE statement is prepared, privileges on all views, indexes, and logical files that reference the table are not checked until the statement is executed.
- · If a DROP VIEW statement is prepared, privileges on all views that reference the view are not checked until the statement is executed.
- If a CREATE TRIGGER statement is prepared, privileges on objects referenced in the triggered-action are not checked until the statement is executed.
- If a DROP, COMMENT, or LABEL of a FUNCTION, PROCEDURE, SEQUENCE, TYPE, or TRIGGER statement is prepared, authorities are not checked until the statement is executed.
- · If a GRANT or REVOKE statement is prepared, authorities are not checked until the statement is executed.

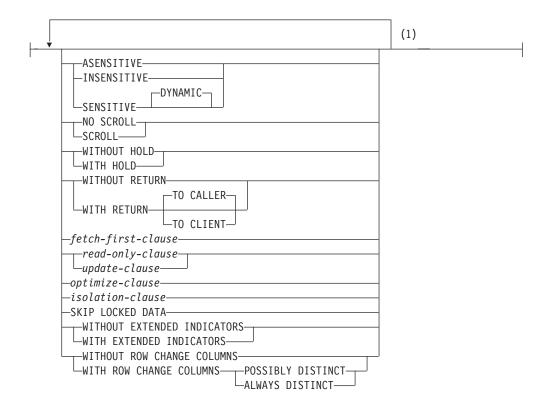
If DLYPRP(*YES) is specified on the CRTSQLxxx command, all authorization checking is deferred until the statement is executed or used in an OPEN statement.

The authorization ID of the statement is the run-time authorization ID unless DYNUSRPRF(*OWNER) was specified on the CRTSQLxxx command when the program was created. For more information, see "Authorization IDs and authorization names" on page 64.

Syntax

►►—PREPARE—statement-name-

attribute-string:



Notes:

The same clause must not be specified more than once. If the options are not specified, their defaults are whatever was specified for the corresponding options in an associated DECLARE CURSOR and the prepared SELECT statement.

Description

statement-name

Names the prepared statement. If the name identifies an existing prepared statement, that prepared statement is destroyed if:

• it was prepared in the same instance of the same program, or

 CLOSQLCSR(*ENDJOB), CLOSQLCSR(*ENDACTGRP), or CLOSQLCSR(*ENDSQL) are specified on the CRTSQLxxx commands associated with both prepared statements.

The name must not identify a prepared statement that is the SELECT statement of an open cursor of this instance of the program.

USING SQL DESCRIPTOR *SQL-descriptor-name*

Identifies an SQL descriptor. If USING is specified, and the PREPARE statement is successfully executed, information about the prepared statement is placed in the SQL descriptor specified by the SQL-descriptor-name. Thus, the PREPARE statement:

```
EXEC SQL PREPARE S1 USING SQL DESCRIPTOR :sqldescriptor FROM :V1;
is equivalent to:
```

```
EXEC SQL PREPARE S1 FROM :V1;
EXEC SQL DESCRIBE S1 USING SQL DESCRIPTOR :sqldescriptor;
```

Specifies the scope of the name of the descriptor to be local to program invocation.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

See "GET DESCRIPTOR" on page 933 for an explanation of the information that is placed in the SQLDA.

INTO

If INTO is used, and the PREPARE statement is successfully executed, information about the prepared statement is placed in the SQLDA specified by the descriptor-name. Thus, the PREPARE statement:

```
EXEC SQL PREPARE S1 INTO :SQLDA FROM :V1;
is equivalent to:
```

```
EXEC SQL PREPARE S1 FROM: V1;
EXEC SQL DESCRIBE S1 INTO :SQLDA;
```

descriptor-name

Identifies an SQL descriptor area (SQLDA), which is described in Appendix D, "SQLDA (SQL descriptor area)," on page 1235. Before the PREPARE statement is executed, the following variable in the SQLDA must be set (The rules for REXX are different. For more information, see the Embedded SQL Programming topic collection.):

SOLN

Indicates the number of variables represented by SQLVAR. (SQLN provides the dimension of the SQLVAR array.) SQLN must be set to a value greater than or equal to zero before the PREPARE statement is executed. For information about techniques to determine the number of occurrences required, see "Determining how many SQLVAR occurrences are needed" on page 1238.

See "DESCRIBE" on page 892 for an explanation of the information that is placed in the SQLDA.

USING

Specifies what value to assign to each SQLNAME variable in the SQLDA. If the requested value does not exist or a name is longer than 30, SQLNAME is set to length 0.

NAMES

Assigns the name of the column. This is the default. For a prepared statement where the names are explicitly specified in the select-list, the name specified is returned.

SYSTEM NAMES

Assigns the system column name of the column.

LABELS

Assigns the label of the column. (Column labels are defined by the LABEL statement.) Only the first 20 bytes of the label are returned.

ANY

Assigns the column label. If the column has no label, the label is the column name.

BOTH

Assigns both the label and name of the column. In this case, two or three occurrences of SQLVAR per column, depending on whether the result set contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 2*n or 3*n(where n is the number of columns in the table or view). The first n occurrences of SQLVAR contain the column names. Either the second or third n occurrences contain the column labels. If there are no distinct types, the labels are returned in the second set of SQLVAR entries. Otherwise, the labels are returned in the third set of SQLVAR entries.

If the same SQLDA is used on a subsequent FETCH statement, set SQLN to $\it n$ after the PREPARE is complete.

ALL

Assigns the label, column name, and system column name. In this case three or four occurrences of SQLVAR per column, depending on whether the result set contains distinct types, are needed to accommodate the additional information. To specify this expansion of the SQLVAR array, set SQLN to 3*n or 4*n (where n is the number of columns in the result table). The first n occurrences of SQLVAR contain the system column names. The second or third n occurrences contain the column labels. The third or fourth n occurrences contain the column names if they are different from the system column name. If there are no distinct types, the labels are returned in the second set of SQLVAR entries and the column names are returned in the third set of SQLVAR entries. Otherwise, the labels are returned in the fourth set of SQLVAR entries and the column names are returned in the fourth set of SQLVAR entries.

If the same SQLDA is used on a subsequent FETCH statement, set SQLN to n after the PREPARE is complete.

ATTRIBUTES attr-variable

Specifies the attributes that are in effect if a corresponding attribute has not been specified as part of the associated statement. If attributes are specified in the statement, they are used instead of the corresponding attributes specified on the PREPARE statement. In turn, if attributes are specified in the PREPARE of a SELECT statement, they are used instead of the corresponding attributes specified on a DECLARE CURSOR statement.

PREPARE

The attributes are ignored if the prepared statement is not a *select-statement*. attr-variable must identify a character-string or Unicode graphic variable that is declared in the program in accordance with the rules for declaring string variables. attr-variable must be a string variable (either fixed-length or varying-length) that has a length attribute that does not exceed the maximum length of a VARCHAR. Leading and trailing blanks are removed from the value of the variable. The variable must contain a valid attribute-string. An indicator variable can be used to indicate whether attributes are actually provided on the PREPARE statement. Thus, applications can use the same PREPARE statement regardless of whether attributes need to be specified or not. The options that can be specified as part of the attribute-string are as follows: ASENSITIVE, SENSITIVE, or INSENSITIVE Specifies whether the cursor is asensitive, sensitive, or insensitive to changes. For more information, see "DECLARE CURSOR" on page 845. If SENSITIVE is specified, then a fetch-first-clause must not be specified. If INSENSITIVE is specified, then an *update-clause* must not be specified. NO SCROLL or SCROLL Specifies whether the cursor is scrollable or not scrollable. For more information, see "DECLARE CURSOR" on page 845. WITHOUT HOLD or WITH HOLD Specifies whether the cursor should be prevented from being closed as a consequence of a commit operation. For more information, see "DECLARE CURSOR" on page 845. WITHOUT RETURN or WITH RETURN Specifies whether the result table of the cursor is intended to be used as a result set that will be returned from a procedure. For more information, see "DECLARE CURSOR" on page 845. fetch-first-clause Specifies that a maximum number of rows should be retrieved. For more information, see "fetch-first-clause" on page 503. If a fetch-first-clause is specified, then an update-clause must not be specified. read-only-clause or update-clause Specifies whether the result table is read-only or updatable. The update-clause clause must be specified without column names (FOR UPDATE). For more information, see "read-only-clause" on page 521 and "update-clause" on page 520. optimize-clause Specifies that the database manager should assume that the program does not intend to retrieve more than integer rows from the result table. For more information, see "optimize-clause" on page 522. isolation-clause Specifies an isolation level at which the select statement is executed. For more information, see "isolation-clause" on page 523. SKIP LOCKED DATA Specifies to skip data on which incompatible locks are held by other transactions. For more information, see "skip-locked-data-clause" on page

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WITHOUT EXTENDED INDICATORS or WITH EXTENDED INDICATORS

Specifies whether the values provided for indicator variables during execution of an INSERT or UPDATE follow standard SQL semantics for indicating NULL values, or may use extended capabilities to indicate the assignment of a DEFAULT or UNASSIGNED value.

WITH EXTENDED INDICATORS must only be specified when the statement is an INSERT using VALUES form of the INSERT statement, an UPDATE statement, or when the statement contains an INSERT using VALUES form of the INSERT statement.

WITHOUT ROW CHANGE COLUMNS or WITH ROW CHANGE COLUMNS POSSIBLY DISTINCT or WITH ROW CHANGE COLUMNS ALWAYS DISTINCT

Specifies whether additional column(s) should be added to the result set of a prepared select-statement that can be subsequently be used to identify whether a value of a column in the row might have changed. Additional row change columns are only added if a single table (or an updatable view) is referenced in the outermost subselect. The DESCRIBE and GET DESCRIPTOR statements will indicate which rows have been added.

WITHOUT ROW CHANGE COLUMNS

Row change columns are not added to the result set. This is the default.

WITH ROW CHANGE COLUMNS POSSIBLY DISTINCT

Row change columns are added to the result set even if they do not uniquely represent a single row. The columns added can be used to determine whether a value of a column in the row might have changed since it was originally fetched.

- If the row change column values have not changed since they were first fetched, then no columns of the row have been changed since they were first fetched.
- · If the row change column values have changed since they were first fetched, then columns of the row may or may not have changed since the row change values are not guaranteed to represent a single row.

WITH ROW CHANGE COLUMNS ALWAYS DISTINCT

Row change columns are added to the result set only if they uniquely represent a single row. Otherwise, no row change columns are added to the result set. The columns added can be used to determine whether a value of a column in the row has changed since it was originally fetched. (Note that a table requires a row change timestamp column to guarantee that the row change columns of a row uniquely identify a single row.)

- If the row change column values have not changed since they were first fetched, then no columns of the row have been changed since they were first fetched.
- If the row change column values have changed since they were first fetched, then columns of the row have changed.

A warning is returned (SQLSTATE 0168T) if WITH ROW CHANGE COLUMNS ALWAYS DISTINCT is specified and the database manager is unable to return distinct row change columns.

FROM

Introduces the statement string. The statement string is the value of the specified string-expression or the identified variable.

string-expression

A *string-expression* is any PL/I *string-expression* that yields a character string. SQL expressions that yield a character string are not allowed. A string-expression is only allowed in PL/I.

variable

Identifies a variable that is declared in the program in accordance with the rules for declaring character-string or Unicode graphic variables. An indicator variable must not be specified.

The statement string must be one of the following SQL statements:

ALTER	INSERT	SET CURRENT DEBUG MODE
CALL	LABEL	SET CURRENT DECFLOAT
		ROUNDING MODE
COMMENT	LOCK TABLE	SET CURRENT DEGREE
COMMIT	REFRESH TABLE	SET ENCRYPTION PASSWORD
CREATE	RELEASE SAVEPOINT	SET PATH
DECLARE GLOBAL	RENAME	SET SCHEMA
TEMPORARY TABLE		
DELETE	REVOKE	SET SESSION AUTHORIZATION
DROP	ROLLBACK	SET TRANSACTION
FREE LOCATOR	SAVEPOINT	UPDATE
GRANT	select-statement	VALUES INTO
HOLD LOCATOR		

The statement string must not:

- Begin with EXEC SQL.
- · End with END-EXEC or a semicolon.
- Include references to variables.

Notes

Parameter markers: Although a statement string cannot include references to variables, it may include parameter markers. These can be replaced by the values of variables when the prepared statement is executed. A parameter marker is a question mark (?) that is used where a variable could be used if the statement string were a static SQL statement. For an explanation of how parameter markers are replaced by values, see "OPEN" on page 1015 and "EXECUTE" on page 919.

There are two types of parameter markers:

Typed parameter marker

A parameter marker that is specified along with its target data type. It has the general form:

```
CAST(? AS data-type)
```

This notation is not a function call, but a "promise" that the type of the parameter at run time will be of the data type specified or some data type that can be converted to the specified data type. For example, in:

```
UPDATE EMPLOYEE
 SET LASTNAME = TRANSLATE(CAST(? AS VARCHAR(12)))
WHERE EMPNO = ?
```

the value of the argument of the TRANSLATE function will be provided at run time. The data type of that value will either be VARCHAR(12), or some type that can be converted to VARCHAR(12). For more information, refer to "CAST specification" on page 170.

Untyped parameter marker

A parameter marker that is specified without its target data type. It has the form of a single question mark. The data type of an untyped parameter marker is provided by context. For example, the untyped parameter marker in the predicate of the above update statement is the same as the data type of the EMPNO column.

Typed parameter markers can be used in dynamic SQL statements wherever a variable is supported and the data type is based on the promise made in the CAST function.

Untyped parameters markers can be used in dynamic SQL statements in selected locations where variables are supported. These locations and the resulting data type are found in Table 80. The locations are grouped in this table into expressions, predicates and functions to assist in determining applicability of an untyped parameter marker.

Table 80. Untyped Parameter Marker Usage

Untyped Parameter Marker Location	Data Type	
Expressions (including select list, CASE, and VALUES)		
Alone in a select list that is not in a subquery	Error	
Alone in a select list that is in an EXISTS subquery	Error	
Alone in a select list that is in a subquery	The data type of the other operand of the subquery. ⁹⁶	
Both operands of a single arithmetic operator, after considering operator precedence and order of operation rules.	Error	
Includes cases such as:		
? + ? + 10		
One operand of a single operator in an arithmetic expression (not a datetime expression)	The data type of the other operand.	
Includes cases such as:		
? + ? * 10		
Labelled duration within a datetime expression. (Note that the portion of a labelled duration that indicates the type of units cannot be a parameter marker.)	DECIMAL(15,0)	
Any other operand of a datetime expression (for instance 'timecol + ?' or '? - datecol').	Error	
Any operands of a CONCAT operator	Error	
As a value on the right hand side of a SET clause of an UPDATE statement.	The data type of the column. If the column is defined as a user-defined distinct type, then it is the source data type of the user-defined distinct type. ⁹⁶	

Table 80. Untyped Parameter Marker Usage (continued)

Table 60. Onlyped Farameter Marker Osage (Softiffueu)
Untyped Parameter Marker Location	Data Type
The expression following the CASE keyword in a simple CASE expression	Error
At least one of the result-expressions in a CASE expression (both Simple and Searched) with the rest of the result-expressions either untyped parameter marker or NULL.	Error
Any or all expressions following WHEN in a simple CASE expression.	Result of applying the "Rules for result data types" on page 105 to the expression following CASE and the expressions following WHEN that are not untyped parameter markers.
A result-expression in a CASE expression (both Simple and Searched) where at least one result-expression is not NULL and not an untyped parameter marker.	Result of applying the "Rules for result data types" on page 105 to all result-expressions that are other than NULL or untyped parameter markers.
Alone as a column-expression in a single-row VALUES clause that is not within an INSERT statement.	Error.
Alone as a column-expression in a multi-row VALUES clause that is not within an INSERT statement, and for which the column-expressions in the same position in all other row-expressions are untyped parameter markers.	Error.
Alone as a column-expression in a multi-row VALUES clause that is not within an INSERT statement, and for which a column-expression in the same position of at least one other row-expression is not an untyped parameter marker or NULL.	Result of applying the "Rules for result data types" on page 105 to all operands that are other than untyped parameter markers.
Alone as a column-expression in a single-row VALUES clause within an INSERT statement.	The data type of the column. If the column is defined as a user-defined distinct type, then it is the source data type of the user-defined distinct type. ⁹⁶
As a value in an <i>insert-multiple-rows</i> of an INSERT statement.	INTEGER
As a value on the right side of a SET special register statement	The data type of the special register.
As a value in the INTO clause of the VALUES INTO statement	The data type of the associated expression. 96
As a value in a FREE LOCATOR or HOLD LOCATOR statement	Locator.
As a value for the password in a SET ENCRYPTION PASSWORD statement	VARCHAR(128)
As a value for the hint in a SET ENCRYPTION PASSWORD statement	VARCHAR(32)
Pred	icates
Both operands of a comparison operator	Error

Table 80. Untyped Parameter Marker Usage (continued)

Untyped Parameter Marker Location	Data Type
One operand of a comparison operator where the other operand is other than an untyped parameter marker or a distinct type.	
One operand of a comparison operator where the other operand is a distinct type.	Error
All operands of a BETWEEN predicate	Error
Two operands of a BETWEEN predicate	Same as that of the only non-parameter marker.
Only one operand of a BETWEEN predicate	Result of applying the "Rules for result data types" on page 105 on all operands that are other than untyped parameter markers, except the CCSID attribute is the CCSID of the value specified at execution time.
All operands of an IN predicate, for example, ? IN (?,?,?)	Error
The first operand of an IN predicate where the right hand side is a fullselect, for example, ? IN (fullselect).	Data type of the selected column
The first operand of an IN predicate where the right hand side is not a fullselect, for example, ? IN (?,A,B) or for example, ? IN (A,?,B,?).	Result of applying the "Rules for result data types" on page 105 on all operands of the IN list (operands to the right of IN keyword) that are other than untyped parameter markers, except the CCSID attribute is the CCSID of the value specified at execution time.
Any or all operands of the IN list of the IN predicate, for example, for example, A IN (?,B,?).	Result of applying the "Rules for result data types" on page 105 on all operands of the IN predicate (operands to the left and right of the IN predicate) that are other than untyped parameter markers, except the CCSID attribute is the CCSID of the value specified at execution time.
Any operands in a <i>row-value-expression</i> of an IN predicate, for example, (c1,?) IN	Error
Any select list items in a subquery if a row-value-expression is specified in an IN predicate, for example, (c1,c2) IN (SELECT ?, c1 FROM)	Error
All three operands of the LIKE predicate.	Error
The match expression of the LIKE predicate.	Error
The pattern expression of the LIKE predicate.	Either VARCHAR(32740) or VARGRAPHIC(16370) or VARBINARY(32740) depending on the data type of the match expression.
	For information about using fixed-length variables for the value of the pattern, see "LIKE predicate" on page 195.
The escape expression of the LIKE predicate.	Either VARCHAR(1) or VARGRAPHIC(1) or VARBINARY(1) depending on the data type of the match expression.

Table 80. Untyped Parameter Marker Usage (continued)

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Untyped Parameter Marker Location	Data Type	
Operand of the NULL or DISTINCT predicate	Error	
Functions		
All operands of COALESCE, IFNULL, LAND, LOR, MIN, MAX, VALUE, or XOR	Error	
The first operand of NULLIF	Error	
Any operand of COALESCE, IFNULL, LAND, LOR, MIN, MAX, VALUE, or XOR where at least one operand is other than an untyped parameter marker.	Result of applying the "Rules for result data types" on page 105 on all operands that are other than untyped parameter markers.	
The first operand of LOCATE, the first operand of POSITION, or the second operand of POSSTR.	Either VARCHAR(32740) or VARGRAPHIC(16370) or VARBINARY(32740) depending on the data type of the other operand.	
The first operand of VARCHAR_FORMAT	TIMESTAMP	
The second operand of TIMESTAMP_FORMAT or VARCHAR_FORMAT	Error	
The operand of UPPER, LOWER, UCASE, and LCASE	DBCLOB(2G) with a CCSID of 13488	
All operands of COMPARE_DECFLOAT, DECFLOAT_SORTKEY, NORMALIZE_DECFLOAT, QUANTIZE, and TOTALORDER	DECFLOAT(34)	
All other operands of all other scalar functions including user-defined functions	Error	
Operand of an aggregate function	Error	

Error checking: When a PREPARE statement is executed, the statement string is parsed and checked for errors. If the statement string is not valid, a prepared statement is not created and an error is returned.

In local and remote processing, the DLYPREP(*YES) option can cause some SQL statements to receive "delayed" errors. For example, DESCRIBE, EXECUTE, and OPEN might receive an SQLCODE that normally occurs during PREPARE processing.

Reference and execution rules: Prepared statements can be referred to in the following kinds of statements, with the following restrictions shown:

Statement The prepared statement restrictions

DESCRIBE None

DECLARE CURSOR Must be SELECT when the cursor is opened

EXECUTE Must not be SELECT

A prepared statement can be executed many times. If a prepared statement is not executed more than once and does not contain parameter markers, it is more efficient to use the EXECUTE IMMEDIATE statement rather than the PREPARE and EXECUTE statements.

^{96.} If the data type is DATE, TIME, or TIMESTAMP, then VARCHAR(32740) is used.

Extended indicator usage: The EXTENDED INDICATORS clause indicates whether extended indicator variable values are enabled in the SET assignment-clause of an UPDATE statement or the VALUES expression-list of an INSERT statement.

Extended indicator variables and deferred error checks: When extended indicator variables are enabled, the UNASSIGNED indicator variable value effectively causes its target column to be omitted from the statement. Because of this, validation that is normally done during statement preparation is delayed until statement execution.

Prepared statement persistence: All prepared statements are destroyed when:⁹⁷

- A CONNECT (Type 1) statement is executed.
- A DISCONNECT statement disconnects the connection with which the prepared statement is associated.
- A prepared statement is associated with a release-pending connection and a successful commit occurs.
- The associated scope (job, activation group, or program) of the SQL statement

Scope of a statement: The scope of statement-name is the source program in which it is defined. You can only reference a prepared statement by other SQL statements that are precompiled with the PREPARE statement. For example, a program called from another separately compiled program cannot use a prepared statement that was created by the calling program.

The scope of statement-name is also limited to the thread in which the program that contains the statement is running. For example, if the same program is running in two separate threads in the same job, the second thread cannot use a statement that was prepared by the first thread.

Although the scope of a statement is the program in which it is defined, each package created from the program includes a separate instance of the prepared statement and more than one prepared statement can exist at run time. For example, assume a program using CONNECT (Type 2) statements connects to location X and location Y in the following sequence:

```
EXEC SQL CONNECT TO X;
EXEC SQL PREPARE S FROM :hv1;
EXEC SQL EXECUTE S;
EXEC SQL CONNECT TO Y;
EXEC SQL PREPARE S FROM :hv1;
EXEC SQL EXECUTE S;
```

The second prepare of S prepares another instance of S at Y.

A prepared statement can only be referenced in the same instance of the program in the program stack, unless CLOSQLCSR(*ENDJOB), CLOSQLCSR(*ENDACTGRP), or CLOSQLCSR(*ENDSQL) is specified on the CRTSQLxxx commands.

^{97.} Prepared statements may be cached and not actually destroyed. However, a cached statement can only be used if the same statement is prepared again.

- If CLOSQLCSR(*ENDJOB) is specified, the prepared statement can be referred to by any instance of the program (that prepared the statement) on the program stack. In this case, the prepared statement is destroyed at the end of the job.
- If CLOSQLCSR(*ENDSQL) is specified, the prepared statement can be referred to by any instance of the program (that prepared the statement) on the program stack until the last SQL program on the program stack ends. In this case, the prepared statement is destroyed when the last SQL program on the program stack ends.
- If CLOSQLCSR(*ENDACTGRP) is specified, the prepared statement can be referred to by all instances of the module in the program that prepared the statement until the activation group ends. In this case, the prepared statement is destroyed when the activation group ends.

Allocating the SQL descriptor: If a USING clause is specified, before the PREPARE statement is executed, the SQL descriptor must be allocated using the ALLOCATE DESCRIPTOR statement. If the number of descriptor items allocated is less than the number of result columns, a warning (SQLSTATE 01005) is returned.

PREPARE and *LIBL: Normally, any unqualified names of objects are resolved when a statement is prepared. Hence, any changes to the CURRENT SCHEMA or CURRENT PATH after the statement has been prepared have no effect on which objects will be referenced when the statement is executed or opened. However, if system naming is used and an object name is implicitly qualified with *LIBL, the object is resolved at execute or open time. Any changes to the library list after the statement is prepared but before execute or open time will affect which objects will be referenced when the statement is executed or opened.

Examples

Example 1: Prepare and execute a non-select-statement in a COBOL program. Assume the statement is contained in a variable HOLDER and that the program will place a statement string into the variable based on some instructions from the user. The statement to be prepared does not have any parameter markers.

```
EXEC SQL PREPARE STMT NAME FROM : HOLDER END-EXEC.
EXEC SQL EXECUTE STMT NAME END-EXEC.
```

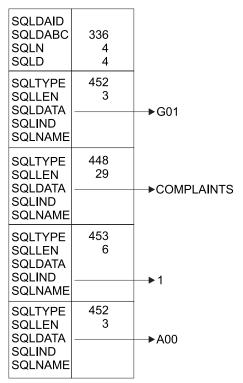
Example 2: Prepare and execute a non-select-statement as in example 1, except assume the statement to be prepared can contain any number of parameter markers.

```
EXEC SQL PREPARE STMT NAME FROM : HOLDER END-EXEC.
EXEC SQL EXECUTE STMT NAME USING DESCRIPTOR : INSERT DA END-EXEC.
```

Assume that the following statement is to be prepared:

```
INSERT INTO DEPARTMENT VALUES(?, ?, ?, ?)
```

To insert department number G01 named COMPLAINTS, which has no manager and reports to department A00, the structure INSERT_DA should have the following values before executing the EXECUTE statement.



RBAL3501-0

REFRESH TABLE

The REFRESH TABLE statement refreshes the data in a materialized query table. The statement deletes all rows in the materialized query table and then inserts the result rows from the *select-statement* specified in the definition of the materialized query table.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- · For the table identified in the statement,
 - The system authority *OBJMGT on the table
 - The DELETE privilege on the table
 - The INSERT privilege on the table
 - The system authority *EXECUTE on the library containing the table
- Administrative authority

For information on the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax



Description

table-name

Identifies the materialized table to be refreshed. The table-name must identify a materialized query table that exists at the current server. REFRESH TABLE evaluates the select-statement in the definition of the materialized query table to refresh the table.

Notes

Refresh use of materialized query tables: No materialized query tables are used to evaluate the select-statement during the processing of REFRESH TABLE statement.

Refresh isolation level: The isolation level used to evaluate the select-statement is either:

- the isolation level specified on the isolation-level clause of the select-statement, or
- if the isolation-level clause was not specified, the isolation level of the materialized query table recorded when CREATE TABLE or ALTER TABLE was issued.

Number of rows: After successful execution of a REFRESH TABLE statement, the ROW_COUNT statement information item in the SQL Diagnostics Area (or SQLERRD(3) in the SQLCA) will contain the number of rows inserted into the materialized query table.

Example

Refresh the data in the TRANSCOUNT materialized query table.

REFRESH TABLE TRANSCOUNT

RELEASE (Connection)

The RELEASE statement places one or more connections in the release-pending state.

Invocation

This statement can only be embedded within an application program or issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

RELEASE is not allowed in a trigger. RELEASE is not allowed in an external procedure if the external procedure is called on a remote application server.

Authorization

None required.

Syntax



Description

server-name or variable

Identifies a connection by the specified server name or the server name contained in the variable. If a variable is specified:

- It must be a character-string variable.
- It must not be followed by an indicator variable.
- The server name must be left-justified within the variable and must conform to the rules for forming an ordinary identifier.
- If the length of the server name is less than the length of the variable, it must be padded on the right with blanks.

When the RELEASE statement is executed, the specified server name or the server name contained in the variable must identify an existing connection of the activation group.

CURRENT

Identifies the current connection of the activation group. The activation group must be in the connected state.

ALL or ALL SOL

Identifies all existing connections of the activation group (local as well as remote connections).

An error or warning does not occur if no connections exist when the statement is executed.

An application server named ALL can only be identified by a variable or a delimited identifier.

If the RELEASE statement is successful, each identified connection is placed in the release-pending state and will therefore be ended during the next commit operation. If the RELEASE statement is unsuccessful, the connection state of the activation group and the states of its connections are unchanged.

Notes

RELEASE and CONNECT (Type 1): Using CONNECT (Type 1) semantics does not prevent using RELEASE.

Scope of RELEASE: RELEASE does not close cursors, does not release any resources, and does not prevent further use of the connection.

Resource considerations for remote connections: Resources are required to create and maintain remote connections. Thus, a remote connection that is not going to be reused should be in the release-pending state and one that is going to be reused should not be in the release-pending state.

Connection states: ROLLBACK does not reset the state of a connection from release-pending to held.

If the current connection is in the release-pending state when a commit operation is performed, the connection is ended and the activation group is in the unconnected state. In this case, the next executed SQL statement must be CONNECT or SET CONNECTION.

RELEASE ALL places the connection to the local release-pending in the release-pending state. A connection in the release-pending state is ended during a commit operation even though it has an open cursor defined with the WITH HOLD clause.

Examples

Example 1: The connection to TOROLAB1 is not needed in the next unit of work. The following statement will cause it to be ended during the next commit operation.

EXEC SQL RELEASE TOROLAB1;

Example 2: The current connection is not needed in the next unit of work. The following statement will cause it to be ended during the next commit operation.

EXEC SQL RELEASE CURRENT;

Example 3: None of the existing connections are needed in the next unit of work. The following statement will cause it to be ended during the next commit operation.

EXEC SQL RELEASE ALL;

The RELEASE SAVEPOINT statement releases the identified savepoint and any subsequently established savepoints within a unit of work at the current server.

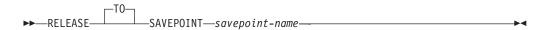
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax 1 4 1



Description

savepoint-name

Identifies the savepoint to release. The name must identify a savepoint that exists at the current server. The named savepoint and all the savepoints at the current server that were subsequently established in the unit of work are released. After a savepoint is released, it is no longer maintained, and rollback to the savepoint is no longer possible.

Notes

Savepoint Names: The name of the savepoint that was released can be re-used in another SAVEPOINT statement, regardless of whether the UNIQUE keyword was specified on an earlier SAVEPOINT statement specifying this same savepoint name.

Isolation Level Restriction: A RELEASE SAVEPOINT statement is not allowed if commitment control is not active for the activation group. For information about determining which commitment definition is used, see "Notes" on page 639 in COMMIT statement.

Example

Assume that a main routine sets savepoint A and then invokes a subroutine that sets savepoints B and C. When control returns to the main routine, release savepoint A and any subsequently set savepoints. Savepoints B and C, which were set by the subroutine, are released in addition to A.

RELEASE SAVEPOINT A

RENAME

The RENAME statement renames a table, view, or index. The name and/or the system object name of the table, view, or index can be changed.

Invocation

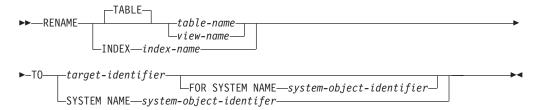
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- The following system authorities:
 - If the name of the object is changed:
 - The system authority of *OBJMGT on the table, view, or index to be renamed
 - The system authority *EXECUTE on the library containing the table, view, or index to be renamed
 - If the system name of the object is changed:
 - The system authority of *OBJMGT on the table, view, or index to be
 - The system authorities *EXECUTE and *UPD on the library containing the table, view, or index to be renamed
- Administrative authority

Syntax



Description

TABLE table-name **or** view-name

Identifies the table or view that will be renamed. The table-name or view-name must identify a table or view that exists at the current server, but must not identify a catalog table or a declared temporary table. The specified name can be an alias name. The specified table or view is renamed to the new name. All privileges, constraints, indexes, triggers, views, and logical files on the table or view are preserved.

Any access plans that reference the table or view are implicitly prepared again when a program that uses the access plan is next run. Since the program refers to a table or view with the original name, if a table or view with the original name does not exist at that time, an error is returned.

Identifies the index that will be renamed. The index-name must identify an index that exists at the current server. The specified index is renamed to the

Any access plans that reference the index are not affected by rename.

target-identifier

Identifies the new table-name, view-name, or index-name of the table, view, or index, respectively. target-identifier must not be the same as a table, view, alias, or index that already exists at the current server. The target-identifier must be an unqualified SQL identifier.

SYSTEM NAME *system-object-identifier*

Identifies the new system-object-identifier of the table, view, or index, respectively. system-object-identifier must not be the same as a table, view, alias, or index that already exists at the current server. The system-object-identifier must be an unqualified system identifier.

If the name of the object and the system name of the object are the same and target-identifier is not specified, specifying system-object-identifier will be the new name and system object name. Otherwise, specifying system-object-identifier will only affect the system name of the object and not affect the name of the object.

If both target-identifier and system-object-identifier are specified, they cannot both be valid system object names.

Notes

Effects of the statement: The specified table, view, or index is renamed to the new name. For a renamed table, all privileges and indexes on the table are preserved. For a renamed index, all privileges are preserved.

Invalidation of packages and access plans: Any access plans that refer to that table are invalidated. For more information see "Packages and access plans" on page 15.

Considerations for aliases: If an alias name is specified for table-name, the table must exist at the current server, and the table that is identified by the alias is renamed. The name of the alias is not changed and continues to refer to the old table name after the rename.

There is no support for changing the name of an alias with the RENAME statement. To change the name to which the alias refers, the alias must be dropped and recreated.

Rename rules: The rename operation performed depends on the new name specified.

- If the new name is a valid system identifier,
 - the alternative name (if any) is removed, and
 - the system object name is changed to the new name.
- · If the new name is not a valid system identifier,
 - the alternative name is added or changed to the new name, and
 - a new system object name is generated if the system object name (of the table or view) was specified as the table, view, or index to rename. For more information about generated table name rules, see "Rules for Table Name Generation" on page 810.

If an alias name is specified for *table-name*, the alias must exist at the current server, and the table that is identified by the alias is renamed. The name of the alias is not changed and continues to refer to the old table after the rename. There is no support for changing the name of an alias.

Examples

Example 1: Change the name of the EMPLOYEE table to CURRENT_EMPLOYEES:

```
RENAME TABLE EMPLOYEE
TO CURRENT_EMPLOYEES
```

Example 2: Change the name of the unique index using EMPNO, called XEMP1, to UXEMPNO:

```
RENAME INDEX XEMP1
TO UXEMPNO
```

Example 3: Rename a table named MY_IN_TRAY to MY_IN_TRAY_94. The system object name will remain unchanged (MY_IN_TRAY).

```
RENAME TABLE MY_IN_TRAY TO MY_IN_TRAY_94
FOR SYSTEM NAME MY_IN_TRAY
```

This form of the REVOKE statement removes the privileges on a function or procedure.

Invocation

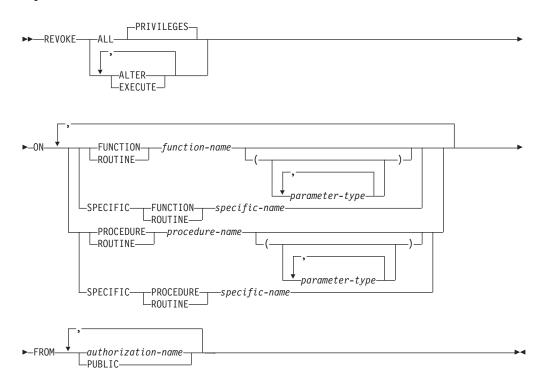
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For each function or procedure identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the function or procedure
 - The system authority *EXECUTE on the library (or directory if this is a Java routine) containing the function or procedure
- Administrative authority

Syntax

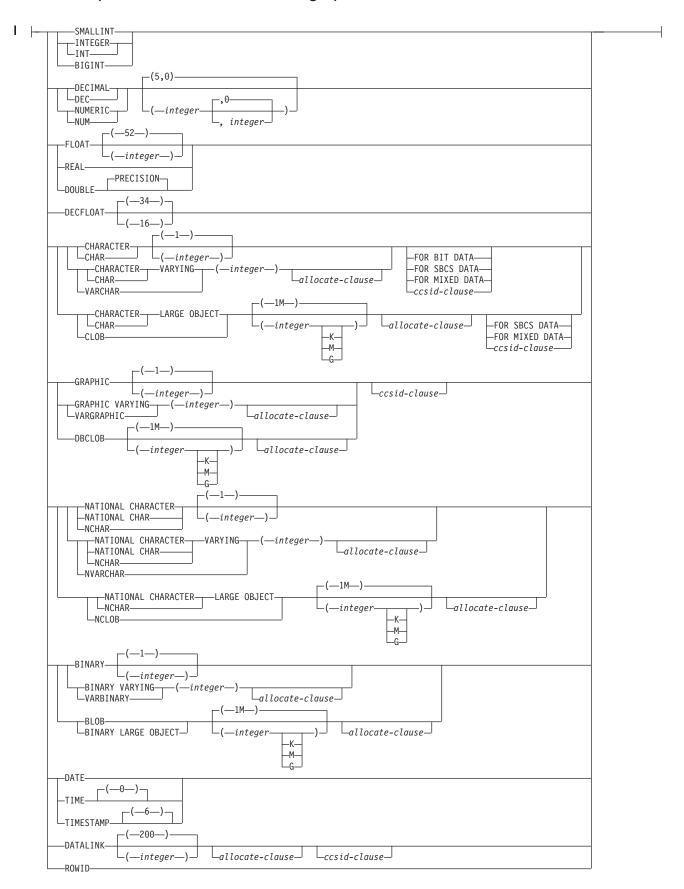


parameter-type:

```
—data-type-
            LAS LOCATOR
```

data-type:

built-in-type:



ccsid-clause:

I

---CCSID--integer-

Description

ALL or ALL PRIVILEGES

Revokes one or more function or procedure privileges from each authorization-name. The privileges revoked are those privileges on the identified functions or procedures that were granted to the *authorization-names*. Note that revoking ALL PRIVILEGES on a function or procedure is not the same as revoking the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword revokes the privilege described.

ALTER

Revokes the privilege to use the ALTER FUNCTION, ALTER PROCEDURE, or COMMENT statement.

EXECUTE

Revokes the privilege to execute a function or procedure.

FUNCTION or SPECIFIC FUNCTION

Identifies the function from which the privilege is revoked. The function must exist at the current server and it must be a user-defined function, but not a function that was implicitly generated with the creation of a distinct type. The function can be identified by its name, function signature, or specific name.

FUNCTION *function-name*

Identifies the function by its name. The function-name must identify exactly one function. The function may have any number of parameters defined for it. If there is more than one function of the specified name in the specified or implicit schema, an error is returned.

FUNCTION *function-name* (parameter-type, ...)

Identifies the function by its function signature, which uniquely identifies the function. The function-name (parameter-type, ...) must identify a function with the specified function signature. The specified parameters must match the data types in the corresponding position that were specified when the function was created. The number of data types, and the logical concatenation of the data types is used to identify the specific function instance on which the privilege is to be revoked. Synonyms for data types are considered a match.

If function-name () is specified, the function identified must have zero parameters.

function-name

Identifies the name of the function.

(parameter-type, ...)

Identifies the parameters of the function.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For

example, DEC() will be considered a match for a parameter of a function defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).

- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE FUNCTION statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE FUNCTION statement.

AS LOCATOR

Specifies that the function is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC FUNCTION *specific-name*

Identifies the function by its specific name. The specific-name must identify a specific function that exists at the current server.

PROCEDURE or SPECIFIC PROCEDURE

Identifies the procedure from which the privilege is revoked. The procedure-name must identify a procedure that exists at the current server.

PROCEDURE procedure-name

Identifies the procedure by its name. The procedure-name must identify exactly one procedure. The procedure may have any number of parameters defined for it. If there is more than one procedure of the specified name in the specified or implicit schema, an error is returned.

PROCEDURE *procedure-name* (*parameter-type*, ...)

Identifies the procedure by its procedure signature, which uniquely identifies the procedure. The procedure-name (parameter-type, ...) must identify a procedure with the specified procedure signature. The specified parameters must match the data types in the corresponding position that were specified when the procedure was created. The number of data types, and the logical concatenation of the data types is used to identify the specific procedure instance which is to be revoked. Synonyms for data types are considered a match.

If procedure-name () is specified, the procedure identified must have zero parameters.

procedure-name

Identifies the name of the procedure.

(parameter-type, ...)

Identifies the parameters of the procedure.

If an unqualified distinct type name is specified, the database manager searches the SQL path to resolve the schema name for the distinct type.

For data types that have a length, precision, or scale attribute, use one of the following:

- Empty parentheses indicate that the database manager ignores the attribute when determining whether the data types match. For example, DEC() will be considered a match for a parameter of a procedure defined with a data type of DEC(7,2). However, FLOAT cannot be specified with empty parenthesis because its parameter value indicates a specific data type (REAL or DOUBLE).
- If a specific value for a length, precision, or scale attribute is specified, the value must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement. If the data type is FLOAT, the precision does not have to exactly match the value that was specified because matching is based on the data type (REAL or DOUBLE).
- If length, precision, or scale is not explicitly specified, and empty parentheses are not specified, the default attributes of the data type are implied. The implicit length must exactly match the value that was specified (implicitly or explicitly) in the CREATE PROCEDURE statement.

Specifying the FOR DATA clause or CCSID clause is optional. Omission of either clause indicates that the database manager ignores the attribute when determining whether the data types match. If either clause is specified, it must match the value that was implicitly or explicitly specified in the CREATE PROCEDURE statement.

AS LOCATOR

Specifies that the procedure is defined to receive a locator for this parameter. If AS LOCATOR is specified, the data type must be a LOB or a distinct type based on a LOB.

SPECIFIC PROCEDURE specific-name

Identifies the procedure by its specific name. The specific-name must identify a specific procedure that exists at the current server.

FROM

Identifies from whom the privileges are revoked.

authorization-name,...

Lists one or more authorization IDs. Do not specify the same authorization-name more than once.

PUBLIC

Revokes a grant of the privilege to PUBLIC. For more information, see "Authorization, privileges and object ownership" on page 18.

Notes

Multiple grants: If you revoke a privilege on a function or procedure, it nullifies any grant of the privilege on that function or procedure, regardless of who granted it.

Revoking WITH GRANT OPTION: The only way to revoke the WITH GRANT OPTION is to revoke ALL.

Privilege warning: Revoking a specific privilege from a user does not necessarily prevent that user from performing an action that requires that privilege. For example, the user may still have the privilege through PUBLIC or administrative privileges.

Corresponding system authorities: When a function or procedure privilege is revoked, the corresponding system authorities are revoked. For information about the system authorities that correspond to SQL privileges see "GRANT (Function or Procedure Privileges)" on page 967.

Privileges revoked from either an SQL or external function or procedure are revoked from its associated program (*PGM) or service program (*SRVPGM) object. Privileges revoked from a Java external function or procedure are revoked from the associated class file or jar file. If the associated program, service program, class file, or jar file is not found when the revoke is executed, an error is returned.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

The keyword RUN can be used as a synonym for EXECUTE.

Example

Revoke the EXECUTE privilege on procedure PROCA from PUBLIC.

REVOKE EXECUTE **ON PROCEDURE PROCA** FROM PUBLIC

REVOKE (Package Privileges)

This form of the REVOKE statement removes the privileges on a package.

Invocation

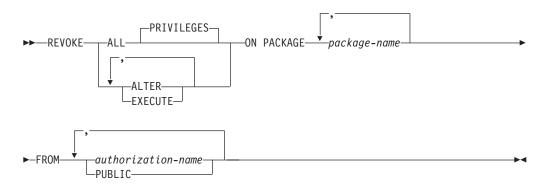
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For each package identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the package
 - The system authority *EXECUTE on the library containing the package
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Revokes one or more package privileges from each *authorization-name*. The privileges revoked are those privileges on the identified packages that were granted to the *authorization-names*. Note that revoking ALL PRIVILEGES on a package is not the same as revoking the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword revokes the privilege described.

ALTER

Revokes the privilege to use the COMMENT and LABEL statements.

EXECUTE

Revokes the privilege to execute statements in a package.

ON PACKAGE package-name

Identifies the package from which the EXECUTE privilege is revoked. The *package-name* must identify a package that exists at the current server.

FROM

Identifies from whom the privileges are revoked.

REVOKE (Package Privileges)

authorization-name,...

Lists one or more authorization IDs. Do not specify the same authorization-name more than once.

PUBLIC

Revokes a grant of the privilege to PUBLIC. For more information, see "Authorization, privileges and object ownership" on page 18.

Notes

Multiple grants: If you revoke a privilege on a package, it nullifies any grant of the privilege on that package, regardless of who granted it.

Revoking WITH GRANT OPTION: The only way to revoke the WITH GRANT OPTION is to revoke ALL.

Privilege warning: Revoking a specific privilege from a user does not necessarily prevent that user from performing an action that requires that privilege. For example, the user may still have the privilege through PUBLIC or administrative privileges.

Corresponding system authorities: When a package privilege is revoked, the corresponding system authorities are revoked. For information about the system authorities that correspond to SQL privileges see "GRANT (Package Privileges)" on page 975.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword RUN can be used as a synonym for EXECUTE.
- The keyword PROGRAM can be used as a synonym for PACKAGE.

Example

Example 1: Revoke the EXECUTE privilege on package PKGA from PUBLIC.

REVOKE EXECUTE ON PACKAGE PKGA FROM PUBLIC

Example 2: Revoke the EXECUTE privilege on package RRSP_PKG from user FRANK and PUBLIC.

REVOKE EXECUTE ON PACKAGE RRSP PKG FROM FRANK, PUBLIC

REVOKE (Sequence Privileges)

This form of the REVOKE statement removes the privileges on a sequence.

Invocation

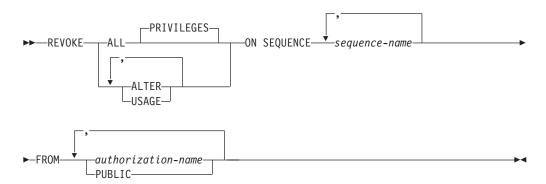
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For each sequence identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the sequence
 - The system authority *EXECUTE on the library containing the sequence
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Revokes one or more sequence privileges from each *authorization-name*. The privileges revoked are those privileges on the identified sequences that were granted to the *authorization-names*. Note that revoking ALL PRIVILEGES on a sequence is not the same as revoking the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword revokes the privilege described.

ALTER

Revokes the privilege to use the ALTER SEQUENCE, COMMENT, and LABEL statements on a sequence.

USAGE

Revokes the privilege to use the sequence in NEXT VALUE or PREVIOUS VALUE expressions.

ON SEQUENCE sequence-name

Identifies the sequence from which the privilege is revoked. The *sequence-name* must identify a sequence that exists at the current server.

REVOKE (Sequence Privileges)

FROM

Identifies from whom the privileges are revoked.

authorization-name,...

Lists one or more authorization IDs. Do not specify the same authorization-name more than once.

PUBLIC

Revokes a grant of the privilege to PUBLIC. For more information, see "Authorization, privileges and object ownership" on page 18.

Notes

Multiple grants: If you revoke a privilege on a sequence, it nullifies any grant of the privilege on that sequence, regardless of who granted it.

Revoking WITH GRANT OPTION: The only way to revoke the WITH GRANT OPTION is to revoke ALL.

Privilege warning: Revoking a specific privilege from a user does not necessarily prevent that user from performing an action that requires that privilege. For example, the user may still have the privilege through PUBLIC or administrative privileges.

Corresponding system authorities: When a sequence privilege is revoked, the corresponding system authorities are revoked. For information on the system authorities that correspond to SQL privileges see "GRANT (Sequence Privileges)" on page 978.

Example

REVOKE the USAGE privilege from PUBLIC on a sequence called ORG_SEQ.

REVOKE USAGE ON SEQUENCE ORG SEQ FROM PUBLIC

REVOKE (Table or View Privileges)

This form of the REVOKE statement removes privileges on a table or view.

Invocation

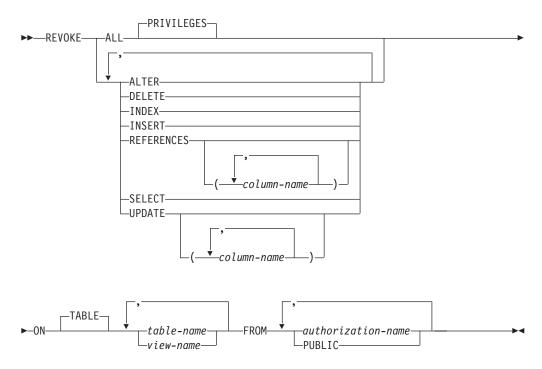
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For each table or view identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the table or view
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Revokes one or more privileges from each *authorization-name*. The privileges revoked are those privileges on the identified tables and views that were granted to the *authorization-names*. Note that revoking ALL PRIVILEGES on a table or view is not the same as revoking the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword revokes the privilege described, but only as it applies to the tables and views named in the ON clause.

REVOKE (Table or View Privileges)

ALTER

Revokes the privilege to alter the specified table and the privilege to add a comment, add a label, or create an index on the specified table or view.

DELETE

Revokes the privilege to delete rows from the specified table or view.

INDEX

Revokes the privilege to create an index on the specified table.

INSERT

Revokes the privilege to insert rows in the specified table or view.

REFERENCES

Revokes the privilege to add a referential constraint in which the table is a parent.

REFERENCES (column-name,...)

Revokes the privilege to add a referential constraint using the specified column(s) in the parent key. Each column name must be an unqualified name that identifies a column in each table identified in the ON clause.

SELECT

Revokes the privilege to use the SELECT or CREATE VIEW statement.

UPDATE

Revokes the privilege to use the UPDATE statement.

UPDATE (column-name,...)

Revokes the privilege to update the specified columns. Each column name must be an unqualified name that identifies a column in each table identified in the ON clause.

ON table-name **or** view-name, ...

Identifies the table or view from which the privileges are revoked. The table-name or view-name must identify a table or view that exists at the current server, but must not identify a declared temporary table.

FROM

Identifies from whom the privileges are revoked.

authorization-name,...

Lists one or more authorization IDs. Do not specify the same authorization-name more than once.

PUBLIC

Revokes a grant of the privilege to PUBLIC. For more information, see "Authorization, privileges and object ownership" on page 18.

Notes

Multiple grants: If the same privilege is granted to the same user more than once, revoking that privilege from that user nullifies all those grants.

If you revoke a privilege, it nullifies any grant of that privilege, regardless of who granted it.

Revoking WITH GRANT OPTION: The only way to revoke the WITH GRANT OPTION is to revoke ALL.

REVOKE (Table or View Privileges)

Privilege warning: Revoking a specific privilege from a user does not necessarily prevent that user from performing an action that requires that privilege. For example, the user may still have the privilege through PUBLIC or administrative privileges.

If more than one system authority will be revoked with an SQL privilege, and any one of the authorities cannot be revoked, then a warning occurs and no authorities will be revoked for that privilege.

Corresponding system authorities: When a table privilege is revoked, the corresponding system authorities are revoked, except:

- When revoking authorities to a table or view, *OBJOPR is revoked only when *ADD, *DLT, *READ, and *UPD have all been revoked.
- When revoking authorities to a view, authorities will not be revoked from any tables or views referenced in the fullselect of the view definition.

For information about the system authorities that correspond to SQL privileges see "GRANT (Table or View Privileges)" on page 981.

Revoking either the INDEX or ALTER privilege, revokes the system authority *OBJALTER.

Examples

Example 1: Revoke SELECT privileges on table EMPLOYEE from user ENGLES.

```
REVOKE SELECT
ON TABLE EMPLOYEE
FROM ENGLES
```

Example 2: Revoke update privileges on table EMPLOYEE previously granted to all users. Note that grants to specific users are not affected.

```
REVOKE UPDATE
ON TABLE EMPLOYEE
FROM PUBLIC
```

Example 3: Revoke all privileges on table EMPLOYEE from users PELLOW and ANDERSON.

```
REVOKE ALL
ON TABLE EMPLOYEE
FROM PELLOW, ANDERSON
```

Example 4: Revoke the privilege to update column_1 in VIEW1 from FRED.

```
REVOKE UPDATE(column_1)
ON VIEW1
FROM FRED
```

REVOKE (Type Privileges)

This form of the REVOKE statement removes the privileges on a distinct type.

Invocation

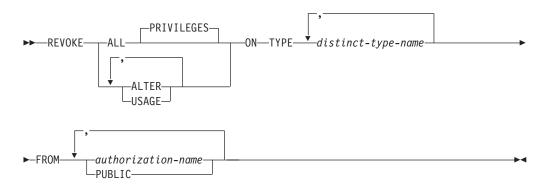
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For each distinct type identified in the statement:
 - Every privilege specified in the statement
 - The system authority of *OBJMGT on the distinct type
 - The system authority *EXECUTE on the library containing the distinct type
- Administrative authority

Syntax



Description

ALL or ALL PRIVILEGES

Revokes one or more distinct type privileges from each *authorization-name*. The privileges revoked are those privileges on the identified distinct types that were granted to the *authorization-names*. Note that revoking ALL PRIVILEGES on a distinct type is not the same as revoking the system authority of *ALL.

If you do not use ALL, you must use one or more of the keywords listed below. Each keyword revokes the privilege described.

ALTER

Revokes the privilege to use the COMMENT statement.

USAGE

Revokes the privilege to use distinct types in tables, functions, procedures, or as the source type in a CREATE TYPE statement.

ON TYPE *distinct-type-name*

Identifies the distinct type from which the privilege is revoked. The *distinct-type-name* must identify a distinct type that exists at the current server.

FROM

Identifies from whom the privileges are revoked.

authorization-name,...

Lists one or more authorization IDs. Do not specify the same authorization-name more than once.

PUBLIC

Revokes a grant of the privilege to PUBLIC. For more information, see "Authorization, privileges and object ownership" on page 18.

Notes

Multiple grants: If authorization ID A granted the same privilege to authorization ID B more than once, revoking that privilege from B nullifies all those grants.

Revoking WITH GRANT OPTION: The only way to revoke the WITH GRANT OPTION is to revoke ALL.

Privilege warning: Revoking a specific privilege from a user does not necessarily prevent that user from performing an action that requires that privilege. For example, the user may still have the privilege through PUBLIC or administrative privileges.

Corresponding system authorities: When a distinct type privilege is revoked, the corresponding system authorities are revoked. For information about the system authorities that correspond to SQL privileges see "GRANT (Type Privileges)" on page 987.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

The keywords DATA TYPE or DISTINCT TYPE can be used as a synonym for TYPE.

Example

ı

Revoke the USAGE privilege on distinct type SHOESIZE from user JONES.

REVOKE USAGE ON DISTINCT TYPE SHOESIZE FROM JONES

The ROLLBACK statement is used to back out changes.

The ROLLBACK statement can be used to either:

- End a unit of work and back out all the relational database changes that were made by that unit of work. If relational databases are the only recoverable resources used by the application process, ROLLBACK also ends the unit of work.
- Back out only the changes made after a savepoint was set within the unit of work without ending the unit of work. Rolling back to a savepoint enables selected changes to be undone.

Invocation

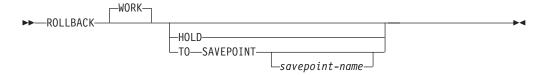
This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

ROLLBACK is not allowed in a trigger if the trigger program and the triggering program run under the same commitment definition. ROLLBACK is not allowed in a procedure if the procedure is called on a Distributed Unit of Work connection to a remote application server or if the procedure is defined as ATOMIC. ROLLBACK is not allowed in a function.

Authorization

None required.

Syntax



Description

When ROLLBACK is used without the TO SAVEPOINT clause, the unit of work in which it is executed is ended. All changes made by SQL schema statements and SQL data change statements during the unit of work are backed out. For more information see Chapter 5, "Statements," on page 529.

The generation of identity values is not under transaction control. Values generated and consumed by inserting rows into a table that has an identity column are independent of executing the ROLLBACK statement. Also, executing the ROLLBACK statement does not affect the IDENTITY_VAL_LOCAL function.

Special registers are not under transaction control. Executing a ROLLBACK statement does not affect special registers.

Sequences are not under transaction control. Executing a ROLLBACK statement does not affect the current value generated and consumed by executing a NEXT VALUE expression.

| | | |

WORK

ROLLBACK WORK has the same effect as ROLLBACK.

HOLD

Specifies a hold on resources. If specified, currently open cursors are not closed cursors whether they are declared with a HOLD option or not. All resources acquired during the unit of work, except locks on the rows of tables, are held. Locks on specific rows implicitly acquired during the unit of work, however, are released.

At the end of a ROLLBACK HOLD, the cursor position is the same as it was at the start of the unit of work, unless

- ALWBLK(*ALLREAD) was specified when the program or routine that contains the cursor was created
- ALWBLK(*READ) and ALWCPYDTA(*OPTIMIZE) were specified when the program or routine that contains the cursor was created

TO SAVEPOINT

Specifies that the unit of work is not to be ended and that only a partial rollback (to a savepoint) is to be performed. If a savepoint name is not specified, rollback is to the last active savepoint. For example, if in a unit of work, savepoints A, B, and C are set in that order and then C is released, ROLLBACK TO SAVEPOINT causes a rollback to savepoint B. If no savepoint is active, an error is returned.

savepoint-name

Identifies the savepoint to which to roll back. The name must identify a savepoint that exists at the current server.

After a successful ROLLBACK TO SAVEPOINT, the savepoint continues to exist.

All database changes (including changes made to declared temporary tables that were declared with the ON ROLLBACK PRESERVE ROWS clause) that were made after the savepoint was set are backed out. All locks and LOB locators are retained.

The impact on cursors resulting from a ROLLBACK TO SAVEPOINT depends on the statements within the savepoint:

- If the savepoint contains SQL schema statements on which a cursor is dependent, the cursor is closed. Attempts to use such a cursor after a ROLLBACK TO SAVEPOINT results in an error.
- Otherwise, the cursor is not affected by the ROLLBACK TO SAVEPOINT (it remains open and positioned).

Any savepoints at the current server that are set after the one to which rollback is performed are released. The savepoint to which rollback is performed is not released.

Notes

Recommended coding practices: Code an explicit COMMIT or ROLLBACK statement at the end of an application process. Either an implicit commit or rollback operation will be performed at the end of an application process depending on the application environment. Thus, a portable application should

explicitly execute a COMMIT or ROLLBACK before execution ends in those environments where explicit COMMIT or ROLLBACK is permitted.

Other effects of rollback: Rollback without the TO SAVEPOINT clause and HOLD clause causes the following to occur:

- · All cursors that were opened during the unit of work are closed whether they are declared with a HOLD option or not.
- All LOB locators, including those that are held, are freed.
- All locks acquired under this unit of work's commitment definition are released.

ROLLBACK has no effect on the state of connections.

Implicit ROLLBACK: The ending of the default activation group causes an implicit rollback. Thus, an explicit COMMIT or ROLLBACK statement should be issued before the end of the default activation group.

A ROLLBACK is automatically performed when:

- 1. The default activation group ends without a final COMMIT being issued.
- 2. A failure occurs that prevents the activation group from completing its work (for example, a power failure).
 - If the unit of work is in the prepared state because a COMMIT was in progress when the failure occurred, a rollback is not performed. Instead, resynchronization of all the connections involved in the unit of work will occur. For more information, see the Commitment control topic collection.
- 3. A failure occurs that causes a loss of the connection to an application server (for example, a communications line failure).
 - If the unit of work is in the prepared state because a COMMIT was in progress when the failure occurred, a rollback is not performed. Instead, resynchronization of all the connections involved in the unit of work will occur. For more information, see the Commitment control topic collection.
- 4. An activation group other than the default activation group ends abnormally.

Row lock limit: A unit of work may include the processing of up to and including 4 million rows, including rows retrieved during a SELECT INTO or FETCH statement, and rows inserted, deleted, or updated as part of INSERT, DELETE, and UPDATE operations. 99

Unaffected statements: The commit and rollback operations do not affect the DROP SCHEMA statement, and this statement is not, therefore, allowed if the current isolation level is anything other than No Commit (NC).

ROLLBACK restrictions: A ROLLBACK statement is not allowed if commitment control is not active for the activation group. For information about determining which commitment definition is used, see the commitment definition discussion in the COMMIT statement.

^{98.} Unless you specified COMMIT(*CHG) or COMMIT(*CS), in which case these rows are not included in this total. 99. This limit also includes:

[·] Any rows accessed or changed through files opened under commitment control through high-level language file processing

[·] Any rows deleted, updated, or inserted as a result of a trigger or CASCADE, SET NULL, or SET DEFAULT referential integrity delete rule.

A commit or rollback in a user-defined function in a secondary thread is not allowed.

ROLLBACK has no effect on the state of connections.

If, within a unit of work, a CLOSE is followed by a ROLLBACK, all changes made within the unit of work are backed out. The CLOSE itself is not backed out and the file is not reopened.

Examples

Ι

Example 1: See the "Example" on page 641 under COMMIT for examples using the ROLLBACK statement.

Example 2: After a unit of recovery started, assume that three savepoints A, B, and C were set and that C was released:

```
SAVEPOINT A ON ROLLBACK RETAIN CURSORS;
SAVEPOINT B ON ROLLBACK RETAIN CURSORS;
SAVEPOINT C ON ROLLBACK RETAIN CURSORS;
RELEASE SAVEPOINT C
```

Roll back all database changes only to savepoint A:

ROLLBACK WORK TO SAVEPOINT A

If a savepoint name was not specified (that is, ROLLBACK WORK TO SAVEPOINT), the rollback would be to the last active savepoint that was set, which is B.

SAVEPOINT

The SAVEPOINT statement sets a savepoint within a unit of work to identify a point in time within the unit of work to which relational database changes can be rolled back.

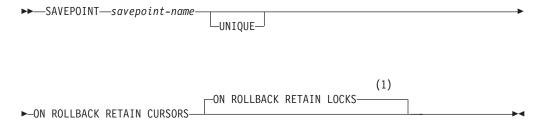
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax 1 4 1



Notes:

The ROLLBACK options can be specified in any order.

Description

savepoint-name

Identifies a new savepoint. The specified savepoint-name cannot begin with 'SYS'.

UNIQUE

Specifies that the application program cannot reuse the savepoint name within the unit of work. An error occurs if a savepoint with the same name as savepoint-name already exists within the unit of work.

Omitting UNIQUE indicates that the application can reuse the savepoint name within the unit of work. If savepoint-name identifies a savepoint that already exists within the unit of work and the savepoint was not created with the UNIQUE option, the existing savepoint is destroyed and a new savepoint is created. Destroying a savepoint to reuse its name for another savepoint is not the same as releasing the savepoint. Reusing a savepoint name destroys only one savepoint. Releasing a savepoint with the RELEASE SAVEPOINT statement releases the savepoint and all savepoints that have been subsequently set.

ON ROLLBACK RETAIN CURSORS

Specifies that cursors that are opened after the savepoint is set are not closed upon rollback to the savepoint.

 If SQL schema statements are executed for a table or view within the scope of the SAVEPOINT statement, any cursor that references that table or view is closed. Attempts to use such a cursor after a ROLLBACK TO SAVEPOINT results in an error.

 Otherwise, the cursor is not affected by the ROLLBACK TO SAVEPOINT (it remains open and positioned).

Although these cursors remain open after rollback to the savepoint, they might not be usable. For example, if rolling back to the savepoint causes the insertion of a row on which the cursor is positioned to be rolled back, using the cursor to update or delete the row results in an error.

ON ROLLBACK RETAIN LOCKS

Specifies that any locks that are acquired after the savepoint is set are not released on rollback to the savepoint.

Notes

Savepoint persistence: A savepoint, *S*, is destroyed when:

- A COMMIT or ROLLBACK (without a TO SAVEPOINT clause) statement is executed.
- A ROLLBACK TO SAVEPOINT statement is executed that specifies savepoint S or a savepoint that was established earlier than *S* in the unit of work.
- A RELEASE SAVEPOINT statement is executed that specifies savepoint S or a savepoint that was established earlier than S in the unit of work.
- A SAVEPOINT statement specifies the same name as an existing savepoint that was not created with the UNIQUE keyword.

Effect on INSERT: In an application, inserts may be buffered. The buffer will be flushed when SAVEPOINT, ROLLBACK, or RELEASE TO SAVEPOINT statements are issued.

SAVEPOINT restriction: A SAVEPOINT statement is not allowed if commitment control is not active for the activation group. For information about determining which commitment definition is used, see "Notes" on page 639 in COMMIT statement.

Example

Assume that you want to set three savepoints at various points in a unit of work. Name the first savepoint A and allow the savepoint name to be reused. Name the second savepoint B and do not allow the name to be reused. Because you no longer need savepoint A when you are ready to set the third savepoint, reuse A as the name of the savepoint.

```
SAVEPOINT A ON ROLLBACK RETAIN CURSORS;
SAVEPOINT B UNIQUE ON ROLLBACK RETAIN CURSORS;
SAVEPOINT A ON ROLLBACK RETAIN CURSORS;
```

SELECT

SELECT

The SELECT statement is a form of query. It can be embedded in an SQLJ application program or issued interactively.

For detailed information, see "select-clause" on page 471 and Chapter 4, "Queries," on page 469.

SELECT INTO

The SELECT INTO statement produces a result table consisting of at most one row, and assigns the values in that row to variables.

Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

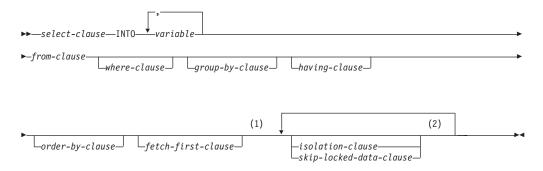
Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- · For each table or view identified in the statement,
 - The SELECT privilege on the table or view, and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

Syntax



Notes:

- 1 Only one row may be specified in the fetch-first-clause.
- Each clause may be specified only once.

Description

The result table is derived by evaluating the isolation-clause, skip-locked-data-clause, from-clause, where-clause, group-by-clause, having-clause, order-by-clause, fetch-first-clause, and select-clause, in this order.

See Chapter 4, "Queries," on page 469 for a description of the select-clause, from-clause, where-clause, group-by-clause, having-clause, order-by-clause, fetch-first-clause, isolation-clause, and skip-locked-data-clause.

INTO variable....

Identifies one or more host structures or variables that must be declared in the program in accordance with the rules for declaring host structures and variables. In the operational form of the INTO clause, a reference to a host

structure is replaced by a reference to each of its variables. The first value in the result row is assigned to the first variable in the list, the second value to the second variable, and so on. The data type of each variable must be compatible with its corresponding column.

Notes

Variable assignment: Each assignment to a variable is performed according to the retrieval assignment rules described in "Assignments and comparisons" on page 89. 100 If the number of variables is less than the number of values in the row, an SQL warning (SQLSTATE 01503) is returned (and the SQLWARN3 field of the SQLCA is set to 'W'). Note that there is no warning if there are more variables than the number of result columns. If a value is null, an indicator variable must be provided for that value.

If the specified variable is character and is not large enough to contain the result, a warning (SQLSTATE 01004) is returned (and 'W' is assigned to SQLWARN1 in the SQLCA). The actual length of the result may be returned in the indicator variable associated with the variable, if an indicator variable is provided. For further information, see "References to variables" on page 136.

If an assignment error occurs, the value of that variable and any following variables is unpredictable. Any values that have already been assigned to variables remain assigned.

Multiple assignments: If more than one variable is specified in the INTO clause, the query is completely evaluated before the assignments are performed. Thus, references to a variable in the select list are always the value of the variable prior to any assignment in the SELECT INTO statement.

Empty result table: If the result table is empty, the statement assigns '02000' to the SQLSTATE variable and does not assign values to the variables.

Result tables with more than one row: If more than one row satisfies the search condition, statement processing is terminated and an error is returned (SQLSTATE 21000). If an error occurs because the result table has more than one row, values may or may not be assigned to the variables. If values are assigned to the variables, the row that is the source of the values is undefined and not predictable.

Result column evaluation considerations: If an error occurs while evaluating a result column in the select list of a SELECT INTO statement, as the result of an arithmetic expression (such as division by zero, or overflow) or a numeric or character conversion error, the result is the null value. As in any other case of a null value, an indicator variable must be provided. The value of the variable is undefined. In this case, however, the indicator variable is set to the value of -2. Processing of the statement continues and a warning is returned. If an indicator variable is not provided, an error is returned and no more values are assigned to variables. It is possible that some values have already been assigned to variables and will remain assigned when the error is returned.

When a datetime value is returned, the length of the variable must be large enough to store the complete value. Otherwise, depending on how much of the

^{100.} If assigning to an SQL-variable or SQL-parameter and the standards option is specified, storage assignment rules apply. For information about the standards option, see "Standards compliance" on page ix.

value would have to be truncated, a warning or an error is returned. See "Datetime assignments" on page 95 for details.

Examples

| |

Example 1: Using a COBOL program statement, put the maximum salary (SALARY) from the EMPLOYEE table into the host variable MAX-SALARY (DECIMAL(9,2)).

```
EXEC SQL SELECT MAX(SALARY)
INTO :MAX-SALARY
FROM EMPLOYEE WITH CS
END-EXEC.
```

Example 2: Using a Java program statement, select the row from the EMPLOYEE table on the connection context 'ctx' with a employee number (EMPNO) value the same as that stored in the host variable HOST_EMP (java.lang.String). Then put the last name (LASTNAME) and education level (EDLEVEL) from that row into the host variables HOST_NAME (String) and HOST_EDUCATE (Integer).

Example 3: Put the row for employee 528671, from the EMPLOYEE table, into the host structure EMPREC. Assume that the row will be updated later and should be locked when the query executes.

```
EXEC SQL SELECT *
INTO :EMPREC
FROM EMPLOYEE
WHERE EMPNO = '528671'
WITH RS USE AND KEEP EXCLUSIVE LOCKS
END-EXEC.
```

SET CONNECTION

The SET CONNECTION statement establishes the current server of the activation group by identifying one of its existing connections.

Invocation

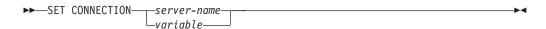
This statement can only be embedded within an application program or issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in Java or REXX.

SET CONNECTION is not allowed in a trigger. SET CONNECTION is not allowed in an external procedure if the external procedure is called on a remote application server.

Authorization

None required.

Syntax



Description

server-name or variable

Identifies the connection by the specified server name or the server name contained in the variable. If a variable is specified:

- It must be a character-string variable with a length attribute that is not greater than 18.
- It must not be followed by an indicator variable.
- The server name must be left-justified within the variable and must conform to the rules for forming an ordinary identifier.
- If the length of the server name is less than the length of the variable, it must be padded on the right with blanks.

Let S denote the specified server name or the server name contained in the variable. S must identify an existing connection of the application process. If S identifies the current connection, the state of S and all other connections of the application process are unchanged, but information about S is placed in the SQLERRP field of the SQLCA. The following rules apply when S identifies a dormant connection.

If the SET CONNECTION statement is successful:

- Connection S is placed in the current state.
- S is placed in the CURRENT SERVER special register.
- Information about the application server is placed in the *connection-information-items* in the SQL Diagnostics Area.
- Information about application server S is also placed in the SQLERRP field of the SQLCA. If the application server is an IBM relational database product, the information has the form *pppvvrrm*, where:
 - ppp identifies the product as follows:

- ARI for DB2 for VSE and VM
- DSN for DB2 for z/OS
- QSQ for DB2 for i
- SQL for all other DB2 products
- vv is a two-digit version identifier such as '04'
- rr is a two-digit release identifier such as '01'
- m is a one-digit modification level such as '0'

For example, if the application server is Version 4 of DB2 for z/OS, the value of SQLERRP is 'DSN04010'.

Additional information about the connection is available from the DB2_CONNECTION_STATUS and DB2_CONNECTION_TYPE connection information items in the SQL Diagnostics Area.

The DB2 CONNECTION STATUS connection information item indicates the status of connection for this unit of work. It will have one of the following values:

- 1 Commitable updates can be performed on the connection for this unit of work.
- 2 No commitable updates can be performed on the connection for this unit of work.

The DB2 CONNECTION TYPE connection information item indicates the type of connection. It will have one of the following values:

- 1 Connection is to a local relational database.
- 2 Connection is to a remote relational database with the conversation unprotected.
- 3 Connection is to a remote relational database with the conversation protected.
- 4 Connection is to an application requester driver program.
- Additional information about the connection is also placed in the SQLERRD(4) field of the SQLCA. SQLERRD(4) will contain a value indicating whether the application server allows commitable updates to be performed. Following is a list of values and their meanings for the SQLERRD(4) field of the SQLCA on the CONNECT:
 - 1 Commitable updates can be performed and either the connection uses an unprotected conversation, is a connection established to an application requester driver program using a CONNECT (Type 1) statement, or is a local connection established using a CONNECT (Type 1) statement.
 - 2 No commitable updates can be performed; conversation is unprotected.
 - 3 It is unknown if commitable updates can be performed; conversation is protected.
 - 4 It is unknown if commitable updates can be performed; conversation is unprotected.
 - 5 It is unknown if commitable updates can be performed and the connection is either a local connection established using a CONNECT (Type 2) statement or a connection to an application requester driver program established using a CONNECT (Type 2) statement.
- Additional information about the connection is placed in the SQLERRMC field of the SQLCA. Refer to Appendix B, "SQL Communication Area" for a description of the information in the SQLERRMC field.
- Any previously current connection is placed in the dormant state.

SET CONNECTION

If the SET CONNECTION statement is unsuccessful, the connection state of the activation group and the states of its connections are unchanged.

Notes

SET CONNECTION for CONNECT (Type 1): The use of CONNECT (Type 1) statements does not prevent the use of SET CONNECTION, but the statement either fails or does nothing because dormant connections do not exist.

Status after connection is restored: When a connection is used, made dormant, and then restored to the current state in the same unit of work, the status of locks, cursors, and prepared statements for that connection reflects its last use by the activation group.

Local connections: A SET CONNECTION to a local connection will fail if the current independent auxiliary Storage pool (IASP) name space does not match the local connection's relational database.

Example

Execute SQL statements at TOROLAB1, execute SQL statements at TOROLAB2, and then execute more SQL statements at TOROLAB1.

```
EXEC SQL CONNECT TO TOROLAB1;
(Execute statements referencing objects at TOROLAB1)
EXEC SQL CONNECT TO TOROLAB2;
(Execute statements referencing objects at TOROLAB2)
EXEC SQL SET CONNECTION TOROLAB1;
(Execute statements referencing objects at TOROLAB1)
```

The first CONNECT statement creates the TOROLAB1 connection, the second CONNECT statement places it in the dormant state, and the SET CONNECTION statement returns it to the current state.

SET CURRENT DEBUG MODE

The SET CURRENT DEBUG MODE statement assigns a value to the CURRENT DEBUG MODE special register.

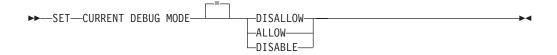
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None.

Syntax



Description

The value of CURRENT DEBUG MODE is replaced by the specified keyword:

DISALLOW

Procedures will be created so they cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is DISALLOW, the procedure can be subsequently altered to change the DEBUG MODE attribute.

ALLOW

Procedures will be created so they can be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is ALLOW, the procedure can be subsequently altered to change the DEBUG MODE attribute.

DISABLE

Procedures will be created so they cannot be debugged by the Unified Debugger. When the DEBUG MODE attribute of a procedure is DISABLE, the procedure cannot be subsequently altered to change the DEBUG MODE attribute.

Notes

Transaction considerations: The SET CURRENT DEBUG MODE statement is not a commitable operation. ROLLBACK has no effect on the current debug mode.

Initial current debug mode: The initial value of the current debug mode is DISALLOW.

Current debug mode scope: The scope of the current debug mode is the job.

Example

Example 1: The following statement sets the CURRENT DEBUG MODE to allow subsequent procedures created by the CREATE PROCEDURE (SQL) statement to be debuggable.

SET CURRENT DEBUG MODE

SET CURRENT DEBUG MODE = ALLOW

Example 2: The following statement sets the CURRENT DEBUG MODE to disallow subsequent procedures created by the CREATE PROCEDURE (SQL) statement to be debuggable and to prevent those procedures from being altered to make them debuggable.

SET CURRENT DEBUG MODE = DISABLE

SET CURRENT DECFLOAT ROUNDING MODE

The SET CURRENT DECFLOAT ROUNDING MODE statement changes the value of the CURRENT DECFLOAT ROUNDING MODE special register.

Invocation

I

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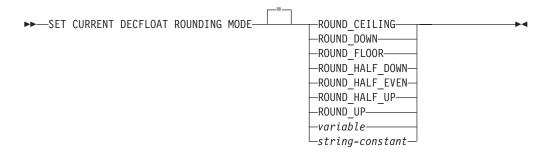
I

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax



Description

ROUND_CEILING

Round toward +Infinity. If all of the discarded digits are zero or if the sign is negative, the result is unchanged other than the removal of discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

ROUND_DOWN

Round toward zero (truncation). The discarded digits are ignored.

ROUND FLOOR

Round toward -Infinity. If all of the discarded digits are zero or if the sign is positive, the result is unchanged other than the removal of the discarded digits. Otherwise, the sign is negative and the result coefficient is incremented by one.

ROUND_HALF_DOWN

Round to nearest; if equidistant, round down. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

This rounding mode is not recommended when creating a portable application since it is not supported by the IEEE draft standard for floating-point arithmetic.

ROUND HALF EVEN

Round to nearest; if equidistant, round so that the final digit is even. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). If they represent less than half, then the result coefficient is not adjusted (that is, the discarded digits are ignored). Otherwise (they represent exactly

SET CURRENT DECFLOAT ROUNDING MODE

half), the result coefficient is unaltered if its rightmost digit is even or incremented by one (rounded up) if its rightmost digit is odd (to make an even digit). ROUND_HALF_UP Round to nearest; if equidistant, round up. If the discarded digits represent greater than or equal to half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

ROUND_UP

Round away from zero. If all of the discarded digits are zero, the result is unchanged other than the removal of discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

This rounding mode is not recommended when creating a portable application since it is not supported by the IEEE draft standard for floating-point arithmetic.

string-constant

A character constant that contains a specification of the rounding mode.

variable

Specifies a variable which contains the value for the CURRENT DECFLOAT ROUNDING MODE. The content is not folded to uppercase.

The variable:

- Must be a character-string or Unicode graphic-string variable.
- Must not be followed by an indicator variable.
- Must contain one of the seven rounding mode keywords.
- Must be padded on the right with blanks if the variable is fixed length.

Notes

Transaction considerations: The SET CURRENT DECFLOAT ROUNDING MODE statement is not a commitable operation. ROLLBACK has no effect on the CURRENT DECFLOAT ROUNDING MODE.

Initial CURRENT DECFLOAT ROUNDING MODE: The initial value of CURRENT DECFLOAT ROUNDING MODE in an activation group is established by the first SQL statement that is executed in the activation group.

- If the first SQL statement in an activation group is executed from an SQL program or SQL package, the CURRENT DECFLOAT ROUNDING MODE special register is set to the value of the DECFLTRND parameter.
- Otherwise, the initial value is ROUND_HALF_EVEN.

CURRENT DECFLOAT ROUNDING MODE scope is activation group.

Examples

Example 1: Set the CURRENT DECFLOAT ROUNDING MODE special register to ROUND_UP using a string constant and using a keyword.

SET CURRENT DECFLOAT ROUNDING MODE = 'ROUND DOWN' SET CURRENT DECFLOAT ROUNDING MODE = ROUND DOWN

SET CURRENT DEGREE

The SET CURRENT DEGREE statement assigns a value to the CURRENT DEGREE special register.

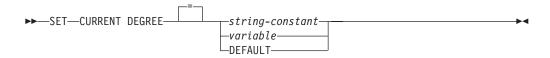
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared. It must not be specified in REXX.

Authorization

The privileges held by the authorization ID of the statement must include the system authority of *JOBCTL.

Syntax 1 4 1



Description

The value of CURRENT DEGREE is replaced by the value of the string constant or variable.

string-constant

Specifies a character string constant. The content is not folded to uppercase.

The length of the *string-constant* must not exceed 5 after trimming any leading and trailing blanks.

variable

Specifies a variable that contains the value for CURRENT DEGREE.

The variable:

- Must be a CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable. The actual length of the contents of the variable must not be greater than 5 after trimming any leading and trailing blanks.
- Must not be the null value.
- Must have contents in uppercase characters. All characters are case-sensitive and are not converted to uppercase characters.

DEFAULT

I

If the PARALLEL_DEGREE parameter in a current query options file (QAQQINI) is specified, the CURRENT DEGREE will be reset to the PARALLEL_DEGREE. Otherwise, the CURRENT DEGREE will be reset from the degree specified by the QQRYDEGREE system value.

The value of the string constant or variable must be one of the following:

- No parallel processing is allowed.
- 2 through 32767

Specifies the degree of parallelism that will be used.

SET CURRENT DEGREE

ANY

Specifies that the database manager can choose to use any number of tasks for either I/O or SMP parallel processing.

Use of parallel processing and the number of tasks used is determined based on the number of processors available in the system, this job's share of the amount of active memory available in the pool in which the job is run, and whether the expected elapsed time for the operation is limited by CPU processing or I/O resources. The database manager chooses an implementation that minimizes elapsed time based on the job's share of the memory in the pool.

NONE

No parallel processing is allowed.

MAX

The database manager can choose to use any number of tasks for either I/O or SMP parallel processing. MAX is similar to ANY except the database manager assumes that all active memory in the pool can be used.

IO Any number of tasks can be used when the database manager chooses to use I/O parallel processing for queries. SMP is not allowed.

Notes

Transaction considerations: The SET CURRENT DEGREE statement is not a commitable operation. ROLLBACK has no effect on CURRENT DEGREE.

Initial current degree: The initial value of CURRENT DEGREE is equal to the parallelism degree in effect from the CHGQRYA CL command, PARALLEL_DEGREE parameter in the current query options file (QAQQINI), or the QQRYDEGREE system value.

Parallelism degree precedence: The parallelism degree can be controlled in several ways. The actual parallelism degree used is determined as follows:

- If a SET CURRENT DEGREE statement or a CHGQRYA CL command with a DEGREE keyword has been executed, the parallelism degree specified by the most recent of either is the value of CURRENT DEGREE.
- If neither a SET CURRENT DEGREE statement nor a CHGQRYA CL command with a DEGREE keyword has been executed,
 - If a current query options file (QAQQINI) with a PARALLEL_DEGREE parameter has been specified, the parallelism degree specified by the QAQQINI file is the value of CURRENT DEGREE.
 - Otherwise, the parallelism degree specified by the QQRYDEGREE system value is the value of CURRENT DEGREE.

For more information, see Database Performance and Query Optimization topic collection.

Current degree scope: The scope of CURRENT DEGREE is the job.

Parallel limitations: If the DB2 Symmetric Multiprocessing feature is not installed, a warning is returned and parallelism is not used.

Some SQL statements cannot use parallelism.

1

Example

Example 1: The following statement sets the CURRENT DEGREE to inhibit parallelism.

SET CURRENT DEGREE = '1'

Example 2: The following statement sets the CURRENT DEGREE to allow parallelism.

SET CURRENT DEGREE = 'ANY'

SET DESCRIPTOR

The SET DESCRIPTOR statement sets information in an SQL descriptor.

Invocation

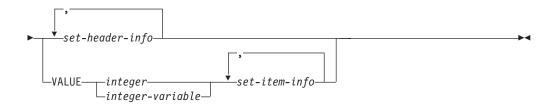
This statement can only be embedded in an application program, SQL function, SQL procedure, or trigger. It cannot be issued interactively. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

Authorization

None required.

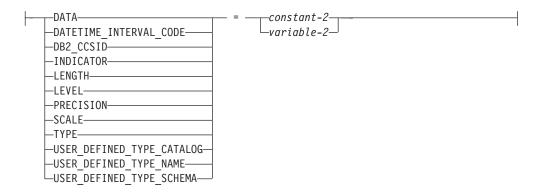
Syntax





set-header-info:

set-item-info:



Description

LOCAL

Specifies the scope of the name of the descriptor to be local to program invocation. The information provided is set into the descriptor known in this local scope.

GLOBAL

Specifies the scope of the name of the descriptor to be global to the SQL session. The information provided is set into the descriptor known to any program that executes using the same database connection.

SQL-descriptor-name

Names the SQL descriptor. The name must identify a descriptor that already exists with the specified scope.

set-header-info

Sets attributes into the SQL descriptor. The same descriptor item must not be specified more than once in a single SET DESCRIPTOR statement.

VALUE

Specifies the item number for which the specified information is set. If the item number is greater than the maximum number of items allocated for the descriptor or the item number is less than 1, an error is returned.

integer

An integer constant in the range of 1 to the number of items allocated in the SQL descriptor.

integer-variable

Identifies a variable declared in the program in accordance with the rules for declaring variables. The data type of the variable must be SMALLINT, INTEGER, BIGINT, or DECIMAL or NUMERIC with a scale of zero. The value of variable must be in the range of 1 to the maximum number of items allocated in the SQL descriptor.

set-item-info

Sets information about a specific item into the SQL descriptor. The same descriptor item must not be specified more than once in a single SET DESCRIPTOR statement. Items that are not applicable to the specified type are ignored.

set-header-info

COUNT

A count of the number of items that will be specified in the descriptor.

variable-1

Identifies a variable declared in the program in accordance with the rules for declaring variables, but must not be a file reference variable. The data type of the variable must be compatible with the COUNT header item as specified in Table 62 on page 940. The variable is assigned (using storage assignment rules) to the COUNT header item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

constant-1

Identifies a constant value used to set the COUNT header item. The data type of the constant must be compatible with the COUNT header item as specified in Table 62 on page 940. The constant is assigned (using storage assignment rules) to the COUNT header item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

set-item-info

DATA

Specifies the value for the data described by the item descriptor. If the value of INDICATOR is negative, then the value of DATA is undefined. The assigned value cannot be a constant.

DATETIME_INTERVAL_CODE

Specifies the specific datetime data type. DATETIME_INTERVAL_CODE must be specified if TYPE is set to 9.

- DATE
- 2 TIME
- 3 TIMESTAMP

DB2_CCSID

Specifies the CCSID of character, graphic, or datetime data. The value is not applicable for all other data types. If the DB2_CCSID is not specified or 0 is specified, the CCSID of the variable will be determined by the CCSID of the job.

INDICATOR

Specifies the value for the indicator. A non-negative indicates a DATA value will be provided for this descriptor item. When extended indicator variables are not enables, a negative value indicates the value described by this descriptor item is the null value If not set, the value of INDICATOR is 0. When extended indicator variables are enabled:

- -1, -2, -3, -4, or -6 indicates the value described by this descriptor item is the null value.
- -5 indicates the value described by this descriptor item is the DEFAULT
- -7 indicates the value described by this descriptor item is the UNASSIGNED
- 0 indicates a DATA value will be provided for this descriptor item.

LENGTH

Specifies the maximum length of the data. If the data type is a character or graphic string type or a datetime type, the length represents the number of characters (not bytes). If the data type is a binary string or any other type, the length represents the number of bytes. If LENGTH is not specified, a default length will be used. For a description of the defaults, see Table 81 on page 1081.

LEVEL

The level of the item descriptor. If specified, the value must be 0.

PRECISION

Specifies the precision for descriptor items of data type DECIMAL, NUMERIC, DECFLOAT, DOUBLE, REAL, and FLOAT. If PRECISION is not specified, a default precision will be used. For a description of the defaults, see Table 81 on page 1081.

SCALE

Specifies the scale for descriptor items of data type DECIMAL or NUMERIC. If SCALE is not specified, a default scale will be used. For a description of the defaults, see Table 81 on page 1081.

TYPE

Specifies a data type code representing the data type of the descriptor item. For a description of the data type codes and lengths, see Table 63 on page 941. Either TYPE or USER DEFINED TYPE NAME and USER_DEFINED_TYPE_SCHEMA (but not both) must be specified for each descriptor item.

USER_DEFINED_TYPE_CATALOG

Specifies the server name of the user-defined type. If

USER_DEFINED_TYPE_CATALOG is specified, it must be equal to the current server. Otherwise, the USER_DEFINED_TYPE_CATALOG is the current server.

USER_DEFINED_TYPE_NAME

Specifies the name of the user-defined data type. Either TYPE or USER_DEFINED_TYPE_NAME and USER_DEFINED_TYPE_SCHEMA (but not both) must be specified for each descriptor item.

USER_DEFINED_TYPE_SCHEMA

Specifies the schema containing the user-defined type. Either TYPE or USER_DEFINED_TYPE_NAME and USER_DEFINED_TYPE_SCHEMA (but not both) must be specified for each descriptor item.

variable-2

Identifies a variable declared in the program in accordance with the rules for declaring variables, but must not be a file reference variable. The data type of the variable must be compatible with the descriptor information item as specified in Table 62 on page 940. The variable is assigned (using storage assignment rules) to the corresponding descriptor item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

When setting the DATA item, in general the variable must have the same data type, length, precision, scale, and CCSID as specified in Table 62 on page 940. For variable-length types, the variable length must not be less than the LENGTH in the descriptor. For C nul-terminated types, the variable length must be at least one greater than the LENGTH in the descriptor.

constant-2

Identifies a constant value used to set the descriptor item. The data type of the constant must have the same data type, length, precision, scale, and CCSID as specified in Table 62 on page 940. The constant is assigned (using storage assignment rules) to the corresponding descriptor item. For details on the assignment rules, see "Assignments and comparisons" on page 89.

If the descriptor item to be set is DATA, constant-2 cannot be specified.

Notes

Default values for descriptor items: The following table represents the default values for LENGTH, PRECISION, and SCALE, if they are not specified for a descriptor item.

Table 81. Default LENGTH, PRECISION, and SCALE

Data Type	LENGTH	PRECISION	SCALE
DECIMAL and NUMERIC		5	0
FLOAT		53	0
DECFLOAT		34	
CHARACTER, VARCHAR, and CLOB	1		
GRAPHIC, VARGRAPHIC, and DBCLOB	1		
BINARY, VARBINARY, and BLOB	1		

Example

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Example 1: Set the number of items in descriptor 'NEWDA' to the value in :numitems.

SET DESCRIPTOR

EXEC SQL SET DESCRIPTOR 'NEWDA' COUNT = :numitems;

Example 2: Set the value of the type and length for the first item descriptor of descriptor 'NEWDA'

SET DESCRIPTOR 'NEWDA' VALUE 1 TYPE = :dtype, LENGTH = :olength; The SET ENCRYPTION PASSWORD statement sets the default password and hint that will be used by the encryption and decryption functions. The password is not associated with authentication and is only used for data encryption and decryption.

For information about using this statement, see "ENCRYPT_AES" on page 310, "ENCRYPT_RC2" on page 313, "ENCRYPT_TDES" on page 316, and "DECRYPT_BIT, DECRYPT_BINARY, DECRYPT_CHAR and DECRYPT_DB" on page 293.

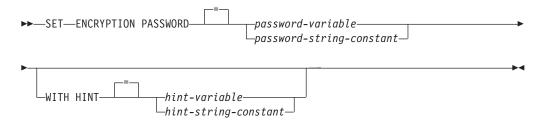
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax



Description

password-variable

Specifies a variable that contains an encryption password.

The variable:

- Must be a CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable. The actual length of the contents of the variable must be between 6 and 127 inclusive or must be an empty string. If an empty string is specified, the default encryption password is set to no value.
- Must not be the null value.
- All characters are case-sensitive and are not converted to uppercase characters.

password-string-constant

A character constant. The length of the constant must be between 6 and 127 inclusive or must be an empty string. If an empty string is specified, the default encryption password is set to no value. The literal form of the password is not allowed in static SQL or REXX.

WITH HINT

Indicates that a value is specified that will help data owners remember passwords (for example, 'Ocean' as a hint to remember 'Pacific'). If a hint value is specified, the hint is used as the default for encryption functions. The

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SET ENCRYPTION PASSWORD

hint can subsequently be retrieved for an encrypted value using the GETHINT function. If this clause is not specified and a hint is not explicitly specified on the encryption function, no hint will be embedded in encrypted data result.

hint-variable

Specifies a variable that contains an encryption password hint.

The variable:

- Must be a CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable. The actual length of the contents of the variable must not be greater than 32. If an empty string is specified, the default encryption password hint is set to no value.
- Must not be the null value.
- All characters are case-sensitive and are not converted to uppercase characters.

hint-string-constant

A character constant. The length of the constant must not be greater than 32. If an empty string is specified, the default encryption password hint is set to no value.

Notes

Password protection: To prevent inadvertent access to the encryption password, do not specify password-string-constant in the source for a program, procedure, or function. Instead, use a variable.

When connected to a remote relational database, the specified password itself is sent "in the clear". That is, the password itself is not encrypted. To protect the password in these cases, consider using a communications encryption mechanism such as IPSEC (or SSL if connecting between System i products).

Transaction considerations: The SET ENCRYPTION PASSWORD statement is not a commitable operation. ROLLBACK has no effect on the default encryption password or default encryption password hint.

Initial encryption password value: The initial value of both the default encryption password and the default encryption password hint is the empty string (").

Encryption password scope: The scope of the default encryption password and default encryption password hint is the activation group and connection.

Example

Set the ENCRYPTION PASSWORD to the value in :hv1.

SET ENCRYPTION PASSWORD :hv1

SET OPTION

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The SET OPTION statement establishes the processing options to be used for SQL statements.

Invocation

This statement can be used in a REXX procedure or embedded in an application program. If used in a REXX procedure, it is an executable statement. If embedded in an application program, it is not executable and must precede any other SQL statements. This statement cannot be dynamically prepared.

Authorization

None required.

Syntax

►►SET OPTION--ALWBLK = *—alwblk-option*-⊢ALWCPYDTA = *─alwcpydta-option*-—CLOSQLCSR = —closqlcsr-option- \vdash CNULRQD = \lnot cnulrqd-option--COMPILEOPT = -compile-option--COMMIT = -commit-option--DATFMT = -datfmt-option-DATSEP = —datsep-option--DBGVIEW = —dbgview-option- $-\mathsf{DECFLTRND} = --decfltrnd-option-$ -DECMPT = -decmpt-option--DECRESULT = —decresult-option--DFTRDBCOL = -dftrdbcol-option- $-\mathsf{DLYPRP} = --dlyprp ext{-}option ext{-}$ -DYNDFTCOL = -dyndftcol-option--DYNUSRPRF = -dynusrprf-option--EVENTF = *—eventf-option*--EXTIND = -extind-option--LANGID = -langid-option--MONITOR = -monitor-option--NAMING = —naming-option--OPTLOB = --optlob-option--OUTPUT = --output-option--RDBCNNMTH = -rdbcnnmth-option-SQLCA = --sqlca-option--SQLCURRULE = -sqlcurrule-option--SQLPATH = -sqlpath-option--SRTSEQ = -srtseq-option- \vdash TGTRLS = -tgtrls-option- \vdash TIMFMT = -timfmt-option--TIMSEP = -timsep-option- \sqcup USRPRF = -usrprf-option-

alwblk-option:



alwcpydta-option:

```
*N0-
-*OPTIMIZE-
```

closqlcsr-option:



cnulrqd-option:

```
-*YES-
-*NO-
```

commit-option:

```
-*CHG-
-*NONE-
—*CS-
 -*ALL-
└─*RR-
```

compile-option:

```
–compile-string-constant\dashv
```

datfmt-option:

```
-*J0B-
-*ISO-
-*EUR-
-*USA-
-*JIS-
-*MDY-
-*DMY-
-*YMD-
-*JUL-
```

datsep-option:

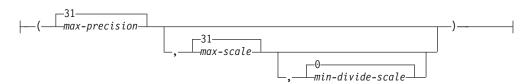
decfltrnd-option:

```
*CEILING
-*DOWN
-*FLOOR
-*HALFDOWN
-*HALFEVEN
-*HALFUP
-*UP
```

decmpt-option:

```
*PERIOD---*COMMA----*SYSVAL---*JOB----*
```

decresult-option:



dbgview-option:



dftrdbcol-option:



dlyprp-option:
*YES*NO
dyndftcol-option:
*YES*NO
dynusrprf-option:
*OWNER
eventf-option:
*YES*NO
extind-option:
*NOEXTIND
langid-option:
*JOB -*JOBRUN
monitor-option:
*USER*SYSTEM-
naming-option:
*SYS
optlob-option:
*YES

output-option:

```
-*NONE-
└-*PRINT
```

rdbcnnmth-option:

```
-*DUW-
∟∗RUW_
```

sqlca-option:

```
-*NO-
```

sqlcurrule-option:

sqlpath-option:

```
-*LIBL---
└path-string-constant ─
```

srtseq-option:

```
-*J0B-
-*HEX-
-*JOBRUN-
--*LANGIDUNQ-
-*LANGIDSHR-
 _*LIBL/_
                   —srtseq-table-name—
 -*CURLIB/-
 └library-name/
```

tgtrls-option:

```
---VxRxMx--
```

timfmt-option:

```
-*HMS-
-*ISO-
-*EUR-
-*USA-
∟*JIS—
```

usrprf-option:



Description

ALWBLK

Specifies whether the database manager can use row blocking and the extent to which blocking can be used for read-only cursors. This option will be ignored in REXX.

*ALLREAD

Rows are blocked for read-only cursors if COMMIT is *NONE, *CHG, or *CS. All cursors in a program that are not explicitly able to be updated are opened for read-only processing even though EXECUTE or EXECUTE IMMEDIATE statements may be in the program.

Specifying *ALLREAD:

- Allows row blocking under commitment control level *CHG and *CS in addition to the blocking allowed for *READ.
- Can improve the performance of almost all read-only cursors in programs, but limits queries in the following ways:
 - The Rollback (ROLLBACK) command, a ROLLBACK statement in host languages, or the ROLLBACK HOLD SQL statement does not reposition a read-only cursor when:
 - ALWBLK(*ALLREAD) was specified when the program or routine that contains the cursor was created
 - ALWBLK(*READ) and ALWCPYDTA(*OPTIMIZE) were specified when the program or routine that contains the cursor was created
 - Dynamic running of a positioned UPDATE or DELETE statement (for example, using EXECUTE IMMEDIATE), cannot be used to update a row in a cursor unless the DECLARE statement for the cursor includes the FOR UPDATE clause.

*NONE

Rows are not blocked for retrieval of data for cursors.

Specifying *NONE:

- Guarantees that the data retrieved is current.
- May reduce the amount of time required to retrieve the first row of data for a query.

- Stops the database manager from retrieving a block of data rows that is not used by the program when only the first few rows of a query are retrieved before the query is closed.
- Can degrade the overall performance of a query that retrieves a large number of rows.

*READ

Rows are blocked for read-only retrieval of data for cursors when:

- *NONE is specified on the COMMIT parameter, which indicates that commitment control is not used.
- The cursor is declared with a FOR READ ONLY clause or there are no dynamic statements that could run a positioned UPDATE or DELETE statement for the cursor.

Specifying *READ can improve the overall performance of queries that meet the above conditions and retrieve a large number of rows.

ALWCPYDTA

Specifies whether a copy of the data can be used in a SELECT statement. This option will be ignored in REXX.

*OPTIMIZE

The system determines whether to use the data retrieved directly from the database or to use a copy of the data. The decision is based on which method provides the best performance. If COMMIT is *CHG or *CS and ALWBLK in not *ALLREAD, or if COMMIT is *ALL or *RR, then a copy of the data is used only when it is necessary to run a query.

*YES

A copy of the data is used only when necessary.

*NO

A copy of the data is not allowed. If a temporary copy of the data is required to perform the query, an error message is returned.

CLOSQLCSR

Specifies when SQL cursors are implicitly closed, SQL prepared statements are implicitly discarded, and LOCK TABLE locks are released. SQL cursors are explicitly closed when you issue the CLOSE, COMMIT, or ROLLBACK (without HOLD) SQL statements. This option will be ignored in REXX. *ENDACTGRP and *ENDMOD are for use by ILE programs and modules, SQL functions, SQL procedures, or SQL triggers. *ENDPGM, *ENDSQL, and *ENDJOB are for use by non-ILE programs.

SQL scalar functions and SQL procedures without a result set, always have an attribute of *ENDMOD.

*ENDACTGRP

SQL cursors are closed, SQL prepared statements are implicitly discarded, and LOCK TABLE locks are released when the activation group ends.

*ENDMOD

SQL cursors are closed and SQL prepared statements are implicitly discarded when the module is exited. LOCK TABLE locks are released when the first SQL program on the call stack ends.

*ENDPGM

SQL cursors are closed and SQL prepared statements are discarded when the program ends. LOCK TABLE locks are released when the first SQL program on the call stack ends.

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*ENDSQL

SQL cursors remain open between calls and can be fetched without running another SQL OPEN. One of the programs higher on the call stack must have run at least one SQL statement. SQL cursors are closed, SQL prepared statements are discarded, and LOCK TABLE locks are released when the first SQL program on the call stack ends. If *ENDSQL is specified for a program that is the first SQL program called (the first SQL program on the call stack), the program is treated as if *ENDPGM was specified.

*ENDJOB

SQL cursors remain open between calls and can be fetched without running another SQL OPEN. The programs higher on the call stack do not need to have run SQL statements. SQL cursors are left open, SQL prepared statements are preserved, and LOCK TABLE locks are held when the first SQL program on the call stack ends. SQL cursors are closed, SQL prepared statements are discarded, and LOCK TABLE locks are released when the job ends.

CNULROD

Specifies whether a NUL-terminator is returned for character and graphic host variables. This option will only be used for SQL statements in C and C++

This option is not allowed in an SQL function, SQL procedure, or SQL trigger.

*YES

Output character and graphic host variables always contain the NUL-terminator. If there is not enough space for the NUL-terminator, the data is truncated and the NUL-terminator is added. Input character and graphic host variables require a NUL-terminator.

*NO

For output character and graphic host variables, the NUL-terminator is not returned when the host variable is exactly the same length as the data. Input character and graphic host variables do not require a NUL-terminator.

COMMIT

Specifies the isolation level to be used. In REXX, files that are referred to in the source are not affected by this option. Only tables, views, and packages referred to in SQL statements are affected. For more information about isolation levels, see "Isolation level" on page 26

Specifies the isolation level of Uncommitted Read.

*NONE

Specifies the isolation level of No Commit. If the DROP SCHEMA statement is included in a REXX procedure, *NONE must be used.

*CS

Specifies the isolation level of Cursor Stability.

Specifies the isolation level of Read Stability.

*RR

Specifies the isolation level of Repeatable Read.

COMPILEOPT

Specifies additional parameters to be used on the compiler command. The COMPILEOPT string is added to the compiler command built by the

precompiler. If 'INCDIR(' is anywhere in the string, the precompiler will call the compiler using the SRCSTMF parameter. The contents of the string is not validated. The compiler command will issue an error if any parameter is incorrect. Using any of the keywords that the precompiler passes to the compiler will cause the compiler command to fail because of duplicate parameters. Refer to the Embedded SQL Programming topic collection for a list of parameters that the precompiler generates for the compiler command. This option will be ignored in REXX.

This option is not allowed in an SQL function, SQL procedure, or SQL trigger.

*NONE

No additional parameters will be used on the compiler command.

character-string

A character constant of no more than 5000 characters containing the compiler options.

DATFMT

Specifies the format used when accessing date result columns. All output date fields are returned in the specified format. For input date strings, the specified value is used to determine whether the date is specified in a valid format.

Note: An input date string that uses the format *USA, *ISO, *EUR, or *JIS is always valid.

*JOB:

The format specified for the job is used. Use the Display Job (DSPJOB) command to determine the current date format for the job.

*ISO

The International Organization for Standardization (ISO) date format (yyyy-mm-dd) is used.

*EUR

The European date format (dd.mm.yyyy) is used.

*USA

The United States date format (mm/dd/yyyy) is used.

*IIS

The Japanese Industrial Standard date format (yyyy-mm-dd) is used.

*MDY

The date format (mm/dd/yy) is used.

*DMY

The date format (dd/mm/yy) is used.

***YM**D

The date format (yy/mm/dd) is used.

*JUL

The Julian date format (yy/ddd) is used.

DATSEP

Specifies the separator used when accessing date result columns.

Note: This parameter applies only when *JOB, *MDY, *DMY, *YMD, or *JUL is specified on the DATFMT parameter.

*IOB

The date separator specified for the job is used. Use the Display Job (DSPJOB) command to determine the current value for the job.

*SLASH or '/'

A slash (/) is used.

*PERIOD or '.'

A period (.) is used.

*COMMA or ','

A comma (,) is used.

*DASH or '-'

A dash (-) is used.

*BLANK or ' '

A blank () is used.

DBGVIEW

Specifies whether the object can be debugged by the system debug facilities and the type of debug information to be provided by the compiler. The DBGVIEW parameter can only be specified in the body of SQL functions, procedures, and triggers.

If DEBUG MODE in a CREATE PROCEDURE or ALTER PROCEDURE statement is specified, a DBGVIEW option in the SET OPTION statement must not be specified.

The possible choices are:

*NONE

A debug view will not be generated.

*SOURCE

Allows the compiled module object to be debugged using SQL statement source. If *SOURCE is specified, the modified source is stored in source file QSQDSRC in the same schema as the created function, procedure, or trigger.

*STMT

Allows the compiled module object to be debugged using program statement numbers and symbolic identifiers.

*LIST

Generates the listing view for debugging the compiled module object.

If DEBUG MODE is not specified, but a DBGVIEW option in the SET OPTION statement is specified, the procedure cannot be debugged by the Unified Debugger, but can be debugged by the system debug facilities. If neither DEBUG MODE nor a DBGVIEW option is specified, the debug mode used is from the CURRENT DEBUG MODE special register.

DECFLTRND

Specifies the DECFLOAT rounding mode used for static SQL statements. The possible choices are:

*CEILING

Round toward +Infinity. If all of the discarded digits are zero or if the sign is negative the result is unchanged other than the removal of the discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

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*DOWN

Round toward zero (truncation). The discarded digits are ignored.

Round toward -Infinity. If all of the discarded digits are zero or if the sign is positive, the result is unchanged other than the removal of the discarded digits. Otherwise, the sign is negative and the result coefficient is incremented by one.

*HALFDOWN

Round to nearest; if equidistant, round down. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

*HALFEVEN

Round to nearest; if equidistant, round so that the final digit is even. If the discarded digits represent greater than half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). If they represent less than half, then the result coefficient is not adjusted (that is, the discarded digits are ignored). Otherwise (they represent exactly half), the result coefficient is unaltered if its rightmost digit is even or incremented by one (rounded up) if its rightmost digit is odd (to make an even digit).

*HALFUP

Round to nearest; if equidistant, round up. If the discarded digits represent greater than or equal to half (0.5) of the value of a one in the next left position, then the result coefficient is incremented by one (rounded up). Otherwise, the discarded digits are ignored.

*UP

Round away from zero. If all of the discarded digits are zero, the result is unchanged other than the removal of discarded digits. Otherwise, the result coefficient is incremented by one (rounded up).

Specifies the symbol that you want to represent the decimal point. The possible choices are:

*PERIOD

The representation for the decimal point is a period.

*COMMA

The representation for the decimal point is a comma.

*SYSVAL

The representation for the decimal point is the system value (QDECFMT).

*IOB

The representation for the decimal point is the job value (DECFMT).

DECRESULT

Specifies the maximum precision, maximum scale, and minimum divide scale that should be used during decimal operations, such as decimal arithmetic. The specified limits only apply to NUMERIC and DECIMAL data types.

max-precision

An integer constant that is the maximum precision that should be returned from decimal operations. The value can be 31 or 63. The default is 31.

max-scale

An integer constant that is the maximum scale that should be returned from decimal operations. The value can range from 0 to the maximum precision. The default is 31.

min-divide-scale

An integer constant that is the minimum scale that should be returned from division operations. The value can range from 0 to the maximum scale. The default is 0.

DFTRDBCOL

Specifies the schema name used for the unqualified names of tables, views, indexes, and SQL packages. This parameter applies only to static SQL statements. This option will be ignored in REXX.

*NONE

The naming convention specified on the OPTION precompile parameter or by the SET OPTION NAMING option will be used.

schema-name

Specify the name of the schema. This value is used instead of the naming convention specified on the OPTION precompile parameter or by the SET OPTION NAMING option.

DLYPRP

Specifies whether the dynamic statement validation for a PREPARE statement is delayed until an OPEN, EXECUTE, or DESCRIBE statement is run. Delaying validation improves performance by eliminating redundant validation. This option will be ignored in REXX.

*NO

Dynamic statement validation is not delayed. When the dynamic statement is prepared, the access plan is validated. When the dynamic statement is used in an OPEN or EXECUTE statement, the access plan is revalidated. Because the authority or the existence of objects referred to by the dynamic statement may change, you must still check the SQLCODE or SQLSTATE after issuing the OPEN or EXECUTE statement to ensure that the dynamic statement is still valid.

*YES

Dynamic statement validation is delayed until the dynamic statement is used in an OPEN, EXECUTE, or DESCRIBE SQL statement. When the dynamic statement is used, the validation is completed and an access plan is built. If you specify *YES, you should check the SQLCODE and SQLSTATE after running an OPEN, EXECUTE, or DESCRIBE statement to ensure that the dynamic statement is valid.

Note: If you specify *YES, performance is not improved if the INTO clause is used on the PREPARE statement or if a DESCRIBE statement uses the dynamic statement before an OPEN is issued for the statement.

DYNDFTCOL

Specifies the schema name specified for the DFTRDBCOL parameter is also used for dynamic statements. This option will be ignored in REXX.

*NO

Do not use the value specified for DFTRDBCOL for unqualified names of tables, views, indexes, and SQL packages for dynamic SQL statements. The naming convention specified on the OPTION precompile parameter or by the SET OPTION NAMING option will be used.

DYNUSRPRF

Specifies the user profile to be used for dynamic SQL statements. This option will be ignored in REXX.

*USER

Local dynamic SQL statements are run under the user profile of the job. Distributed dynamic SQL statements are run under the user profile of the application server job.

*OWNER

Local dynamic SQL statements are run under the user profile of the program's owner. Distributed dynamic SQL statements are run under the user profile of the SQL package's owner.

EVENTF

Specifies whether an event file will be generated. CoOperative Development Environment/400 (CODE/400) uses the event file to provide error feedback integrated with the CODE/400 editor.

*YES

The compiler produces an event file for use by CoOperative Development Environment/400 (CODE/400).

*NO

The compiler will not produce an event file for use by CoOperative Development Environment/400 (CODE/400).

EXTIND

Specifies how to treat indicator variable values passed for SQL statements. This option is not allowed in an SQL function, SQL procedure, or SQL trigger.

*NOEXTIND

Specifies that extended indicator variables are not enabled and non-updatable columns are not allowed in the implicit or explicit UPDATE clause of a select-statement

*EXTIND

Specifies that extended indicator variables are enabled and non-updatable columns are allowed in the implicit or explicit UPDATE clause of a select-statement.

LANGID

Specifies the language identifier to be used when SRTSEQ(*LANGIDUNQ) or SRTSEQ(*LANGIDSHR) is specified.

*JOB or *JOBRUN

The LANGID value for the job is used.

For distributed applications, LANGID(*JOBRUN) is valid only when SRTSEQ(*JOBRUN) is also specified.

language-id

Specify a language identifier to be used. For information about the values that can be used for the language identifier, see the Language identifier topic in the Globalization topic collection.

MONITOR

Specifies whether the statements should be identified as user or system statements when a database monitor is run.

*USER

The SQL statements are identified as user statements. This is the default.

*SYSTEM

The SQL statements are identified as system statements.

NAMING

Specifies whether the SQL naming convention or the system naming convention is to be used. This option is not allowed in an SQL function, SQL procedure, or SQL trigger.

The possible choices are:

*SYS

The system naming convention will be used.

*SOL

The SQL naming convention will be used.

OPTLOB

Specifies whether accesses to LOBs can be optimized when accessing through DRDA. The possible choices are:

*YES

LOB accesses should be optimized. The first FETCH for a cursor determines how the cursor will be used for LOBs on all subsequent FETCHes. This option remains in effect until the cursor is closed.

If the first FETCH uses a LOB locator to access a LOB column, no subsequent FETCH for that cursor can fetch that LOB column into a LOB variable.

If the first FETCH places the LOB column into a LOB variable, no subsequent FETCH for that cursor can use a LOB locator for that column.

*NO

LOB accesses should not be optimized. There is no restriction on whether a column is retrieved into a LOB locator or into a LOB variable. This option can cause performance to degrade.

OUTPUT

Specifies whether the precompiler and compiler listings are generated. The OUTPUT parameter can only be specified in the body of SQL functions, procedures, and triggers. The possible choices are:

*NONE

The precompiler and compiler listings are not generated.

*PRINT

The precompiler and compiler listings are generated.

RDBCNNMTH

Specifies the semantics used for CONNECT statements. This option will be ignored in REXX.

*DUW

CONNECT (Type 2) semantics are used to support distributed unit of work. Consecutive CONNECT statements to additional relational databases do not result in disconnection of previous connections.

*RUW

CONNECT (Type 1) semantics are used to support remote unit of work. Consecutive CONNECT statements result in the previous connection being disconnected before a new connection is established.

SOLCA

Specifies whether the fields in an SQLCA will be set after each SQL statement. The SQLCA option is only allowed for ILE C, ILE C++, ILE COBOL, and ILE RPG. This option is not allowed in an SQL function, SQL procedure, or SQL trigger.

The possible choices are:

*YES

The fields in an SQLCA will be set after each SQL statement. The user program can reference all the values in the SQLCA following the execution of an SQL statement.

*NO

The fields in an SQLCA will not be set after each SQL statement. The user program should use the GET DIAGNOSTICS statement to retrieve information about the execution of the SQL statement.

SQLCA(*NO) will typically perform better than SQLCA(*YES).

In other host languages, an SQLCA is required and fields in the SQLCA will be set after each SQL statement.

SQLCURRULE

Specifies the semantics used for SQL statements.

*DB2

The semantics of all SQL statements will default to the rules established for DB2. The following semantics are controlled by this option:

- · Hexadecimal constants are treated as character data.
- Unicode graphic-string constants are UCS-2 (CCSID 13488).
- Assignments to SQL-variables and SQL-parameters within the body of a routine or a trigger will use retrieval assignment rules.
- When describing a select statement into an SQLDA and SQLN is smaller than the required number of SQLVAR entries, SQLSTATE 01005 is returned only when the result table contains LOBs or UDTs.

*STD

The semantics of all SQL statements will default to the rules established by the ISO and ANSI SQL standards. The following semantics are controlled by this option:

- Hexadecimal constants are treated as binary data.
- Unicode graphic-string constants are UTF-16 (CCSID 1200).
- Assignments to SQL-variables and SQL-parameters within the body of a routine or a trigger will use storage assignment rules.
- When describing a select statement into an SQLDA and SQLN is smaller than the required number of SQLVAR entries, SQLSTATE 01005 is always returned.

SOLPATH

Specifies the path to be used to find procedures, functions, and user defined types in static SQL statements. This option will be ignored in REXX.

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*LIBL

The path used is the library list at runtime.

character-string

A character constant with one or more schema names that are separated by commas.

SRTSEO

Specifies the collating sequence table to be used for string comparisons in SQL statements.

Note: *HEX must be specified if a REXX procedure connects to an application server that is not a DB2 for i or a System i product whose release level is prior to V2R3M0.

*JOB or *JOBRUN

The SRTSEQ value for the job is used.

*HEX

A collating sequence table is not used. The hexadecimal values of the characters are used to determine the collating sequence.

*LANGIDUNQ

The collating sequence table must contain a unique weight for each character in the code page.

*LANGIDSHR

The shared-weight sort table for the LANGID specified is used.

srtseq-table-name

Specify the name of the collating sequence table to be used with this program. The name of the collating sequence table can be qualified by one of the following library values:

*LIBL

All libraries in the user and system portions of the job's library list are searched until the first match is found.

*CURLIB

The current library for the job is searched. If no library is specified as the current library for the job, the QGPL library is used.

library-name

Specify the name of the library to be searched.

TGTRLS

Specifies the release of the operating system on which the user intends to use the object being created. The TGTRLS parameter can only be specified in the body of SQL functions, procedures, and triggers. The possible choices are:

VxRxMx

Specify the release in the format VxRxMx, where Vx is the version, Rx is the release, and Mx is the modification level. For example, V5R4M0 is version 5, release 4, modification level 0. The object can be used on a system with the specified release or with any subsequent release of the operating system installed.

Valid values depend on the current version, release, and modification level, and they change with each new release. If you specify a release-level which is earlier than the earliest release level supported by the database manager, an error message is sent indicating the earliest supported release.

The TGTRLS option can only be specified for SQL functions, SQL procedures, and triggers.

TIMFMT

Specifies the format used when accessing time result columns. All output time fields are returned in the specified format. For input time strings, the specified value is used to determine whether the time is specified in a valid format.

Note: An input time string that uses the format *USA, *ISO, *EUR, or *JIS is always valid.

*HMS

The (hh:mm:ss) format is used.

*ISO

The International Organization for Standardization (ISO) time format (hh.mm.ss) is used.

*EUR

The European time format (hh.mm.ss) is used.

*USA

The United States time format (hh:mm xx) is used, where xx is AM or PM.

*JIS

The Japanese Industrial Standard time format (hh:mm:ss) is used.

TIMSEP

Specifies the separator used when accessing time result columns.

Note: This parameter applies only when *HMS is specified on the TIMFMT parameter.

*JOB

The time separator specified for the job is used. Use the Display Job (DSPJOB) command to determine the current value for the job.

*COLON or ':'

A colon (:) is used.

*PERIOD or '.'

A period (.) is used.

*COMMA or ','

A comma (,) is used.

*BLANK or ' '

A blank () is used.

USRPRF

Specifies the user profile that is used when the compiled program object is run, including the authority that the program object has for each object in static SQL statements. The profile of either the program owner or the program user is used to control which objects can be used by the program object. This option will be ignored in REXX.

*NAMING

The user profile is determined by the naming convention. If the naming convention is *SQL, USRPRF(*OWNER) is used. If the naming convention is *SYS, USRPRF(*USER) is used.

*USER

The profile of the user running the program object is used.

*OWNER

The user profiles of both the program owner and the program user are used when the program is run.

Notes

Default values: The default values for the options depend on the language, object type, and the options in effect at create time:

- When an SQL procedure, SQL function, or SQL trigger is created, the default values for the options are those in effect at the time the object is created. For example, if an SQL procedure is created and the current COMMIT option is *CS, *CS is the default COMMIT option. Each option is then updated as it is encountered within the SET OPTION statement.
- For application programs other than REXX, the default values for the options are specified on the CRTSQLxxx command. Each option is then updated as it is encountered within a SET OPTION statement. All SET OPTION statements must precede any other embedded SQL statements.
- At the start of a REXX procedure the options are set to their default value. The default value for each option is the first value listed in the syntax diagram. When an option is changed by a SET OPTION statement, the new value will stay in effect until the option is changed again or the REXX procedure ends.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- *UR can be used as a synonym for *CHG.
- *NC can be used as a synonym for *NONE.
- *RS can be used as a synonym for *ALL.

Examples

Example 1: Set the isolation level to *ALL and the naming mode to SQL names. EXEC SQL SET OPTION COMMIT =*ALL, NAMING =*SQL

Example 2: Set the date format to European, the isolation level to *CS, and the decimal point to the comma.

EXEC SQL SET OPTION DATFMT = *EUR, COMMIT = *CS, DECMPT = *COMMA

SET PATH

The SET PATH statement changes the value of the CURRENT PATH special register.

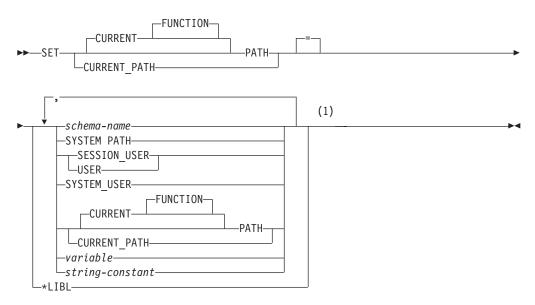
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax



Notes:

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1 SYSTEM PATH, SESSION_USER, USER, SYSTEM_USER, and CURRENT PATH may each be specified at most once on the right side of the statement.

Description

schema-name

Identifies a schema. No validation that the schema exists is made at the time the PATH is set. For example, if a *schema-name* is misspelled, it could affect the way subsequent SQL operates. Although not recommended, PATH can be specified as a *schema-name* if it is specified as a *delimited* identifier.

SYSTEM PATH

Specifies the schema names for the system path. This value is the same as specifying the schema names "QSYS", "QSYS2", "SYSPROC", "SYSIBMADM".

SESSION_USER or USER

Specifies the value of the SESSION_USER special register.

SYSTEM USER

Specifies the value of the SYSTEM_USER special register.

CURRENT PATH

Specifies the value of the CURRENT PATH special register before the execution of this statement. CURRENT PATH is not allowed if the current path is *LIBL.

variable

Specifies a variable that contains one or more schema names that are separated by commas.

The variable:

- Must be a CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable. The actual length of the contents of the variable must not exceed the maximum length of a path.
- Must not be followed by an indicator variable.
- Must not be the null value.
- Each schema name must conform to the rules for forming an ordinary or delimited identifier.
- Each schema name must not contain lowercase letters or characters that cannot be specified in an ordinary identifier.
- Must be padded on the right with blanks if the variable is fixed length character.

string-constant

A character constant with one or more schema names that are separated by commas.

The string constant:

- Each schema name must conform to the rules for forming an ordinary or delimited identifier.
- · Each schema name must not contain lowercase letters or characters that cannot be specified in an ordinary identifier.

Notes

Transaction considerations: The SET PATH statement is not a commitable operation. ROLLBACK has no effect on the CURRENT PATH.

Rules for the content of the SQL path:

- A schema name must not appear more than once in the path.
- The number of schemas that can be specified is limited by the total length of the CURRENT PATH special register. The special register string is built by taking each schema name specified and removing trailing blanks, delimiting with double quotes, and separating each schema name by a comma. An error is returned if the length of the resulting string exceeds 3483 bytes. A maximum of 268 schema names can be represented in the path.
- There is a difference between specifying a single keyword (such as USER, or PATH, or CURRENT PATH) as a single keyword, or as a delimited identifier. To indicate that the current value of a special register specified as a single keyword should be used in the SQL path, specify the name of the special register as a keyword. If the name of the special register is specified as a delimited identifier instead (for example, "USER"), it is interpreted as a schema name of that value ('USER'). For example, assuming that the current value of the USER special register is SMITH, then SET PATH = SYSIBM, USER, "USER" results in a CURRENT PATH value of "SYSIBM", "SMITH", "USER".
- The following rules are used to determine whether a value specified in a SET PATH statement is a variable or a *schema-name*:

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- If *name* is the same as a parameter or SQL variable in the SQL procedure, name is interpreted as a parameter or SQL variable, and the value in name is assigned to PATH.
- If name is not the same as a parameter or SQL variable in the SQL procedure, name is interpreted as schema-name, and the value name is assigned to PATH.

The system path: SYSTEM PATH refers to the system path for a platform. The schemas QSYS, QSYS2, SYSPROC, and SYSIBMADM do not need to be specified. If not included in the path, they are implicitly assumed as the last schemas (in this case, it is not included in the CURRENT PATH special register).

The initial value of the CURRENT PATH special register is *LIBL if system naming was used for the first SQL statement run in the activation group. The initial value is "QSYS", "QSYS2", "SYSPROC", "SYSIBMADM", "X" (where X is the value of the USER special register) if SQL naming was used for the first SQL statement.

Using the SQL path: The CURRENT PATH special register is used to resolve user-defined distinct types, functions, and procedures in dynamic SQL statements. For more information see "SQL path" on page 60.

Example

The following statement sets the CURRENT PATH special register.

SET PATH = FERMAT, "McDuff", SYSIBM

The following statement retrieves the current value of the SQL path special register into the host variable called CURPATH.

EXEC SQL VALUES (CURRENT PATH) INTO : CURPATH;

The value would be "FERMAT", "McDuff", "SYSIBM" if set by the previous example.

SET RESULT SETS

The SET RESULT SETS statement the result sets that can be returned from an external procedure when the procedure is called by a System i Access Family client, the SQL Call Level Interface, or when accessed from a remote system using DRDA.

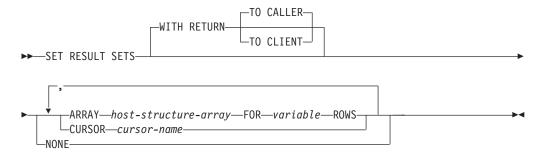
Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It is not allowed in a Java or REXX procedure.

Authorization

None required.

Syntax



Description

WITH RETURN

Specifies that the result table of the cursor is intended to be used as a result set that will be returned from a procedure.

For non-scrollable cursors, the result set consists of all rows from the current cursor position to the end of the result table. For scrollable cursors, the result set consists of all rows of the result table.

TO CALLER

Specifies that the cursor can return a result set to the caller of the procedure. For example, if the caller is a client application, the result set is returned to the client application.

TO CLIENT

Specifies that the cursor can return a result set to the client application. This cursor is invisible to any intermediate nested procedures. If a function or trigger called the procedure either directly or indirectly, result sets cannot be returned to the client and the cursor will be closed after the procedure finishes.

CURSOR cursor-name

Identifies a cursor to be used to define a result set that can be returned from a procedure. The cursor-name must identify a declared cursor as explained in "Description" on page 846 for the DECLARE CURSOR statement. When the SET RESULT SETS statement is executed, the cursor must be in the open state.

ARRAY *host-structure-array*

host-structure-array identifies an array of host structures defined in accordance with the rules for declaring host structures. The array cannot contain a C NUL-terminated host variable.

The first structure in the array corresponds to the first row of the result set, the second structure in the array corresponds to the second row of the result set, and so on. In addition, the first value in the row corresponds to the first item in the structure, the second value in the row corresponds to the second item in the structure, and so on.

LOBs cannot be returned in an array when using DRDA.

Only one array can be specified in a SET RESULT SETS statement, including any RETURN TO CLIENT array result sets from nested calls to procedures.

FOR variable ROWS

Specifies the number of rows in the result set. The variable must be a numeric variable with zero scale, and it must not include an indicator variable. The number of rows specified must be in the range of 0 to 32767 and must be less than or equal to the dimension of the host structure array.

NONE

Specifies that no result sets will be returned. Cursors left open when the procedure ends will not be returned.

Notes

Result sets are only returned if the procedure is directly called or if the procedure is a RETURN TO CLIENT procedure and is indirectly called from ODBC, JDBC, OLE DB, .NET, the SQL Call Level Interface, or the System i Access Family Optimized SQL API. For more information about result sets, see Result sets from procedures and WITH RETURN clause.

External procedures: There are three ways to return result sets from an external procedure:

- If a SET RESULT SETS statement is executed in the procedure, the SET RESULT SETS statement identifies the result sets. The result sets are returned in the order specified on the SET RESULT SETS statement.
- If a SET RESULT SETS statement is not executed in the procedure,
 - If no cursors have specified a WITH RETURN clause, each cursor that the procedure opens and leaves open when it returns identifies a result set. The result sets are returned in the order in which the cursors are opened.
 - If any cursors have specified a WITH RETURN clause, each cursor that is defined with the WITH RETURN clause that the procedure opens and leaves open when it returns identifies a result set. The result sets are returned in the order in which the cursors are opened.

When a result set is returned using an open cursor, the rows are returned starting with the current cursor position.

The RESULT SETS clause should be specified on the ALTER PROCEDURE (External), CREATE PROCEDURE (External) statement, or DECLARE PROCEDURE statement to return result sets from a procedure. The maximum number of result sets returned cannot be larger than the number specified on the ALTER PROCEDURE (External), CREATE PROCEDURE (External) statement, or DECLARE PROCEDURE statement.

SET RESULT SETS

SQL procedures: In order to return result sets from an SQL procedure, the procedure must be created with the RESULT SETS clause. Each cursor that is defined with the WITH RETURN clause that the procedure opens and leaves open when it returns identifies a result set.

- If a SET RESULT SETS statement is executed in the procedure, the SET RESULT SETS statement identifies which of these result sets to return. The result sets are returned in the order specified on the SET RESULT SETS statement.
- If a SET RESULT SETS statement is not executed in the procedure the result sets are returned in the order in which the cursors are opened.

When a result set is returned using an open cursor, the rows are returned starting with the current cursor position.

The RESULT SETS clause must be specified on the CREATE PROCEDURE (SQL) statement to return any result sets from an SQL procedure. The maximum number of result sets returned cannot be larger than the number specified on the CREATE PROCEDURE statement.

Example

The following SET RESULT SETS statement specifies cursor X as the result set that will be returned when the procedure is called. For more information and complete examples showing the use of result sets from ODBC clients, see the System i Access Family topic collection.

EXEC SQL SET RESULT SETS CURSOR X;

SET SCHEMA

The SET SCHEMA statement changes the value of the CURRENT SCHEMA special register.

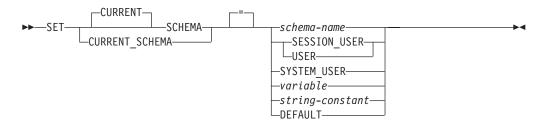
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax



Description

schema-name

Identifies a schema. No validation that the schema exists is made at the time the current schema is set.

If the value specified does not conform to the rules for a schema-name, an error is returned.

SESSION_USER or USER

This value is the SESSION_USER special register.

SYSTEM USER

This value is the SYSTEM_USER special register.

Specifies a variable which contains a schema name. The content is not folded to uppercase.

The variable:

- Must be a character-string or Unicode graphic variable. The actual length of the contents of the variable after trimming any trailing blanks must not exceed the length of a schema name. See Appendix A, "SQL limits," on page 1205.
- Must not be followed by an indicator variable.
- Must not be the null value.
- Must conform to the rules for forming an ordinary or delimited identifier.
- Must be padded on the right with blanks if the variable is fixed length.
- Must not be the keyword SESSION_USER, SYSTEM_USER, or USER.

string-constant

A character constant with a schema name.

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The string constant:

- Must have a length after trimming any trailing blanks that does not exceed the maximum length of a schema name
- Must include a schema name that is left justified and conforms to the rules for forming an ordinary or delimited identifier.
- Must not be the keyword SESSION_USER, SYSTEM_USER, or USER.

DEFAULT

The CURRENT SCHEMA is set to its initial value. The initial value for SQL naming is USER. The initial value for system naming is *LIBL.

Notes

Considerations for keywords: There is a difference between specifying a single keyword (such as USER) as a single keyword or as a delimited identifier. To indicate that the current value of the USER special register should be used for setting the current schema, specify USER as a keyword. If USER is specified as a delimited identifier instead (for example, "USER"), it is interpreted as a schema name of that value ("USER").

Transaction considerations: The SET SCHEMA statement is not a commitable operation. ROLLBACK has no effect on the CURRENT SCHEMA.

Impact on other special registers: Setting the CURRENT SCHEMA special register does not effect the CURRENT PATH special register. Hence, the CURRENT SCHEMA will not be included in the SQL path and functions, procedures and user-defined type resolution may not find these objects. To include the current schema value in the SQL path, whenever the SET SCHEMA statement is issued, also issue the SET PATH statement including the schema name from the SET SCHEMA statement.

CURRENT SCHEMA: The value of the CURRENT SCHEMA special register is used as the qualifier for some unqualified names in all dynamic SQL statements except in programs where the DYNDFTCOL has been specified. If DYNDFTCOL is specified in a program, its schema name is used instead of the CURRENT SCHEMA schema name. For information about qualification of names, see "Qualification of unqualified object names" on page 60.

For SQL naming, the initial value of the CURRENT SCHEMA special register is equivalent to USER. For system naming, the initial value of the CURRENT SCHEMA special register is '*LIBL'.

Syntax alternatives: CURRENT SQLID is accepted as a synonym for CURRENT SCHEMA and the effect of a SET CURRENT SQLID statement will be identical to that of a SET CURRENT SCHEMA statement. No other effects, such as statement authorization changes, will occur.

SET SCHEMA is equivalent to calling the QSQCHGDC API.

Examples

Example 1: The following statement sets the CURRENT SCHEMA special register. SET SCHEMA = RICK

Example 2: The following example retrieves the current value of the CURRENT SCHEMA special register into the host variable called CURSCHEMA.

SET SCHEMA

EXEC SQL VALUES(CURRENT SCHEMA) INTO :CURSCHEMA

The value would be RICK, set by the previous example.

SET SESSION AUTHORIZATION

The SET SESSION AUTHORIZATION statement changes the value of the SESSION_USER and USER special registers. It also changes the name of the user profile associated with the current thread.

Invocation

This statement can be embedded within an application program or issued interactively. It is an executable statement that can be dynamically prepared. It must not be specified in REXX.

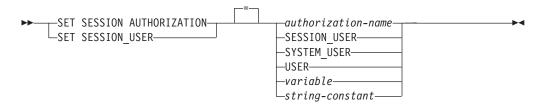
SET SESSION AUTHORIZATION is not allowed in an SQL trigger, SQL function, or SQL procedure.

Authorization

If the authorization name specified on the statement is different than the value in the SYSTEM_USER special register, the privileges held by the authorization ID of the statement must include the system authority of *ALLOBJ.

No authorization is required to execute this statement if the authorization name specified on the statement is the same as the SYSTEM_USER special register.

Syntax



Description

authorization-name

Identifies an authorization ID that is to be used as the new value for the SESSION_USER special register and the runtime authorization ID.

The authorization ID must be a valid user profile or group user profile that exists at the current server. Several system user profiles that do not have a user profile handle may not be used. For more information, see the Get Profile Handle API.

SESSION USER or USER

The SESSION_USER special register and the runtime authorization ID are set to the USER special register.

SYSTEM USER

The SESSION_USER special register and the runtime authorization ID are set to the SYSTEM_USER special register.

variable

A variable which contains an authorization ID name.

The variable:

Must be a character-string variable.

SET SESSION AUTHORIZATION

- If variable has an associated indicator variable, the value of that indicator variable must not indicate a null value
- · Must include an authorization ID that is left justified and must conform to the rules for forming an ordinary or delimited identifier.
- Must be padded on the right with blanks.
- · Must not be the null value.
- Must not be the keyword USER, SESSION_USER, or SYSTEM_USER.

string-constant

A character constant with an authorization ID.

Notes

Other effects of SET SESSION AUTHORIZATION: SET SESSION

AUTHORIZATION causes the following to occur:

- All cursors that were opened during the unit of work are closed.
- All LOB locators are freed.
- All locks acquired under this unit of work's commitment definition are released.
- All prepared statements are destroyed.
- All SQL descriptor areas are deallocated.
- All procedure result sets are cleared.
- The encryption password is reset.
- · All open native database files and Integrated File System (IFS) files are closed, including sockets, NTC sessions, and memory maps.

Other resources are preserved when SET SESSION AUTHORIZATION is executed, including declared temporary tables. It is recommended that all declared temporary tables be dropped or cleared before executing the SET SESSION AUTHORIZATION statement.

SET SESSION AUTHORIZATION restrictions: This statement can only be issued as the first statement that results in work that might be backed out during the unit of work. The following executable statements may be issued prior to executing SET SESSION AUTHORIZATION:

- All SQL transaction statements
- All SQL connection statements
- · All SQL session statements
- GET DIAGNOSTICS

SET SESSION AUTHORIZATION is not allowed if any connections other than the connection to the current server exist, including any local connections to a non-default activation group.

SET SESSION AUTHORIZATION is not allowed if any held cursors are open or any held locators exist.

SET SESSION AUTHORIZATION scope: The scope of the SET SESSION AUTHORIZATION is the current thread. Other threads in the application process are unaffected.

SET SESSION AUTHORIZATION

Examples

Example 1: The following statement sets the SESSION_USER special register. SET SESSION_USER = RAJIV

Example 2: Set the session authorization ID (the SESSION_USER special register) to be the value of the system authorization ID, which is the ID that established the connection on which the statement has been issued.

SET SESSION AUTHORIZATION SYSTEM_USER

SET TRANSACTION

The SET TRANSACTION statement sets the isolation level, read only attribute, or diagnostics area size for the current unit of work.

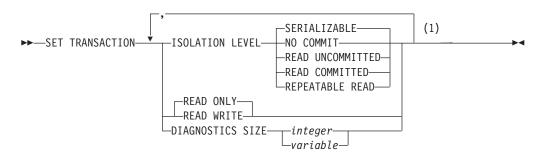
Invocation

This statement can be embedded within an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax 1 4 1



Notes:

Only one ISOLATION LEVEL clause, one READ WRITE or READ ONLY 1 clause, and one DIAGNOSTICS SIZE clause may be specified.

Description

ISOLATION LEVEL

Specifies the isolation level of the transaction. If the ISOLATION LEVEL clause is not specified, ISOLATION LEVEL SERIALIZABLE is implicit

NO COMMIT

Specifies isolation level NC (COMMIT(*NONE)).

READ UNCOMMITTED

Specifies isolation level UR (COMMIT(*CHG)).

READ COMMITTED

Specifies isolation level CS (COMMIT(*CS)).

REPEATABLE READ

Specifies isolation level RS (COMMIT(*ALL)).

SERIALIZABLE

Specifies isolation level RR (COMMIT(*RR)).

READ WRITE or READ ONLY

Specifies whether the transaction allows data change operations.

READ WRITE

Specifies that all SQL operations are allowed. This is the default unless ISOLATION LEVEL READ UNCOMMITTED is specified.

READ ONLY

Specifies that only SQL operations that do not change SQL data are allowed. If ISOLATION LEVEL READ UNCOMMITTED is specified, this is the default.

DIAGNOSTICS SIZE

Specifies the maximum number of GET DIAGNOSTICS condition areas for the current transaction. The GET DIAGNOSTICS statement-information-item MORE will be set to 'Y' for the current statement if the statement exceeds the maximum number of condition areas for the current transaction. The specified maximum number of condition areas must be between 1 and 32767.

integer

An integer constant that specifies the maximum number of condition areas for the current transaction.

variable

Identifies a variable which contains the maximum number of condition areas for the current transaction. The variable must be a numeric variable with a zero scale and must not be followed by an indicator variable.

Notes

Scope of SET TRANSACTION: The SET TRANSACTION statement sets the isolation level for SQL statements for the current activation group of the process. If that activation group has commitment control scoped to the job, then the SET TRANSACTION statement sets the isolation level of all other activation groups with job commit scoping as well.

If an isolation clause is specified in an SQL statement, that isolation level overrides the transaction isolation level and is used for the SQL statement.

The scope of the SET TRANSACTION statement is based on the context in which it is run. If the SET TRANSACTION statement is run in a trigger, the isolation level specified applies to all subsequent SQL statements until another SET TRANSACTION statement occurs or until the trigger completes, whichever happens first. If the SET TRANSACTION statement is run outside a trigger, the isolation level specified applies to all subsequent SQL statements (except those statements within a trigger that are executed after a SET TRANSACTION statement in the trigger) until a COMMIT or ROLLBACK operation occurs.

For more information about isolation levels, see "Isolation level" on page 26.

SET TRANSACTION restrictions: The SET TRANSACTION statement can only be executed when it is the first SQL statement in a unit of work, unless:

- all previous statements executed in the unit of work are SET TRANSACTION statements or statements that are executed under isolation level NC, or
- it is executed in a trigger.

In a trigger, SET TRANSACTION with READ ONLY is allowed only on a COMMIT boundary. The SET TRANSACTION statement can be executed in a trigger at any time, but it is recommended that it be executed as the first statement in the trigger. The SET TRANSACTION statement is useful within triggers to set the isolation level for SQL statements in the trigger to the same level as the application which caused the trigger to be activated.

A SET TRANSACTION statement is not allowed if the current connection is to a remote application server unless it is in a trigger at the current server. Once a SET TRANSACTION statement is executed, CONNECT and SET CONNECTION statements are not allowed until the unit of work is committed or rolled back.

SET TRANSACTION is not allowed as the first statement in a secondary thread.

The SET TRANSACTION statement has no effect on WITH HOLD cursors that are still open when the SET TRANSACTION statement is executed.

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keywords NC or NONE can be used as synonyms for NO COMMIT.
- The keywords UR and CHG can be used as synonyms for READ UNCOMMITTED.
- The keyword CS can be used as a synonym for READ COMMITTED.
- The keywords RS or ALL can be used as synonyms for REPEATABLE READ.
- The keyword RR can be used as a synonym for SERIALIZABLE.

Examples

Example 1: The following SET TRANSACTION statement sets the isolation level to NONE (equivalent to specifying *NONE on the SQL precompiler command).

EXEC SQL SET TRANSACTION ISOLATION LEVEL NO COMMIT;

Example 2: The following SET TRANSACTION statement sets the isolation level to SERIALIZABLE.

SET TRANSACTION ISOLATION LEVEL SERIALIZABLE

SET transition-variable

The SET transition-variable statement assigns values to new transition variables.

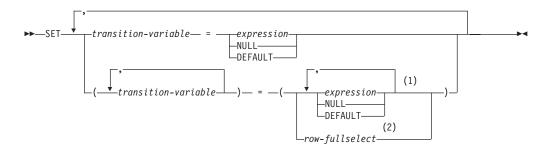
Invocation

This statement can only be used as an SQL statement in a BEFORE trigger. It is an executable statement that cannot be dynamically prepared.

Authorization

If a row-fullselect is specified, see "fullselect" on page 506 for an explanation of the authorization required for each subselect.

Syntax



Notes:

- The number of expressions, NULLs, and DEFAULTs must match the number of transition-variables.
- 2 The number of columns in the select list must match the number of transition-variables.

Description

transition-variable

Identifies the column to be updated in the new row. A transition-variable must identify a column in the subject table of a trigger, optionally qualified by a correlation name that identifies the new value. An OLD transition-variable must not be identified.

A transition-variable must not be identified more than once in the same SET transition-variable statement.

The data type of each transition-variable must be compatible with its corresponding result column. Values are assigned to transition-variables according to the storage assignment rules. For more information see "Assignments and comparisons" on page 89.

expression

Specifies the new value of the transition-variable. The expression is any expression of the type described in "Expressions" on page 152. The expression cannot include an aggregate function.

An expression may contain references to OLD and NEW transition-variables. If the CREATE TRIGGER statement contains both OLD and NEW clauses, references to transition-variables must be qualified by the correlation-name.

NULL

Specifies the null value. NULL can only be specified for nullable columns.

DEFAULT

Specifies that the default value of the column associated with the *transition-variable* will be used. DEFAULT is not allowed if the column is an IDENTITY column, a row change timestamp column, or has a ROWID data type.

row-fullselect

A fullselect that returns a single result row. The result column values are assigned to each corresponding *transition-variable*. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

Notes

Multiple assignments: If more than one assignment is included in the same SET *transition-variable* statement, all *expressions* are evaluated before the assignments are performed. Thus, references to *transition-variables* in an expression are always the value of the *transition-variables* prior to any assignment in the SET statement.

Examples

Example 1: Ensure that the salary column is never greater than 50000. If the new value is greater than 50000, set it to 50000.

```
CREATE TRIGGER LIMIT_SALARY
BEFORE INSERT ON EMPLOYEE
REFERENCING NEW AS NEW_VAR
FOR EACH ROW MODE DB2SQL
WHEN (NEW_VAR.SALARY > 50000)
BEGIN ATOMIC
SET NEW_VAR.SALARY = 50000;
END
```

Example 2: When the job title is updated, increase the salary based on the new job title. Assign the years in the position to 0.

```
CREATE TRIGGER SET_SALARY

BEFORE UPDATE OF JOB ON STAFF

REFERENCING OLD AS OLD_VAR

NEW AS NEW_VAR

FOR EACH ROW MODE DB2SQL

BEGIN ATOMIC

SET (NEW_VAR.SALARY, NEW_VAR.YEARS) =

(OLD_VAR.SALARY * CASE NEW_VAR.JOB

WHEN 'Sales' THEN 1.1

WHEN 'Mgr' THEN 1.05

ELSE 1 END ,0);

END
```

SET variable

The SET variable statement produces a result table consisting of at most one row and assigns the values in that row to variables.

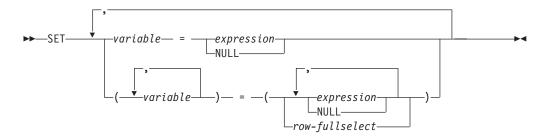
Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

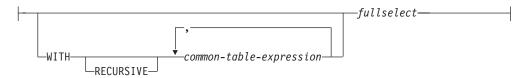
Authorization

If a row-fullselect is specified, see "fullselect" on page 506 for an explanation of the authorization required for each subselect.

Syntax



row-fullselect:



Description

variable, ...

Identifies one or more variables or host structures that must be declared in accordance with the rules for declaring variables (see "References to host variables" on page 136). A host structure is logically replaced by a list of variables that represent each of the elements of the host structure.

The value to be assigned to each *variable* can be specified immediately following the variable, for example, variable = expression, variable = expression. Or, sets of parentheses can be used to specify all the variables and then all the values, for example, (variable, variable) = (expression, expression).

The data type of each variable must be compatible with its corresponding result column. Each assignment is made according to the rules described in "Assignments and comparisons" on page 89. The number of variables specified to the left of the equal operator must equal the number of values in the corresponding result specified to the right of the equal operator. If the value is null, an indicator variable must be provided. If an assignment error occurs, the

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value is not assigned to the variable, and no more values are assigned to variables. Any values that have already been assigned to variables remain assigned.

If an error occurs as the result of an arithmetic expression in the expression or SELECT list of the subselect (division by zero, or overflow) or a character conversion error occurs, the result is the null value. As in any other case of a null value, an indicator variable must be provided. The value of the variable is undefined. In this case, however, the indicator variable is set to -2. Processing of the statement continues as if the error had not occurred. (However, a warning is returned.) If you do not provide an indicator variable, an error is returned. It is possible that some values have already been assigned to variables and will remain assigned when the error occurs.

expression

Specifies the new value of the variable. The *expression* is any expression of the type described in "Expressions" on page 152. It must not include a column name.

NULL

Specifies that the new value for the variable is the null value.

A fullselect that returns a single result row. The result column values are assigned to each corresponding variable. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

WITH *common-table-expression*

Specifies a common table expression. For an explanation of common table expression, see "common-table-expression" on page 513.

A fullselect that returns a single result row. The result column values are assigned to each corresponding variable. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

Notes

Variable assignment: If the specified variable is character and is not large enough to contain the result, a warning (SQLSTATE 01004) is returned (and 'W' is assigned to SQLWARN1 in the SQLCA). The actual length of the result is returned in the indicator variable associated with the variable, if an indicator variable is provided.

If the specified variable is a C NUL-terminated variable and is not large enough to contain the result and the NUL-terminator:

- If the *CNULRQD option is specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*YES) on the SET OPTION statement), the following
 - The result is truncated.
 - The last character is the NUL-terminator.
 - The value 'W' is assigned to SQLWARN1 in the SQLCA.
- If the *NOCNULRQD option on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement) is specified, the following
 - The NUL-terminator is not returned.

- The value 'N' is assigned to SQLWARN1 in the SQLCA.

Multiple assignments: If more than one assignment is included in the same SET statement, all expressions and row-fullselects are completely evaluated before the assignments are performed. Thus, references to a target variable in an expression or row-fullselect are always the value of the target variable prior to any assignment in the SET statement.

Examples

Example 1: Assign the value of the CURRENT PATH special register to host variable HV1.

```
EXEC SQL SET :HV1 = CURRENT PATH;
```

Example 2: Assume that LOB locator LOB1 is associated with a CLOB value. Assign a portion of the CLOB value to host variable DETAILS using the LOB locator.

```
EXEC SQL SET :DETAILS = SUBSTR(:LOB1,1,35);
```

SIGNAL

The SIGNAL statement signals an error or warning condition. It causes an error or warning to be returned with the specified SQLSTATE and optional *condition-information-items*.

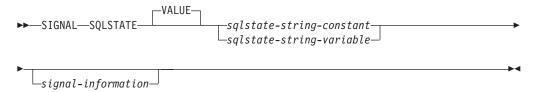
Invocation

This statement can only be embedded in an application program. It is an executable statement that cannot be dynamically prepared. It must not be specified in REXX.

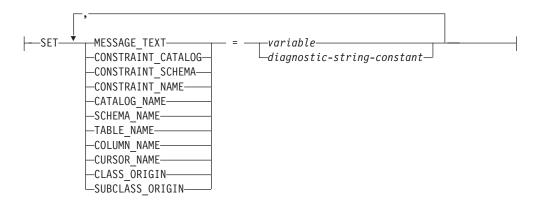
Authorization

None required.

Syntax



signal-information:



Description

SQLSTATE VALUE

Specifies the SQLSTATE that will be signalled. The specified value must not be null and must follow the rules for SQLSTATEs:

- Each character must be from the set of digits ('0' through '9') or non-accented upper case letters ('A' through 'Z').
- The SQLSTATE class (first two characters) cannot be '00' since this represents successful completion.

If the SQLSTATE does not conform to these rules, an error is returned.

sqlstate-string-constant

The *sqlstate-string-constant* must be a character string constant with exactly 5 characters.

sqlstate-string-variable

The *sqlstate-string-variable* must be a character or Unicode graphic variable. The actual length of the contents of the *variable* must be 5.

SET

Introduces the assignment of values to *condition-information-items*. The *condition-information-item* values can be accessed using the GET DIAGNOSTICS statement. The only *condition-information-item* that can be accessed in the SQLCA is MESSAGE_TEXT.

MESSAGE TEXT

Specifies a string that describes the error or warning.

If an SQLCA is used,

- · the string is returned in the SQLERRMC field of the SQLCA
- if the actual length of the string is longer than 1000 bytes, it is truncated without a warning.

CONSTRAINT CATALOG

Specifies a string that indicates the name of the database that contains a constraint related to the signalled error or warning.

CONSTRAINT SCHEMA

Specifies a string that indicates the name of the schema that contains a constraint related to the signalled error or warning.

CONSTRAINT NAME

Specifies a string that indicates the name of a constraint related to the signalled error or warning.

CATALOG_NAME

Specifies a string that indicates the name of the database that contains a table or view related to the signalled error or warning.

SCHEMA_NAME

Specifies a string that indicates the name of the schema that contains a table or view related to the signalled error or warning.

TABLE NAME

Specifies a string that indicates the name of a table or view related to the signalled error or warning.

COLUMN_NAME

Specifies a string that indicates the name of a column in the table or view related to the signalled error or warning.

CURSOR NAME

Specifies a string that indicates the name of a cursor related to the signalled error or warning.

CLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE class related to the signalled error or warning.

SUBCLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE subclass related to the signalled error or warning.

variable

Identifies a variable that must be declared in accordance with the rules for declaring variables (see "References to host variables" on page 136). The variable contains the value to be assigned to the *condition-information-item*. The variable must be defined as CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable.

diagnostic-string-constant

Specifies a character string constant that contains the value to be assigned to the condition-information-item.

Notes

SQLSTATE values: Any valid SQLSTATE value can be used in the SIGNAL statement. However, it is recommended that programmers define new SQLSTATEs based on ranges reserved for applications. This prevents the unintentional use of an SQLSTATE value that might be defined by the database manager in a future release.

SQLSTATE values are comprised of a two-character class code value, followed by a three-character subclass code value. Class code values represent classes of successful and unsuccessful execution conditions.

- SQLSTATE classes that begin with the characters '7' through '9' or 'I' through 'Z' may be defined. Within these classes, any subclass may be defined.
- SQLSTATE classes that begin with the characters '0' through '6' or 'A' through 'H' are reserved for the database manager. Within these classes, subclasses that begin with the characters '0' through 'H' are reserved for the database manager. Subclasses that begin with the characters 'I' through 'Z' may be defined.

For more information about SQLSTATEs, see the SQL Messages and Codes topic collection.

Assignment: When the SIGNAL statement is executed, the value of each of the specified string-constants and variables is assigned to the corresponding condition-information-item. However, if the length of a string-constant or variable is longer than the maximum length of the corresponding condition-information-item, it is truncated without a warning. For details on the assignment rules, see "Assignments and comparisons" on page 89. For details on the maximum length of specific condition-information-items, see "GET DIAGNOSTICS" on page 943.

Processing a SIGNAL statement: When a SIGNAL statement is issued, the SQLCODE is based on the SQLSTATE value as follows:

- If the specified SQLSTATE class is either '01' or '02', a warning or not found is signalled and the SQLCODE is set to +438.
- Otherwise, an exception is signalled and the SQLCODE is set to -438.

Examples

Example 1: Signal SQLSTATE '75002' with a descriptive message text.

```
EXEC SQL SIGNAL SQLSTATE '75002'
            SET MESSAGE_TEXT = 'Customer number is not known';
```

Example 2: Signal SQLSTATE '75002' with a descriptive message text and associate a specific table with the error.

SIGNAL

EXEC SQL SIGNAL SQLSTATE '75002'

SET MESSAGE_TEXT = 'Customer number is not known',

SCHEMA_NAME = 'CORPDATA',

TABLE_NAME = 'CUSTOMER';

UPDATE

The UPDATE statement updates the values of specified columns in rows of a table or view. Updating a row of a view updates a row of its base table, if no INSTEAD OF UPDATE trigger is defined on this view. If such a trigger is defined, the trigger will be activated instead.

There are two forms of this statement:

- The Searched UPDATE form is used to update one or more rows (optionally determined by a search condition).
- The Positioned UPDATE form is used to update exactly one row (as determined by the current position of a cursor).

Invocation

A Searched UPDATE statement can be embedded in an application program or issued interactively. A Positioned UPDATE must be embedded in an application program. Both forms are executable statements that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- For the table or view identified in the statement:
 - The UPDATE privilege on the table or view, or
 - The UPDATE privilege on each column to be updated, or
 - Ownership of the table; and
 - The system authority *EXECUTE on the library containing the table or view
- Administrative authority

If the expression in the assignment-clause contains a reference to a column of the table or view, or if the search-condition in a Searched UPDATE contains a reference to a column of the table or view, then the privileges held by the authorization ID of the statement must also include one of the following:

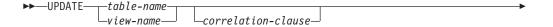
- The SELECT privilege on the table or view
- Administrative authority

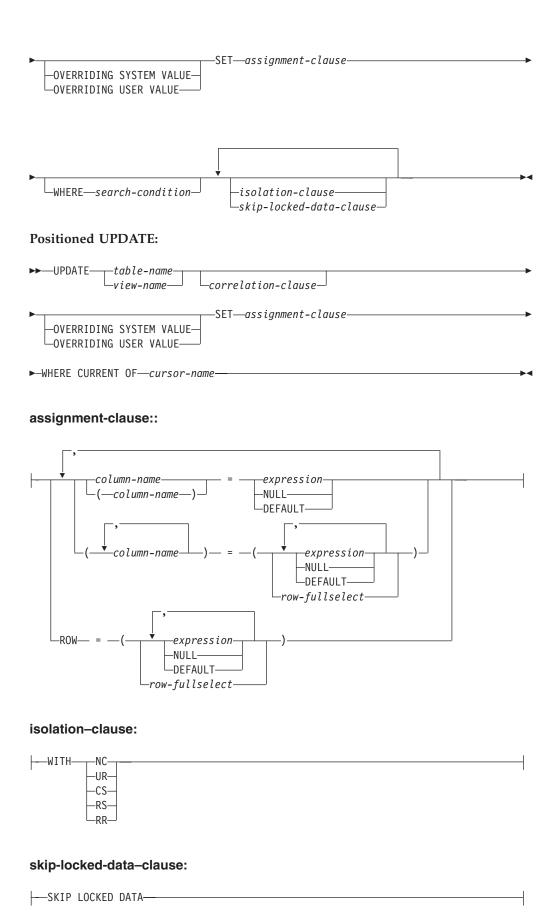
If the search-condition includes a subquery or if the assignment-clause includes a scalar-fullselect or row-fullselect, see Chapter 4, "Queries," on page 469 for an explanation of the authorization required for each subselect.

For information about the system authorities corresponding to SQL privileges, see Corresponding System Authorities When Checking Privileges to a Table or View.

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Searched UPDATE:





Description

table-name or view-name

Identifies the table or view to be updated. The name must identify a table or view that exists at the current server, but it must not identify a catalog table, a view of a catalog table, or a read-only view. For an explanation of read-only views and updatable views, see "CREATE VIEW" on page 835.

correlation-clause

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1 Ι Can be used within search-condition or assignment-clause to designate the table or view. For an explanation of correlation-clause, see "table-reference" on page 475. For an explanation of *correlation-name*, see "Correlation names" on page 129.

OVERRIDING SYSTEM VALUE or OVERRIDING USER VALUE

Specifies whether system-generated values or user-specified values for a ROWID, identity, or row change timestamp column are used. If OVERRIDING SYSTEM VALUE is specified, the implicit or explicit list of columns in the SET clause must contain a column defined as GENERATED ALWAYS. If OVERRIDING USER VALUE is specified, the implicit or explicit list of columns in the SET clause must contain a column defined as either GENERATED ALWAYS or GENERATED BY DEFAULT.

OVERRIDING SYSTEM VALUE

Specifies that the value specified in the SET clause for a column that is defined as GENERATED ALWAYS is used. A system-generated value is not used.

OVERRIDING USER VALUE

Specifies that the value specified in the SET clause for a column that is defined as either GENERATED ALWAYS or GENERATED BY DEFAULT is ignored. Instead, a system-generated value is used, overriding the user-specified value.

If neither OVERRIDING SYSTEM VALUE or OVERRIDING USER VALUE is specified:

- A value cannot be specified for a ROWID, identity, or row change timestamp column that is defined as GENERATED ALWAYS.
- A value can be specified for a ROWID column that is defined as GENERATED BY DEFAULT. If a value is specified, that value is assigned to the column. However, a value in a ROWID column defined BY DEFAULT can be updated only if the specified value is a valid row ID value that was previously generated by DB2 for z/OS or DB2 for i.
- A value can be specified for an identity or row change timestamp column that is defined as GENERATED BY DEFAULT. When a value of an identity column or row change timestamp column defined BY DEFAULT is updated, the database manager does not verify that the specified value is a unique value for the column unless the identity column or row change timestamp column is the sole key in a unique constraint or unique index. Without a unique constraint or unique index, the database manager can guarantee unique values only among the set of system-generated values as long as NO CYCLE is in effect.

If a value is not specified the database manager generates a new value.

SET

Introduces the assignment of values to column names.

assignment-clause

column-name

Identifies a column to be updated. The column-name must identify a column of the specified table or view. If extended indicator variables are not enabled, that column must not identify a view column derived from a scalar function, constant, or expression. A column must not be specified more than once.

For a Positioned UPDATE:

- If the UPDATE clause was specified in the SELECT statement of the cursor, each column name in the SET list must also appear in the UPDATE clause.
- If the UPDATE clause was not specified in the SELECT statement of the cursor, the name of any updatable column may be specified.

For more information, see "update-clause" on page 520.

A view column derived from the same column as another column of the view can be updated, but both columns cannot be updated in the same UPDATE statement.

If a list of column-names is specified, the number of expressions, NULLs, and DEFAULTS must match the number of column-names.

ROW

Identifies all the columns of the specified table or view except for columns defined with the hidden attribute. If a view is specified, none of the columns of the view may be derived from a scalar function, constant, or expression.

The number of expressions, NULLs, and DEFAULTs (or the number of result columns from a row-fullselect) must match the number of columns in the

For a Positioned UPDATE, if the UPDATE clause was specified in the SELECT statement of the cursor, each column of the table or view must also appear in the UPDATE clause. For more information, see "update-clause" on page 520.

ROW may not be specified for a view that contains a view column derived from the same column as another column of the view, because both columns cannot be updated in the same UPDATE statement.

expression

Specifies the new value of the column. The expression is any expression of the type described in "Expressions" on page 152. It must not include an aggregate function.

A column-name in an expression must name a column of the named table or view. For each row updated, the value of the column in the expression is the value of the column in the row before the row is updated.

Each variable in the clause must identify a host structure or variable that is declared in accordance with the rules for declaring host structures and variables. In the operational form of the statement, a reference to a host structure is replaced by a reference to each of its variables. If expression is a single host variable, the host variable can include an indicator that is enabled for extended indicator variables. If extended indicator variables are enabled and an expression in the assignment clause is not a single host variable, the extended indicator variable values of DEFAULT and UNASSIGNED must not be used. For further information about variables

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and structures, see "References to host variables" on page 136 and "Host structures" on page 142. If a host structure is specified, the keyword ROW must be specified.

NULL

Specifies the new value for a column is the null value. NULL should only be specified for nullable columns.

DEFAULT

Specifies that the default value is assigned to a column. The value that is used depends on how the column was defined, as follows:

- If the column is a ROWID or identity column, the database manager will generate a new value.
- · If the WITH DEFAULT clause is used, the default used is as defined for the column (see default-clause in column-definition in "CREATE TABLE" on page 768).
- If the WITH DEFAULT clause or the NOT NULL clause is not used, the value used is NULL.
- If the column is defined as a row change timestamp column, a new row change timestamp value is assigned to the column.

If the NOT NULL clause is used and the WITH DEFAULT clause is not used, or if DEFAULT NULL is used, the DEFAULT keyword cannot be specified for that column.

DEFAULT must be specified for an identity column defined as GENERATED ALWAYS unless OVERRIDING SYSTEM VALUE is used.

row-fullselect

A fullselect that returns a single result row. The number of result columns in the select list must match the number of column-names (or if ROW is specified, the number of columns in the row) specified for assignment. The result column values are assigned to each corresponding column-name. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

The row-fullselect may contain references to columns of the target table of the UPDATE statement. For each row updated, the value of such a column in the expression is the value of the column in the row before the row is updated.

WHERE

Specifies the rows to be updated. The clause can be omitted, or a search-condition or cursor-name can be specified. If the clause is omitted, all rows of the table or view are updated.

search-condition

Is any search described in "Search conditions" on page 201. Each column-name in the search condition, other than in a subquery, must name a column of the table or view. When the search condition includes a subquery in which the same table is the base object of both the UPDATE and the subquery, the subquery is completely evaluated before any rows are updated.

The search-condition is applied to each row of the table or view. The updated rows are those for which the results of the search-condition are true.

If the search-condition contains a subquery, the subquery can be thought of as being executed each time the search-condition is applied to a row, and the results of that subquery used in applying the search-condition. In actuality, a subquery with no correlated references may be executed only once. A subquery with a correlated reference may have to be executed once for each row.

CURRENT OF cursor-name

Identifies the cursor to be used in the update operation. The *cursor-name* must identify a declared cursor as explained in "DECLARE CURSOR" on page 845.

The table or view named must also be named in the FROM clause of the SELECT statement of the cursor, and the result table of the cursor must not be read-only. For an explanation of read-only result tables, see "DECLARE CURSOR" on page 845.

When the UPDATE statement is executed, the cursor must be positioned on a row; that row is updated.

isolation-clause

Specifies the isolation level to be used for this statement.

Introduces the isolation level, which may be one of:

- RR Repeatable read
- RS Read stability
- CS Cursor stability
- UR Uncommitted read
- NC No commit

If isolation-clause is not specified the default isolation is used. See "isolation-clause" on page 523 for a description of how the default is determined.

skip-locked-data-clause

Specifies to skip rows on which incompatible locks are held by other transactions.

UPDATE Rules

Assignment: Update values are assigned to columns in accordance with the storage assignment rules described in "Assignments and comparisons" on page 89.

Validity: Updates must obey the following rules. If they do not, or if any other errors occur during the execution of the UPDATE statement, no rows are updated.

- Fullselects: The row-fullselect or scalar-fullselect shall return no more than one row (SQLSTATE 21000).
- *Unique constraints and unique indexes:* If the identified table, or the base table of the identified view, has one or more unique indexes or unique constraints, each row update in the table must conform to the limitations imposed by those indexes and constraints (SQLSTATE 23505).
 - All uniqueness checks are effectively made at the end of the statement. In the case of a multiple-row UPDATE statement of a column involved in a unique index or unique constraint, this would occur after all rows were updated.
- Check constraints: If the identified table, or the base table of the identified view, has one or more check constraints, each check constraint must be true or unknown for each row updated in the table (SQLSTATE 23513).

All check constraints are effectively validated at the end of the statement. In the case of a multiple-row UPDATE statement, this would occur after all rows were updated.

• Views and the WITH CHECK OPTION: If a view is identified, the updated rows must conform to any applicable WITH CHECK OPTION (SQLSTATE 44000). For more information, see "CREATE VIEW" on page 835.

Triggers: If the identified table or the base table of the identified view has an update trigger, the trigger is activated. A trigger might cause other statements to be executed or raise error conditions based on the updated values.

Referential Integrity: The value of the parent key in a parent row must not be changed.

If the update values produce a foreign key that is nonnull, the foreign key must be equal to some value of the parent key of the parent table of the relationship.

The referential constraints (other than a referential constraint with a RESTRICT delete rule) are effectively checked at the end of the statement. In the case of a multiple-row UPDATE statement, this would occur after all rows were updated.

Extended indicator variable usage: If enabled, indicator variable values other than positive values and 0 (zero) through -7 must not be used. The DEFAULT and UNASSIGNED extended indicator variable values must not appear in contexts in which they are not supported.

Extended indicator variables: In the assignment-clause of an UPDATE statement, an expression that is a reference to a single host variable can result in assigning an extended indicator variable value. Assigning an extended indicator variable value of UNASSIGNED has the effect of leaving the target column set to its current values, as if it hadn't be specified in the statement. Assigning an extended indicator variable value of DEFAULT can only be used for columns that have a default value.

If a target column is not updatable, for example an identity column defined as GENERATED ALWAYS, it must be assigned the extended indicator variable value of UNASSIGNED.

An UPDATE statement must not assign all target columns from an extended indicator variable value of UNASSIGNED.

Extended indicator variables and update triggers: If a target column has been assigned an extended indicator variable value of UNASSIGNED, that column is not considered to have been updated.

Extended indicator variables and deferred error checks: When extended indicator variables are enabled, validation that would otherwise be done during statement preparation to recognize an update of a non-updatable column is deferred until the statement is executed.

Notes

Update operation errors: If an update value violates any constraints, or if any other error occurs during the execution of the UPDATE statement and COMMIT(*NONE) was not specified, all changes made during the execution of the statement are backed out. However, other changes in the unit of work made prior

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UPDATE

to the error are not backed out. If COMMIT(*NONE) is specified, changes are not backed out.

It is possible for an error to occur that makes the state of the cursor unpredictable.

Number of rows updated: When an UPDATE statement completes execution, the number of rows updated is returned in the ROW_COUNT statement information item in the SQL Diagnostics Area (and SQLERRD(3) in the SQLCA). For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

For a description of ROW_COUNT, see "GET DIAGNOSTICS" on page 943. For a description of the SQLCA, see Appendix C, "SQLCA (SQL communication area)," on page 1225.

Locking: Unless appropriate locks already exist, one or more exclusive locks are acquired by the execution of a successful UPDATE statement. Until these locks are released by a commit or rollback operation, the updated rows can only be accessed

- The application process that performed the update.
- Another application process using COMMIT(*NONE) or COMMIT(*CHG) through a read-only operation

The locks can prevent other application processes from performing operations on the table. For further information about locking, see the description of the COMMIT, ROLLBACK, and LOCK TABLE statements, and isolation levels in "Isolation level" on page 26. Also, see the Database Programming topic collection.

A maximum of 500 000 000 rows can be updated or changed in any single UPDATE statement when COMMIT(*RR), COMMIT(*ALL), COMMIT(*CS), or COMMIT(*CHG) has been specified. The number of rows changed includes any rows inserted, updated, or deleted under the same commitment definition as a result of a trigger.

REXX: Variables cannot be used in the UPDATE statement within a REXX procedure. Instead, the UPDATE must be the object of a PREPARE and EXECUTE using parameter markers.

Datalinks: If the URL value of a DATALINK column is updated, this is the same as deleting the old DATALINK value then inserting the new one. First, if the old value was linked to a file, that file is unlinked. Then, unless the linkage attributes of the DATALINK value are empty, the specified file is linked to that column.

The comment value of a DATALINK column can be updated without relinking the file by specifying an empty string as the URL path (for example, as the data-location argument of the DLVALUE scalar function or by specifying the new value to be the same as the old value). If a DATALINK column is updated with a null, it is the same as deleting the existing DATALINK value.

An error may occur when attempting to update a DATALINK value if the file server of either the existing value or the new value is no longer registered with the database server

Syntax alternatives: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword NONE can be used as a synonym for NC.
- The keyword CHG can be used as a synonym for UR.
- The keyword ALL can be used as a synonym for RS.

Examples

Example 1: Change the job (JOB) of employee number (EMPNO) '000290' in the EMPLOYEE table to 'LABORER'.

```
UPDATE EMPLOYEE
SET JOB = 'LABORER'
WHERE EMPNO = '000290'
```

Example 2: Increase the project staffing (PRSTAFF) by 1.5 for all projects that department (DEPTNO) 'D21' is responsible for in the PROJECT table.

```
UPDATE PROJECT
  SET PRSTAFF = PRSTAFF + 1.5
  WHERE DEPTNO = 'D21'
```

Example 3: All the employees except the manager of department (WORKDEPT) 'E21' have been temporarily reassigned. Indicate this by changing their job (JOB) to NULL and their pay (SALARY, BONUS, COMM) values to zero in the EMPLOYEE table.

```
UPDATE EMPLOYEE
SET JOB=NULL, SALARY=0, BONUS=0, COMM=0
WHERE WORKDEPT = 'E21' AND JOB <> 'MANAGER'
```

Example 4: In a Java program display the rows from the EMPLOYEE table on the connection context 'ctx' and then, if requested to do so, change the job (JOB) of certain employees to the new job keyed in (NEWJOB).

VALUES

The VALUES statement provides a method for invoking a user-defined function from a trigger. Transition variables can be passed to the user-defined function.

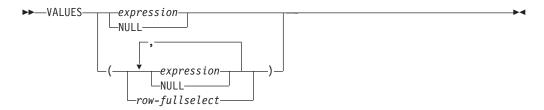
Invocation

This statement can only be used in the triggered action of a CREATE TRIGGER statement.

Authorization

If a row-fullselect is specified, see Chapter 4, "Queries," on page 469 for an explanation of the authorization required for each subselect.

Syntax



Description

VALUES

Introduces a single row consisting of one of more columns.

expression

Any expression of the type described in "Expressions" on page 152.

NULL

Specifies the null value.

row-fullselect

A full select that returns a single result row. If the result of the full select is no rows, then null values are returned. An error is returned if there is more than one row in the result.

Notes

Effects of the statement: The statement is evaluated, but the resulting values are discarded and are not assigned to any output variables. If an error is returned, the database manager stops executing the trigger and rolls back any triggered actions that were performed as well as the statement that caused the triggered action (unless the trigger is running under isolation level *NONE).

Examples

Create an after trigger EMPISRT1 that invokes user-defined function NEWEMP when the trigger is activated. An insert operation on table EMP activates the trigger. Pass transition variables for the new employee number, last name, and first name to the user-defined function.

VALUES

```
CREATE TRIGGER EMPISRT1
   AFTER INSERT ON EMPLOYEE
   REFERENCING NEW AS N
   FOR EACH ROW
   MODE DB2SQL
   BEGIN ATOMIC
    VALUES( NEWEMP(N.EMPNO, N.LASTNAME, N.FIRSTNAME));
```

VALUES INTO

The VALUES INTO statement produces a result table consisting of at most one row and assigns the values in that row to variables.

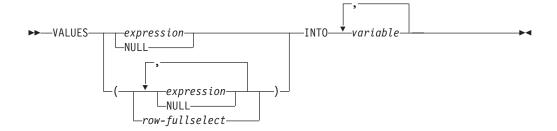
Invocation

This statement can be embedded in an application program. It is an executable statement that can be dynamically prepared, but cannot be issued interactively. It must not be specified in Java.

Authorization

If a row-fullselect is specified, see Chapter 4, "Queries," on page 469 for an explanation of the authorization required for each subselect.

Syntax 5 4 1



Description

VALUES

Introduces a single row consisting of one of more columns.

Specifies the new value of the variable. The *expression* is any expression of the type described in "Expressions" on page 152. It must not include a column name. Host structures are not supported.

NULL

Specifies that the new value for the variable is the null value.

row-fullselect

A fullselect that returns a single result row. The result column values are assigned to each corresponding variable. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

INTO variable....

Identifies one or more host structures or variables that must be declared in the program in accordance with the rules for declaring host structures and variables. In the operational form of INTO, a reference to a host structure is replaced by a reference to each of its variables. The first value specified is assigned to the first variable, the second value to the second variable, and so on.

Notes

Variable assignment: Each assignment to a variable is performed according to the retrieval assignment rules described in "Assignments and comparisons" on page 89. 101 If the number of variables is less than the number of values in the row, an SQL warning (SQLSTATE 01503) is returned (and the SQLWARN3 field of the SQLCA is set to 'W'). Note that there is no warning if there are more variables than the number of result columns. If a value is null, an indicator variable must be provided for that value.

If the specified variable is character and is not large enough to contain the result, a warning (SQLSTATE 01004) is returned (and 'W' is assigned to SQLWARN1 in the SQLCA). The actual length of the result may be returned in the indicator variable associated with the variable, if an indicator variable is provided. For further information, see "References to variables" on page 136.

If an assignment error occurs, the value is not assigned to the variable, and no more values are assigned to variables. Any values that have already been assigned to variables remain assigned.

If the specified variable is a C NUL-terminated host variable and is not large enough to contain the result and the NUL-terminator:

- If the *CNULRQD option is specified on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*YES) on the SET OPTION statement), the following occurs:
 - The result is truncated.
 - The last character is the NUL-terminator.
 - The value 'W' is assigned to SQLWARN1 in the SQLCA.
- If the *NOCNULRQD option on the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement) is specified, the following occurs:
 - The NUL-terminator is not returned.
 - The value 'N' is assigned to SQLWARN1 in the SQLCA.

Result column evaluation considerations: If an error occurs while evaluating a result column in the expression list of a VALUES INTO statement as the result of an arithmetic expression (such as division by zero, or overflow) or a numeric or character conversion error, the result is the null value. As in any other case of a null value, an indicator variable must be provided. The value of the variable is undefined. In this case, however, the indicator variable is set to the value of -2. Processing of the statement continues and a warning is returned. If an indicator variable is not provided, an error is returned and no more values are assigned to variables. It is possible that some values have already been assigned to variables and will remain assigned when the error is returned.

When a datetime value is returned, the length of the variable must be large enough to store the complete value. Otherwise, depending on how much of the value would have to be truncated, a warning or error is returned. See "Datetime assignments" on page 95 for details.

^{101.} If assigning to an SQL-variable or SQL-parameter and the standards option is specified, storage assignment rules apply. For information about the standards option, see "Standards compliance" on page ix.

VALUES INTO

Multiple assignments: If more than one variable is specified in the INTO clause, all expressions are evaluated before the assignments are performed. Thus, references to a variable in an expression are always the value of the variable prior to any assignment in the VALUES INTO statement.

Examples

Example 1: Assign the value of the CURRENT PATH special register to host variable HV1.

EXEC SQL VALUES CURRENT PATH INTO :HV1;

Example 2: Assume that LOB locator LOB1 is associated with a CLOB value. Assign a portion of the CLOB value to host variable DETAILS using the LOB locator, and assign CURRENT TIMESTAMP to the host variable TIMETRACK.

EXEC SQL VALUES (SUBSTR(:LOB1,1,35), CURRENT TIMESTAMP) INTO :DETAILS, :TIMETRACK;

WHENEVER

The WHENEVER statement specifies the action to be taken when a specified exception condition occurs.

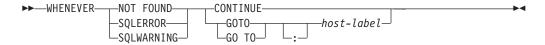
Invocation

This statement can only be embedded in an application program. It is not an executable statement. It must not be specified in Java or REXX. See the Embedded SQL Programming topic collection for information about handling errors in REXX.

Authorization

None required.

Syntax 1 4 1



Description

The NOT FOUND, SQLERROR, or SQLWARNING clause is used to identify the type of exception condition.

NOT FOUND

Identifies any condition that results in an SQLSTATE of '02000' or an SQLCODE of +100.

SQLERROR

Identifies any condition that results in an SQLSTATE value where the first two characters are not '00', '01', or '02'.

SOLWARNING

Identifies any condition that results in an SQLSTATE value where the first two characters are '01', or a warning condition (SQLWARN0 is 'W').

The CONTINUE or GO TO clause are used to specify the next statement to be executed when the identified type of exception condition exists.

CONTINUE

Specifies the next sequential instruction of the source program.

GOTO or GO TO host-label

Specifies the statement identified by host-label. For host-label, substitute a single token, optionally preceded by a colon. The form of the token depends on the host language. In a COBOL program, for example, it can be a section-name or an unqualified paragraph-name.

Notes

WHENEVER statement scope: Every executable SQL statement in a program is within the scope of one implicit or explicit WHENEVER statement of each type. The scope of a WHENEVER statement is related to the listing sequence of the statements in the program, not their execution sequence.

WHENEVER

An SQL statement is within the scope of the last WHENEVER statement of each type that is specified before that SQL statement in the source program. If a WHENEVER statement of some type is not specified before an SQL statement, that SQL statement is within the scope of an implicit WHENEVER statement of that type in which CONTINUE is specified.

SQL does support nested programs in COBOL, C, and RPG. However, SQL does not honor normal COBOL, C, and RPG scoping rules. That is, the last WHENEVER statement specified in the program source prior to the nested procedure is still in effect for that nested program. The label referenced in the WHENEVER statement must be duplicated within that inner program. Alternatively, the inner program could specify a new WHENEVER statement.

Example

The following statements can be embedded in a COBOL program.

Example 1: Go to the label HANDLER for any statement that produces an error. EXEC SQL WHENEVER SQLERROR GOTO HANDLER END-EXEC.

Example 2: Continue processing for any statement that produces a warning. EXEC SQL WHENEVER SQLWARNING CONTINUE END-EXEC.

Example 3: Go to the label ENDDATA for any statement that does not return data when expected to do so.

EXEC SQL WHENEVER NOT FOUND GOTO ENDDATA END-EXEC.

Chapter 6. SQL control statements

Control statements are SQL statements that allow SQL to be used in a manner similar to writing a program in a structured programming language. SQL control statements provide the capability to control the logic flow, declare and set variables, and handle warnings and exceptions. Some SQL control statements include other nested SQL statements.

SQL-control-statement:

Control statements are supported in SQL procedures, SQL functions, and SQL triggers.

SQL procedures are created by specifying an SQL routine body on the CREATE PROCEDURE statement. SQL functions are created by specifying an SQL routine body on the CREATE FUNCTION statement. SQL routines are SQL procedures or SQL functions. SQL triggers are created by specifying an SQL routine body on the CREATE TRIGGER statement.

An SQL procedure can also be altered. A new SQL routine body can be specified on the ALTER PROCEDURE statement. An SQL function can also be altered. A new SQL routine body can be specified on the ALTER FUNCTION statement.

An SQL routine body must be a single SQL statement which may be an SQL control statement.

The SQL routine body is the executable part of the procedure, function, or trigger that is transformed by the database manager into a program or service program. When an SQL routine or trigger is created, SQL creates a temporary source file (QTEMP/QSQLSRC and QTEMP/QSQLT00000) that will contain C source code with embedded SQL statements. If either of these source files exist, they will be modified if needed to have the same CCSID as the source. If DBGVIEW(*SOURCE) is specified, SQL creates the root source for the routine or trigger in source file QSQDSRC in the same library as the procedure, function or trigger.

An SQL procedure or SQL trigger is created as a program (*PGM) object using the CRTPGM command. An SQL function is created as a service program (*SRVPGM)

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SQL control statements

object using the CRTSRVPGM command. The program or service program is created in the library that is the implicit or explicit qualifier of the procedure, function, or trigger name.

When the program or service program is created, the SQL statements other than certain control statements become embedded SQL statements in the program or service program. The CALL, SIGNAL, RESIGNAL, and GET DIAGNOSTIC control statements also become embedded SQL statements in the program or service program.

The specified procedure or function is registered in the SYSROUTINES and SYSPARMS catalog tables, and an internal link is created from SYSROUTINES to the program. When the procedure is called using the SQL CALL statement or when the function is invoked in an SQL statement, the program associated with the routine is called. The specified SQL trigger is registered in the SYSTRIGGER catalog table.

References to SQL parameters and SQL variables

SQL parameters and SQL variables can be referenced anywhere in an SQL procedure statement where an expression or variable can be specified.

Host variables cannot be specified in SQL functions, SQL procedures, or SQL triggers. SQL parameters can be referenced anywhere in the routine and can be qualified with the routine name. SQL variables can be referenced anywhere in the compound statement in which they are declared, including any statement that is directly or indirectly nested within that compound statement. If the compound statement where the variable is declared has a label, references to the variable name can be qualified with that label

All SQL parameters and SQL variables are considered nullable except SQL variables that are explicitly declared as NOT NULL. The name of an SQL parameter or SQL variable in an SQL routine can be the same as the name of a column in a table or view referenced in the routine. The name of an SQL variable can also be the same as the name of another SQL variable declared in the same routine. This can occur when the two SQL variables are declared in different compound-statements. The compound-statement that contains the declaration of an SQL variable determines the scope of that variable. See "compound-statement" on page 1160, for more information.

Names that are the same should be explicitly qualified. Qualifying a name clearly indicates whether the name refers to a column, SQL variable, or SQL parameter. If the name is not qualified, or qualified but still ambiguous, the following rules describe how the name is resolved. The name is resolved by checking for a match in the following order:

- If the tables and views specified in an SQL routine body exist at the time the routine is created, the name will first be checked as a column name.
- If not found as a column, it will then be checked as an SQL variable name. The SQL variable can be declared within the *compound-statement* that contains the reference, or within a compound statement in which that compound statement is nested. If two SQL variables are within the same scope and have the same name, ¹⁰² the SQL variable that is declared in the innermost compound statement is used
- If not found as an SQL variable name, the name will be checked as an SQL parameter name.

If the name is still not resolved as a column, SQL variable, or SQL parameter and the scope of the name included a table or view that does not exist at the current server, it will be assumed to be a column. Otherwise, an error is returned.

The name of an SQL variable or SQL parameter in an SQL routine can be the same as the name of an identifier used in certain SQL statements. If the name is not qualified, the following rules describe whether the name refers to the identifier or to the SQL parameter or SQL variable:

- In the SET PATH and SET SCHEMA statements, the name is checked as an SQL parameter name or SQL variable name. If not found as an SQL variable or SQL parameter name, it will then be used as an identifier.
- In the CONNECT, DISCONNECT, RELEASE, and SET CONNECTION statements, the name is used as an identifier.

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^{102.} Which can happen if they are declared in different compound statements.

References to SQL condition names

The name of an SQL condition can be the same as the name of another SQL condition declared in the same routine. This can occur when the two SQL conditions are declared in different compound-statements.

The compound-statement that contains the declaration of an SQL condition name determines the scope of that condition name. A condition name must be unique within the compound statement in which it is declared, excluding any declarations in compound statements that are nested within that compound statement. A condition name can only be referenced within the compound statement in which it is declared, including any compound statements that are nested within that compound statement. When there is a reference to a condition name, the condition that is declared in the innermost compound statement is the condition that is used. See "compound-statement" on page 1160, for more information.

References to SQL cursor names

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The name of an SQL cursor can be the same as the name of another SQL cursor declared in the same routine. This can occur when the two SOL cursors are declared in different compound-statements. The cursor name specified in a FOR statement can be the same as the name of another SQL cursor declared in the same compound-statement.

The compound-statement that contains the declaration of an SQL cursor determines the scope of that cursor name. A cursor name must be unique within the compound statement in which it is declared, excluding any declarations in compound statements that are nested within that compound statement. A cursor name can only be referenced within the compound statement in which it is declared, including any compound statements that are nested within that compound statement. When there is a reference to a cursor name, the cursor that is declared in the innermost compound statement is the cursor that is used. See "compound-statement" on page 1160, for more information.

References to SQL labels

Labels can be specified at the beginning of most SQL procedure statements. If a label is specified on an SQL procedure statement, it must be unique from other labels within the same scope. A label must not be the same as any other label within the same compound statement, must not be the same as a label specified on the compound statement itself, and if the compound statement is nested within another compound statement, the label must not be the same as the label specified on any higher level compound statement. The label must not be the same as the name of the SQL function, SQL procedure, or SQL trigger that contains the SQL procedure statement.

Specifying a label for an SQL procedure statement defines that label and determines the scope of that label. A label name can only be referenced within the compound statement in which it is defined, including any statement that is directly or indirectly nested within that compound statement. A label can be specified as the target of a GOTO, LEAVE, or ITERATE statement, subject to the rules for the statement that references the label as a target.

Summary of 'name' scoping in nested compound statements

Nested compound statements can be used within an SQL routine to define the scope of SQL variable declarations, cursors, condition names, and condition handlers.

Additionally, labels have a defined scope in the context of nested compound statements. However the rules for name space, and how non-unique names can be referenced, differs depending on the type of name. The following table summarizes these differences.

Table 82. Summary of 'Name' Scoping in Nested Compound Statements

Type of name	Must be unique within	Qualification allowed?	Can be referenced within
SQL variable	the compound statement in which it is declared, excluding any declarations in compound statements that are nested within that compound statement.	Yes, can be qualified with the label of the compound statement in which the variable was declared.	the compound statement in which it is declared, including any compound statements that are nested within that compound statement. When multiple SQL variables are defined with the same name you can use a label to explicitly refer to a specific variable that is not the most local in scope.
condition	the compound statement in which it is declared, excluding any declarations in compound statements that are nested within that compound statement.	No	the compound statement in which it is declared, including any compound statements that are nested within that compound statement. Can be used in the declaration of a condition handler, or in a SIGNAL or RESIGNAL statement. Note: When multiple conditions are defined with the same name there is no way to explicitly refer to the condition that is not the most local in scope.
cursor	the compound statement in which it is declared, excluding any declarations in compound statements that are nested within that compound statement.	No	the compound statement in which it is declared, including any compound statements that are nested within that compound statement. Note: When multiple cursors are defined with the same name there is no way to explicitly refer to the cursor that is not the most local in scope. However, if the cursor is defined as a result set cursor (for example, the WITH RETURN clause was specified as part of the cursor declaration), the invoking application can access the result set.
label	the compound statement that declared the variable, including any declarations in compound statements that are nested within that compound statement.	No	the compound statement in which it is declared, including any compound statements that are nested within that compound statement. Use a label to qualify the name of an SQL variable or as the target of a GOTO, LEAVE, or ITERATE statement.

SQL-procedure-statement

An SQL control statement may allow multiple SQL statements to be specified within the SQL control statement. These statements are defined as SQL procedure statements.

Syntax

-SQL-control-statement--ALLOCATE DESCRIPTOR-statement--ALTER FUNCTION-statement-(2)--ALTER PROCEDURE-statement-(2)--ALTER SEQUENCE-statement-—ALTER TABLE-statement—— --CLOSE-statement----—COMMENT-statement— -COMMIT-statement-(1)-–CONNECT-statement-(1)---CREATE ALIAS-statement----CREATE FUNCTION (External Scalar)-statement--CREATE FUNCTION (External Table)-statement--CREATE FUNCTION (Sourced)-statement--CREATE INDEX-statement--CREATE PROCEDURE (External)-statement— -CREATE SCHEMA-statement-—CREATE SEQUENCE-statement— --CREATE TABLE-statement —CREATE TYPE-statement— --CREATE VIEW-statement----DEALLOCATE DESCRIPTOR-statement--DECLARE GLOBAL TEMPORARY TABLE-statement-–DELETE**-**statement— -DESCRIBE-statement------DESCRIBE INPUT-statement--DESCRIBE TABLE-statement-–DISCONNECT-statement—(1)— -DROP-statement--EXECUTE-statement----—EXECUTE IMMEDIATE-statement— -FETCH-statement------GET DESCRIPTOR-statement--GRANT-statement--INSERT-statement--LABEL-statement--LOCK TABLE-statement--OPEN-statement---PREPARE-statement----REFRESH TABLE-statement--RELEASE-statement--RELEASE SAVEPOINT-statement--RENAME-statement-----—REVOKE-statement— —ROLLBACK-statement—(1)— —SAVEPOINT-statement— —SELECT INTO-statement— -SET CONNECTION-statement-(1)-—SET CURRENT DEBUG MODE-statement— -SET CURRENT DECFLOAT ROUNDING MODE-statement--SET CURRENT DEGREE-statement-—SET DESCRIPTOR-statement— -SET ENCRYPTION PASSWORD-statement-—SET PATH-statement—— —SET RESULT SETS-statement—(1)— —SET SCHEMA-statement—— —SET TRANSACTION-statement—(3)—— —SET transition-variable-statement $-\!-$ (4) $-\!-$ --UPDATE-statement dashVALUES INTO-statement-

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SQL-procedure-statement

Notes:

- A COMMIT, ROLLBACK, CONNECT, DISCONNECT, SET CONNECTION, or SET RESULT SETS statement is only allowed in an SQL procedure.
- 2. An ALTER PROCEDURE (SQL), ALTER FUNCTION (SQL Scalar), or ALTER FUNCTION (SQL Table) statement with a REPLACE keyword is not allowed in an *SQL-routine-body*.
- 3. A SET TRANSACTION statement is only allowed in an SQL function or trigger.
- 4. A SET transition-variable-statement is only allowed in a trigger. A fullselect and VALUES-statement can also be specified in a trigger.

Notes

Comments: Comments can be included within the body of an SQL procedure. In addition to the double-dash form of comments (--), a comment can begin with /* and end with */. The following rules apply to this form of a comment.

- The beginning characters /* must be adjacent and on the same line.
- The ending characters */ must be adjacent and on the same line.
- Comments can be started wherever a space is valid.
- Comments can be continued to the next line.

Detecting and processing error and warning conditions: As an SQL statement is executed, the database manager stores information about the processing of the statement in a diagnostics area (including the SQLSTATE and SQLCODE), unless otherwise noted in the description of the SQL statement. A completion condition indicates the SQL statement completed successfully, completed with a warning condition, or completed with a not found condition. An exception condition indicates that the SQL statement was not successful.

A condition handler can be defined in a compound statement to execute when an exception condition, a warning condition, or a not found condition occurs. The declaration of a condition handler includes the code that is to be executed when the condition handler is activated. When a condition other than a successful completion occurs in the processing of *SQL-procedure-statement*, if a condition handler that could handle the condition is within scope, one such condition handler will be activated to process the condition. See "compound-statement" on page 1160 for information about defining condition handlers. The code in the condition handler can check for a warning condition, not found condition, or exception condition and take the appropriate action. Use one of the following methods at the beginning of the body of a condition handler to check the condition in the diagnostics area that caused the handler to be activated:

- Issue a GET DIAGNOSTICS statement to request the condition information. See "GET DIAGNOSTICS statement" on page 1172.
- Test the SQL variables SQLSTATE and SQLCODE.

If the condition is a warning and there is not a handler for the condition, the above two methods can also be used outside of the body of a condition handler immediately following the statement for which the condition is wanted. If the condition is an error and there is not a handler for the condition, the routine or trigger terminates with the error condition.

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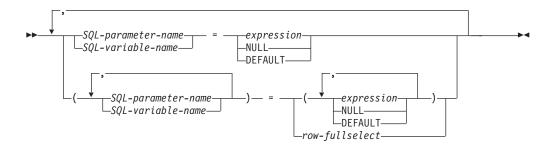
assignment-statement

The assignment-statement assigns a value to an SQL parameter or SQL variable.

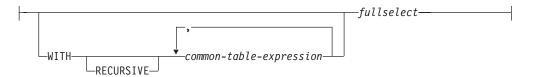
Syntax



assignment-clause:



row-fullselect:



Description

label

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Specifies the label for the *assignment-statement* statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

SQL-parameter-name

Identifies the SQL parameter that is the assignment target. The SQL parameter must be specified in *parameter-declaration* in the CREATE PROCEDURE or CREATE FUNCTION statement.

SOL-variable-name

Identifies the SQL variable that is the assignment target. SQL variables can only be declared in a *compound-statement* or be a transition variable.

expression or NULL

Specifies the expression or value that is the source for the assignment.

DEFAULT

Specifies that the default value for the column associated with the transition variable will be used. This can only be specified in SQL triggers for transition variables.

row-fullselect

A fullselect that returns a single result row. The result column values are

assignment-statement

assigned to the corresponding SQL variable or parameter. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

WITH common-table-expression

Specifies a common table expression. For an explanation of common table expression, see "common-table-expression" on page 513.

fullselect

A fullselect that returns a single result row. The result column values are assigned to each corresponding variable. If the result of the fullselect is no rows, then null values are assigned. An error is returned if there is more than one row in the result.

Notes

Assignment rules: Assignments in the assignment statement must conform to the SQL retrieval assignment rules as described in "Assignments and comparisons" on page 89.¹⁰³

Assignments involving SQL parameters: An IN parameter can appear on the left or right side of an assignment-statement. When control returns to the caller, the original value of the IN parameter is retained. An OUT parameter can also appear on the left or right side of an assignment-statement. If used without first being assigned a value, the value is null. When control returns to the caller, the last value that is assigned to an OUT parameter is returned to the caller. For an INOUT parameter, the first value of the parameter is determined by the caller, and the last value that is assigned to the parameter is returned to the caller.

Special Registers: If a variable has been declared with an identifier that matches the name of a special register (such as PATH), then the variable must be delimited to distinguish it from assignment to the special register (for example, SET "PATH" = 1; for a variable called PATH declared as an integer).

Considerations for SQLSTATE and SQLCODE variables: Assignment to these variables is not prohibited; however, it is not recommended as assignment does not affect the diagnostics area or result in the activation of condition handlers. The SQLCODE and SQLSTATE will be reset and the diagnostics area or SQLCA initialized for each assignment-statement other than assignment-statements that:

- assign the SQLSTATE or SQLCODE variable to another variable or
- set a constant value into the SQLSTATE or SQLCODE variable.

Example

Increase the SQL variable p_salary by 10 percent. **SET** p salary = p salary + (p salary * .10) Set SQL variable p_salary to the null value **SET** p salary = **NULL**

^{103.} If assigning to an SQL-variable or SQL-parameter and the standards option is specified, storage assignment rules apply. For information about the standards option, see "Standards compliance" on page ix.

CALL statement

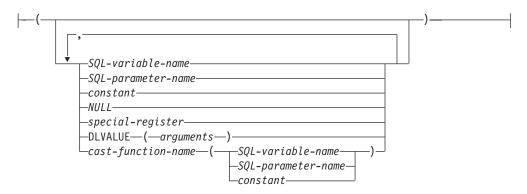
The CALL statement invokes a procedure. The syntax of CALL in an SQL function, SQL procedure, or SQL trigger is a subset of what is supported as a CALL statement in other contexts.

See "CALL" on page 620 for details.

Syntax

```
-CALL—procedure-name—argument-list—
```

argument-list:



Description

label

Specifies the label for the CALL statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

procedure-name

Identifies the procedure to call. The procedure-name must identify a procedure that exists at the current server.

argument-list

Identifies a list of values to be passed as parameters to the procedure. The *n*th value corresponds to the *n*th parameter in the procedure.

Each parameter defined (using CREATE PROCEDURE) as OUT or INOUT must be specified as either a SQL-variable-name or a SQL-parameter-name.

The number of arguments specified must be the same as the number of parameters of a procedure defined at the current server with the specified procedure-name.

The application requester assumes all parameters that are variables are INOUT parameters. All parameters that are not variables are assumed to be input parameters. The actual attributes of the parameters are determined by the current server.

SQL-variable-name

Specifies an SQL variable as an argument to the procedure. For an

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CALL statement

explanation of references to SQL variables, see "References to SQL parameters and SQL variables" on page 1145.

SQL-parameter-name

Specifies an SQL parameter as an argument to the procedure. For an explanation of references to SQL parameters, see "References to SQL parameters and SQL variables" on page 1145.

constant or NULL

Specifies a constant value or null value as an argument to the procedure. For an explanation of *constant*, see "Constants" on page 112.

special-register

Specifies the value of a special register as an argument to the procedure. For an explanation of special-register, see "Special registers" on page 119.

DLVALUE(arguments)

Specifies the value for the parameter is the value resulting from a DLVALUE scalar function. A DLVALUE scalar function can only be specified for a DataLink parameter. The DLVALUE function requires a link value on insert (scheme, server, and path/file). The first argument of DLVALUE must be a constant, variable, or a typed parameter marker (CAST(? AS data-type)). The second and third arguments of DLVALUE must be constants or variables. For an explanation of DLVALUE, see "DLVALUE" on page 306.

cast-function-name

This form of an argument can only be used with parameters defined as distinct types, BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME or TIMESTAMP data types. The following table describes the allowed uses of these cast-functions.

Parameter Type	Cast Function Name
Distinct type N based on a BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
Distinct type N based on a DATE, TIME, or TIMESTAMP	DATE, TIME, or TIMESTAMP *
BINARY, VARBINARY, BLOB, CLOB, or DBCLOB	BINARY, VARBINARY, BLOB, CLOB, or DBCLOB *
DATE, TIME, or TIMESTAMP	DATE, TIME, or TIMESTAMP *
Notes:	

^{*} The name of the function must match the name of the data type (or the source type of the distinct type) with an implicit or explicit schema name of QSYS2.

SOL-variable-name

Specifies an SQL variable as the argument. The SQL variable must conform to the rules of a constant for the source type of the distinct type or for the data type if not a distinct type.

SQL-parameter-name

Specifies an SQL parameter as the argument. The SQL parameter must conform to the rules of a constant for the source type of the distinct type or for the data type if not a distinct type.

constant

Specifies a constant as the argument. The constant must conform to the rules of a constant for the source type of the distinct type or for the

ı data type if not a distinct type. For BINARY, VARBINARY, BLOB, CLOB, DBCLOB, DATE, TIME, and TIMESTAMP functions, the constant must be a string constant.

Notes

Rules for arguments to OUT and INOUT parameters: Each OUT or INOUT parameter must be specified as an SQL parameter or SQL variable.

Special registers: The initial value of a special register in a procedure is inherited from the caller of the procedure. A value assigned to a special register within the procedure is used for the entire SQL procedure and will be inherited by any procedure subsequently called from that procedure. When a procedure returns to its caller, the special registers are restored to the original values of the caller.

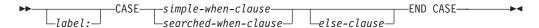
Related information: See "CALL" on page 620 for more information.

Example

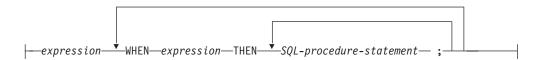
Call procedure proc1 and pass SQL variables as parameters. CALL proc1(v empno, v salary)

The CASE statement selects an execution path based on multiple conditions.

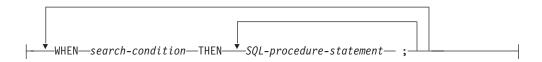
Syntax



simple-when-clause:



searched-when-clause:



else-clause:

```
-SOL-procedure-statement— :-
```

Description

label

Specifies the label for the CASE statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

simple-when-clause

The value of the *expression* prior to the first WHEN keyword is tested for equality with the value of each expression that follows the WHEN keyword. If the comparison is true, the statements in the associated THEN clause are executed and processing of the CASE statement ends. If the result is unknown or false, processing continues to the next comparison. If the result does not match any of the comparisons, and an ELSE clause is present, the statements in the ELSE clause are executed.

searched-when-clause

The search-condition following the WHEN keyword is evaluated. If it evaluates to true, the statements in the associated THEN clause are executed and processing of the CASE statement ends. If it evaluates to false, or unknown, the next search-condition is evaluated. If no search-condition evaluates to true and an ELSE clause is present, the statements in the ELSE clause are executed.

else-clause

If none of the conditions specified in the *simple-when-clause* or searched-when-clause are true, then the statements in the else-clause are executed.

SQL-procedure-statement

Specifies a statement to execute. See "SQL-procedure-statement" on page 1150.

Notes

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Nesting of CASE statements: CASE statements that use a *simple-when-clause* can be nested up to three levels. CASE statements that use a *searched-when-clause* have no limit to the number of nesting levels.

Considerations for SQLSTATE and SQLCODE variables: When the first *SQL-procedure-statement* in the CASE statement is executed, the SQLSTATE and SQLCODE SQL variables reflect the result of evaluating the *expressions* or *search-conditions* of that CASE statement. If a CASE statement does not include an ELSE clause and none of the *search-conditions* evaluate to true, then any error returned from the *expression* is returned.

Examples

Example 1: Depending on the value of SQL variable v_workdept, update column DEPTNAME in table DEPARTMENT with the appropriate name.

The following example shows how to do this using the syntax for a *simple-when-clause*.

```
CASE v_workdept
WHEN 'A00'
THEN UPDATE department SET
deptname = 'DATA ACCESS 1';
WHEN 'B01'
THEN UPDATE department SET
deptname = 'DATA ACCESS 2';
ELSE UPDATE department SET
deptname = 'DATA ACCESS 3';
END CASE
```

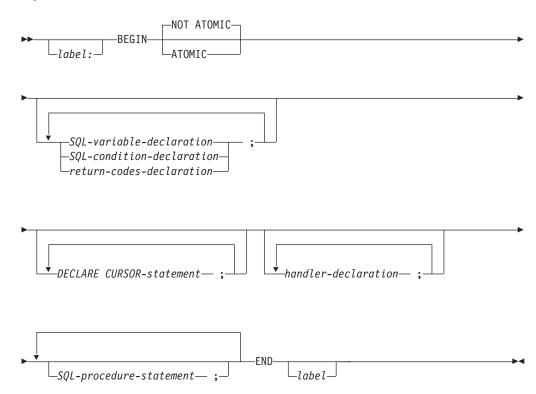
Example 2: The following example shows how to do this using the syntax for a *searched-when-clause:*

```
CASE
WHEN v_workdept = 'A00'
THEN UPDATE department SET
deptname = 'DATA ACCESS 1';
WHEN v_workdept = 'B01'
THEN UPDATE department SET
deptname = 'DATA ACCESS 2';
ELSE UPDATE department SET
deptname = 'DATA ACCESS 3';
END CASE
```

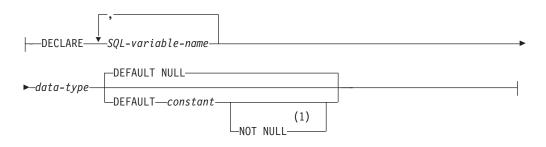
compound-statement

A compound statement groups other statements together in an SQL procedure. A compound statement allows the declaration of SQL variables, cursors, and condition handlers.

Syntax



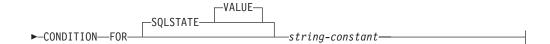
SQL-variable-declaration:



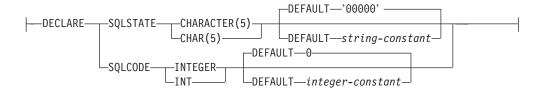
SQL-condition-declaration:

--- DECLARE-SQL-condition-name-

compound-statement



return-codes-declaration:



handler-declaration:

```
→ DECLARE — CONTINUE — HANDLER FOR — specific-condition-value — general-condition-value — PSQL-procedure-statement — (2)
```

specific-condition-value:



general-condition-value:

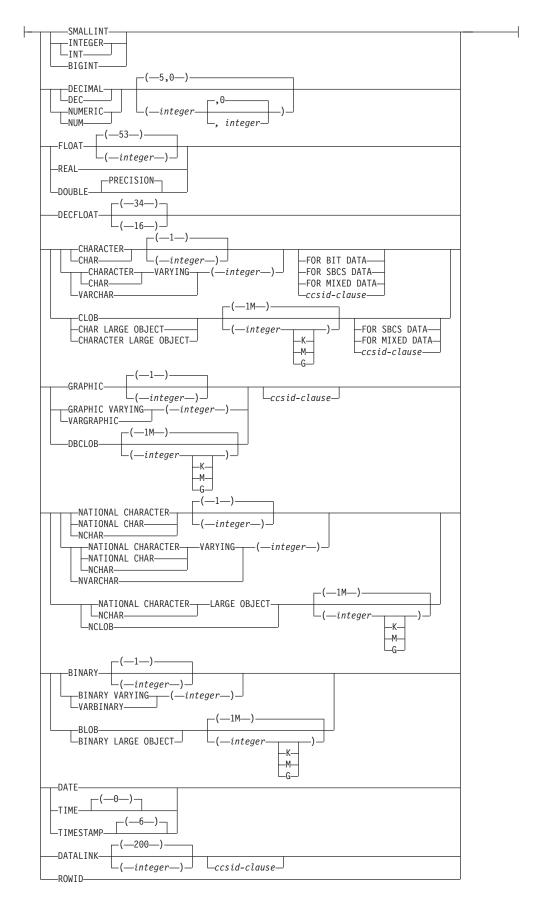
data-type:

Notes:

- 1 The DEFAULT and NOT NULL clauses can be specified in either order.
- 2 *specific-condition-value* and *general-condition-value* cannot be specified in the same handler declaration.

built-in-type:

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Description

label

Specifies the label for the *compound-statement*. If the ending label is specified, it must be the same as the beginning label. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

ATOMIC

ATOMIC indicates that an unhandled exception condition within the *compound-statement* causes the *compound-statement* to be rolled back. If ATOMIC is specified, COMMIT or ROLLBACK statements cannot be specified in the compound statement (ROLLBACK TO SAVEPOINT may be specified).

NOT ATOMIC

NOT ATOMIC indicates that an unhandled exception condition within the *compound-statement* does not causes the *compound-statement* to be rolled back. If NOT ATOMIC is specified in the outermost compound statement of an SQL trigger, it is treated as ATOMIC.

SQL-variable-declaration

Declares a variable that is local to the *compound-statement*.

SQL-variable-name

Defines the name of a local SQL variable. The database manager converts all undelimited SQL variable names to uppercase. The name must not be the same as another SQL variable within the same *compound-statement*, excluding any declarations in *compound-statements* nested within the *compound-statement*. Do not name SQL variables the same as column names or parameter names. See "References to SQL parameters and SQL variables" on page 1145 for how SQL variable names are resolved when there are columns with the same name involved in a statement. Variable names should not begin with 'SQL'.

data-type

Specifies the data type of the variable. See "CREATE TABLE" on page 768 for a description of data type.

If the *data-type* is a graphic string data type, consider specifying CCSID 1200 or 13488 to indicate UTF-16 or UCS-2 data. If a CCSID is not specified, the CCSID of the graphic string variable will be the associated DBCS CCSID for the job.

DEFAULT constant or **NULL**

Defines the default for the SQL variable. The specified constant must represent a value that could be assigned to the variable in accordance with the rules of assignment as described in "Assignments and comparisons" on page 89. The variable is initialized when the *compound-statement* in which it is declared is entered. If a default value is not specified, the SQL variable is initialized to NULL.

NOT NULL

Prevents the SQL variable from containing the NULL value. Omission of NOT NULL implies that the column can be null.

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SQL-condition-declaration

Declares a condition name and corresponding SQLSTATE value.

SQL-condition-name

Specifies the name of the condition. The condition name must be unique within the compound-statement (excluding any declarations in compound-statements nested within the compound-statement) in which it is declared.

FOR SQLSTATE *string-constant*

Specifies the SQLSTATE associated with this condition. The string constant must be specified as 5 characters. The SQLSTATE class (the first 2 characters) must not be '00'.

return-codes-declaration

Declares special SQL variables called SQLSTATE and SQLCODE that are set for the first condition in the diagnostics area after executing an SQL statement other than GET DIAGNOSTICS or an empty compound-statement. The SQLSTATE and SQLCODE variables can only be declared in the outermost compound-statement of an SQL procedure, SQL function, or SQL trigger.

The SQLSTATE and SQLCODE special variables are only intended to be used as a means of obtaining the SQL return codes that resulted from processing the previous SQL statement other than GET DIAGNOSTICS. If there is any intention to use the SQLSTATE and SQLCODE values, save the values immediately to other SQL variables to avoid having the values replaced by the SQL return codes returned after executing the next SQL statement. If a handler is defined that handles an SQLSTATE, you can use an assignment statement to save that SQLSTATE (or the associated SQLCODE) value in another SQL variable, if the assignment is the first statement in the handler.

Assignment to these variables is not prohibited; however, it is not recommended. Assignment to these special variables is ignored by condition handlers. The SQLSTATE and SQLCODE special variables cannot be set to NULL.

DECLARE CURSOR-statement

Declares a cursor in the routine body. The cursor name must be unique within the compound-statement, excluding any declarations in compound-statements nested within the compound-statement.

A cursor-name can only be referenced within the compound-statement in which it is declared, including any compound-statements nested within the compound-statement.

Use an OPEN statement to open the cursor, and a FETCH statement to read rows using the cursor. If the cursor in an SQL procedure and is intended for use as a result set:

- specify WITH RETURN when declaring the cursor
- create the procedure using the DYNAMIC RESULT SETS clause with a non-zero value
- do not specify a CLOSE statement in the *compound-statement*.

Any open cursor that does not meet these criteria is closed at the end of the compound-statement.

For more information about declaring a cursor, refer to "DECLARE CURSOR" on page 845.

handler-declaration

Specifies a handler, an SQL-procedure-statement to execute when an exception or completion condition occurs in the compound-statement.

A condition handler declaration cannot reference the same condition value or SQLSTATE value more than once, and cannot reference an SQLSTATE value and a condition name that represent the same SQLSTATE value. For a list of SQLSTATE values as well as more information, see the SQL messages and codes topic collection.

Furthermore, when two or more condition handlers are declared in a compound statement, no two condition handler declarations may specify the same:

- general condition category or
- specific condition, either as an SQLSTATE value or as a condition name that represents the same value.

A condition handler is active for the set of SQL-procedure-statements that follow the handler-declarations within the compound-statement in which it is declared, including any nested compound statements.

A handler for a condition may exist at several levels of nested compound statements. For example, assume that compound statement n1 contains another compound statement n2 which contains another compound statement n3. When an exception condition occurs within *n*3, any active handlers within *n*3 are first allowed to handle the condition. If no appropriate handler exists in n3, then the condition is resignalled to n2 and the active handlers within n2 may handle the condition. If no appropriate handler exists in n2, then the condition is resignalled to n1 and the active handlers within n1 may handle the condition. If no appropriate handler exists in n1, the condition is considered unhandled.

There are three types of condition handlers:

CONTINUE

Specifies that after the condition handler is activated and completes successfully, control is returned to the SQL statement following the one that raised the exception. If the error occurs while executing a comparison as in an IF, CASE, FOR, WHILE, or REPEAT, control returns to the statement following the corresponding END IF, END CASE, END FOR, END WHILE, or END REPEAT.

EXIT

Specifies that after the condition handler is activated and completes successfully, control is returned to the end of the compound statement that declared the condition handler.

UNDO

Specifies that when the condition handler is activated changes made by the compound-statement are rolled back. When the handler completes successfully, control is returned to the end of the compound-statement. If UNDO is specified, then ATOMIC must be specified.

UNDO cannot be specified in the outermost *compound-statement* of an SQL function or SQL trigger.

The conditions under which the handler is activated are:

SQLSTATE *string*

Specifies that the handler is invoked when the specific SQLSTATE occurs. The SQLSTATE class (the first 2 characters) must not be '00'.

SOL-condition-name

Specifies that the handler is invoked when the specific SQLSTATE associated with the condition name occurs. The SQL-condition-name must be previously defined in a *SQL-condition-declaration*.

SQLEXCEPTION

Specifies that the handler is invoked when an exception condition occurs. An exception condition is represented by an SQLSTATE value where the first two characters are not '00', '01', or '02'.

SOLWARNING

Specifies that the handler is invoked when a warning condition occurs. A warning condition is represented by an SQLSTATE value where the first two characters are '01'.

NOT FOUND

Specifies that the handler is invoked when a NOT FOUND condition occurs. A NOT FOUND condition is represented by an SQLSTATE value where the first two characters are '02'.

Notes

Nesting compound statements: Compound statements can be nested. Nested compound statements can be used to scope variable definitions, condition names, condition handlers, and cursors to a subset of the statements in the compound-statement. This can simplify the processing done for each SQL procedure statement. Support for nested compound statements enables the use of a compound statement within the declaration of a condition handler.

Condition handlers: Condition handlers in a compound-statement are similar to WHENEVER statements used in external SQL application programs. A condition handler can be defined to automatically get control when an exception, warning, or not found condition occurs. The body of a condition handler contains code that is executed when the condition handler is activated. A condition handler can be activated as a result of an exception, warning, or not found condition that is returned by the database manager for the processing of an SQL statement, or the activating condition can be the result of a SIGNAL or RESIGNAL statement issued within the procedure body.

A condition handler is declared within a compound statement, and it is active for the set of SQL-procedure-statements that follow all of the condition handler declarations within the compound statement in which the condition handler is declared. To be more specific, the scope of a condition handler declaration H is the list of SQL-procedure-statements that follows the condition handler declarations contained within the compound statement in which H appears. This means that the scope of H does not include the statements contained in the body of the condition handler H, implying that a condition handler cannot handle conditions that arise inside its own body. Similarly, for any two condition handlers H1 and H2 declared in the same compound statement, H1 will not handle conditions arising in the body of H2, and H2 will not handle conditions arising in the body of H1.

The declaration of a condition handler specifies the condition that activates it, the type of the condition handler (CONTINUE, EXIT, or UNDO), and the handler

action. The type of the condition handler determines where control is returned to after successful completion of the handler action.

Condition handler activation: When a condition other than successful completion occurs in the processing of an *SQL-procedure-statement*, if a condition handler that could handle the condition is within scope, one such condition handler will be activated to process the condition.

In a routine with nested compound statements, condition handlers that could handle a specific condition may exist at several levels of the nested compound statements. The condition handler that is activated is a condition handler that is declared innermost to the scope in which the condition was encountered. If more than one condition handler at that nesting level could handle the condition, the condition handler that is activated is the most appropriate handler declared in that compound statement.

The most appropriate handler is a handler that is defined in the *compound-statement* which most closely matches the SQLSTATE of the exception or completion condition.

For example, if the innermost compound statement declares a specific handler for SQLSTATE 22001 as well as a handler for SQLEXCEPTION, the specific handler for SQLSTATE 22001 is the most appropriate handler when an SQLSTATE 22001 is encountered. In this case, the specific handler is activated.

When a condition handler is activated, the condition handler action is executed. If the handler action completes successfully or with an unhandled warning, the diagnostics area is cleared, and the type of the condition handler (CONTINUE, EXIT, or UNDO handler) determines where control is returned. Additionally, the SQLSTATE and SQLCODE SQL variables are cleared when a handler completes successfully or with an unhandled warning.

If the handler action does not complete successfully, and an appropriate handler exists for the condition encountered in the handler action, that condition handler is activated. Otherwise, the condition encountered within the condition handler is unhandled.

Unhandled conditions: If a condition is encountered and an appropriate handler does not exist for that condition, the condition is unhandled.

- If the unhandled condition is an exception, the SQL procedure, SQL function, or SQL trigger containing the failing statement is terminated with an unhandled exception condition.
- If the unhandled condition is a warning or not found condition, processing
 continues with the next statement. Note that the processing of the next SQL
 statement will cause information about the unhandled condition in the
 diagnostics area to be overwritten, and evidence of the unhandled condition will
 no longer exist.

Considerations for using SIGNAL or RESIGNAL statements with nested compound statements: If an *SQL-procedure-statement* specified in the condition handler is either a SIGNAL or RESIGNAL statement with an exception SQLSTATE, the compound statement terminates with the specified exception. This happens even if this condition handler or another condition handler in the same compound statement specifies CONTINUE, since these condition handlers are not in the scope of this exception. If the compound statement is nested in another compound

statement, condition handlers in the higher level compound statement may handle the exception because those condition handlers are within the scope of the exception.

Null values in SQL parameters and SQL variables: If the value of an SQL parameter or SQL variable is null and it is used in an SQL statement (such as CONNECT or DESCRIBE) that does not allow an indicator variable, an error is returned.

Effect on open cursors: Upon exit from the *compound-statement* for any reason, all open cursors that are declared in that compound statement are closed, unless they are declared to return result sets or unless *ENDACTGRP is specified.

Considerations for SQLSTATE and SQLCODE SQL variables: The compound statement itself does not affect the SQLSTATE and SQLCODE SQL variables. However, SQL statements contained within the compound statement can affect the SQLSTATE and SQLCODE SQL variables. At the end of the compound statement the SQLSTATE and SQLCODE SQL variables reflect the result of the last SQL statement executed within that compound statement that caused a change to the SQLSTATE and SQLCODE SQL variables. If the SQLSTATE and SQLCODE variables were not changed within the compound statement, they contain the same values as when the compound statement was entered.

Examples

Create a procedure body with a compound statement that performs the following actions.

- 1. Declares SQL variables.
- 2. Declares a cursor to return the salary of employees in a department determined by an IN parameter.
- 3. Declares an EXIT handler for the condition NOT FOUND (end of file) which assigns the value 6666 to the OUT parameter medianSalary.
- 4. Select the number of employees in the given department into the SQL variable v numRecords.
- 5. Fetch rows from the cursor in a WHILE loop until 50% + 1 of the employees have been retrieved.
- 6. Return the median salary.

```
CREATE PROCEDURE DEPT MEDIAN
   (IN deptNumber SMALLINT,
   OUT medianSalary DOUBLE)
   LANGUAGE SQL
   DECLARE v numRecords INTEGER DEFAULT 1;
   DECLARE v counter INTEGER DEFAULT 0;
   DECLARE c1 CURSOR FOR
      SELECT salary FROM staff
          WHERE DEPT = deptNumber
          ORDER BY salary;
    DECLARE EXIT HANDLER FOR NOT FOUND
      SET medianSalary = 6666;
       /* initialize OUT parameter */
      SET medianSalary = 0;
      SELECT COUNT(*) INTO v numRecords FROM staff
          WHERE DEPT = deptNumber;
       OPEN c1;
      WHILE v counter < (v numRecords / 2 + 1) DO
          FETCH c1 INTO medianSalary;
```

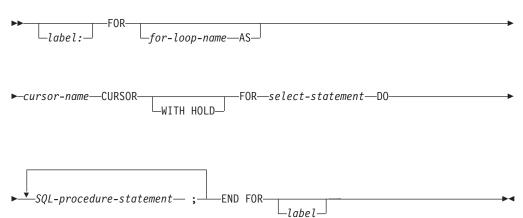
compound-statement

```
SET v_counter = v_counter + 1;
END WHILE;
CLOSE c1;
END
```

FOR statement

The FOR statement executes a statement or group of statements for each row of a table.

Syntax



Description

label

Specifies the label for the FOR statement. If the ending label is specified, it must be the same as the beginning label. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

for-loop-name

Specifies the label for the implicit *compound-statement* that is generated to implement the FOR statement. It follows the rules for the label of a compound-statement except that it cannot be used with an ITERATE, GOTO, or LEAVE statement within the FOR statement. The for-loop-name is used to qualify the column names returned by the specified select-statement. It must not be the same as any label within the same scope. For more information, see "References to SQL labels" on page 1148.

Either the for-loop-name or label can be used to qualify other SQL variable names in the statement.

If for-loop-name is specified, then it should be used to qualify any other SQL variable names in the statement when debugging the SQL function, SQL procedure, or SQL trigger.

cursor-name

Names a cursor.

WITH HOLD

Prevents the cursor from being closed as a consequence of a commit operation. A cursor declared using the WITH HOLD clause is implicitly closed at commit time only if the connection associated with the cursor is ended during the commit operation. For more information, see "DECLARE CURSOR" on page 845.

select-statement

Specifies the select statement of the cursor.

Each expression in the select list must have a name. If an expression is not a simple column name, the AS clause must be used to name the expression. If the AS clause is specified, that name is used for the variable and must be unique.

SQL-procedure-statement

Specifies the SQL statements to be executed for each row of the result table of the cursor. The SQL statements should not include an OPEN, FETCH, or CLOSE specifying the cursor name of the FOR statement.

Notes

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FOR statement rules: The FOR statement executes one or multiple statements for each row in a result table of the cursor. The cursor is defined by specifying a select list that describes the columns and rows selected. The statements within the FOR statement are executed for each row selected.

The select list must consist of unique column names and the objects referenced in the *select-statement* must exist when the function, procedure, or trigger is created.

The cursor specified in a FOR statement cannot be referenced outside the FOR statement and cannot be specified on an OPEN, FETCH, or CLOSE statement.

Handler warning: Handlers may be used to handle errors that might occur on the open of the cursor or fetch of a row using the cursor in the FOR statement. Handlers defined to handle these open or fetch conditions should not be CONTINUE handlers as they may cause the FOR statement to loop indefinitely.

Example

In this example, the FOR statement is used to specify a cursor that selects 3 columns from the employee table. For every row selected, SQL variable *fullname* is set to the last name followed by a comma, the first name, a blank, and the middle initial. Each value for *fullname* is inserted into table TNAMES.

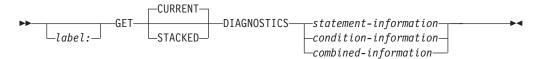
```
BEGIN
  DECLARE fullname CHAR(40);
FOR v1 AS
    c1 CURSOR FOR
  SELECT firstnme, midinit, lastname FROM employee
  DO
    SET fullname =
        lastname || ', ' || firstnme || ' ' || midinit;
    INSERT INTO TNAMES VALUES ( fullname );
    END FOR;
END;
```

GET DIAGNOSTICS statement

The GET DIAGNOSTICS statement obtains information about the previous SQL statement that was executed. The syntax of GET DIAGNOSTICS in an SQL function, SQL procedure, or SQL trigger is a subset of what is supported as a GET DIAGNOSTICS statement in other contexts.

See "GET DIAGNOSTICS" on page 943 for details.

Syntax



statement-information:

```
SQL-variable-name-1
                          = -statement-information-item
└SQL-parameter-name-1
```

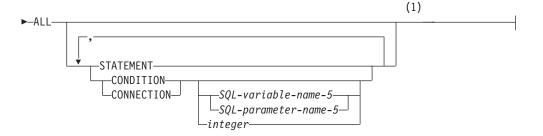
condition-information:



```
-SQL-variable-name-3-
                                   -connection-information-item-
-SQL-parameter-name-3⊸
                                  \vdashcondition-information-item\vdash
```

combined-information:

```
-SQL-variable-name-4
└SQL-parameter-name-4
```

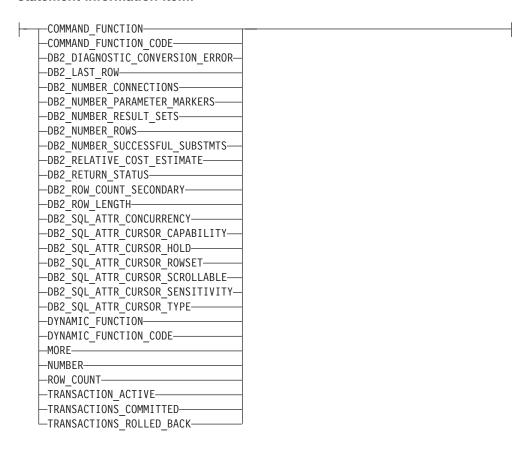


Notes:

STATEMENT can only be specified once. If SQL-variable-name-5,

SQL-parameter-name-5, or integer is not specified, CONDITION and CONNECTION can only be specified once.

statement-information-item:



connection-information-item:

```
-CONNECTION NAME-
-DB2 AUTHENTICATION TYPE-
-DB2 AUTHORIZATION ID-
-DB2 CONNECTION METHOD-
-DB2 CONNECTION NUMBER-
-DB2 CONNECTION STATE-
-DB2 CONNECTION STATUS-
-DB2 CONNECTION TYPE-
-DB2_DYN_QUERY_MGMT-
-DB2 ENCRYPTION TYPE-
-DB2 PRODUCT ID-
-DB2 SERVER CLASS NAME-
-DB2 SERVER NAME-
```

condition-information-item:

CATALOG_NAME————————————————————————————————————	
-CLASS_ORIGIN-	
COLUMN_NAME	
-CONDITION_IDENTIFIER-	
CONDITION_NUMBER	
-CONSTRAINT_CATALOG-	
-CONSTRAINT_NAME	
-CONSTRAINT_SCHEMA-	
CURSOR_NAME	
—DB2 ERROR CODE1—	
DB2_ERROR_CODE1	
—DB2 ERROR CODE3—————	
-DB2_ERROR_CODE4	
—DB2 INTERNAL FRROR POINTER——	
DB2_LINE_NUMBER	
—DB2 MESSAGE ID—————	
—DB2 MESSAGE ID1—————	
—DB2 MESSAGE ID2————	
—DB2_MESSAGE_KEY—————	
—DB2_MODULE_DETECTING_ERROR——	
—DB2 NUMBER FAILING STATEMENTS—	
—DB2 OFFSET	
DB2_ORDINAL_TOKEN_n	
—DB2_PARTITION_NUMBER—	
—DB2 REASON CODE—————	
-DB2_RETURNED_SQLCODE-	
—DB2_ROW_NUMBER—	
—DB2 SOLERRD SET—	
—DB2 SQLERRD1—	
-DB2_SQLERRD2	
-DB2 SQLERRD3-	
-DB2 SQLERRD4-	
DB2_SQLERRD5	
—DB2 SQLERRD6—	
—DB2_TOKEN_COUNT—————	
-DB2_TOKEN_STRING-	
-MESSAGE LENGTH-	
-MESSAGE OCTET LENGTH	
-MESSAGE TEXT-	
—PARAMETER MODE—————	
—PARAMETER_NAME	
PARAMETER ORDINAL POSITION	
RETURNED SQLSTATE	
-ROUTINE CATALOG-	
DOUTING NAME	
-ROUTINE_SCHEMA-	
—SCHEMA_NAME——————	
—SERVER_NAME—————	
SPECIFIC_NAME	
-SUBCLASS ORIGIN-	
-TABLE NAME	
-TRIGGER_CATALOG-	
-TRIGGER NAME-	
_TRIGGER_SCHEMA	

Description

label

Specifies the label for the GET DIAGNOSTICS statement. If the ending label is specified, it must be the same as the beginning label. The label name cannot be

the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

CURRENT or STACKED

Specifies which diagnostics area to access.

CURRENT

Specifies to access the first diagnostics area. It corresponds to the previous SQL statement that was executed and that was not a GET DIAGNOSTICS statement. This is the default.

STACKED

Specifies to access the second diagnostics area. The second diagnostics area is only available within a handler. It corresponds to the previous SQL statement that was executed before the handler was entered and that was not a GET DIAGNOSTICS statement. If the GET DIAGNOSTICS statement is the first statement within a handler, then the first diagnostics area and the second diagnostics area contain the same diagnostics information.

statement-information

Returns information about the last SQL statement executed.

SQL-variable-name-1 or SQL-parameter-name-1

Identifies a variable described in the program in accordance with the rules for declaring SQL variables and SQL parameters. The data type of the SQL variable or SQL parameter must be compatible with the data type as specified in Table 64 on page 960 for the specified condition information item. The variable is assigned the value of the specified statement information item according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the value is truncated when assigning it to the SQL variable or SQL parameter, a warning is returned (SQLSTATE 01004) and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

If a specified diagnostic item does not contain diagnostic information , then the SQL variable or SQL parameter is set to a default value, based on its data type: 0 for an exact numeric diagnostic item, an empty string for a VARCHAR diagnostic item and blanks for a CHAR diagnostic item.

condition-information

Returns information about the condition or conditions that occurred when the last SQL statement was executed.

Identifies the diagnostic for which information is requested. Each diagnostic that occurs while executing an SQL statement is assigned an integer. The value 1 indicates the first diagnostic, 2 indicates the second diagnostic and so on. If the value is 1, then the diagnostic information retrieved corresponds to the condition indicated by the SQLSTATE value actually returned by the execution of the previous SQL statement (other than a GET DIAGNOSTICS statement). The SQL variable or SQL parameter specified must be described in the program in accordance with the rules for declaring numeric SQL variables or SQL parameters. The value specified must not be less than one or greater than the number of available diagnostics

SQL-variable-name-3 **or** SQL-parameter-name-3

Identifies a variable described in the program in accordance with the rules for declaring SQL variables or SQL parameters. The data type of the SQL variable or SQL parameter must be compatible with the data type as

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specified in Table 64 on page 960 for the specified condition information item. The SQL variable or SQL parameter is assigned the value of the specified condition information item according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the value is truncated when assigning it to the SQL variable or SQL parameter, a warning is returned (SQLSTATE 01004) and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

If a specified diagnostic item does not contain diagnostic information, then the SQL variable or SQL parameter is set to a default value, based on its data type: 0 for an exact numeric diagnostic item, an empty string for a VARCHAR diagnostic item and blanks for a CHAR diagnostic item.

combined-information

Returns multiple information items combined into one string.

If the GET DIAGNOSTICS statement is specified in an SQL function, SQL procedure, or trigger, the GET DIAGNOSTICS statement must be the first statement specified in the handler that will handle the error.

If information is wanted about a warning,

- If a handler will get control for the warning condition, the GET DIAGNOSTICS statement must be the first statement specified in that handler.
- If a handler will not get control for the warning condition, the GET DIAGNOSTICS statement must be the next statement executed after that previous statement.

SQL-variable-name-4 **or** SQL-parameter-name-4

Identifies a variable described in the program in accordance with the rules for declaring SQL variables or SQL parameters. The data type of the SQL variable or SQL parameter must be VARCHAR. The SQL variable or SQL parameter is assigned according to the retrieval assignment rules described in "Retrieval assignment" on page 93. If the length of SQL-variable-name-4 or SQL-parameter-name-4 is not sufficient to hold the full returned diagnostic string, the string is truncated, a warning is returned (SQLSTATE 01004) and the GET_DIAGNOSTICS_DIAGNOSTICS item of the diagnostics area is updated with the details of this condition.

ALL

Indicates that all diagnostic items that are set for the last SQL statement executed should be combined into one string. The format of the string is a semicolon separated list of all of the available diagnostic information in the form:

item-name=character-form-of-the-item-value;

The character form of a positive numeric value will not contain a leading plus sign (+) unless the item is RETURNED SQLCODE. In this case, a leading plus sign (+) is added. For example:

NUMBER=1;RETURNED SQLSTATE=02000;DB2 RETURNED SQLCODE=+100;

Only items that contain diagnostic information are included in the string.

STATEMENT

Indicates that all statement-information-item diagnostic items that contain

diagnostic information for the last SQL statement executed should be combined into one string. The format is the same as described above for ALL.

CONDITION

Indicates that *condition-information-item* diagnostic items that contain diagnostic information for the last SQL statement executed should be combined into one string. If SQL-variable-name-5 or SQL-parameter-name-5 or integer is specified, then the format is the same as described above for the ALL option. If SQL-variable-name-5 or SQL-parameter-name-5 or integer is not specified, then the format includes a condition number entry at the beginning of the information for that condition in the form:

CONDITION NUMBER=X; item-name=character-form-of-the-item-value;

where X is the number of the condition. For example: CONDITION NUMBER=1; RETURNED SQLSTATE=02000; RETURNED SQLCODE=+100; CONDITION NUMBER=2; RETURNED SQLSTATE=01004;

CONNECTION

Indicates that connection-information-item diagnostic items that contain diagnostic information for the last SQL statement executed should be combined into one string. If SQL-variable-name-5 or SQL-parameter-name-5 or integer is specified, then the format is the same as described above for ALL. If SQL-variable-name-5 or SQL-parameter-name-5 or integer is not specified, then the format includes a connection number entry at the beginning of the information for that condition in the form:

CONNECTION NUMBER=X; item-name=character-form-of-the-item-value;

where X is the number of the condition. For example: CONNECTION NUMBER=1; CONNECTION NAME=SVL1; DB2 PRODUCT ID=DSN07010;

SQL-variable-name-5 or SQL-parameter-name-5 or integer Identifies the diagnostic for which ALL CONDITION or ALL CONNECTION information is requested. The SQL variable or SQL parameter specified must be described in the program in accordance with the rules for declaring numeric SQL variables or SQL parameters. The value specified must not be less than one or greater than the number of available diagnostics.

statement-information-item

For a description of the statement-information-items, see "statement-information-item" on page 948.

connection-information-item

For a description of the connection-information-items, see "connection-information-item" on page 952.

condition-information-item

For a description of the condition-information-items, see "condition-information-item" on page 953.

Notes

1

Effect of statement:: The GET DIAGNOSTICS statement does not change the contents of the diagnostics area except for DB2 GET DIAGNOSTICS DIAGNOSTICS.

Considerations for the SQLCODE and SQLSTATE SQL variables: The GET DIAGNOSTICS statement does not change the value of the SQLSTATE and SQLCODE SQL variables.

Case of return values: Values for identifiers in returned diagnostic items are not delimited and are case sensitive. For example, a table name of "abc" would be returned, simply as abc.

Data types for items: When a diagnostic item is assigned to a SQL variable or SQL parameter, the SQL variable or SQL parameter must be compatible with the data type of the diagnostic item. For more information, see Table 64 on page 960.

Keyword Synonym: The following keywords are synonyms supported for compatibility to prior releases. These keywords are non-standard and should not be used:

- The keyword EXCEPTION can be used as a synonym for CONDITION.
- The keyword RETURN_STATUS can be used as a synonym for DB2_RETURN_STATUS.

Example

Example 1:: In an SQL procedure, execute a GET DIAGNOSTICS statement to determine how many rows were updated.

```
CREATE PROCEDURE sqlprocg (IN deptnbr VARCHAR(3))
 LANGUAGE SQL
 BEGIN
   DECLARE SQLSTATE CHAR(5);
   DECLARE roount INTEGER;
   UPDATE CORPDATA.PROJECT
     SET PRSTAFF = PRSTAFF + 1.5
     WHERE DEPTNO = deptnbr;
   GET DIAGNOSTICS roount = ROW COUNT;
    /* At this point, rcount contains the number of rows that were updated. */
 END
```

Example 2:: Within an SQL procedure, handle the returned status value from the invocation of a stored procedure called TRYIT. TRYIT could use the RETURN statement to explicitly return a status value or a status value could be implicitly returned by the database manager. If the procedure is successful, it returns a value of zero.

```
CREATE PROCEDURE TESTIT ()
 LANGUAGE SQL
 A1: BEGIN
     DECLARE RETVAL INTEGER DEFAULT 0;
     CALL TRYIT
      GET DIAGNOSTICS RETVAL = RETURN_STATUS;
      IF RETVAL <> 0 THEN
         LEAVE A1;
     ELSE
     END IF;
 END A1
```

Example 3:: In an SQL procedure, execute a GET DIAGNOSTICS statement to retrieve the message text for an error.

GET DIAGNOSTICS statement

```
CREATE PROCEDURE divide2 ( IN numerator INTEGER,
                      IN denominator INTEGER,
                     OUT divide result INTEGER,
                         OUT divide_error VARCHAR(70) )
LANGUAGE SQL
  BEGIN
     DECLARE CONTINUE HANDLER FOR SQLEXCEPTION
        GET DIAGNOSTICS EXCEPTION 1
         divide_error = MESSAGE_TEXT;
     SET divide_result = numerator / denominator;
  END;
```

GOTO statement

The GOTO statement branches to a user-defined label within an SQL function, SQL procedure, or SQL trigger.

Syntax 1 4 1



Description

label1

Specifies the label for the GOTO statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

label2

Specifies the labelled statement where processing is to continue. The labelled statement and the GOTO statement must both be in the same scope:

- If the GOTO statement is defined in a FOR statement, label2 must be defined inside the same FOR statement, excluding a nested FOR statement or nested compound statement.
- If the GOTO statement is defined outside a FOR statement, label2 must not be defined within a FOR statement or nested compound statement.
- If the GOTO statement is defined in a condition handler, label2 must be defined inside the same handler.
- If the GOTO statement is defined outside a condition handler, label2 must not be defined within a condition handler.

If label2 is not defined within a scope that the GOTO statement can reach, an error is returned.

Notes

Using a GOTO statement: It is recommended that the GOTO statement be used sparingly. This statement interferes with normal sequence of processing SQL statements, thus making a routine more difficult to read and maintain. Before using a GOTO statement, determine whether another statement, such as IF or LEAVE, can be used in place, to eliminate the need for a GOTO statement.

Effect on open cursors: When a GOTO statement transfers control out of a compound statement, all open cursors that are declared in the compound statement that contains the GOTO statement are closed, unless they are declared to return result sets or unless *ENDACTGRP is specified.

Effect on ATOMIC compound statements: When a GOTO statement transfers control out of an ATOMIC compound statement, the savepoint that was implicitly started when the ATOMIC compound statement was entered is released.

Considerations for SQLSTATE and SQLCODE variables: The GOTO statement does not affect the SQLSTATE and SQLCODE SQL variables. At the end of the GOTO statement the SQLSTATE and SQLCODE SQL variables reflect the result of the last statement executed before that GOTO statement.

Example

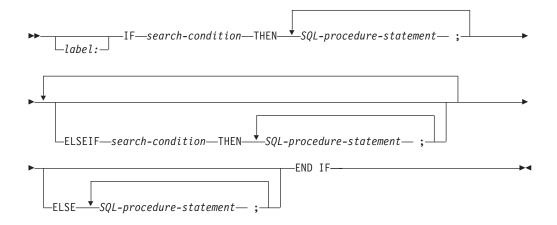
In the following statement, the parameters *rating* and *v_empno* are passed in to the procedure. The time in service is returned as a date duration in output parameter *return_parm*. If the time in service with the company is less then 6 months, the GOTO statement transfers control to the end of the procedure and *new_salary* is left unchanged.

```
CREATE PROCEDURE adjust_salary
  (IN v empno CHAR(6),
  IN rating INTEGER,
  OUT return_parm DECIMAL(8,2))
 LANGUAGE SQL
 MODIFIES SQL DATA
    BEGIN
       DECLARE new_salary DECIMAL(9,2);
       DECLARE service DECIMAL(8,2);
            SELECT salary, CURRENT DATE - hiredate
               INTO new salary, service
               FROM employee
              WHERE empno = v_empno;
            IF service < 600</pre>
             THEN GOTO exit1;
            END IF;
            IF rating = 1
             THEN SET new_salary = new_salary + (new_salary * .10);
             ELSEIF rating = 2
             THEN SET new_salary = new_salary + (new_salary * .05);
            END IF;
            UPDATE employee
               SET salary = new_salary
               WHERE empno = v_empno;
       EXIT1: SET return_parm = service;
    END
```

IF statement

The IF statement executes different sets of SQL statements based on the result of search conditions.

Syntax 1 4 1



Description

label

Specifies the label for the IF statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

search-condition

Specifies the search-condition for which an SQL statement should be executed. If the condition is unknown or false, processing continues to the next search condition, until either a condition is true or processing reaches the ELSE clause.

SQL-procedure-statement

Specifies an SQL statement to execute if the preceding *search-condition* is true.

Notes

Considerations for SQLSTATE and SQLCODE SQL variables: When the first SQL-procedure-statement in the IF statement is executed, the SQLSTATE and SQLCODE SQL variables reflect the result of evaluating the search-conditions of that IF statement. If an IF statement does not include an ELSE clause and none of the search-conditions evaluate to true, then when the statement that follows the IF statement is executed, the SQLSTATE and SQLCODE SQL variables reflect the result of evaluating the search conditions of that IF statement.

Example

The following SQL procedure accepts two IN parameters: an employee number and an employee rating. Depending on the value of rating, the employee table is updated with new values in the salary and bonus columns.

```
CREATE PROCEDURE UPDATE SALARY IF
   (IN employee number CHAR(6), INOUT rating SMALLINT)
   LANGUAGE SQL
```

```
MODIFIES SQL DATA
BEGIN
   DECLARE not_found CONDITION FOR SQLSTATE '02000';
DECLARE EXIT HANDLER FOR not_found
       SET rating = -1;
   IF rating = 1
      THEN UPDATE employee
       SET salary = salary * 1.10, bonus = 1000
      WHERE empno = employee_number;
   ELSEIF rating = 2
       THEN UPDATE employee
      SET salary = salary * 1.05, bonus = 500
WHERE empno = employee_number;
   ELSE UPDATE employee
       SET salary = salary * 1.03, bonus = 0
       WHERE empno = employee_number;
   END IF;
END
```

ITERATE statement

The ITERATE statement causes the flow of control to return to the beginning of a labelled loop.

Syntax

```
-ITERATE—target-label
-label:-
```

Description

label

Specifies the label for the ITERATE statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

target-label

Specifies the label of the FOR, LOOP, REPEAT, or WHILE statement to which the flow of control is passed. target-label must be defined as a label for a FOR, LOOP, REPEAT, or WHILE statement. The ITERATE statement must be in that FOR, LOOP, REPEAT, or WHILE statement, or in the block of code that is directly or indirectly nested within that statement, subject to the following restrictions:

- If the ITERATE statement is in a condition handler, target-label must be defined in that condition handler.
- If the ITERATE statement is not in a condition handler, target-label must not be defined in a condition handler.
- If the ITERATE statement is in a FOR statement, target-label must be that label on that FOR statement, or the label must be defined inside that FOR statement.

Notes

Considerations for SQLSTATE and SQLCODE variables: The ITERATE statement does not affect the SQLSTATE and SQLCODE SQL variables. At the end of the ITERATE statement the SQLSTATE and SQLCODE SQL variables reflect the result of the last statement executed before that ITERATE statement.

Example

This example uses a cursor to return information for a new department. If the not_found condition handler was invoked, the flow of control passes out of the loop. If the value of v_dept is 'D11', an ITERATE statement passes the flow of control back to the top of the LOOP statement. Otherwise, a new row is inserted into the DEPARTMENT table.

```
CREATE PROCEDURE ITERATOR ()
  LANGUAGE SQL
  MODIFIES SQL DATA
   BEGIN
      DECLARE v_dept CHAR(3);
      DECLARE v deptname VARCHAR(29);
      DECLARE v_admdept CHAR(3);
      DECLARE at end INTEGER DEFAULT 0;
      DECLARE not found CONDITION FOR SQLSTATE '02000';
      DECLARE c1 CURSOR FOR
        SELECT deptno, deptname, admrdept
```

ITERATE statement

```
FROM department
     ORDER BY deptno;
   DECLARE CONTINUE HANDLER FOR not_found
     SET at_end = 1;
   OPEN c1;
   ins_loop:
   L00P
      FETCH c1 INTO v_dept, v_deptname, v_admdept;
      IF at_end = 1 THEN
        LEAVE ins_loop;
      ELSEIF v_dept ='D11' THEN ITERATE ins_loop;
      END IF;
      INSERT INTO department (deptno,deptname,admrdept)
         VALUES('NEW', v_deptname, v_admdept);
   END LOOP;
   CLOSE c1;
END
```

LEAVE statement

The LEAVE statement continues execution by leaving a block or loop.

Syntax



Description

label1

Specifies the label for the LEAVE statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

label2

Specifies the label of the compound, FOR, LOOP, REPEAT, or WHILE statement to exit.

The LEAVE statement cannot be used to leave a handler.

Notes

Effect on open cursors: When a LEAVE statement transfers control out of a compound statement, all open cursors that are declared in the compound statement that contains the LEAVE statement are closed, unless they are declared to return result sets or unless *ENDACTGRP is specified.

Considerations for SQLSTATE and SQLCODE variables: The LEAVE statement does not affect the SQLSTATE and SQLCODE SQL variables. At the end of the LEAVE statement the SQLSTATE and SQLCODE SQL variables reflect the result of the last statement executed before that LEAVE statement.

Examples

The example contains a loop that fetches data for cursor c1. If the value of SQL variable *at_end* is not zero, the LEAVE statement transfers control out of the loop.

```
CREATE PROCEDURE LEAVE LOOP (OUT COUNTER INTEGER)
   LANGUAGE SQL
   BEGIN
      DECLARE v counter INTEGER;
      DECLARE v firstnme VARCHAR(12);
      DECLARE v_midinit CHAR(1);
      DECLARE v_lastname VARCHAR(15);
      DECLARE at end SMALLINT DEFAULT 0;
      DECLARE not found CONDITION FOR SQLSTATE '02000';
      DECLARE c1 CURSOR FOR
         SELECT firstnme, midinit, lastname
         FROM employee;
      DECLARE CONTINUE HANDLER FOR not found
         SET at end = 1;
      SET v counter = 0;
      OPEN c1;
      fetch_loop:
         FETCH c1 INTO v firstnme, v midinit, v lastname;
         IF at end \Leftrightarrow 0 THEN
            LEAVE fetch loop;
```

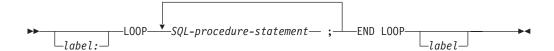
LEAVE statement

```
SET v_counter = v_counter + 1;
END LOOP fetch_loop;
SET counter = v_counter;
CLOSE c1;
END
```

LOOP statement

The LOOP statement repeats the execution of a statement or a group of statements.

Syntax



Description

label

Specifies the label for the LOOP statement. If the ending label is specified, it must be the same as the beginning label. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

SQL-procedure statement

Specifies an SQL statement to be executed in the loop

Notes

Considerations for the diagnostics area: At the beginning of the first iteration of the LOOP statement, and with every subsequent iteration, the diagnostics area is cleared.

Considerations for SQLSTATE and SQLCODE variables: Prior to executing the first *SQL-procedure statement* within that LOOP statement, the SQLSTATE and SQLCODE values reflect the last values that were set prior to the LOOP statement. If the loop is terminated with a GOTO or a LEAVE statement, the SQLSTATE and SQLCODE values reflect the successful completion of that statement. When the LOOP statement iterates, the SQLSTATE and SQLCODE values reflect the result of the last SQL statement executed within the LOOP statement.

Examples

This procedure uses a LOOP statement to fetch values from the employee table. Each time the loop iterates, the OUT parameter *counter* is incremented and the value of $v_midinit$ is checked to ensure that the value is not a single space (' '). If $v_midinit$ is a single space, the LEAVE statement passes the flow of control outside of the loop.

```
CREATE PROCEDURE LOOP_UNTIL_SPACE (OUT COUNTER INTEGER)

LANGUAGE SQL

BEGIN

DECLARE v_counter INTEGER DEFAULT 0;

DECLARE v_firstnme VARCHAR(12);

DECLARE v_midinit CHAR(1);

DECLARE v_lastname VARCHAR(15);

DECLARE c1 CURSOR FOR

SELECT firstnme, midinit, lastname

FROM employee;

DECLARE CONTINUE HANDLER FOR NOT FOUND

SET counter = -1;

OPEN c1;

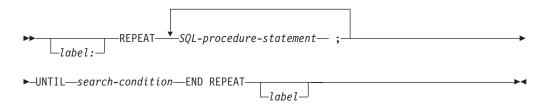
fetch_loop:
LOOP
```

LOOP statement

```
FETCH c1 INTO v_firstnme, v_midinit, v_lastname; IF v_midinit = ' ' THEN
           LEAVE fetch_loop;
       END IF;
   SET v_counter = v_counter + 1;
END LOOP fetch_loop;
   SET counter = v_counter;
   CLOSE c1;
END
```

The REPEAT statement executes a statement or group of statements until a search condition is true.

Syntax



Description

label

Specifies the label for the REPEAT statement. If the ending label is specified, it must be the same as the beginning label. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

SQL-procedure-statement

Specifies an SQL statement to be executed in the REPEAT loop.

search-condition

The *search-condition* is evaluated after each execution of the REPEAT loop. If the condition is true, the REPEAT loop will exit. If the condition is unknown or false, the looping continues.

Notes

Considerations for the diagnostics area: At the beginning of the first iteration of the REPEAT statement, and with every subsequent iteration, the diagnostics area is cleared.

Considerations for SQLSTATE and SQLCODE SQL variables: With each iteration of the REPEAT statement, the SQLSTATE and SQLCODE SQL variables are cleared prior to executing the first *SQL-procedure-statement* within the REPEAT statement. At the beginning of the first iteration of the REPEAT statement, the SQLSTATE and SQLCODE values reflect the last values that were set prior to the REPEAT statement. At the beginning of iterations 2 through n of the REPEAT statement, the SQLSTATE and SQLCODE values reflect the result of evaluating the search condition in the UNTIL clause of that REPEAT statement. If the loop is terminated with a GOTO, ITERATE, or LEAVE statement, the SQLSTATE and SQLCODE values reflect the successful completion of that statement. Otherwise, after the END REPEAT of the REPEAT statement completes, the SQLSTATE and SQLCODE values reflect the result of evaluating the search condition in the UNTIL clause of that REPEAT statement.

Example

A REPEAT statement fetches rows from a table until the *not_found* condition handler is invoked.

| | | |

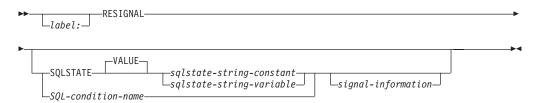
```
CREATE PROCEDURE REPEAT_STMT (OUT COUNTER INTEGER)
   LANGUAGE SQL
   BEGIN
     DECLARE v_{counter} INTEGER DEFAULT 0;
     DECLARE v_firstnme VARCHAR(12);
      DECLARE v midinit CHAR(1);
     DECLARE v lastname VARCHAR(15);
     DECLARE at end SMALLINT DEFAULT 0;
     DECLARE not_found CONDITION FOR SQLSTATE '02000';
     DECLARE c1 CURSOR FOR
         SELECT firstnme, midinit, lastname
         FROM employee;
     DECLARE CONTINUE HANDLER FOR not_found
         SET at_end = 1;
      OPEN c1;
      fetch_loop:
      REPEAT
         FETCH c1 INTO v_firstnme, v_midinit, v_lastname;
         SET v_counter = v_counter + 1;
         UNTIL at_end > 0
     END REPEAT fetch loop;
     SET counter = v_counter;
      CLOSE c1;
   END
```

RESIGNAL statement

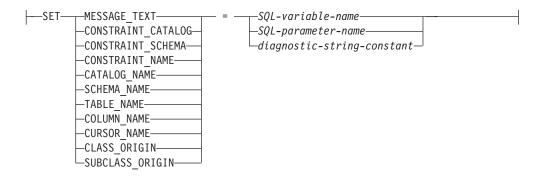
The RESIGNAL statement is used within a condition handler to re-raise the current condition, or raise an alternate condition so that it can be processed at a higher level. It causes an exception, warning, or not found condition to be returned, along with optional message text.

Issuing the RESIGNAL statement without an operand causes the current condition to be passed outwards.

Syntax 1 4 1



signal-information:



Description

label

Specifies the label for the RESIGNAL statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

SQLSTATE VALUE

Specifies the SQLSTATE that will be resignaled. Any valid SQLSTATE value can be used. The specified value must follow the rules for SQLSTATEs:

- Each character must be from the set of digits ('0' through '9') or non-accented upper case letters ('A' through 'Z').
- The SQLSTATE class (first two characters) cannot be '00' since this represents successful completion.

If the SQLSTATE does not conform to these rules, an error is returned.

sqlstate-string-constant

The sqlstate-string-constant must be a character string constant with exactly 5 characters.

sqlstate-string-variable

The *sqlstate-string-variable* must be a character or Unicode graphic variable. The actual length of the contents of the *sqlstate-string-variable* must be 5.

SQL-condition-name

Specifies the name of the condition that will be returned. The *SQL-condition-name* must be declared within the *compound-statement*.

SET

Introduces the assignment of values to condition-information-items. The condition-information-item values can be accessed using the GET DIAGNOSTICS statement. The only condition-information-item that can be accessed in the SQLCA is MESSAGE_TEXT.

MESSAGE_TEXT

Specifies a string that describes the error or warning.

If an SQLCA is used,

- · the string is returned in the SQLERRMC field of the SQLCA
- if the actual length of the string is longer than 1000 bytes, it is truncated without a warning.

CONSTRAINT CATALOG

Specifies a string that indicates the name of the database that contains a constraint related to the signalled error or warning.

CONSTRAINT SCHEMA

Specifies a string that indicates the name of the schema that contains a constraint related to the signalled error or warning.

CONSTRAINT NAME

Specifies a string that indicates the name of a constraint related to the signalled error or warning.

CATALOG NAME

Specifies a string that indicates the name of the database that contains a table or view related to the signalled error or warning.

SCHEMA_NAME

Specifies a string that indicates the name of the schema that contains a table or view related to the signalled error or warning.

TABLE NAME

Specifies a string that indicates the name of a table or view related to the signalled error or warning.

COLUMN NAME

Specifies a string that indicates the name of a column in the table or view related to the signalled error or warning.

CURSOR_NAME

Specifies a string that indicates the name of a cursor related to the signalled error or warning.

CLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE class related to the signalled error or warning.

SUBCLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE subclass related to the signalled error or warning.

SQL-variable-name

Identifies an SQL variable declared within the compound-statement, that

contains the value to be assigned to the condition-information-item. The SQL variable must be defined as CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable.

SQL-parameter-name

Identifies an SQL parameter declared within the compound-statement, that contains the value to be assigned to the condition-information-item. The SQL parameter must be defined as CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable.

diagnostic-string-constant

Specifies a character string constant that contains the value to be assigned to the *condition-information-item*.

Notes

SQLSTATE values: Any valid SQLSTATE value can be used in the RESIGNAL statement. However, it is recommended that programmers define new SQLSTATEs based on ranges reserved for applications. This prevents the unintentional use of an SQLSTATE value that might be defined by the database manager in a future release.

For more information about SQLSTATEs, see the SQL Messages and Codes topic collection.

Assignment: When the RESIGNAL statement is executed, the value of each of the specified string-constants and variables is assigned to the corresponding condition-information-item. However, if the length of a string-constant or variable is longer than the maximum length of the corresponding *condition-information-item*, it is truncated without a warning. For details on the assignment rules, see "Assignments and comparisons" on page 89. For details on the maximum length of specific condition-information-items, see "GET DIAGNOSTICS" on page 943.

Processing a RESIGNAL statement:

- · If the RESIGNAL statement is specified without a SQLSTATE clause or a SQL-condition-name, the SQL function, SQL procedure, or SQL trigger resignals the identical condition that invoked the handler and the SQLCODE is not changed.
- When a RESIGNAL statement is issued and an SQLSTATE or SQL-condition-name is specified, the SQLCODE is based on the SQLSTATE value as follows:
 - If the specified SQLSTATE class is either '01' or '02', a warning or not found is signalled and the SQLCODE is set to +438.
 - Otherwise, an exception is returned and the SQLCODE is set to -438.

If the SQLSTATE or condition indicates that an exception is signalled (SQLSTATE class other than '01' or '02');,

- If a handler exists in the same compound statement as the RESIGNAL statement, and the compound-statement contains a handler for SQLEXCEPTION or the specified SQLSTATE or condition; the exception is handled and control is transferred to that handler.
- If the compound-statement is nested and an outer level compound-statement has a handler for SQLEXCEPTION or the specified SQLSTATE or condition; the exception is handled and control is transferred to that handler.
- Otherwise, the exception is not handled and control is immediately returned to the end of the compound statement.

If the SQLSTATE or condition indicates that a warning (SQLSTATE class '01') or not found (SQLSTATE class '02') is signalled:

- If a handler exists in the same compound statement as the RESIGNAL statement, and the *compound-statement* contains a handler for SQLWARNING (if the SQLSTATE class is '01'), NOT FOUND (if the SQLSTATE class is '02'), or the specified SQLSTATE or condition; the warning or not found condition is handled and control is transferred to that handler.
- If the *compound-statement* is nested and an outer level compound statement contains a handler for SQLWARNING (if the SQLSTATE class is '01'), NOT FOUND (if the SQLSTATE class is '02'), or the specified SQLSTATE or condition; the warning or not found condition is handled and the exception is handled and control is returned to that handler.
- Otherwise, the warning is not handled and processing continues with the next statement.

Considerations for the diagnostics area: The RESIGNAL statement might modify the contents of the current diagnostics area. If an SQLSTATE or *SQL-condition-name* is specified as part of the RESIGNAL statement, the RESIGNAL statement starts with a clear of the diagnostics area and sets the RETURNED_SQLSTATE to reflect the specified SQLSTATE or *SQL-condition-name*. If any *signal-information* is specified, the corresponding items in the condition area are assigned the specified values. DB2_RETURNED_SQLCODE is set to +438 or -438 corresponding to the specified SQLSTATE or *SQL-condition-name*.

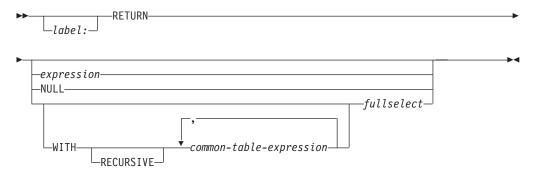
Example

This example detects a division by zero error. The IF statement uses a SIGNAL statement to invoke the overflow condition handler. The condition handler uses a RESIGNAL statement to return a different SQLSTATE value to the client application.

RETURN statement

The RETURN statement returns from a routine. For SQL functions, it returns the result of the function. For an SQL procedure, it optionally returns an integer status value. For SQL table functions, it returns a table as the result of the function.

Syntax



Description

label

Specifies the label for the RETURN statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

expression

Specifies a value that is returned from the routine:

- If the routine is a scalar function, the data type of the result must be assignable to the data type defined for the function result, using the storage assignment rules as described in "Assignments and comparisons" on page 89. An aggregate function, or user-defined function that is sourced on an aggregate function must not be specified for a RETURN statement in an SQL scalar function.
- If the routine is a table function, a scalar expression (other than a scalar fullselect) cannot be specified.
- If the routine is a procedure, the data type of expression must be INTEGER. If the *expression* evaluates to the null value, a value of zero is returned.

NULL

Specifies that the null value is returned from the routine.

- If the routine is a scalar function, the null value is returned.
- If the routine is a table function, NULL must not be specified.
- If the routine is a procedure, NULL must not be specified.

WITH common-table-expression

Specifies one or more *common table expressions* to be used in the fullselect.

Specifies the row or rows to be returned for the routine.

• If the routine is a scalar function, the fullselect must return one column and, at most, one row. The data type of the result column must be assignable to the data type defined for the function result, using the storage assignment rules as described in "Assignments and comparisons" on page 89.

- If the routine is a table function, the fullselect can return zero or more rows
 with one or more columns. The number of columns in the fullselect must
 match the number of columns in the function result. In addition, the data
 types of the result table columns of the fullselect must be assignable to the
 data types of the columns defined for the function result, using the storage
 assignment rules as described in "Assignments and comparisons" on page
 89.
- If the routine is a procedure, fullselect must not be specified.

Notes

Returning from a procedure:

- If a RETURN statement with a specified return value is used to return from a procedure then the SQLCODE, SQLSTATE, and message length in the SQLCA or diagnostics area are initialized to zeros, and message text is set to blanks. An error is not returned to the caller.
- If a RETURN statement is not used to return from a procedure or if a value is not specified on the RETURN statement,
 - if the procedure returns with an SQLCODE that is greater than or equal to zero, the specified target for DB2_RETURN_STATUS in a GET DIAGNOSTICS statement will be set to a value of 0
 - if the procedure returns with an SQLCODE that is less than zero, the specified target for DB2_RETURN_STATUS in a GET DIAGNOSTICS statement will be set to a value of -1.
- When a value is returned from a procedure, the caller may access the value using:
 - the GET DIAGNOSTICS statement to retrieve the DB2_RETURN_STATUS when the SQL procedure was called from another SQL procedure
 - the parameter bound for the return value parameter marker in the escape clause CALL syntax (?=CALL...) in a ODBC or JDBC application
 - directly from the SQLCA returned from processing the CALL of an SQL procedure by retrieving the value of sqlerrd[0] when the SQLCODE is not less than zero. When the SQLCODE is less than zero, the sqlerrd[0] value is not set and the application should assume a return status value of -1.

RETURN restrictions:

- RETURN is not allowed in SQL triggers.
- Only one RETURN statement is allowed in an SQL table function statement *routine-body*.

Example

Example 1: Use a RETURN statement to return from an SQL procedure with a status value of zero if successful, and –200 if not.

BEGIN ... GOTO fail; ... success: RETURN 0 failure: RETURN -200 ... END

Example 2: Define a scalar function that returns the tangent of a value using the existing sine and cosine functions.

RETURN statement

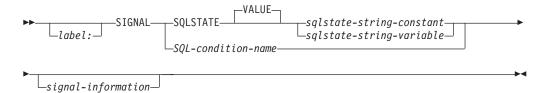
CREATE FUNCTION mytan (x DOUBLE) RETURNS DOUBLE LANGUAGE SQL CONTAINS SQL NO EXTERNAL ACTION **DETERMINISTIC** RETURN SIN(x)/COS(x)

SIGNAL statement

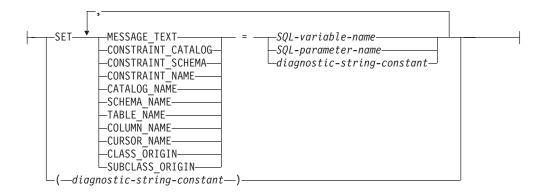
The SIGNAL statement signals an error or warning condition. It causes an error or warning to be returned with the specified SQLSTATE and optional *condition-information-items*. The syntax of SIGNAL in an SQL function, SQL procedure, or SQL trigger is a similar to what is supported as a SIGNAL statement in other contexts.

See "SIGNAL" on page 1123 for details.

Syntax



signal-information:



Description

label

Specifies the label for the SIGNAL statement. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

SQLSTATE VALUE

Specifies the SQLSTATE that will be signalled. The specified value must not be null and must follow the rules for SQLSTATEs:

- Each character must be from the set of digits ('0' through '9') or non-accented upper case letters ('A' through 'Z').
- The SQLSTATE class (first two characters) cannot be '00' since this represents successful completion.

If the SQLSTATE does not conform to these rules, an error is returned.

sqlstate-string-constant

The *sqlstate-string-constant* must be a character string constant with exactly 5 characters.

sqlstate-string-variable

The sqlstate-string-variable must be a character or Unicode graphic variable. The actual length of the contents of the *variable* must be 5.

SOL-condition-name

Specifies the name of the condition that will be signalled. The *SQL-condition-name* must be declared within the *compound-statement*.

SET

Introduces the assignment of values to condition-information-items. The condition-information-item values can be accessed using the GET DIAGNOSTICS statement. The only condition-information-item that can be accessed in the SQLCA is MESSAGE_TEXT.

MESSAGE TEXT

Specifies a string that describes the error or warning.

If an SOLCA is used,

- the string is returned in the SQLERRMC field of the SQLCA
- if the actual length of the string is longer than 1000 bytes, it is truncated without a warning.

CONSTRAINT CATALOG

Specifies a string that indicates the name of the database that contains a constraint related to the signalled error or warning.

CONSTRAINT SCHEMA

Specifies a string that indicates the name of the schema that contains a constraint related to the signalled error or warning.

CONSTRAINT NAME

Specifies a string that indicates the name of a constraint related to the signalled error or warning.

CATALOG_NAME

Specifies a string that indicates the name of the database that contains a table or view related to the signalled error or warning.

SCHEMA_NAME

Specifies a string that indicates the name of the schema that contains a table or view related to the signalled error or warning.

TABLE NAME

Specifies a string that indicates the name of a table or view related to the signalled error or warning.

COLUMN_NAME

Specifies a string that indicates the name of a column in the table or view related to the signalled error or warning.

CURSOR NAME

Specifies a string that indicates the name of a cursor related to the signalled error or warning.

CLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE class related to the signalled error or warning.

SUBCLASS ORIGIN

Specifies a string that indicates the origin of the SQLSTATE subclass related to the signalled error or warning.

Identifies an SQL variable declared within the *compound-statement*, that contains the value to be assigned to the *condition-information-item*. The SQL variable must be defined as CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable.

SQL-parameter-name

Identifies an SQL parameter declared within the *compound-statement*, that contains the value to be assigned to the *condition-information-item*. The SQL parameter must be defined as CHAR, VARCHAR, Unicode GRAPHIC, or Unicode VARGRAPHIC variable.

diagnostic-string-constant

Specifies a character string constant that contains the value to be assigned to the *condition-information-item*.

(diagnostic-string-constant)

Specifies a character string constant that contains the message text.

This form is only allowed in the triggered action of a CREATE TRIGGER statement.

To conform with the ANS and ISO standards, this form should not be used. It is provided for compatibility with other products.

Notes

SQLSTATE values: Any valid SQLSTATE value can be used in the SIGNAL statement. However, it is recommended that programmers define new SQLSTATEs based on ranges reserved for applications. This prevents the unintentional use of an SQLSTATE value that might be defined by the database manager in a future release.

For more information about SQLSTATEs, see the SQL Messages and Codes topic collection.

Assignment: When the SIGNAL statement is executed, the value of each of the specified *string-constants* and *variables* is assigned to the corresponding *condition-information-item*. However, if the length of a *string-constant* or *variable* is longer than the maximum length of the corresponding *condition-information-item*, it is truncated without a warning. For details on the assignment rules, see "Assignments and comparisons" on page 89. For details on the maximum length of specific *condition-information-items*, see "GET DIAGNOSTICS" on page 943.

Processing a SIGNAL statement: When a SIGNAL statement is issued, the SQLCODE returned in the SQLCA is based on the SQLSTATE value as follows:

- If the specified SQLSTATE class is either '01' or '02', a warning or not found is signalled and the SQLCODE is set to +438.
- Otherwise, an exception is signalled and the SQLCODE is set to -438.

If the SQLSTATE or condition indicates that an exception (SQLSTATE class other than '01' or '02') is signalled,

• If a handler exists in the same compound statement as the SIGNAL statement, and the compound statement contains a handler for SQLEXCEPTION or the specified SQLSTATE or condition; the exception is handled and control is transferred to that handler.

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- If the compound-statement is nested and an outer level compound-statement has a handler for SQLEXCEPTION or the specified SQLSTATE or condition; the exception is handled and control is transferred to that handler.
- Otherwise, the exception is not handled and control is immediately returned to the end of the compound statement.

If the SQLSTATE or condition indicates that a warning (SQLSTATE class '01') or not found (SQLSTATE class '02') is signalled,

- If a handler exists in the same compound statement as the SIGNAL statement, and the compound statement contains a handler for SQLWARNING (if the SQLSTATE class is '01'), NOT FOUND (if the SQLSTATE class is '02'), or the specified SQLSTATE or condition; the warning or not found condition is handled and control is transferred to that handler.
- If the compound-statement is nested and an outer level compound statement contains a handler for SQLWARNING (if the SQLSTATE class is '01'), NOT FOUND (if the SQLSTATE class is '02'), or the specified SQLSTATE or condition; the warning or not found condition is handled and the exception is handled and control is returned to that handler.
- Otherwise, the warning is not handled and processing continues with the next

Considerations for the diagnostics area: The SIGNAL statement starts with a clear of the diagnostics area and then sets the RETURNED_SQLSTATE to reflect the specified SQLSTATE or SQL-condition-name. If any signal-information is specified, the corresponding items in the condition area are assigned the specified values. DB2_RETURNED_SQLCODE is set to +438 or -438 corresponding to the specified SQLSTATE or SQL-condition-name.

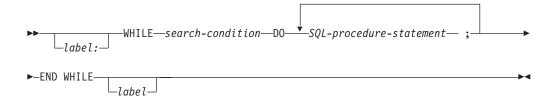
Example

An SQL procedure for an order system that signals an application error when a customer number is not known to the application. The ORDERS table includes a foreign key to the CUSTOMER table, requiring that the CUSTNO exist before an order can be inserted.

```
CREATE PROCEDURE SUBMIT ORDER
   (IN ONUM INTEGER, IN CNUM INTEGER,
   IN PNUM INTEGER, IN QNUM INTEGER)
   LANGUAGE SQL
   MODIFIES SQL DATA
     DECLARE EXIT HANDLER FOR SQLSTATE VALUE '23503'
        SIGNAL SQLSTATE '75002'
           SET MESSAGE_TEXT = 'Customer number is not known';
     INSERT INTO ORDERS (ORDERNO, CUSTNO, PARTNO, QUANTITY)
        VALUES (ONUM, CNUM, PNUM, QNUM);
  END
```

The WHILE statement repeats the execution of a statement while a specified condition is true.

Syntax



Description

label

Specifies the label for the WHILE statement. If the ending label is specified, it must be the same as the beginning label. The label name cannot be the same as the routine name or another label within the same scope. For more information, see "References to SQL labels" on page 1148.

search-condition

Specifies a condition that is evaluated before each execution of the WHILE loop. If the condition is true, the *SQL-procedure-statements* in the WHILE loop are executed.

SQL-procedure-statement

Specifies an SQL statement or statements to execute within the WHILE loop.

Notes

Considerations for the diagnostics area: At the beginning of the first iteration of the WHILE statement, and with every subsequent iteration, the diagnostics area is cleared.

Considerations for SQLSTATE and SQLCODE SQL variables: With each iteration of the WHILE statement, when the first *SQL-procedure-statement* is executed, the SQLSTATE and SQLCODE SQL variables reflect the result of evaluating the search condition of that WHILE statement. If the loop is terminated with a GOTO, ITERATE, or LEAVE statement, the SQLSTATE and SQLCODE values reflect the successful completion of that statement. Otherwise, after the END WHILE of the WHILE statement completes, the SQLSTATE and SQLCODE reflect the result of evaluating the search condition of that WHILE statement.

Example

This example uses a WHILE statement to iterate through FETCH and SET statements. While the value of SQL variable $v_counter$ is less than half of number of employees in the department identified by the IN parameter deptNumber, the WHILE statement continues to perform the FETCH and SET statements. When the condition is no longer true, the flow of control leaves the WHILE statement and closes the cursor.

WHILE statement

```
CREATE PROCEDURE dept median
   (IN deptNumber SMALLINT,
    OUT medianSalary DECIMAL(7,2))
    LANGUAGE SQL
    BEGIN
       DECLARE v_numRecords INTEGER DEFAULT 1;
       DECLARE v_counter INTEGER DEFAULT 0;
       DECLARE c\overline{1} CURSOR FOR
          SELECT salary
          FROM staff
          WHERE dept = deptNumber
          ORDER BY salary;
       DECLARE EXIT HANDLER FOR NOT FOUND
          SET medianSalary = 6666;
       SET medianSalary = 0;
       SELECT COUNT(*) INTO v_numRecords
          FROM staff
          WHERE dept = deptNumber;
       OPEN c1;
       WHILE v_{counter} < (v_{numRecords}/2 + 1) DO
          FETCH c1 INTO medianSalary;
          SET v_counter = v_counter +1;
       END WHILE;
       CLOSE c1;
    END
```

Appendix A. SQL limits

The following tables describe certain SQL and database limits imposed by the DB2 for i database manager.

Note:

- System storage limits may preclude the limits specified here. For example, see "Maximum row sizes" on page 807.
- A limit of *storage* means that the limit is dependent on the amount of storage available.
- A limit of *statement* means that the limit is dependent on the limit for the maximum length of a statement.

SQL limits

Table 83. Identifier Length Limits

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	Identifier Limits	DB2 for i Limit
	Longest authorization name	10 ¹⁰⁴
	Longest correlation name	128
I	Longest cursor name	128
	Longest descriptor name	128
	Longest external program name (string form)	279 ¹⁰⁵
	Longest external program name (unqualified form)	10
	Longest host identifier ¹⁰⁶	128
	Longest package version-id	64
	Longest partition name	10
	Longest savepoint name	128
	Longest schema name	10
	Longest server name	18
I	Longest statement name	128
	Longest SQL condition name	128
	Longest SQL label	128
	Longest unqualified alias name	128
	Longest unqualified column name	128
	Longest unqualified constraint name	128
	Longest unqualified distinct type name	128
	Longest unqualified function name	128
	Longest unqualified index name	128
	Longest unqualified nodegroup name	10
	Longest unqualified package name	10
	Longest unqualified procedure name	128
	Longest unqualified sequence name	128
	Longest unqualified specific name	128
	Longest unqualified SQL parameter name	128
	Longest unqualified SQL variable name	128
	Longest unqualified system column name	10
	Longest unqualified system table, view, and index name	10
	Longest unqualified table and view name	128
	Longest unqualified trigger name	128

¹⁰⁴. As an application requester, DB2 for i can send an authorization name of up to 255 bytes.

^{105.} For REXX procedures, the limit is 33.

^{106.} For an RPG, COBOL, or REXX program, the limit is 64.

Table 84. Numeric Limits

	Numeric Limits	DB2 for i Limit
	Smallest SMALLINT value	-32 768
	Largest SMALLINT value	+32 767
	Smallest INTEGER value	-2 147 483 648
	Largest INTEGER value	+2 147 483 647
	Smallest BIGINT value	-9 223 372 036 854 775 808
	Largest BIGINT value	+9 223 372 036 854 775 807
	Largest decimal precision	63
1	Maximum exponent (E ^{max}) for REAL values	38
	Smallest REAL value ¹⁰⁷	-3.4x10 ³⁸
	Largest REAL value ¹⁰⁷	+3.4x10 ³⁸
	Minimum exponent (E ^{min}) for REAL values	-38
	Smallest positive REAL value ¹⁰⁷	+1.18×10 ⁻³⁸
	Largest negative REAL value ¹⁰⁷	-1.18x10 ⁻³⁸
I	Maximum exponent (E ^{max}) for DOUBLE values	308
	Smallest DOUBLE value ¹⁰⁷	-1.79x10 ³⁰⁸
	Largest DOUBLE value ¹⁰⁷	+1.79×10 ³⁰⁸
I	Minimum exponent (E ^{min}) for DOUBLE values	-308
	Smallest positive DOUBLE value ¹⁰⁷	+2.23×10 ⁻³⁰⁸
	Largest negative DOUBLE value ¹⁰⁷	-2.23x10 ⁻³⁰⁸
	Maximum exponent (E ^{max}) for DECFLOAT(16) values	384
	Smallest DECFLOAT(16) value ¹⁰⁸	-9.999999999999x10 ³⁸⁴
1	Largest DECFLOAT(16) value ¹⁰⁸	9.999999999999x10 ³⁸⁴
1	Minimum exponent (E ^{min}) for DECFLOAT(16) values	-383
1	Smallest positive DECFLOAT(16) value ¹⁰⁸	1x10 ⁻³⁸³
1	Largest negative DECFLOAT(16) value ¹⁰⁸	-1x10 ⁻³⁸³
1	Maximum exponent (E ^{max}) for DECFLOAT(34) values	6144
1	Smallest DECFLOAT(34) value ¹⁰⁸	-9.9999999999999999999999999999999x10 ⁶¹⁴
I	Largest DECFLOAT(34) value ¹⁰⁸	9.999999999999999999999999999999999x10 ⁶¹⁴⁴
I	Minimum exponent (E ^{min}) for DECFLOAT(34) values	-6143
I	Smallest positive DECFLOAT(34) value ¹⁰⁸	1x10 ⁻⁶¹⁴³
I	Largest negative DECFLOAT(34) value ¹⁰⁸	-1x10 ⁻⁶¹⁴³

^{107.} The values shown are approximate.

¹⁰⁸. These are the limits for normal numbers in DECFLOAT. DECFLOAT also contains special values such as NaN and Infinity that are also valid. DECFLOAT also supports subnormal numbers that are outside of the documented range.

SQL limits

Table 85. String Limits

String Limits	DB2 for i Limit
Maximum length of CHAR (in bytes)	32765 ¹⁰⁹
Maximum length of VARCHAR (in bytes)	32739 ¹⁰⁹
Maximum length of CLOB (in bytes)	2 147 483 647
Maximum length of GRAPHIC (in double-byte characters)	16382 ¹⁰⁹
Maximum length of VARGRAPHIC (in double-byte characters)	16369 ¹⁰⁹
Maximum length of DBCLOB (in double-byte characters)	1 073 741 823
Maximum length of BINARY (in bytes)	32765 ¹⁰⁹
Maximum length of VARBINARY (in bytes)	32739 ¹⁰⁹
Maximum length of BLOB (in bytes)	2 147 483 647
Maximum length of character constant	32740
Maximum length of a graphic constant	16370
Maximum length of binary constant	32740
Maximum length of concatenated character string	2 147 483 647
Maximum length of concatenated graphic string	1 073 741 823
Maximum length of concatenated binary string	2 147 483 647
Maximum number of hexadecimal constant digits	32 762
Maximum length of catalog comments	2000110
Maximum length of column label (in bytes)	60
Maximum length of SQL routine label	128
Maximum length of table, package, or alias label	50
Maximum length of C NUL-terminated	32739 ¹⁰⁹
Maximum length of C NUL-terminated graphic	16369^{109}

 $1208 \hspace{0.5cm} \hbox{System i: DB2 for i SQL Reference} \\$

^{109.} If the column is NOT NULL, the maximum is one more.

^{110.} For sequences the limit is 500.

Table 86. Datetime Limits

DB2 for i Limit
0001-01-01
9999-12-31
00:00:00
24:00:00
0001-01-01-00.00.00.000000
9999-12-31-24.00.00.000000

Table 87. DataLink Limits

Datalink Limits	DB2 for i Limit
Maximum length of DATALINK	32718
Maximum length of DATALINK comment	254

SQL limits

Table 88. Database Manager Limits

	Database Manager Limits	DB2 for i Limit
I	Relational Database	
I	Maximum number of schemas	storage
ı	Maximum number of tables in a relational database	storage
ı	Maximum number of nodes in a nodegroup	32
I	Schemas	
	Maximum number of objects in a schema	approximately 360 000
I	Tables and Views	
I	Maximum number of columns in a table	8000
	Maximum number of columns in a view	8000
	Maximum length of a row without LOBs including all overhead	32766
	Maximum length of a row with LOBs including all overhead	3 758 096 383
	Maximum number of rows in a non-partitioned table	4 294 967 288
I	Maximum number of rows in a data partition	4 294 967 288
	Maximum size of a non-partitioned table	1.7 terabytes
	Maximum size of a data partition	1.7 terabytes
	Maximum number of data partitions in a single partitioned table	256
I	Maximum number of table partitioning columns	8000
	Maximum number of tables referenced in a view or materialized query table	256111
I	Maximum number of dependent views, materialized query tables, and indexes on a table or view.	storage
	Constraints	
	Maximum number of constraints on a table	300
I	Maximum number of columns in a UNIQUE constraint	120
I	Maximum combined length of columns in a UNIQUE constraint (in bytes)	32767 ¹⁰⁹
I	Maximum number of referencing columns in a foreign key	120
	Maximum combined length of referencing columns in a foreign key (in bytes)	32767 ¹⁰⁹
	Maximum length of a CHECK constraint (in bytes)	statement
	Triggers	
	Maximum number of triggers on a table	300
	Maximum runtime depth of cascading triggers	200
	Indexes	
	Maximum number of indexes on a table	approximately 4000
	Maximum number of columns in an index key	120
	Maximum length of an index key	32767 ¹⁰⁹
	Maximum size of a non-partitioned index	1 terabyte
I	Maximum size of a partition of a partitioned index	1 terabyte
I	SQL	
I	Maximum length of an SQL statement (in bytes)	2 097 152
	Maximum number of tables referenced in an SQL statement	1000111

Table 88. Database Manager Limits (continued)

	Database Manager Limits	DB2 for i Limit
	Maximum number of variables and constants in an SQL statement	4096 ¹¹²
	Maximum number of elements in a select list	approximately 8000 ¹¹³
	Maximum number of predicates in a WHERE or HAVING clause	statement
I	Maximum number of columns in a GROUP BY clause	total GROUP BY length
I	Maximum total length of columns in a GROUP BY clause	32766 114
I	Maximum number of columns in an ORDER BY clause	total ORDER BY length
I	Maximum total length of columns in an ORDER BY clause	32766 114
I	Maximum levels allowed for a subquery	256
I	Maximum number of values in an insert operation	8000
I	Maximum number of SET clauses in a single update operation	8000
I	Routines	
	Maximum number of parameters in a procedure	1024 ¹¹⁵
	Maximum number of parameters in a function	90
I	Maximum number of nested levels for routines	storage
I	Applications	
	Maximum number of host variable declarations in a precompiled program	storage ¹¹⁶
	Maximum length of a host variable value (in bytes)	2 147 483 647
	Maximum number of declared cursors in a program	storage
	Maximum number of cursors opened at one time	storage ¹¹⁷
	Maximum number of rows changed in a unit of work	500 000 000
	Maximum number of locators in a transaction	16 000 000 ¹¹⁸
I	Maximum size of an SQLDA (in bytes)	16 777 215
	Maximum number of prepared statements	storage
	Maximum number of savepoints active at one time	storage
	Maximum number of simultaneously allocated CLI handles in a process	160 000 119
	Maximum size of a package	500 megabytes ¹²⁰
	Maximum length of a path	3483 ¹²¹
	Maximum number of schemas in a path	268
I	Maximum length of a password	127
	Maximum length of a hint	32
	Maximum size of a program, service program, or module associated space (in bytes)	16 777 216

SQL limits

Appendix B. Characteristics of SQL statements

This appendix contains information on the characteristics of SQL statements pertaining to the various places where they are used.

- "Actions allowed on SQL statements" on page 1214 shows whether an SQL statement can be executed, prepared interactively or dynamically, and whether the statement is processed by the requester, the server or the precompiler.
- "SQL statement data access classification for routines" on page 1217 shows the level of SQL data access that must be specified to use the SQL statement in a routine.
- "Considerations for using distributed relational database" on page 1220 provides information about the use of SQL statements when the application server is not the same as the application requester.

The maximum number of parameters for external procedures is also limited by the maximum number of parameters allowed by the licensed program used to compile the external program.

^{111.} The maximum number of members (and partitions) referenced is also 1000. In DELETE and UPDATE statements the maximum number is 256

^{112.} If the statement is not read-only, the limit is 2048. The limit is approximate and may be less if very large string constants or string variables are used.

^{113.} The limit is based on the size of internal structures generated for the parsed SQL statement.

^{114.} The limit is 3.5 Gigabytes if SQE processed the select statement. The limit will be less if an ICU collating sequence is used.

^{115.} SQL procedures are limited to 1024 parameters. The number of parameters for external procedures depends on the PARAMETER STYLE:

[·] PARAMETER STYLE GENERAL has a maximum of 1024.

[•] PARAMETER STYLE GENERAL WITH NULLS has a maximum of 1023.

[•] PARAMETER STYLE SQL or PARAMETER STYLE DB2SQL has a maximum of 508.

[•] PARAMETER STYLE JAVA or PARAMETER STYLE DB2GENERAL has a maximum of 90.

^{116.} In RPG/400 and PL/I programs when the old parameter passing technique is used, the limit is approximately 4000. The limit is based on the number of pointers allowed in the program. In all other cases, the limit is based on operating system constraints.

^{117.} The maximum number of cursors open at one time in a single job is approximately 21 754.

^{118.} The maximum number of locators in a transaction in SQL Server mode is 209 000.

^{119.} The maximum number of allocated handles per DRDA connection is 500.

^{120.} The maximum size can be increased to 1 gigabyte by using a QAQQINI option.

^{121.} The maximum length of a path in DRDA is 255.

Actions allowed on SQL statements

Indicates whether an SQL statement can be executed, prepared interactively or dynamically, and whether the statement is processed by the requester, the server, or the precompiler.

The table below shows whether a specific DB2 statement can be executed, prepared interactively or dynamically, or processed by the requester, the server, or the precompiler. The letter Y means yes.

Table 89. Actions allowed on SQL statements

		Interactively		Processed by	
SQL statement	Executable	or dynamically prepared	Requesting system	Server	Precompiler
ALLOCATE DESCRIPTOR ⁴ ⁵	Y			Y	
ALTER	Y	Y		Y	
BEGIN DECLARE SECTION ^{4 5}					Y
CALL	Y	Y		Y	
CLOSE ⁴	Y			Y	
COMMENT	Y	Y		Y	
COMMIT	Y	Y		Y	
CONNECT (Type 1 and Type 2) ⁴ ⁵	Y		Y		
CREATE	Y	Y		Y	
DEALLOCATE DESCRIPTOR ^{4 5}	Y			Y	
DECLARE CURSOR ⁴					Y
DECLARE GLOBAL TEMPORARY TABLE	Y	Y		Y	
DECLARE PROCEDURE ^{4 5}					Y
DECLARE STATEMENT ^{4 5}					Y
DECLARE VARIABLE ^{4 5}					Y
DELETE	Y	Y		Y	
DESCRIBE ⁴	Y			Y	
DESCRIBE INPUT ^{4 5}	Y			Y	
DESCRIBE TABLE ⁴	Y			Y	
DISCONNECT ^{4 5}	Y		Y		
DROP	Y	Y		Y	
END DECLARE SECTION ^{4 5}					Y
EXECUTE ⁴	Y			Y	
EXECUTE IMMEDIATE ⁴	Y			Y	
FETCH	Y			Y	
FREE LOCATOR ^{4 5}	Y	Y		Y	
GET DESCRIPTOR ⁴ ⁵	Y			Y	
GET DIAGNOSTICS ⁵	Y			Y	
GRANT	Y	Y		Y	
HOLD LOCATOR ^{4 5}	Y	Y		Y	

Table 89. Actions allowed on SQL statements (continued)

		Interactively or		Processed by	
		dynamically	Requesting		
SQL statement	Executable	prepared	system	Server	Precompiler
INCLUDE ^{4 5}					Y
INSERT	Y	Y		Y	
LABEL	Y	Y		Y	
LOCK TABLE	Y	Y		Y	
OPEN ⁴	Y			Y	
PREPARE ⁴	Y			Y	
REFRESH TABLE	Y	Y		Y	
RELEASE connection ^{4 5}	Y		Y		
RELEASE SAVEPOINT	Y	Y		Y	
RENAME	Y	Y		Y	
REVOKE	Y	Y		Y	
ROLLBACK	Y	Y		Y	
SAVEPOINT	Y	Y		Y	
SELECT INTO 5	Y			Y	
SET CONNECTION ^{4 5}	Y		Y		
SET CURRENT DEBUG MODE	Y	Y		Y	
SET CURRENT DECFLOAT ROUNDING MODE	Y	Y		Y	
SET CURRENT DEGREE ⁵	Y	Y		Y	
SET DESCRIPTOR ^{4 5}	Y			Y	
SET ENCRYPTION PASSWORD	Y	Y		Y	
SET OPTION ^{4 5}					Y
SET PATH	Y	Y		Y	
SET RESULT SETS ^{3 5}	Y			Y	
SET SCHEMA	Y	Y		Y	
SET SESSION AUTHORIZATION ⁵	Y	Y		Y	
SET TRANSACTION	Y	Y		Y	
SET transition-variable ¹	Y			Y	
SET variable	Y		Y		
SIGNAL ⁵	Y			Y	
SQL-control-statement ²	Y			Y	
UPDATE	Y	Y		Y	
VALUES ¹	Y			Y	
VALUES INTO ⁵	Y	Y		Y	
WHENEVER ⁴ ⁵					Y

Characteristics of SQL statements

Table 89. Actions allowed on SQL statements (continued)

		Interactively		Processed by	l by		
		or - dynamically	Requesting				
SQL statement	Executable	prepared	system	Server	Precompiler		

Notes:

- 1. This statement can only be used in the triggered action of a trigger.
- 2. This statement can only be used in an SQL function, SQL procedure, or SQL trigger.
- 3. This statement can only be used in a procedure.
- 4. This statement is not applicable in a Java program.
- 5. This statement is not supported in a REXX program.

SQL statement data access classification for routines

Indicates the level of SQL data access that must be specified to use the SQL statement in a routine.

The following table indicates whether an SQL statement (specified in the first column) is allowed to execute in a function or procedure with the specified SQL data access classification. If an executable SQL statement is encountered in a function or procedure defined with NO SQL, SQLSTATE 38001 is returned. For other executions contexts, SQL statements that are not supported in any context return SQLSTATE 38003. For other SQL statements not allowed in a CONTAINS SQL context, SQLSTATE 38004 is returned and in a READS SQL DATA context, SQLSTATE 38002 is returned. During creation of an SQL function or SQL procedure, a statement that does not match the SQL data access classification will cause SQLSTATE 42895 to be returned.

Table 90. SQL Statement and SQL Data Access Classification

SQL Statement	NO SQL	CONTAINS SQL	READS SQL DATA	MODIFIES SQL DATA
ALLOCATE DESCRIPTOR			Y	Y
ALTER				Y
BEGIN DECLARE SECTION	Y^1	Y	Y	Y
CALL		Y	Y	Y
CLOSE			Y	Y
COMMENT				Y
COMMIT ³		Y	Y	Y
CONNECT (Type 1 and Type 2) ³				
CREATE				Y
DEALLOCATE DESCRIPTOR			Y	Y
DECLARE CURSOR	Y^1	Y	Y	Y
DECLARE GLOBAL TEMPORARY TABLE				Y
DECLARE PROCEDURE	Y^1	Y	Y	Y
DECLARE STATEMENT	Y^1	Y	Y	Y
DECLARE VARIABLE	Y^1	Y	Y	Y
DELETE				Y
DESCRIBE			Y	Y
DESCRIBE INPUT			Y	Y
DESCRIBE TABLE			Y	Y
DISCONNECT ³				
DROP				Y
END DECLARE SECTION	Y^1	Y	Y	Y
EXECUTE		Y^2	Y^2	Y
EXECUTE IMMEDIATE		Y^2	Y^2	Y
FETCH			Y	Y

Table 90. SQL Statement and SQL Data Access Classification (continued)

SQL Statement	NO SQL	CONTAINS SQL	READS SQL DATA	MODIFIES SQL DATA
FREE LOCATOR		Y	Y	Y
GET DESCRIPTOR			Y	Y
GET DIAGNOSTICS		Y	Y	Y
GRANT				Y
HOLD LOCATOR		Y	Y	Y
INCLUDE	Y^1	Y	Y	Y
INSERT				Y
LABEL				Y
LOCK TABLE		Y	Y	Y
OPEN			Y	Y
PREPARE		Y	Y	Y
REFRESH TABLE				Y
RELEASE CONNECTION ³				
RELEASE SAVEPOINT				Y
RENAME				Y
REVOKE				Y
ROLLBACK ³		Y	Y	Y
ROLLBACK TO SAVEPOINT				Y
SAVEPOINT				Y
SELECT INTO			Y	Y
SET CONNECTION ³				
SET CURRENT DEBUG MODE			Y	Y
SET CURRENT DECFLOAT ROUNDING MODE		Y	Y	Y
SET CURRENT DEGREE			Y	Y
SET DESCRIPTOR			Y	Y
SET ENCRYPTION PASSWORD		Y	Y	Y
SET OPTION	Y^1	Y	Y	Y
SET PATH		Y	Y	Y
SET RESULT SETS		Y	Y	Y
SET SCHEMA			Y	Y
SET SESSION AUTHORIZATION			Y	Y
SET TRANSACTION		Y	Y	Y
SET variable		Y	Y	Y
SIGNAL		Y	Y	Y
UPDATE				Y
VALUES				

Characteristics of SQL statements

Table 90. SQL Statement and SQL Data Access Classification (continued)

SQL Statement	NO SQL	CONTAINS SQL	READS SQL DATA	MODIFIES SQL DATA
VALUES INTO			Y	Y
WHENEVER	Y^1	Y	Y	Y

Note:

- 1. Although the NO SQL option implies that no SQL statements can be specified, non-executable statements are not restricted.
- 2. It depends on the statement being executed. The statement specified for the EXECUTE statement must be a statement that is allowed in the context of the particular SQL access level in effect. For example, if the SQL access level in effect is READS SQL DATA, the statement must not be an INSERT, UPDATE, or DELETE.
- 3. Connection management and transaction statements are not allowed in a procedure running on a remote server. COMMIT and ROLLBACK are not allowed in an ATOMIC SQL procedure.

Considerations for using distributed relational database

This section contains information that may be useful in developing applications that use application servers which are not the same product as their application requesters.

All DB2 products support extensions to IBM SQL. Some of these extensions are product-specific, but many are already shared by more than one product or support is planned but not yet generally available.

For the most part, an application can use the statements and clauses that are supported by the database manager of the current server, even though that application might be running through the application requester of a database manager that does not support some of those statements and clauses. Restrictions to this general rule are identified by application requester:

- for DB2 for z/OS Application Server application requester, see Table 91
- for DB2 for i Application Server application requester, see Table 92 on page 1221
- for DB2 LUW application requester, see Table 93 on page 1221.

Note that an 'R' in the table indicates that this SQL function is not supported in the specified environment. An 'R' in every column of the same row means that the function is available only if the current server and requester are the same product or that the statement is blocked by the application requester from being processed at the application server.

Table 91. DB2 for z/OS Application Requester

SQL Statement or Function	DB2 for z/OS Application Server	DB2 for i Application Server	DB2 LUW Application Server
COMMIT HOLD	R	R	R
DECLARE STATEMENT			
DECLARE TABLE			
DECLARE VARIABLE			
DESCRIBE TABLE			R
DESCRIBE with USING clause			R
DISCONNECT	R	R	R
ROWID data types			R
DATALINK data types	R	R	R
BINARY and VARBINARY data types			R
Host declarations not documented in language specific appendices		122	122
PREPARE with USING clause			R
ROLLBACK HOLD	R	R	R
SET CURRENT PACKAGESET			
SET variable		R	R
SET TRANSACTION	R	R	R
Scrollable Cursor statements	R	R	R
UPDATE cursor - FOR UPDATE clause not specified			

Table 92. DB2 for i Application Requester

SQL Statement or Function	DB2 for z/OS Application Server	DB2 for i Application Server	DB2 LUW Application Server
COMMIT HOLD	R		R
DECLARE STATEMENT			
DECLARE TABLE			
DECLARE VARIABLE			
DESCRIBE TABLE			R
DESCRIBE with USING clause			R
DISCONNECT			
Host Variables - optional colon	R	R	R
ROWID data types			R
DATALINK data types	R		R
BINARY and VARBINARY data types			R
Host declarations not documented in language specific appendices	122		122
PREPARE with USING clause			R
ROLLBACK HOLD	R		R
SET CURRENT PACKAGESET	R	R	R
SET variable	R	R	R
SET TRANSACTION	R		R
Scrollable Cursor statements	R		R
UPDATE cursor - FOR UPDATE clause not specified	R		

Table 93. DB2 LUW application requester

SQL Statement or Function	DB2 for z/OS Application Server	DB2 for i Application Server	DB2 LUW Application Server
COMMIT HOLD	R	R	R
DECLARE STATEMENT	R	R	R
DECLARE TABLE	R	R	R
DECLARE VARIABLE	R	R	R
DESCRIBE TABLE	R	R	R
DESCRIBE with USING clause	R	R	R
DISCONNECT			
Host Variables - optional colon	R	R	R
ROWID data types	123	123	R
DATALINK data types	R	R	R
BINARY and VARBINARY data types	R	R	R
Host declarations not documented in language specific appendices	122	122	
PREPARE with USING clause	R	R	R

^{122.} The statement is supported if the application requester understands it.

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Table 93. DB2 LUW application requester (continued)

SQL Statement or Function	DB2 for z/OS Application Server	DB2 for i Application Server	DB2 LUW Application Server
ROLLBACK HOLD	R	R	R
SET CURRENT PACKAGESET			
SET variable	R	R	R
SET TRANSACTION	R	R	R
Scrollable Cursor statements	R	R	R
UPDATE cursor - FOR UPDATE clause not specified	R		

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^{123.} The DB2 LUW application requester application requester will process a ROWID data type at the application server using the compatible VARCHAR(40) FOR BIT DATA data type.

There are two types of CONNECT statements.

They have the same syntax, but they have different semantics:

- CONNECT (Type 1) is used for remote unit of work. See "Remote unit of work" on page 41.
- CONNECT (Type 2) is used for distributed unit of work. See "CONNECT (Type 2)" on page 647.

The following table summarizes the differences between CONNECT (Type 1) and CONNECT (Type 2) rules:

Table 94. CONNECT (Type 1) and CONNECT (Type 2) Differences

Type 1 Rules	Type 2 Rules
CONNECT statements can only be executed when the activation group is in the connectable state. No more than one CONNECT statement can be executed within the same unit of work.	More than one CONNECT statement can be executed within the same unit of work. There are no rules about the connectable state.
If the CONNECT statement fails because the server name is not listed in the local directory, the connection state of the activation group is unchanged.	If a CONNECT statement fails, the current SQL connection is unchanged and any subsequent SQL statements are executed by the current server.
If a CONNECT statement fails because the activation group is not in the connectable state, the SQL connection status of the activation group is unchanged.	
If a CONNECT statement fails for any other reason, the activation group is placed in the unconnected state.	
CONNECT ends all existing connections of the activation group. Accordingly, CONNECT also closes any open cursors for that activation group.	CONNECT does not end connections and does not close cursors.
A CONNECT to the current server is executed like any other CONNECT (Type 1) statement.	A CONNECT to the current server causes an error.

Determining the CONNECT rules that apply

A program preparation option is used to specify the type of CONNECT that will be performed by a program. The program preparation option is specified using the RDBCNNMTH parameter on the CRTSQLxxx command.

Connecting to servers that only support remote unit of work

CONNECT (Type 2) connections to application servers that only support remote unit of work might result in connections that are read-only.

Characteristics of SQL statements

If a CONNECT (Type 2) is performed to an application server that only supports remote unit of work:

- The connection allows read-only operations if, at the time of the connect, there
 are any dormant connections that allow updates. In this case, the connection
 does not allow updates.
- Otherwise, the connection allows updates.

If a CONNECT (Type 2) is performed to an application server that supports distributed unit of work:

- The connection allows read-only operations when there are dormant connections
 that allow updates to application servers that only support remote unit of work.
 In this case, the connection allows updates as soon as the dormant connection is
 ended.
- Otherwise, the connection allows updates.

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^{124.} DB2 for i using the initial DRDA support for native TCP/IP is an example of an application server that supports only remote unit of work.

Appendix C. SQLCA (SQL communication area)

An SQLCA is a set of variables that may be updated at the end of the execution of every SQL statement. A program that contains executable SQL statements may provide one, but no more than one SQLCA (unless a stand-alone SQLCODE or a stand-alone SQLSTATE variable is used instead), except in Java, where the SQLCA is not applicable.

Instead of using an SQLCA, the GET DIAGNOSTICS statement can be used in all languages to return return codes and other information about the previous SQL statement. For more information, see "GET DIAGNOSTICS" on page 943.

The SQL INCLUDE statement can be used to provide the declaration of the SQLCA in all host languages except Java, RPG, or REXX. For information about the use of the SQLCA in a REXX procedure, see the Embedded SQL Programming topic collection. For information about how to access the information regarding errors and warnings in Java, refer to the IBM Developer Kit for Java topic collection.

In C, COBOL, and PL/I, the name of the storage area must be SQLCA. Every SQL statement must be within the scope of its declaration.

If a stand-alone SQLCODE or SQLSTATE is specified in the program, the SQLCA must not be included. For more information, see "SQL diagnostic information" on page 537.

The stand-alone SQLCODE and stand-alone SQLSTATE must not be specified in the Java or REXX language.

Field descriptions

I

The names in the following table are those provided by the SQL INCLUDE statement.

For the most part, C (and C++), COBOL, and PL/I use the same names. RPG names are different, because in RPG/400, they are limited to 6 characters. In ILE RPG, both a long name and the short 6 character name is supported. Note one instance where PL/I names differ from the COBOL names.

Table 95. Names Provided by the SQL INCLUDE Statement

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Data Type	Field Value
SQLCAID sqlcaid	SQLCAID SQLAID	CHAR(8)	An "eye catcher" for storage dumps, containing 'SQLCA'.
SQLCABC sqlcabc	SQLCABC SQLABC	INTEGER	Contains the length of the SQLCA, 136.

SQLCA

Table 95. Names Provided by the SQL INCLUDE Statement (continued)

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Data Type	Field Value	
SQLCODE	SQLCODE	INTEGER	Contains an SQL return code.	
sqlcode	SQLCOD		Code Meaning	
			O Successful execution although SQLWARN indicators might have been set.	
			positive Successful execution, but with a warning condition.	
			negative Error condition.	
SQLERRML ¹ sqlerrml	SQLERRML SQLERL	SMALLINT	Length indicator for SQLERRMC, in the range 0 through 70. 0 means that the value of SQLERRMC is not pertinent.	
SQLERRMC ¹ sqlerrmc	SQLERRMC SQLERM	CHAR(70)	Contains message replacement text associated with the SQLCODE. For CONNECT and SET CONNECTION, the SQLERRMC field contains information about the connection, see Table 98 on page 1229 for a description of the replacement text.	
SQLERRP sqlerrp	SQLERRP SQLERP	CHAR(8)	Contains the name of the product and module returning the error or warning. The first three characters identify the product: • ARI for DB2 for VM and VSE • DSN for DB2 for z/OS • QSQ for DB2 for i • SQL for all other DB2 products	
			See "CONNECT (Type 1)" on page 642 or "CONNECT (Type 2)" on page 647 for additional information.	
SQLERRD sqlerrd	SQLERRD SQLERR ²	Array	Contains six INTEGER variables that provide diagnostic information, see Table 97 on page 1227 for a description of the diagnostic information.	
SQLWARN sqlwarn	SQLWARN SQLWRN ³	CHAR(11)	A set of 11 CHAR(1) warning indicators, each containing blank or 'W' or 'N'.	
SQLSTATE sqlstate	SQLSTATE SQLSTT	CHAR(5)	A return code that indicates the outcome of the most recently executed SQL statement.	
NT - f				

Notes:

- In COBOL, SQLERRM includes SQLERRML and SQLERRMC. In PL/I, the varying-length string SQLERRM is equivalent to SQLERRML prefixed to SQLERRMC.
- In RPG/400, SQLERR is defined as 24 characters (not an array) that are redefined by the fields SQLER1 through SQLER6. The fields are full-word binary. In ILE RPG, SQLERR is also redefined as an array. The name of the array is SQLERRD.
- In RPG/400, SQLWRN is defined as 11 characters (not an array) that are redefined by the fields SQLWN0 through SQLWNA. The fields are full-word binary. In ILE RPG, SQLWRN is also redefined as an array. The name of the array is SQLWARN.

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Value
SQLWARN0 sqlwarn[0]	SQLWARN(1) SQLWN0	Contains 'W' if at least one other indicator contains 'W' or 'N', it is blank if all other indicators are blank.
SQLWARN1 sqlwarn[1]	SQLWARN(2) SQLWN1	Contains 'W' if the value of a string column was truncated when assigned to a host variable. Contains 'N' if *NOCNULRQD was specified an the CRTSQLCI or CRTSQLCPPI command (or CNULRQD(*NO) on the SET OPTION statement) and if the value of a string column was assigned to a C NUL-terminated host variable and if the host variable was large enough to contain the result but not large enough to contain the NUL-terminator.
SQLWARN2 sqlwarn[2]	SQLWARN(3) SQLWN2	Contains 'W' if the null values were eliminated from the argument of a function; not necessarily set to 'W' for the MIN function because its results are not dependent on the elimination of null values.
SQLWARN3 sqlwarn[3]	SQLWARN(4) SQLWN3	Contains 'W' if the number of columns is larger than the number of host variables.
SQLWARN4 sqlwarn[4]	SQLWARN(5) SQLWN4	Contains 'W' if a prepared UPDATE or DELETE statement does not include a WHERE clause.
SQLWARN5 sqlwarn[5]	SQLWARN(6) SQLWN5	Contains a character value of 1 (read only), 2 (read and delete), or 4 (read, delete, and update) to reflect capability of a cursor after the OPEN statement.
SQLWARN6 sqlwarn[6]	SQLWARN(7) SQLWN6	Contains 'W' if date arithmetic results in an end-of-month adjustment.
SQLWARN7 sqlwarn[7]	SQLWARN(8) SQLWN7	Reserved
SQLWARN8 sqlwarn[8]	SQLWARN(9) SQLWN8	Contains 'W' if the result of a character conversion contains the substitution character.
SQLWARN9 sqlwarn[9]	SQLWARN(10) SQLWN9	Reserved
SQLWARNA sqlwarn[10]	SQLWARN(11) SQLWNA	Reserved

Table 97. SQLERRD Diagnostic Information

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Value
SQLERRD(1) sqlerrd[0]	SQLERRD(1) SQLER1	Contains the last four characters of the CPF escape message if SQLCODE is less than 0. For example, if the message is CPF5715, X'F5F7F1F5' is placed in SQLERRD(1). ¹
		For a call to a procedure, contains the return status value specified on the RETURN statement. If a return status value is not specified on the RETURN statement or the procedure is an external procedure,
		• 0 is returned if the CALL statement is successful, or
		• -1 is returned if the CALL statement is not successful.

SQLCA

Table 97. SQLERRD Diagnostic Information (continued)

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Value
SQLERRD(2) sqlerrd[1]	SQLERRD(2) SQLER2	Contains the last four characters of a CPD diagnostic message if the SQL code is less than 0.1
		For a CALL statement, SQLERRD(2) contains the number of result sets.
		For an OPEN statement, if the cursor is insensitive to changes, SQLERRD(2) contains the actual number of rows in the result set. If the cursor is sensitive to changes, SQLERRD(2) contains an estimated number of rows in the result set.
SQLERRD(3) sqlerrd[2]	SQLERRD(3) SQLER3	For a CONNECT for status statement, SQLERRD(3) contains information about the connection status. See "CONNECT (Type 2)" on page 647 for more information.
		For INSERT, UPDATE, REFRESH, and DELETE, shows the number of rows affected.
		For a FETCH statement, SQLERRD(3) contains the number of rows fetched.
		For the PREPARE statement, contains the estimated number of rows selected. If the number of rows is greater than 2 147 483 647, then 2 147 483 647 is returned.
SQLERRD(4) sqlerrd[3]	SQLERRD(4) SQLER4	For the PREPARE statement, contains a relative number estimate of the resources required for every execution. This number varies depending on the current availability of indexes, file sizes, CPU model, etc. It is an estimated cost for the access plan chosen by the DB2 for i Query Optimizer.
		For a CONNECT and SET CONNECTION statement, SQLERRD(4) contains the type of conversation used and whether or not committable updates can be performed. See "CONNECT (Type 2)" on page 647 for more information.
		For a CALL statement, SQLERRD(4) contains the message key of the error that caused the procedure to fail. The QMHRTVPM API can be used to return the message description for the message key.
		For a trigger error in a DELETE, INSERT or UPDATE statement, SQLERRD(4) contains the message key of the error that was signaled from the trigger program. The QMHRTVPM API can be used to return the message description for the message key.
		For a FETCH statement, SQLERRD(4) contains the length of the row retrieved.

C Name COBOL Name PL/I Name	ILE RPG Name RPG/400 Name	Field Value
SQLERRD(5) sqlerrd[4]	SQLERRD(5) SQLER5	For a CALL statement, SQLERRD(5) contains the number of result sets returned from the procedure.
		For a CONNECT or SET CONNECTION statement, SQLERRD(5) contains:
		• -1 if the connection is unconnected
		• 0 if the connection is local
		• 1 if the connection is remote
		For a DELETE, INSERT, or UPDATE statement, shows the number of rows affected by referential constraints and triggers.
		For an EXECUTE IMMEDIATE or PREPARE statement, may contain the position of a syntax error.
		For a multiple-row FETCH statement, SQLERRD(5) contains +100 if the last row currently in the table has been fetched.
		For a PREPARE statement, SQLERRD(5) contains the number of parameter markers in the prepared statement.
SQLERRD(6) sqlerrd[5]	SQLERRD(6) SQLER6	Contains the SQL completion message identifier when the SQLCODE is 0.
		In all other cases, it is undefined.

Note:

Table 98. SQLERRMC Replacement Text for CONNECT and SET CONNECTION

Description	Data type
Relational Database Name	CHAR(18)
Product Identification (same as SQLERRP)	CHAR(8)
User ID of the server job	CHAR(10)
Connection method (*DUW or *RUW)	CHAR(10)

SQLERRD(1) and SQLERRD(2) are set only if appropriate and only if the current server is DB2 for i.

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Table 98. SQLERRMC Replacement Text for CONNECT and SET CONNECTION (continued)

	Descrip	tion	Data type				
	DDM se	erver class name	CHAR(10)				
I	QAS	DB2 for i					
I	QDB2	DB2 for z/OS					
 	QDB2/6	QDB2/6000 DB2 for AIX					
 	QDB2/HPUX DB2 for HP-UX**						
 	QDB2/L	LINUX DB2 for Linux [®]					
 	QDB2/N	NT DB2 for Windows** NT, 2000, and XP					
 	QDB2/S	SUN DB2 for SUN** Solaris**					
I	QSQLDS/VM DB2 Server for VM						
 	QSQLDS/VSE DB2 Server for VSE						
	Connect	tion type (same as SQLERRD(4))	SMALLINT				

INCLUDE SQLCA declarations

This section shows the equivalent INCLUDE SQLCA declaration for C and C++, COBOL, PL/I, RPG/400, and ILE RPG.

In C and C++, INCLUDE SQLCA declarations are equivalent to the following:

```
#ifndef
           SQLCODE
struct
           sqlca
           unsigned char
                          sqlcaid[8];
                          sqlcabc;
           long
           long
                          sqlcode;
           short
                          sqlerrml;
           unsigned char
                          sqlerrmc[70];
           unsigned char
                          sqlerrp[8];
                          sqlerrd[6];
           unsigned char
                          sqlwarn[11];
           unsigned char sqlstate[5];
#define
             SQLCODE
                       sqlca.sqlcode
#define
             SQLWARN0
                       sqlca.sqlwarn[0]
#define
             SQLWARN1
                       sqlca.sqlwarn[1]
                       sqlca.sqlwarn[2]
#define
             SQLWARN2
#define
             SQLWARN3
                       sqlca.sqlwarn[3]
#define
             SQLWARN4
                       sqlca.sqlwarn[4]
             SQLWARN5
#define
                       sqlca.sqlwarn[5]
#define
             SQLWARN6
                       sqlca.sqlwarn[6]
#define
             SQLWARN7
                       sqlca.sqlwarn[7]
#define
             SQLWARN8
                       sqlca.sqlwarn[8]
#define
             SQLWARN9
                       sqlca.sqlwarn[9]
#define
             SQLWARNA
                       sqlca.sqlwarn[10]
             SQLSTATE sqlca.sqlstate
#define
#endif
struct sqlca sqlca;
```

In COBOL, INCLUDE SQLCA declarations are equivalent to the following:

```
01 SQLCA.
   05 SQLCAID
                   PIC X(8).
  05 SQLCABC
                   PIC S9(9) BINARY.
  05 SQLCODE
                   PIC S9(9) BINARY.
  05 SQLERRM.
      49 SQLERRML
                   PIC S9(4) BINARY.
      49 SQLERRMC
                   PIC X(70).
   05 SQLERRP
                   PIC X(8).
  05 SQLERRD
                   OCCURS 6 TIMES
                   PIC S9(9) BINARY.
   05 SQLWARN.
      10 SQLWARNO PIC X(1).
      10 SQLWARN1
                   PIC X(1).
                  PIC X(1).
      10 SQLWARN2
      10 SOLWARN3
                   PIC X(1).
      10 SQLWARN4
                   PIC X(1).
      10 SQLWARN5
                   PIC X(1).
      10 SQLWARN6
                   PIC X(1).
      10 SQLWARN7
                   PIC X(1).
      10 SQLWARN8
                   PIC X(1).
      10 SQLWARN9
                  PIC X(1).
      10 SQLWARNA PIC X(1).
   05 SQLSTATE
                   PIC X(5).
```

Note: In COBOL, INCLUDE SQLCA must not be specified outside the Working Storage Section.

In PL/I; INCLUDE SQLCA declarations are equivalent to the following:

```
DCL 1 SQLCA,
      2 SQLCAID
                      CHAR(8),
      2 SQLCABC
                      BIN FIXED(31),
      2 SQLCODE
                      BIN FIXED(31),
      2 SQLERRM
                      CHAR(70) VAR,
      2 SQLERRP
                      CHAR(8),
      2 SQLERRD(6)
                      BIN FIXED(31),
      2 SQLWARN,
        3 SQLWARNO
                      CHAR(1),
                      CHAR(1),
        3 SQLWARN1
        3 SQLWARN2
                      CHAR(1),
        3 SQLWARN3
                      CHAR(1),
        3 SQLWARN4
                      CHAR(1),
        3 SQLWARN5
                      CHAR(1),
        3 SQLWARN6
                      CHAR(1),
        3 SQLWARN7
                      CHAR(1),
        3 SQLWARN8
                      CHAR(1),
                      CHAR(1),
        3 SQLWARN9
                      CHAR(1),
        3 SQLWARNA
      2 SQLSTATE
                      CHAR(5);
```

In RPG/400; SQLCA declarations are equivalent to the following:

```
ISQLCA
                 DS
                                             8 SQLAID
                                                                    SQL
Ι
                                     В
                                         9
                                            120SQLABC
                                                                    SQL
                                     B 13
                                            160SQLCOD
                                                                    SQL
Ι
Ι
                                     B 17
                                            180SQLERL
                                                                    SQL
Ι
                                        19
                                            88 SQLERM
                                                                    SQL
                                            96 SQLERP
                                                                    SQL
T
                                        97 120 SQLERR
                                                                    SQL
                                     B 97 1000SQLER1
Ι
                                                                    SQL
                                     B 101 1040SQLER2
Τ
                                                                    SQL
                                     B 105 1080SQLER3
Ι
                                                                    SQL
                                     B 109 1120SQLER4
                                                                    SQL
Ι
                                     B 113 1160SQLER5
                                                                    SQL
                                     B 117 1200SQLER6
Ι
                                                                    SQL
                                       121 131 SQLWRN
                                                                    SQL
Ι
                                       121 121 SQLWN0
                                                                    SQL
                                       122 122 SQLWN1
                                                                    SQL
                                       123 123 SQLWN2
Ι
                                                                    SQL
                                       124 124 SQLWN3
Ι
                                                                    SQL
Ι
                                       125 125 SOLWN4
                                                                    SOL
                                       126 126 SQLWN5
                                                                    SQL
                                       127 127 SQLWN6
Ι
                                                                    SQL
                                       128 128 SQLWN7
Ι
                                                                    SQL
Ι
                                       129 129 SQLWN8
                                                                    SQL
                                       130 130 SQLWN9
                                                                    SQL
Ι
Ι
                                       131 131 SQLWNA
                                                                    SQL
Ι
                                       132 136 SQLSTT
                                                                    SQL
```

In ILE RPG; SQLCA declarations are equivalent to the following:

```
D*
        SQL Communications area
D SQLCA
                   DS
                                        INZ(X'00000000000000000')
D SQLCAID
                                   88
                                        OVERLAY (SQLCAID)
D
  SQLAID
                                  8A
                                  10I 0
D
   SQLCABC
D
   SQLABC
                                  9B 0 OVERLAY (SQLCABC)
D
   SQLCODE
                                  10I 0
                                  9B 0 OVERLAY (SQLCODE)
D
  SQLCOD
D
  SOLERRML
                                  5I 0
                                  4B 0 OVERLAY (SQLERRML)
  SQLERL
                                  70A
D
  SQLERRMC
D
   SQLERM
                                  70A
                                        OVERLAY (SQLERRMC)
D
   SQLERRP
                                  8A
D
                                  8A
                                        OVERLAY (SQLERRP)
   SQLERP
  SQLERR
                                  24A
```

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D	SQLER1	9B	0	OVERLAY(SQLERR:*NEXT)
D	SQLER2	9B		OVERLAY(SQLERR: *NEXT)
D	SQLER3	9B	0	OVERLAY(SQLERR: *NEXT)
D	SQLER4	9B	0	OVERLAY(SQLERR: *NEXT)
D	SQLER5	9B	0	OVERLAY(SQLERR:*NEXT)
D	SQLER6	9B	0	OVERLAY(SQLERR: *NEXT)
D	SQLERRD	10 I	0	DIM(6) OVERLAY(SQLERR)
D	SQLWRN	11A		
D	SQLWN0	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN1	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN2	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN3	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN4	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN5	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN6	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN7	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN8	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWN9	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWNA	1A		OVERLAY(SQLWRN:*NEXT)
D	SQLWARN	1A		<pre>DIM(11) OVERLAY(SQLWRN)</pre>
D	SQLSTATE	5A		
D	SQLSTT	5A		OVERLAY(SQLSTATE)
D*	End of SQLCA			

SQLCA

Appendix D. SQLDA (SQL descriptor area)

An SQLDA is a set of variables that is used for execution of the SQL DESCRIBE statement, and it may optionally be used by the PREPARE, OPEN, CALL, FETCH, and EXECUTE statements.

An SQLDA can be used in a DESCRIBE or PREPARE statement, altered with the addresses of storage areas¹²⁵, and then used again in a FETCH statement.

SQLDAs are supported for all languages, but predefined declarations are provided only for C (and C++), COBOL, ILE RPG, PL/I, and REXX. In REXX, the SQLDA is somewhat different than in the other languages; for information about the use of SQLDAs in REXX, see the Embedded SQL Programming topic collection.

The meaning of the information in an SQLDA depends on its use.

- When an SQLDA is used in a DESCRIBE or PREPARE statement, an SQLDA provides information to an application program about a prepared *select-statement*.
 Each column of the result table is described in an SQLVAR occurrence or set of related SOLVAR occurrences.
- In OPEN, EXECUTE, CALL, and FETCH, an SQLDA provides information to the database manager about storage areas for input or output data. Each storage area is described in the SQLVARs.
 - For OPEN and EXECUTE of a statement other than CALL, each SQLVAR occurrence or set of related SQLVAR occurrences describes a storage area that is used to contain an input value which is substituted for a parameter marker in the associated SQL statement that was previously prepared.
 - For FETCH, each SQLVAR occurrence or set of related SQLVAR occurrences describes a storage area that is used to contain an output value from a row of the result table.
 - For CALL and EXECUTE of a prepared CALL statement, each SQLVAR occurrence or set of related SQLVAR occurrences describes a storage area that is used to contain an input or output value (or both) that corresponds to an argument in the argument list for the procedure.

An SQLDA consists of four variables in a header followed by an arbitrary number of occurrences of a *base SQLVAR*. When the SQLDA desribes either LOBs or distint types the base SQLVARs are followed by the same number of occurrences of an *extended SQLVAR*.

Base SQLVAR entry

The base SQLVAR entry is always present. The fields of this entry contain the base information about the column or variable such as data type code, length attribute (except for LOBs), column name (or label), CCSID, variable address, and indicator variable address.

Extended SQLVAR entry

The extended SQLVAR entry is needed (for each column) if the result includes any LOB or distinct type columns. For distinct types, the extended SQLVAR contains the distinct type name. For LOBs, the extended SQLVAR contains the length attribute of the variable and a pointer to the buffer that

^{125.} A storage area could be the storage for a variable defined in the program (that may also be a host variable) or an area of storage explicitly allocated by the application.

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contains the actual length. If locators or file reference variables are used to represent LOBs, an extended SQLVAR is not necessary.

The extended SQLVAR entry is also needed for each column when:

- · USING BOTH is specified, which indicates that column names and labels are returned.
- USING ALL is specified, which indicates that column names, labels, and system column names are returned.

The fields in the extended SQLVAR that return LOB and distinct type information do not overlap, and the fields that return LOB and label information do not overlap. Depending on the combination of labels, LOBs and distinct types, more than one extended SQLVAR entry per column may be required to return the information. See "Determining how many SQLVAR occurrences are needed" on page 1238.

Field descriptions in an SQLDA header

An SQLDA consists of four variables in a header structure followed by an arbitrary number of occurrences of a sequence of five variables collectively named SQLVAR. In OPEN, CALL, FETCH, and EXECUTE, each occurrence of SQLVAR describes a variable. In PREPARE and DESCRIBE, each occurrence describes a column of a result table.

The SQL INCLUDE statement provides the following field names:

Table 99. Field Descriptions for an SQLDA Header

C Name ¹²⁶ PL/I Name COBOL Name	Field Data Type	Usage in DESCRIBE and PREPARE (set by the database manager except for SQLN)	Usage in FETCH, OPEN, CALL, or EXECUTE (set by the user prior to executing the statement)
sqldaid SQLDAID	CHAR(8)	An 'eye catcher' for storage dumps, containing 'SQLDA '. The 7th byte of the SQLDAID can be used to determine whether more than one SQLVAR entry is needed for each column. For details, see "Determining how many SQLVAR occurrences are needed" on page 1238.	A '2' in the 7th byte indicates that two SQLVAR entries were allocated for each column. A '3' in the 7th byte indicates that three SQLVAR entries were allocated for each column. A '4' in the 7th byte indicates that four SQLVAR entries were allocated for each column.
sqldabc SQLDABC	INTEGER	Length of the SQLDA.	Number of bytes of storage allocated for the SQLDA. Enough storage must be allocated to contain SQLN occurrences. SQLDABC must be set to a value greater than or equal to 16+SQLN*(80), where 80 is the length of an SQLVAR occurrence. If LOBs or distinct types are specified, there must be two SQLVAR entries for each parameter marker.
sqln SQLN	SMALLINT	Unchanged by the database manager. Must be set to a value greater than or equal to zero before the PREPARE or DESCRIBE statement is executed. It should be set to a value that is greater than or equal to the number of columns in the result or a multiple of the number of columns in the result when multiple sets of SQLVAR entries are necessary. Indicates the total number of occurrences of SQLVAR.	Total number of occurrences of SQLVAR provided in the SQLDA. SQLN must be set to a value greater than or equal to zero. If LOBs or distinct types are specified, there must be two SQLVAR entries for each parameter marker and SQLN must be set to two times the number of parameter markers.
sqld SQLD	SMALLINT	The number of columns described by occurrences of SQLVAR (zero if the statement being described is not a select-statement).	Number of occurrences of SQLVAR entries in the SQLDA that are used when executing the statement. SQLD must be set to a value greater than or equal to zero and less than or equal to SQLN.

^{126.} In this column, the lowercase name is the C Name. The uppercase name is the COBOL, PL/I, or RPG Name.

Determining how many SQLVAR occurrences are needed

The number of SQLVAR occurrences needed depends on the statement that the SQLDA was provided for and the data types of the columns or parameters being described. See the tables above for more information.

The 7th byte of SQLDAID is always set to the number of sets of SQLVARs necessary when LOBs or UDTs are in the result set.

If SQLD is not set to a sufficient number of SQLVAR occurrences:

- When LOBs and UDTs are not in the result set, SQLD is set to the total number of SQLVAR occurrences needed for all sets. When there are LOBs or UDTs in the result set, SOLD is set to the number of columns in the result table and the seventh byte of SQLDAID indicates the number of sets of SQLVAR entries needed. The number of required SQLVAR entries can always be determined by multiplying SQLD by the value in the seventh byte of SQLDAID.
- A warning (SQLSTATE 01594) is returned if at least enough SQLVARs were specified for the Base SQLVAR Entries. The Base SQLVAR entries are returned, but no extended SQLVARs are returned.
- A warning (SQLSTATE 01005) is returned if enough SQLVARs were not specified for even the Base SQLVAR Entries. No SQLVAR entries are returned. 127

Table 100, Table 101 on page 1239, and Table 102 on page 1239 show how to map the base and extended SQLVAR entries. For an SQLDA that contains both base and extended SQLVAR entries, the base SQLVAR entries are in the first block, followed by a block of extended SQLVAR entries, which if necessary, are followed by a second or third block of extended SQLVAR entries. In each block, the number of occurrences of the SQLVAR entry is equal to the value in SQLD even though many of the extended SQLVAR entries might be unused.

Table 100. Contents of SQLVAR Arrays for USING NAMES, USING SYSTEM NAMES, USING LABELS or USING ANY

LOBs	DISTINCT types	7th byte of SQLDAID	SQLN Minimum	First Set (Base)	Second Set (Extended)	Third Set (Extended)	Fourth Set (Extended)
No	No	Blank	n	Column names, system column names, or labels	Not used	Not used	Not used
Yes	No	2	2n	Column names, system column names, or labels	LOBs	Not used	Not used
No	Yes	2	2n	Column names, system column names, or labels	Distinct types	Not used	Not used

^{127.} If LOBs or UDTs are not in the result set, the warning is only returned if the standards option is specified. For information about the standards option, see "Standards compliance" on page ix.

Table 100. Contents of SQLVAR Arrays for USING NAMES, USING SYSTEM NAMES, USING LABELS or USING ANY (continued)

LOBs	DISTINCT types	7th byte of SQLDAID	SQLN Minimum	First Set (Base)	Second Set (Extended)	Third Set (Extended)	Fourth Set (Extended)
Yes	Yes	2	2n	Column names, system column names, or labels	LOBs and distinct types	Not used	Not used

Table 101. Contents of SQLVAR Arrays for USING BOTH

LOBs	DISTINCT types	7th byte of SQLDAID	SQLN Minimum	First Set (Base)	Second Set (Extended)	Third Set (Extended)	Fourth Set (Extended)
No	No	2	2n	Column names	Labels	Not used	Not used
Yes	No	2	2n	Column names	LOBs and labels	Not used	Not used
No	Yes	3	3n	Column names	Distinct types	Labels	Not used
Yes	Yes	3	3n	Column names	LOBs and distinct types	Labels	Not used

Table 102. Contents of SQLVAR Arrays for USING ALL

LOBs	DISTINCT types	7th byte of SQLDAID	SQLN Minimum	First Set (Base)	Second Set (Extended)	Third Set (Extended)	Fourth Set (Extended)
No	No	3	3n	System column names	Labels	Column names	Not used
Yes	No	3	3n	System column names	LOBs and labels	Column names	Not used
No	Yes	4	4n	System column names	Distinct types	Labels	Column names
Yes	Yes	4	4n	System column names	LOBs and distinct types	Labels	Column names

Field descriptions in an occurrence of SQLVAR

This section includes field descriptions in an occurrence of a base and secondary SQLVAR.

Fields in an occurrence of a base SQLVAR

Table 103. Field Descriptions for an SQLVAR

C Name ¹²⁸ COBOL Name PL/I Name RPG Name	Field Data Type	Usage in DESCRIBE and PREPARE (set by the database manager)	Usage in FETCH, OPEN, CALL, and EXECUTE (set by the user prior to executing the statement)
sqltype SQLTYPE	SMALLINT	Indicates the data type of the column and whether it can contain nulls. For a description of the type codes, see Table 105 on page 1243.	Indicates the data type of the host variable and whether an indicator variable is provided. For a description of the type codes, see Table 105 on page 1243.
		For a distinct type, the data type on which the distinct type is based is placed in this field. The base SQLVAR contains no indication that this is part of the description of a distinct type.	
sqllen SQLLEN	SMALLINT	The length attribute of the column. For datetime columns, the length of the string representation of the values. See	The length attribute of the host variable. See Table 105 on page 1243.
		Table 105 on page 1243.	For a LOB, the value is 0 regardless of the length attribute of the LOB. Field
		For a LOB, the value is 0 regardless of the length attribute of the LOB. Field SQLLONGLEN in the extended SQLVAR entry contains the length attribute of the LOB.	SQLLONGLEN in the extended SQLVAR entry contains the length attribute of the LOB.
sqlres SQLRES	CHAR(12)	Reserved. Provides boundary alignment for SQLDATA.	Reserved. Provides boundary alignment for SQLDATA.
sqldata SQLDATA	pointer	The CCSID of a string column as described in Table 106 on page 1245.	Contains the address of the host variable.
			For LOB host variables, if the SQLDATALEN field in the extended SQLVAR is null, this points to the four-byte LOB length, followed immediately by the LOB data.
			If the SQLDATALEN field in the extended SQLVAR is not null, this points to the LOB data and the SQLDATALEN field points to the four-byte LOB length.

^{128.} In this column, the lowercase name is the C Name. The uppercase name is the PL/I, COBOL, and RPG Name.

	C Name ¹²⁸ COBOL Name PL/I Name RPG Name	Field Data Type	Usage in DESCRIBE and PREPARE (set by the database manager)	Usage in FETCH, OPEN, CALL, and EXECUTE (set by the user prior to executing the statement)
	sqlind SQLIND	pointer	For a select-statement, indicates whether the column was added as a result of using the WITH ROW CHANGE COLUMNS attribute: • -1 ROW CHANGE TOKEN (distinct) • -2 ROW CHANGE TOKEN (not distinct) • -3 RID • -4 RID_BIT	Contains the address of the indicator variable. Not used if there is no indicator variable (as indicated by an even value of SQLTYPE).
			Otherwise, reserved.	
	sqlname SQLNAME	VARCHAR(30)	The unqualified name of the column. If the column does not have a name, a string is constructed from the expression and returned. The name is case sensitive and does not contain surrounding delimiters.	Contains the CCSID of the host variable as described in Table 106 on page 1245.

Fields in an occurrence of a secondary SQLVAR

Table 104. Field Descriptions for an Extended SQLVAR

C Name ¹²⁹ COBOL Name PL/I Name RPG Name	Field Data Type	Usage in DESCRIBE and PREPARE (set by the database manager)	Usage in FETCH, OPEN, CALL, and EXECUTE (set by the user prior to executing the statement)
len.sqllonglen SQLLONGL SQLLONGLEN	INTEGER	The length attribute of a LOB column.	The length attribute of a LOB host variable. The database manager ignores the SQLLEN field in the base SQLVAR for these data types. The length attribute indicates the number of bytes for a BLOB or CLOB, and the number of characters for a DBCLOB.
*	CHAR(12)	Reserved. Provides boundary alignment for SQLDATALEN.	Reserved. Provides boundary alignment for SQLDATALEN.
*	pointer	Reserved.	Reserved.

^{129.} In this column, the lowercase name is the C Name. The first uppercase name is the PL/I and RPG Name. The second uppercase name is the COBOL Name.

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Table 104. Field Descriptions for an Extended SQLVAR (continued)

C Name ¹²⁹ COBOL Name PL/I Name RPG Name	Field Data Type	Usage in DESCRIBE and PREPARE (set by the database manager)	Usage in FETCH, OPEN, CALL, and EXECUTE (set by the user prior to executing the statement)
sqldatalen SQLDATAL SQLDATALEN	pointer	Not used.	Used only for LOB host variables. If the value of this field is not null, this field points to a four-byte long buffer that contains the actual length of the LOB in bytes (even for DBCLOBs). The SQLDATA field in the matching base SQLVAR then points to the LOB data.
			If the value of this field is null, the actual length of the LOB is stored in the first four bytes pointed to by the SQLDATA field in the matching base SQLVAR, and the LOB data immediately follows the four-byte length. The actual length indicates the number of bytes for a BLOB or CLOB and the number of double-byte characters for a DBCLOB. Regardless of whether this field is used,
			field SQLLONGLEN must be set.
sqldatatype_name SQLTNAME SQLDATATYPE-NAME	VARCHAR (30)	 The SQLTNAME field of the extended SQLVAR is set to one of the following: For a distinct type column, the database manager sets this to the fully qualified distinct type name. If the qualified name is longer than 30 bytes, it is truncated. For a label, the database manager sets this to the first 20 bytes of the label. For a column name, the database manager sets this to the column name. 	Not used.

SQLTYPE and SQLLEN

The following table shows the values that may appear in the SQLTYPE and SQLLEN fields of the SQLDA. In PREPARE and DESCRIBE, an even value of SQLTYPE means the column does not allow nulls, and an odd value means the column does allow nulls.

Note: In an SQLDA used in DESCRIBE or PREPARE statements, an odd value is returned for an expression if one operand is nullable or if the expression may result in a -2 mapping-error null value.

In FETCH, OPEN, CALL, and EXECUTE, an even value of SQLTYPE means no indicator variable is provided, and an odd value means that SQLIND contains the address of an indicator variable.

Table 105. SQLTYPE and SQLLEN values for PREPARE, DESCRIBE, FETCH, OPEN, CALL, or EXECUTE

	For PREPARE	and DESCRIBE	For FETCH, OPEN, CALL, and EXECUTE				
SQLTYPE	COLUMN DATA TYPE	SQLLEN	HOST VARIABLE DATA TYPE	SQLLEN			
384/385	Date ¹³²	10	Fixed-length character-string representation of a date	Length attribute of the host variable			
388/389	9 Time 8		Fixed-length character-string representation of a time	Length attribute of the host variable			
392/393	/393 Timestamp 26		Fixed-length character-string representation of a time stamp	Length attribute of the host variable			
396/397	DataLink	Length attribute of the column	DataLink	Length attribute of the host variable			
400/401	Not Applicable	Not Applicable	NUL-terminated graphic string	Length attribute of the host variable			
404/405	BLOB	0 131	BLOB	Not used. 131			
408/409	CLOB	0 131	CLOB	Not used. 131			
412/413	DBCLOB	0 131	DBCLOB	Not used. 131			
448/449	Varying-length character string	Length attribute of the column	Varying-length character string	Length attribute of the host variable			
452/453	Fixed-length character string	Length attribute of the column	Fixed-length character string	Length attribute of the host variable			
456/457	Long varying-length character string	Length attribute of the column	Long varying-length character string	Length attribute of the host variable			
460/461	Not Applicable	Not Applicable	NUL-terminated character string	Length attribute of the host variable			
464/465	Varying-length graphic string	Length attribute of the column	Varying-length graphic string	Length attribute of the host variable			
468/469	Fixed-length graphic string	Length attribute of the column	Fixed-length graphic string	Length attribute of the host variable			
472/473	Long varying-length Length graphic string the co		Long graphic string	Length attribute of the host variable			

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Table 105. SQLTYPE and SQLLEN values for PREPARE, DESCRIBE, FETCH, OPEN, CALL, or EXECUTE (continued)

	For PREPARE	and DESCRIBE	For FETCH, OPEN,	CALL, and EXECUTE		
SQLTYPE	COLUMN DATA TYPE	SQLLEN	HOST VARIABLE DATA TYPE	SQLLEN		
476/477	Not Applicable	Not Applicable	PASCAL L-string	Length attribute of the host variable		
480/481	Floating point	4 for single precision, 8 for double precision	Floating point	4 for single precision, 8 for double precision		
484/485	Packed decimal	Precision in byte 1; Packed decimal scale in byte 2		Precision in byte 1; scale in byte 2		
488/489	Zoned decimal	Precision in byte 1; Zoned decimal scale in byte 2		Precision in byte 1; scale in byte 2		
492/493	Big integer	8 130	Big integer	8		
496/497	Large integer	4 130	Large integer	4		
500/501	Small integer	2 130	Small integer	2		
504/505	Not Applicable	Not Applicable	DISPLAY SIGN LEADING SEPARATE	Precision in byte 1; scale in byte 2		
904/905	ROWID	40	ROWID	40		
908/909	Varying-length binary string	Length attribute of the column	Varying-length binary string	Length attribute of the host variable		
912/913	Fixed-length binary string	Length attribute of the column	Fixed-length binary string	Length attribute of the host variable		
916/917	Not Applicable	Not Applicable	BLOB file reference variable	267		
920/921	Not Applicable	Not Applicable	CLOB file reference variable	267		
924/925	Not Applicable	Not Applicable	DBCLOB file reference variable	267		
960/961	Not Applicable	Not Applicable	BLOB locator	4		
964/965	Not Applicable	Not Applicable	CLOB locator	4		
968/969	Not Applicable	Not Applicable	DBCLOB locator	4		
996/997	6/997 Not Applicable Not A DECFLOAT(16) 8 DECFLOAT(34) 16		DECFLOAT(7) ¹³³ DECFLOAT(16) DECFLOAT(34)	4 8 16		

^{130.} Binary numbers can be represented in the SQLDA with a length of 2, 4, or 8, or with the precision in byte 1 and the scale in byte 2. If the first byte is greater than x'00', it indicates precision and scale.

^{131.} Field SQLLONGLEN in the extended SQLVAR contains the length attribute of the column.

^{132.} Less for *JUL, *YMD, *DMY, and *MDY formats. For more information, see Table 8 on page 78

^{133.} DB2 does not internally store DECFLOAT(7) numbers, but it will support DECFLOAT(7) numbers from applications. A DECFLOAT(7) variable referenced in an SQL statement will be converted to DECFLOAT(16).

CCSID values in SQLDATA or SQLNAME

In the OPEN, FETCH, CALL, and EXECUTE statements, the SQLNAME field of the SQLVAR element can be used to specify a CCSID for string host variables. If the SQLNAME field is used to specify a CCSID, the SQLNAME length must be set to 8. In addition, the first 4 bytes of SQLNAME must be set as described in the table below. If no CCSID is specified, the job CCSID is used.

In the DESCRIBE, DESCRIBE TABLE, and PREPARE statements, the SQLDATA field of the SQLVAR element contains the CCSID of the column of the result table if that column is a string column. The CCSID is located in bytes 3 and 4 as described in Table 106.

Table 106. CCSID values for SQLDATA or SQLNAME

Data Type	Encoding Scheme	Bytes 1 & 2	Bytes 3 & 4
Character	SBCS data	X'0000'	ccsid
Character	Mixed data	X'0000'	ccsid
Character	Bit data	X'0000'	65535
Graphic	Not Applicable	X'0000'	ccsid
Any other data type	Not Applicable	Not Applicable	Not Applicable

Unrecognized and unsupported SQLTYPES

The values that appear in the SQLTYPE field of the SQLDA are dependent on the level of data type support available at the sender as well as the receiver of the data. This is particularly important as new data types are added to the product.

New data types may or may not be supported by the sender or receiver of the data and may or may not even be recognized by the sender or receiver of the data. Depending on the situation, the new data type may be returned, or a compatible data type agreed upon by both the sender and receiver of the data may be returned or an error may result.

When the sender and receiver agree to use a compatible data type, the following indicates the mapping that will take place. This mapping will take place when at least one of the sender or receiver does not support the data type provided. The unsupported data type can be provided by either the application or the database manager.

Table 107. Compatible Data Types for Unsupported Data Types

Data Type	Compatible Data Type
BIGINT	DECIMAL(19,0)
ROWID	VARCHAR(40) FOR BIT DATA

INCLUDE SQLDA declarations

This section shows the equivalent INCLUDE SQLDA declaration for C and C++, COBOL, ILE COBOL, PL/I, and ILE RPG.

For C and C++

In C and C++, INCLUDE SQLDA declarations are equivalent to the following:

```
#ifndef SQLDASIZE
struct sqlda
       unsigned char sqldaid[8];
                      sqldabc;
       short
                      sqln;
      short
                      sqld;
      struct sqlvar
              short
                             sqltype;
              short
                             sqllen;
              unsigned char *sqldata;
              short
                            *sqlind;
              struct sqlname
                                    length;
                     short
                     unsigned char data[30];
              } sqlname;
      } sqlvar[1];
};
struct sqlvar2
       { struct
                  long
                                  sqllonglen;
                                  reserve1[28];
                   char
                  len;
                char *sqldatalen;
                struct sqldistinct type
                       { short
                                         length;
                          unsigned char data[30];
                       } sqldatatype_name;
      };
#define SQLDASIZE(n) (sizeof(struct sqlda)+(n-1) * sizeof(struct sqlvar))
#endif
```

Figure 11. INCLUDE SQLDA Declarations for C and C++

```
/* Macros for using the sqlvar2 fields.
/*
  '2' in the 7th byte of sqldaid indicates a doubled number of
     sqlvar entries.
   '3' in the 7th byte of sqldaid indicates a tripled number of
/*
                                             */
/*
     sqlvar entries.
   '4' in the 7th byte of sqldaid indicates a quadrupled number of \star/
/*
     sglvar entries.
#define SQLDOUBLED '2'
#define SQLSINGLED ' '
/* GETSQLDOUBLED(daptr) returns 1 if the SQLDA pointed to by
```

```
/* daptr has been doubled, or 0 if it has not been doubled.
#define GETSQLDOUBLED(daptr) (((daptr)->sqldaid[6]== \
(char) SQLDOUBLED) ?
  (1) :
   (0)
/* SETSQLDOUBLED(daptr, SQLDOUBLED) sets the 7th byte of sqldaid */
/* to '2'.
/* SETSQLDOUBLED(daptr, SQLSINGLED) sets the 7th byte of sqldaid
                                               */
/* to be a ' '.
                                               */
#define SETSQLDOUBLED(daptr, newvalue)
 (((daptr)->sqldaid[6] =(newvalue)))
/* GETSQLDALONGLEN(daptr,n) returns the data length of the nth
                                               */
/* entry in the sqlda pointed to by daptr. Use this only if the
/* sqlda was doubled or tripled and the nth SQLVAR entry has a
/* LOB datatype.
#define GETSQLDALONGLEN(daptr,n) ((long) (((struct sqlvar2 *) \
&((daptr)->sqlvar[(n) +((daptr)->sqld)])) ->len.sqllonglen))
/* SETSQLDALONGLEN(daptr,n,len) sets the sqllonglen field of the */
/* sqlda pointed to by daptr to len for the nth entry. Use this only */
/* if the sqlda was doubled or tripled and the nth SQLVAR entry has */
/* a LOB datatype.
#define SETSQLDALONGLEN(daptr,n,length) {
struct sqlvar2 *var2ptr;
var2ptr = (struct sqlvar2 *) &((daptr)->sqlvar[(n)+ \
  ((daptr)->sqld)]);
var2ptr->len.sqllonglen = (long) (length);
/* SETSQLDALENPTR(daptr,n,ptr) sets a pointer to the data length for */
/* the nth entry in the sqlda pointed to by daptr. //
/* Use this only if the sqlda has been doubled or tripled.
#define SETSQLDALENPTR(daptr,n,ptr) {
struct sqlvar2 *var2ptr;
var2ptr = (struct sqlvar2 *) &((daptr)->sqlvar[(n)+
 ((daptr)->sqld)]);
var2ptr->sqldatalen = (char *) ptr;
/* GETSQLDALENPTR(daptr,n) returns a pointer to the data length for */
/st the nth entry in the sqlda pointed to by daptr. Unlike the inline st/
/* value (union sql8bytelen len), which is 8 bytes, the sqldatalen */
/* pointer field returns a pointer to a long (4 byte) integer.
/* If the SQLDATALEN pointer is zero, a NULL pointer is be returned. */
/*
                                               */
/* NOTE: Use this only if the sqlda has been doubled or tripled.
#define GETSQLDALENPTR(daptr,n) (
 (((struct sqlvar2 *) &(daptr)->sqlvar[(n) +
   (daptr)->sqld])->sqldatalen == NULL) ?
  ((long *) NULL ) : ((long *) ((struct sqlvar2 *) \
 &(daptr)->sqlvar[(n) + (daptr) ->sqld])->sqldatalen))
```

For COBOL

In COBOL, INCLUDE SQLDA declarations are equivalent to the following:

```
1 SQLDA.
 05 SQLDAID
                 PIC X(8).
 05 SQLDABC
                 PIC S9(9) BINARY.
 05 SQLN
                 PIC S9(4) BINARY.
                 PIC S9(4) BINARY.
 05 SQLD
 05 SQLVAR OCCURS 0 TO 409 TIMES DEPENDING ON SQLD.
    10 SQLTYPE PIC S9(4) BINARY.
     10 SQLLEN
                 PIC S9(4) BINARY.
     10 FILLER REDEFINES SQLLEN.
        15 SQLPRECISION PIC X.
        15 SQLSCALE
                        PIC X.
     10 SQLRES
                 PIC X(12).
     10 SQLDATA
                 POINTER.
     10 SQLIND
                  POINTER.
     10 SQLNAME.
        49 SQLNAMEL PIC S9(4) BINARY.
        49 SQLNAMEC PIC X(30).
```

Figure 12. INCLUDE SQLDA Declarations for COBOL

For ILE COBOL

In ILE COBOL, INCLUDE SQLDA declarations are equivalent to the following:

```
1 SQLDA.
                 PIC X(8).
 05 SQLDAID
 05 SQLDABC
                 PIC S9(9) BINARY.
                 PIC S9(4) BINARY.
 05 SQLN
                 PIC S9(4) BINARY.
 05 SQLD
 05 SQLVAR OCCURS 0 TO 409 TIMES DEPENDING ON SQLD.
     10 SQLVAR1.
        15 SQLTYPE
                     PIC S9(4) BINARY.
        15 SQLLEN
                     PIC S9(4) BINARY.
        15 FILLER REDEFINES SQLLEN.
           20 SQLPRECISION PIC X.
           20 SQLSCALE
                           PIC X.
        15 SQLRES
                     PIC X(12).
        15 SQLDATA
                     POINTER.
        15 SQLIND
                     POINTER.
        15 SOLNAME.
           49 SQLNAMEL PIC S9(4) BINARY.
           49 SQLNAMEC PIC X(30).
     10 SQLVAR2 REDEFINES SQLVAR1.
        15 SQLVAR2-RESERVED-1 PIC S9(9) BINARY.
                              REDEFINES SQLVAR2-RESERVED-1
        15 SQLLONGLEN
                              PIC S9(9) BINARY.
        15 SQLVAR2-RESERVED-2 PIC X(28).
        15 SQLDATALEN
                              POINTER.
        15 SQLDATATYPE-NAME.
           49 SQLDATATYPE-NAMEL PIC S9(4) BINARY.
           49 SQLDATATYPE-NAMEC PIC X(30).
```

Figure 13. INCLUDE SQLDA Declarations for ILE COBOL

For PL/I

In PL/I, INCLUDE SQLDA declarations are equivalent to the following:

```
DCL 1 SQLDA BASED(SQLDAPTR),
      2 SQLDAID
                    CHAR(8),
      2 SQLDABC
                    BIN FIXED(31),
      2 SQLN
                    BIN FIXED,
      2 SQLD
                    BIN FIXED,
      2 SQLVAR
                    (99)
       3 SQLTYPE
                    BIN FIXED,
        3 SQLLEN
                    BIN FIXED,
        3 SQLRES
                    CHAR(12),
        3 SQLDATA
                    PTR,
        3 SQLIND
                    PTR,
                    CHAR(30) VAR,
        3 SQLNAME
    1 SQLDA2 BASED(SQLDAPTR),
      2 SQLDAID2
                    CHAR(8),
                    FIXED(31) BINARY,
      2 SQLDABC2
      2 SQLN2
                    FIXED(15) BINARY,
      2 SQLD2
                    FIXED(15) BINARY,
      2 SQLVAR2
                    (99),
        3 SQLBIGLEN,
          4 SQLLONGL FIXED(31) BINARY,
          4 SQLRSVDL FIXED(31) BINARY,
        3 SQLDATAL POINTER,
        3 SQLTNAME CHAR(30) VAR;
   DECLARE SQLSIZE
                       FIXED(15) BINARY;
    DECLARE SQLDAPTR
                       PTR;
                                 INITIAL('2') STATIC;
    DECLARE SQLDOUBLED CHAR(1)
                                 INITIAL(' ') STATIC;
    DECLARE SQLSINGLED CHAR(1)
```

Figure 14. INCLUDE SQLDA Declarations for PL/I

For ILE RPG

In ILE RPG, INCLUDE SQLDA declarations are equivalent to the following:

```
D*
        SQL Descriptor area
D SQLDA
D
  SQLDAID
                           1
                                  88
  SQLDABC
                           9
                                 12B 0
D
  SQLN
                          13
                                 14B 0
D
D
  SQLD
                          15
                                 16B 0
  SQL VAR
                                 80A
                                       DIM(SQL NUM)
                          17
D
                                 18B 0
                          19
                                 20B 0
D
                          21
D
                                 32A
D
                          33
                                 48*
D
                          49
                                 64*
                          65
                                 66B 0
D
D
                          67
                                 96A
   End of SQLDA
```

Figure 15. INCLUDE SQLDA Declarations for ILE RPG

```
D*
D SQLVAR DS
D SQLTYPE 1 2B 0
D SQLLEN 3 4B 0
D SQLRES 5 16A
```

SQLDA

D	SQLDATA		17	32*
D	SQLIND		33	48*
D	SQLNAMELEN		49	50B 0
D	SQLNAME		51	80A
D۶	k			
D	SQLVAR2	DS		
D	SQLLONGL		1	4B 0
D	SQLRSVDL		5	32A
D	SQLDATAL		33	48*
D	SQLTNAMELN		49	50B 0
D	SQLTNAME		51	80A

The user is responsible for the definition of SQL_NUM. SQL_NUM must be defined as a numeric constant with the dimension required for SQL_VAR.

Since RPG does not support structures within arrays, the SQLDA generates three data structures. The second and third data structures are used to setup/reference the part of the SQLDA which contains the field descriptions.

To set the field descriptions of the SQLDA the program sets up the field description in the subfields of SQLVAR (or SQLVAR2) and then does a MOVEA of SQLVAR (or SQLVAR2) to SQL_VAR, n where n is the number of the field in the SQLDA. This is repeated until all the field descriptions are set.

When the SQLDA field descriptions are to be referenced the user does a MOVEA of SQL_VAR, n to SQLVAR (or SQLVAR2) where n is the number of the field description to be processed.

Appendix E. CCSID values

The tables in this section describe the CCSIDs and conversions provided by the IBM relational database products.

For more information, see "Character conversion" on page 32.

The following list defines the symbols used in the DB2 product column in the following tables:

- X Indicates that the conversion tables exist to convert from or to that CCSID. This also implies that this CCSID can be used to tag local data.
- C Indicates that conversion tables exist to convert from that CCSID to another CCSID. This also implies that this CCSID cannot be used to tag local data, because the CCSID is in a foreign encoding scheme (for example, a PC-Data CCSID such as 850 cannot be used to tag local data in DB2 for i).
- **blank** Indicates that the specific product does not support the CCSID at all. Such a CCSID must not be used unless interoperability with the specific product is not necessary.

This information is current as of the publishing date of this book for the CCSIDs listed. Additional CCSIDs may have been added since the publishing date and are not in the lists below.

Table 108. Universal Character Set (UTF-8, UTF-16, and UCS-2)

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
1200	UTF-16	Х	Χ	Х	Χ	Х	Χ	Х	Х	X
1208	UTF-8 Level 3	Х	Х	Х	Χ	Х	Х	Х	Х	Х
13488	UCS-2 Level 1	С	Х	C *	C *	C *	C *	C *	C *	C *

 $\textbf{Note:} \ ^*\text{In DB2 LUW, } 13488 \text{ is only used to tag the GRAPHIC column of eucJP and eucTW databases.}$

Table 109. CCSIDs for EBCDIC Group 1 (Latin-1) Countries or Regions

1

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
37	USA, Canada, Netherlands, Portugal, Brazil, Australia, New Zealand	Х	Х	С	С	С	С	С	С	С
256	Word Processing, Netherlands	Х	X							
273	Austria, Germany	Х	Х	С	С	С	С	С	С	С
274	Belgium	Х		С	С	С	С	С	С	С
277	Denmark, Norway	Х	Х	С	С	С	С	С	С	С
278	Finland, Sweden	Х	Х	С	С	С	С	С	С	С
280	Italy	Х	Х	С	С	С	С	С	С	С
284	Spain, Latin America (Spanish)	Х	X	С	С	С	С	С	С	С
285	United Kingdom	Х	Х	С	С	С	С	С	С	С
297	France	Х	Х	С	С	С	С	С	С	С
500	Belgium, Canada, Switzerland, International Latin-1	Х	Х	С	С	С	С	С	С	С
871	Iceland	Х	Х	С	С	С	С	С	С	С
924	Latin-0	Х	Х							
1047	Latin-0 (with Euro)	Х	Х							
1140	USA, Canada, Netherlands, Portugal, Brazil, Australia, New Zealand	Х	Х	С	С	С	С	С	С	С
1141	Austria, Germany	Х	Х	С	С	С	С	С	С	С
1142	Denmark, Norway	Х	Х	С	С	С	С	С	С	С
1143	Finland, Sweden	Х	Х	С	С	С	С	С	С	С
1144	Italy	Х	Х	С	С	С	С	С	С	С
1145	Spain, Latin America (Spanish)	Х	Х	С	С	С	С	С	С	С
1146	United Kingdom	Х	Х	С	С	С	С	С	С	С
1147	France	Х	Χ	С	С	С	С	С	С	С
1148	Belgium, Canada, Switzerland, International Latin-1	X	Х	С	С	С	С	С	С	С
1149	Iceland	Х	Х	С	С	С	С	С	С	С

Table 110. CCSIDs for PC-Data and ISO Group 1 (Latin-1) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
437	USA	X	С	С	С	С	С	С	С	С
819	Latin-1 countries (ISO 8859-1)	X	С	Х	Х	Х	С	Х	Х	Х
850	Latin Alphabet Number 1; Latin-1 countries	X	С	Χ	С	С	С	С	С	С
858	Latin Alphabet Number 1; Latin-1 countries (with Euro)	Χ	С							
860	Portugal (850 subset)	X	С	С	С	С	С	С	С	С
861	Iceland	X	С							
863	Canada (850 subset)	Х	С	С	С	С	С	С	С	С
865	Denmark, Norway, Finland, Sweden	X	С							
923	Latin-0	Х	С	Х	Х	Х	С	С	С	Х
1009	IRV 7-bit	Х	С							
1010	France 7-bit	Х	С							
1011	Germany 7-bit	Х	С							
1012	Italy 7-bit	X	С							
1013	United Kingdom 7-bit	X	С							
1014	Spain 7-bit	X	С							
1015	Portugal 7-bit	X	С							
1016	Norway 7-bit	X	С							
1017	Denmark 7-bit	X	С							
1018	Finland and Sweden 7-bit	X	С							
1019	Belgium and Netherlands 7-bit	X	С							
1051	HP Emulation	X	С	С	Х	С	С	С	С	С
1252	Windows ** Latin-1	Χ	С	С	С	С	Х	С	С	С
1275	Macintosh ** Latin-1	Χ	С							
5348	Windows Latin-1 (with Euro)	X	С							

Table 111. CCSIDs for EBCDIC Group 1a (Non-Latin-1 SBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	sco	SGI	Linux
420	Arabic (Type 4)	Χ	X	С	С	С	С	С	С	С
423	Greek	X	X	С	С	С	С	С	С	С
424	Hebrew(Type 4)	Χ	Χ	С	С	С	С	С	С	С
425	Arabic (Type 5)		Χ	С	С	С	С	С	С	С
870	Latin-2 Multilingual	Χ	Χ	С	С	С	С	С	С	С
875	Greek	Χ	X	С	С	С	С	С	С	С
880	Cyrillic Multilingual	Χ	Χ							
905	Turkey Latin-3 Multilingual	Χ	X							
918	Urdu	Χ	Χ							
1025	Cyrillic Multilingual	Χ	Χ	С	С	С	С	С	С	С
1026	Turkey Latin-5	Χ	Χ	С	С	С	С	С	С	С
1097	Farsi	Х	Х							
1112	Baltic Multilingual	Х	Х	С	С	С	С	С	С	С
1122	Estonia	Х	Х	С	С	С	С	С	С	С
1123	Ukraine	Х	Х	С	С	С	С	С	С	С
1137	Devanagari	Х	Х	С	С	С	С	С	С	С
1153	Latin-2 (with Euro)	Х	X	С	С	С	С	С	С	С
1154	Cyrillic (with Euro)	Х	Х	С	С	С	С	С	С	С
1155	Turkey Latin-5 (with Euro)	Х	Х	С	С	С	С	С	С	С
1156	Balitic (with Euro)	X	Χ	С	С	С	С	С	С	С
1157	Estonia (with Euro)	Χ	Χ	С	С	С	С	С	С	С
1158	Ukraine (with Euro)	Х	Х	С	С	С	С	С	С	С
1166	Cyrillic Multilingual (with Euro)		X							
4971	Greek (with Euro)	Х	X							
8612	Arabic (Type 5)	Х	Х							
12708	Arabic (Type 7)		Х							
62211	Hebrew (Type 5)		X	С	С	С	С	С	С	С
62224	Arabic (Type 6)		Х	С	С	С	С	С	С	С
62229	Hebrew (Type 8)			С	С	С	С	С	С	С
62233	Arabic (Type 8)			С	С	С	С	С	С	С
62234	Arabic (Type 9)			С	С	С	С	С	С	С
62235	Hebrew (Type 6)		Χ	С	С	С	С	С	С	С
62240	Hebrew (Type 11)			С	С	С	С	С	С	С
62245	Hebrew (Type 10)		Χ	С	С	С	С	С	С	С
62250	Arabic (Type 12)			С	С	С	С	С	С	С
62251	Arabic (Type 6)		Χ	С	С	С	С	С	С	С

Table 111. CCSIDs for EBCDIC Group 1a (Non-Latin-1 SBCS) Countries or Regions (continued)

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
String 7	Гуреs:									
4	Visual / Left-to-Right / Shap	ped / Syr	nmetric	al Swapp	ing Off					
5	Implicit / Left-to-Right / Ur	nshaped /	Symm	etrical Sw	apping (On				
6	Implicit / Right-to-Left / Ur	nshaped /	Symm	etrical Sw	apping (On				
7	Visual / Contextual / Unsha	aped / Sy	mmetri	cal Swap _l	oing Off					
8	Visual / Right-to-Left / Shap	ped / Syr	nmetric	al Swapp	ing Off					
9	Visual / Right-to-Left / Shap	ped / Syr	nmetric	al Swapp	ing On					
10	Implicit / Contextual-Left /	Unshaped	l / Syn	nmetrical	Swappin	g On				
11	Implicit / Contextual-Right	/ Unshape	ed / Sy	mmetrica	l Swappi	ng On				
12	Implicit / Right-to-Left / Sh	aped / Sy	ymmetri	ical Swap	ping On					

Table 112. CCSIDs for PC-Data and ISO Group 1a (Non-Latin-1 SBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
720	Arabic (MS-Dos)	X	С							
737	Greek (MS-Dos)	Х	С	С	С	С	Χ	С	С	С
775	Baltic (MS-Dos)	Х	С							
808	Cyrillic (with Euro)	Х								
813	Greek/Latin (ISO 8859-7)	Х	С	Х	Х	С	С	Х	С	X
848	Ukraine (with Euro)	Х								
849	Belarus (with Euro)	Х								
851	Greek	Х	С							
852	Latin-2 Multilingual	Х	С	С	С	С	С	С	С	С
855	Cyrillic Multilingual	Х	С	С	С	С	С	С	С	C
856	Arabic (Type 5)	Х	С	Х	С	С	С	С	С	C
857	Turkey Latin-5	Х	С	С	С	С	С	С	С	С
862	Hebrew (Type 4)	Х	С	С	С	С	С	С	С	С
864	Arabic (Type 5)	Х	С	С	С	С	С	С	С	С
866	Cyrillic	Х	С	С	С	С	С	С	С	С
867	Hebrew (with Euro) (Type 10)	Х								
868	Urdu	Х	С							
869	Greek	Х	С	С	С	С	С	С	С	C
872	Cyrillic Multilingual (with Euro)	Х								
878	Russian Internet	Х	С							
901	Baltic 8-bit (with Euro)	Х	С							
902	Estonia 8-bit (with Euro)	Х	С							
912	Latin-2 (ISO 8859-2)	Х	С	X	Х	С	С	Х	С	X
914	Latin-4 (ISO 8859-4)	Х	С							
915	Cyrillic Multilingual (ISO 8859-5)	Х	С	Х	Х	С	С	Χ	С	Х
916	Hebrew/Latin (ISO 8859-8) (Type 5)	Х	С	Х	С	С	С	С	С	Х
920	Turkey Latin-5 (ISO 8859-9)	Х	С	Х	Х	С	С	Х	С	X
921	Baltic 8-bit (ISO 8859-13)	Х	С	Х	С	С	С	С	С	С
922	Estonia 8-bit	Х	С	Х	С	С	С	С	С	С
1008	Arabic 8-bit ISO	Х	С							
1046	Arabic (Type 5)	Х	С	Х	С	С	С	С	С	С
1089	Arabic (ISO 8859-6) (Type 5)	Х	С	Х	Х	С	С	С	С	С
1098	Farsi	Х	С							
1124	Ukraine 8-bit ISO	Х	С	Х	С	С	С	С	С	С
1125	Ukraine	X	С	С	С	С	С	С	С	С
1131	Belarus	Х	С	С	С	С	С	С	С	С
1250	Windows Latin-2	Х	С	С	С	С	Х	С	С	С

Table 112. CCSIDs for PC-Data and ISO Group 1a (Non-Latin-1 SBCS) Countries or Regions (continued)

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
1251	Windows Cyrillic	X	С	С	С	С	Χ	С	С	С
1253	Windows Greek	Х	С	С	С	С	Х	С	С	С
1254	Windows Turkey	Х	С	С	С	С	Χ	С	С	С
1255	Windows Hebrew (Type 5)	Х	С	С	С	С	Χ	С	С	С
1256	Windows Arabic (Type 5)	Х	С	С	С	С	Χ	С	С	С
1257	Windows Baltic	X	С	С	С	С	Χ	С	С	С
1280	Macintosh** Greek	Х	С							
1281	Macintosh** Turkish	Х	С							
1282	Macintosh** Latin-2	Х	С							
1283	Macintosh** Cyrillic	Х	С							
4909	ISO 8859-7 Greek/Latin (with Euro)	X	С							
4948	Latin-2 Multilingual	Х	С							
4951	Cyrillic Multilingual	Х	С							
4952	Hebrew	Х	С							
4953	Turkey Latin-5	Х	С							
4960	Arabic	Х	С							
4965	Greek		С							
5346	Windows Latin-2 (with Euro)	Х								
5347	Windows Cyrillic (with Euro)	X								
5349	Windows Greek (with Euro)	Х								
5350	Windows Turkey (with Euro)	Х								
5351	Windows Hebrew (with Euro)	Χ								
5352	Windows Arabic (with Euro)	Х								
5353	Windows Baltic Rim (with Euro)	Х								
9056	Arabic (Storage Interchange)	Х	С							
62208	Hebrew (Type 4)			Х	Х	Х	Х	Х	Х	Χ
62209	Hebrew (Type 10)		С	С	С	С	С	С	С	С
62210	Hebrew/Latin (ISO 8859-8) (Type 4)		С	Χ	Х	С	С	С	С	С
62213	Hebrew (Type 5)		С	С	С	С	С	С	С	С
62215	Windows Hebrew (Type 4)		С	С	С	С	Χ	С	С	С
62218	Arabic (Type 4)		С	С	С	С	С	С	С	С
62220	Hebrew (Type 6)			Х	Х	Х	Χ	Х	С	С
62221	Hebrew (Type 6)		С	С	С	С	С	С	С	С
62222	Hebrew/Latin (ISO 8859-8) (Type 6)		С	Χ	Х	С	С	С	С	С
62223	Windows Hebrew (Type 6)		С	С	С	С	Х	С	С	С
62225	Arabic (Type 6)			С	С	С	С	С	С	С

Table 112. CCSIDs for PC-Data and ISO Group 1a (Non-Latin-1 SBCS) Countries or Regions (continued)

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
62226	Arabic (Type 6)			Х	С	С	С	С	С	С
62227	Arabic (ISO 8859-6) (Type 6)			Х	Χ	С	С	С	С	С
62228	Windows Arabic (Type 6)		С	С	С	С	Х	С	С	С
62230	Hebrew (Type 8)			Х	Х	Х	Х	Х	С	С
62231	Hebrew (Type 8)			С	С	С	С	С	С	С
62232	Hebrew/Latin (ISO 8859-8) (Type 8)			Х	X	С	С	С	С	С
62236	Hebrew (Type 10)			Х	Χ	Х	Х	Х	Х	Х
62238	ISO 8859-8 Hebrew/Latin (Type 10)		С	С	С	С	Х	С	С	С
62239	Windows Hebrew (Type 10)		С	С	С	С	Х	С	С	С
62241	Hebrew (Type 11)			Х	Х	Х	Х	Х	Х	X
62242	Hebrew (Type 11)			С	С	С	С	С	С	С
62243	Hebrew/Latin (ISO 8859-8) (Type 11)			Х	X	С	С	С	С	С
62244	Windows Hebrew (Type 11)			С	С	С	Х	С	С	С
62248	Arabic (Type 4)		С							

String Types:

- 4 Visual / Left-to-Right / Shaped / Symmetrical Swapping Off
- 5 Implicit / Left-to-Right / Unshaped / Symmetrical Swapping On
- 6 Implicit / Right-to-Left / Unshaped / Symmetrical Swapping On
- 7 Visual / Contextual / Unshaped / Symmetrical Swapping Off
- 8 Visual / Right-to-Left / Shaped / Symmetrical Swapping Off
- 9 Visual / Right-to-Left / Shaped / Symmetrical Swapping On
- 10 Implicit / Contextual-Left / Unshaped / Symmetrical Swapping On
- 11 Implicit / Contextual-Right / Unshaped / Symmetrical Swapping On
- 12 Implicit / Right-to-Left / Shaped / Symmetrical Swapping On

Table 113. SBCS CCSIDs for EBCDIC Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
290	Japan Katakana (extended)	Х	Х	С	С	С	С	С	С	С
833	Korea (extended)	Х	Х	С	С	С	С	С	С	С
836	Simplified Chinese (extended)	Х	X	С	С	С	С	С	С	С
838	Thailand (extended)	Х	Х	С	С	С	С	С	С	С
1027	Japan English (extended)	Х	Х	С	С	С	С	С	С	С
1130	Vietnam	Х	Х	С	С	С	С	С	С	С
1132	Lao	Х	Х							
1159	Traditional Chinese (extended with Euro)			С	С	С	С	С	С	С
1160	Thai (with Euro)	Х	Х	С	С	С	С	С	С	С
1164	Vietnam (with Euro)	Х	Х	С	С	С	С	С	С	С
5123	Japan (with Euro)	Х	Х							
8482	Japan Katakana (extended with Euro)	Х		С	С	С	С	С	С	С
9030	Thailand (extended)	Х	Х							
13121	Korea Windows	Х	Х							
13124	Traditional Chinese	Х	Х							
28709	Traditional Chinese (extended)	Х	X	С	С	С	С	С	С	С

Table 114. SBCS CCSIDs for PC-Data Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
367	Korea and Simplified Chinese EUC	Х	С	Х			С			
874	Thailand (extended)	Х	С	Х	Х		Х			
891	Korea (non-extended)	С	С							
895	Japan EUC - JISX201 Roman Set	С	С							
896	Japan EUC - JISX201 Katakana Set	С								
897	Japan (non-extended)	С	С							
903	Simplified Chinese (non-extended)	С	С							
904	Traditional Chinese (non-extended)	Х	С							
1040	Korea (extended)	С	С							
1041	Japan (extended)	Х	С							
1042	Simplified Chinese (extended)	С	С							
1043	Traditional Chinese (extended)	Х	С							
1088	Korea (KS Code 5601-89)	Х	С							
1114	Traditional Chinese (Big-5)	Х	С							
1115	Simplified Chinese GB-Code	Х	С							
1126	Korea Windows	Х	С							
1129	Vietnam	Х	С	Х						
1133	Lao ISO	Х	С							
1162	Thailand (extended) (180 char) (with Euro)	Х								
1163	ISO Vietnam (with Euro)	Х								
1258	Vietnam	Х	С			Х				
4970	Thailand (extended)	Х	С							
5210	Traditional Chinese	Х	С							
9066	Thailand (extended)	Х	С							

Table 115. DBCS CCSIDs for EBCDIC Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
300	Japan - including 4370 user-defined characters (UDC)	Х	Х	С	С	С	С	С	С	С
834	Korea - including 1880 UDC	Х	Х	С	С	С	С	С	С	С
835	Traditional Chinese - including 6204 UDC	Х	X	С	С	С	С	С	С	С
837	Simplified Chinese - including 1880 UDC	Х	Х	С	С	С	С	С	С	С
4396	Japan - including 1880 UDC	Х	Х	С	С	С	С	С	С	С
4930	Korea Windows	Х	Х	С	С	С	С	С	С	С
4933	Simplified Chinese	Х	Х	С	С	С	С	С	С	С
9027	Traditional Chinese (with Euro) - including 6204 UDC	С		С	С	С	С	С	С	С
16684	Japan (with Euro)	Х	Х	С	С	С	С	С	С	С

Table 116. DBCS CCSIDs for PC-Data Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
301	Japan - including 1880 UDC	Х	С	X	С	С	С	С	С	С
926	Korea - including 1880 UDC	С	С							
927	Traditional Chinese - including 6204 UDC	Х	С	С	С	С	С	С	С	С
928	Simplified Chinese - including 1880 UDC	С	С							
941	Japan Windows	X	С	С	С	С	Χ	С	С	С
947	Traditional Chinese (Big-5)	Х	С	Х	С	С	Х	С	С	С
951	Korea (KS Code 5601-89) - including 1880 UDC	Х	С	С	С	С	Х	С	С	С
952	Japan (EUC) X208-1990 set	С								
953	Japan (EUC) X212-1990 set	С								
971	Korea (EUC) - including 188 UDC	Х	С	Х	Х	X	С	С	С	С
1351	Japan HP-UX (J15)	Х		С	Х	С	С	С	С	С
1362	Korea Windows	Х	С	С	С	С	Х	С	С	С
1380	Simplified Chinese (GB-Code) - including 1880 UDC	Х	С	С	С	С	X	Х	С	С
1382	Simplified Chinese (EUC) - including 1360 UDC	Х	С	Х	X	X	С	Х	С	С
1385	Traditional Chinese	Х	С	С	С	С	Х	С	С	С

Table 117. Mixed CCSIDs for EBCDIC Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
930	Japan Katakana/Kanji (extended) - including 4370 UDC	Х	Х	С	С	С	С	С	С	С
933	Korea (extended) - including 1880 UDC	Х	X	С	С	С	С	С	С	С
935	Simplified Chinese (extended) - including 1880 UDC	Х	Х	С	С	С	С	С	С	С
937	Traditional Chinese (extended) - including 4370 UDC	Х	Х	С	С	С	С	С	С	С
939	Japan English/Kanji (extended) - including 4370 UDC	Х	Х	С	С	С	С	С	С	С
1364	Korea (extended)	Х	Х	С	С	С	С	С	С	С
1371	Traditional Chinese (extended with Euro) - including 4370 UDC			С	С	С	С	С	С	С
1388	Simplified Chinese	Х	Х	С	С	С	С	С	С	С
1390	Japan Katakana/Kanji (extended with Euro) - including 4370 UDC	Х		С	С	С	С	С	С	С
1399	Japan (with Euro)	Х	Х						С	С
5026	Japan Katakana/Kanji (extended) - including 1880 UDC)	Х	Х	С	С	С	С	С	С	С
5035	Japan English/Kanji (extended) - including 1880 UDC	Х	Х	С	С	С	С	С	С	С

Table 118. Mixed CCSIDs for PC-Data Group 2 (DBCS) Countries or Regions

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
932	Japan (non-extended) - including 1880 UDC	Χ	С	Χ	С	С	С	С	С	С
934	Korea (non-extended) including 1880 UDC		С							
936	Simplified Chinese (non-extended) - including 1880 UDC		С							
938	Traditional Chinese (non-extended) - including 6204 UDC)	X	С	С	С	С	С	С	С	С
942	Japan (extended) - including 1880 UDC	Χ	С	С	С	С	С	С	С	С
943	Japan NT	Х	С	С	С	Х	Х	С	С	С
944	Korea (extended) - including 1880 UDC		С							
946	Simplified Chinese (extended) - including 1880 UDC		С							
948	Traditional Chinese (extended) - including 6204 UDC	X	С	С	С	С	С	С	С	С
949	Korea (KS Code 5601-89) - including 1880 UDC	X	С	С	С	С	С	С	С	С
950	Traditional Chinese (Big-5)	Х	С	Х	Χ	Х	Χ	С	С	Х
954	Japan (EUC)		С	Χ	Χ	X	С	X	С	Χ
956	Japan 2022 TCP		С							
957	Japan 2022 TCP		С							
958	Japan 2022 TCP		С							
959	Japan 2022 TCP		С							
964	Traditional Chinese (EUC)		С	Х	Х	Х	С	С	С	С
965	Traditional Chinese 2022 TCP		С							
970	Korea EUC	X	С	X	Χ	X	С	С	Χ	Χ
1363	Korea Windows	Х	С	С	С	С	Χ	С	С	С
1381	Simplified Chinese GB-Code	Х	С	С	С	С	Χ	С	С	С
1383	Simplified Chinese EUC	Х	С	Х	Χ	Х	С	Х	С	Х
1386	Simplified Chinese	Х	С	Х	С	С	Х	С	С	С
1392	Simplified Chinese GB18030		С							
5039	Japan HP-UX (J15)	Χ		С	Х	С	С	С	С	С
5050	Japan (EUC)		С							
5052	Japan 2022 TCP		С							
5053	Japan 2022 TCP		С							
5054	Japan 2022 TCP		С							
5055	Japan 2022 TCP		С							

Table 118. Mixed CCSIDs for PC-Data Group 2 (DBCS) Countries or Regions (continued)

CCSID	Description	z/OS	i	AIX	HP	Sun	NT	SCO	SGI	Linux
5307	Japan HP-UX (J15) HISTORICAL	Х								
17354	Korea 2022 TCP		С							
25546	Korea 2022 TCP		С							
33722	Japan EUC		С							

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Appendix F. DB2 for i catalog views

The views contained in a DB2 for i catalog are described in this section.

The database manager maintains a set of tables containing information about the data in each relational database. These tables are collectively known as the *catalog*. The *catalog tables* contain information about tables, user-defined functions, distinct types, parameters, procedures, packages, views, indexes, aliases, sequences, constraints, triggers, and languages supported by DB2 for i. The catalog also contains information about all relational databases that are accessible from this system.

There are three classes of catalog views:

· IBM i catalog tables and views

The i catalog tables and views are modeled after the ANS and ISO catalog views, but are not identical to the ANS and ISO catalog views. These tables and views are compatible with prior releases of DB2 for i.

These tables and views exist in schemas QSYS and QSYS2.

The catalog tables and views contain information about all tables, parameters, procedures, functions, distinct types, packages, views, indexes, aliases, sequences, triggers, and constraints in the entire relational database. When an SQL schema is created, an additional subset of these views are created into the schema that only contain information about tables, packages, views, indexes, and constraints in that schema.

ODBC and JDBC catalog views

The ODBC and JDBC catalog views are designed to satisfy ODBC and JDBC metadata API requests. For example, SQLCOLUMNS. These views are compatible with views on DB2 LUW Version 8. These views will be modified as ODBC or JDBC enhances or modifies their metadata APIs.

These views exist in schema SYSIBM.

· ANS and ISO catalog views

The ANS and ISO catalog views are designed to comply with the ANS and ISO SQL standard (the Information Schema catalog views). These views will be modified as the ANS and ISO standard is enhanced or modified.

There are several columns in these views that are reserved for future standard enhancements.

There are two versions of these views:

- The first version of these views exist in schema INFORMATION_SCHEMA¹³⁴.
 Only rows associated with objects to which the user has some privilege are included in the views. This version is compatible with the ANS and ISO SQL standard.
 - If you use of this set of catalog views to prevent users from seeing any information about objects to which they have no privilege, you should revoke privileges to the other catalog views from users and PUBLIC.
- The second version of these views exist in schema SYSIBM. All rows are included in these views whether or not the user has some privilege to the

^{134.} INFORMATION_SCHEMA is the ANS and ISO SQL standard schema name that contains catalog views. It is a synonym for OSYS2.

Catalog views

objects associated with rows in the views. These views are compatible with views on DB2 LUW Version 8 and will generally perform better than the ANS and ISO views in QSYS2.

For example, assume that a user has the SELECT privilege to the QSYS2.TABLES and SYSIBM.TABLES catalog views but does not have any privilege to a table called WORK.EMPLOYEE. The following SQL statement will not return a result row:

```
SELECT *
    FROM QSYS2.TABLES
    WHERE TABLE SCHEMA = 'WORK' AND TABLE NAME = 'EMPLOYEE'
However, the following SQL statement will return a result row:
  SELECT *
    FROM SYSIBM. TABLES
    WHERE TABLE SCHEMA = 'WORK' AND TABLE NAME = 'EMPLOYEE'
```

Note: Some of these views use special catalog functions as part of the view definition. These functions exist in SYSIBM, but should not be used directly in applications. The functions are created for specific independent auxiliary storage pools (IASP) and will likely change in future releases.

Notes

Names in the Catalog: In general, all names stored in columns of a catalog table are undelimited and case sensitive. For example, assume the following table was created:

```
CREATE TABLE "colname"/"long_table_name"
                         ("long column name" CHAR(10),
                          INTCOL INTEGER)
```

If the following select statement is used to return information about the mapping between SQL names and system names, the following select statement could be used:

```
SELECT TABLE_NAME, SYSTEM_TABLE_NAME, COLUMN_NAME, SYSTEM_COLUMN_NAME
   FROM QSYS2/SYSCOLUMNS
   WHERE TABLE NAME = 'long table name' AND
          TABLE SCHEMA = 'colname'
```

The following rows would be returned:

TABLE_NAME	SYSTEM_TABLE_NAME	COLUMN_NAME	SYSTEM_COLUMN_NAME
long_table_name	"long0001"	long_column_name	LONG_00001
long_table_name	"long0001"	INTCOL	INTCOL

System Names in the Catalog: In general, the longer SQL column names should be used rather than the short system column names. The short system column names for i catalog tables and views are explicitly maintained for compatibility with prior releases and other DB2 products. The short system column names for the ODBC and JDBC catalog views and the ANS and ISO catalog views are not explicitly maintained and may change between releases.

Null Values in the Catalog: If the information in a column is not applicable, the null value is returned. Using the table created above, the following select statement, which queries the NUMERIC_SCALE and the CHARACTER_MAXIMUM_LENGTH, would return the null value when the data was not applicable to the data type of the column.

The following rows would be returned:

COLUMN_NAME	NUMERIC_SCALE	CHARACTER_MAXIMUM_LENGTH
long_column_name	?	10
INTCOL	0	?

Because numeric scale is not valid for a character column, the null value is returned for NUMERIC_SCALE for the "long_column_name" column. Because character length is not valid for a numeric column, the null value is returned for CHARACTER_MAXIMUM_LENGTH for the INTCOL column.

Install and Backup Considerations: Certain catalog tables and any views created over the catalog tables and views should be regularly saved:

- The catalog table QSYS.QADBXRDBD contains relational database information. This table should be regularly saved.
- When an ILE external function or procedure or an SQL function or procedure is restored, information is automatically inserted into these catalog tables. This does not occur for non-ILE external functions and procedures. In order to back up the definitions of non-ILE external functions or procedures, ensure that the catalog tables SYSROUTINES and SYSPARMS are saved or ensure you have a back up of the SQL source statements that were used to create these functions and procedures.
- All catalog views in the QSYS2 or SYSIBM schemas are system objects. This
 means that any user views created over these catalog views must be deleted
 when the operating system is installed. All dependent objects must be deleted as
 well. To avoid this requirement, you can save views before installation and then
 restore them afterwards.
- Catalog tables in the QSYS library are also system objects. However, the catalog tables in the QSYS library are not deleted during installation. Hence, any views created over these tables are preserved throughout the installation process.

Granting Privileges to Catalog Views: Tables and views in the catalog are like any other database tables and views. If you have authorization, you can use SQL statements to look at data in the catalog views in the same way that you retrieve data from any other table. The tables and views in the catalogs are shipped with the SELECT privilege to PUBLIC. This privilege may be revoked and the SELECT privilege granted to individual users.

QSYS Catalog Tables: Most of the catalog views are based on the following tables in the QSYS library (sometimes called the database cross reference files). These tables are not shipped with the SELECT privilege to PUBLIC and should not be used directly:

QADBCCST	QADBKFLD	QADBXSFLD
QADBFDEP	QADBPKG	QADBXTRIGB
QADBFCST	QADBXRDBD	QADBXTRIGC
OADBIFLD	OADBXREF	OADBXTRIGD

Catalog views

Use of SELECT *: New columns are likely to be added to tables and views in the catalog as new functionality is implemented and as the ISO/ANSI standards evolve. For this reason, it is recommended that SELECT * not be used when accessing catalog tables and views unless your application is prepared to tolerate these new columns.

IBM i catalog tables and views

The i catalog includes the views and tables in the QSYS2 schema displayed in this section.

	DB2 for i name	Corresponding ANSI/ISO name	Description
	"SYSCATALOGS" on page 1273	CATALOGS	Information about relational databases
	"SYSCHKCST" on page 1274	CHECK_CONSTRAINTS	Information about check constraints
	"SYSCOLUMNS" on page 1275	COLUMNS	Information about column attributes
I	"SYSCOLUMNSTAT" on page 1283		Information about column statistics
	"SYSCST" on page 1287	TABLE_CONSTRAINTS	Information about all constraints
	"SYSCSTCOL" on page 1289	CONSTRAINT_COLUMN_USAGE	Information about the columns referenced in a constraint
	"SYSCSTDEP" on page 1290	CONSTRAINT_TABLE_USAGE	Information about constraint dependencies on tables
	"SYSFUNCS" on page 1291	ROUTINES	Information about user-defined functions
	"SYSINDEXES" on page 1296		Information about indexes
I	"SYSINDEXSTAT" on page 1298		Information about index statistics
	"SYSJARCONTENTS" on page 1304		Information about jars for Java routines.
	"SYSJAROBJECTS" on page 1305		Information about jars for Java routines.
	"SYSKEYCST" on page 1306	KEY_COLUMN_USAGE	Information about unique, primary, and foreign keys
	"SYSKEYS" on page 1307		Information about index keys
	"SYSMQTSTAT" on page 1308		Information about materialized query table statistics
	"SYSPACKAGE" on page 1312		Information about packages
I	"SYSPACKAGESTAT" on page 1314		Information about package statistics
	"SYSPARMS" on page 1319	PARAMETERS	Information about routine parameters
 	"SYSPARTITIONINDEXES" on page 1323		Information about partition indexes
 	"SYSPARTITIONINDEXSTAT" on page 1330		Information about partition index statistics
 	"SYSPARTITIONMQTS" on page 1335		Information about partition materialized query tables
I	"SYSPARTITIONSTAT" on page 1340		Information about partition statistics
	"SYSPROCS" on page 1343	ROUTINES	Information about procedures
 	"SYSPROGRAMSTAT" on page 1347		Information about programs, service programs, and modules that contain SQL statements
	"SYSREFCST" on page 1354	REFERENTIAL_CONSTRAINTS	Information about referential constraints
	"SYSROUTINEDEP" on page 1355	ROUTINE_TABLE_USAGE	Information about function and procedure dependencies
	"SYSROUTINES" on page 1356	ROUTINES	Information about functions and procedures
I	"SYSSCHEMAS" on page 1363		Information about schemas
	"SYSSEQUENCES" on page 1364		Information about sequences
	"SYSTABLEDEP" on page 1366		Information about materialized query table dependencies
I	"SYSTABLEINDEXSTAT" on page 1367		Information about table index statistics
	"SYSTABLES" on page 1373	TABLES	Information about tables and views
I	"SYSTABLESTAT" on page 1376		Information about table statistics
	"SYSTRIGCOL" on page 1379	TRIGGER_COLUMN_USAGE	Information about columns used in a trigger
	"SYSTRIGDEP" on page 1380	TRIGGER_TABLE_USAGE	Information about objects used in a trigger

IBM i catalog

DB2 for i name	Corresponding ANSI/ISO name	Description	
"SYSTRIGGERS" on page 1381	TRIGGERS	Information about triggers	
"SYSTRIGUPD" on page 1385	TRIGGERED_UPDATE_COLUMNS	Information about columns in the WHEN clause of a trigger	
"SYSTYPES" on page 1386	USER_DEFINED_TYPES	Information about built-in data types and distinct types	
"SYSVIEWDEP" on page 1391	VIEW_TABLE_USAGE	Information about view dependencies on tables	
"SYSVIEWS" on page 1393	VIEWS	Information about definition of a view	

SYSCATALOGS

The SYSCATALOGS view contains one row for each relational database that a user can connect to. The following table describes the columns in the SYSCATALOGS view.

Table 119. SYSCATALOGS view

Column Name	System Column Name	Data Type	Description
CATALOG_NAME	LOCATION	VARCHAR(18)	Relational database name.
CATALOG_STATUS	RDBASPSTAT	CHAR(10)	Status of a relational database.
			ACTIVE The relational database is associated with an independent auxiliary storage pool (IASP) that is active, but not yet available.
			AVAILABLE The relational database is available.
			VARYOFF
			The relational database is associated with an independent auxiliary storage pool (IASP) that is varied off.
			VARYON
			The relational database is associated with an independent auxiliary storage pool (IASP) that is varied on, but not yet available.
			UNKNOWN The status of the relational database is unknown. The status of remote relational databases is always unknown.
CATALOG_TYPE	RDBTYPE	CHAR(7)	Relational database type.
			LOCAL The relational database is local to this system.
			REMOTE The relational database is on a remote system.
CATALOG_ASPGRP	RDBASPGRP	VARCHAR(10)	Independent auxiliary storage pool (IASP) name.
		Nullable	Contains the null value if the relational database status is UNKNOWN.
CATALOG_ASPNUM	RDBASPNUM	VARCHAR(10)	Independent auxiliary storage pool (IASP) number.
		Nullable	Contains the null value if the relational database status is UNKNOWN.
CATALOG_TEXT	RDBTEXT	CHAR(50)	Relational database text description.

SYSCHKCST

SYSCHKCST

The SYSCHKCST view contains one row for each check constraint in the SQL schema. The following table describes the columns in the SYSCHKCST view.

Table 120. SYSCHKCST view

		System Column			
	Column Name	Name	Data Type	Description	
	CONSTRAINT_SCHEMA	DBNAME	VARCHAR(128)	Name of the schema containing the cons	
	CONSTRAINT_NAME	ME RELNAME VARCHAR(128) Name of the co		f the constraint	
	CHECK_CLAUSE	CHECK	VARCHAR(2000)	Text of the check constraint clause	
			Nullable		s the null value if the check clause expressed without truncation.
	ROUNDING_MODE	DECFLTRND	CHAR(1)	The rou	nding mode for the check constraint:
			Nullable	C	ROUND_CEILING
			rvanaore	D	ROUND_DOWN
				F	ROUND_FLOOR
				G	ROUND_HALF_DOWN
				E	ROUND_HALF_EVEN
				Н	ROUND_HALF_UP
				U	ROUND_UP
	SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name of the system schema containing the constraint.	

SYSCOLUMNS

The SYSCOLUMNS view contains one row for every column of each table and view in the SQL schema (including the columns of the SQL catalog).

The following table describes the columns in the SYSCOLUMNS view:

Table 121. SYSCOLUMNS view

Column name	System Column Name	Data Type	Description
COLUMN_NAME	NAME	VARCHAR(128)	Name of the column. This will be the SQL column name if one exists; otherwise, it will be the system column name.
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table or view that contains the column. This will be the SQL table or view name if one exists; otherwise, it will be the system table or view name.
TABLE_OWNER	TBCREATOR	VARCHAR(128)	The owner of the table or view.
ORDINAL_POSITION	COLNO	INTEGER	Numeric place of the column in the table or view, ordered from left to right.

SYSCOLUMNS

Table 121. SYSCOLUMNS view (continued)

Column name	System Colun Name	nn Data Type	Description
DATA_TYPE	COLTYPE	VARCHAR(8)	Type of column:
			BIGINT Big number
			INTEGER
			Large number
			SMALLINT Small number
			DECIMAL Packed decimal
			NUMERIC Zoned decimal
			FLOAT Floating point; FLOAT, REAL, or DOUBLE PRECISION
			DECFLOAT Decimal floating-point
			CHAR Fixed-length character string
			VARCHAR
			Varying-length character string
			CLOB Character large object string
			GRAPHIC Fixed-length graphic string
			VARG Varying-length graphic string
			DBCLOB
			Double-byte character large objestring
			BINARY Fixed-length binary string
			VARBIN Varying-length binary string
			BLOB Binary large object string
			DATE Date
			TIME Time
			TIMESTMP Timestamp
			DATALINK Datalink
			ROWID Row ID
			DISTINCT
			Distinct type

Table 121. SYSCOLUMNS view (continued)

Column name	System Colui Name	Data Type	Description
LENGTH	LENGTH	INTEGER	The length attribute of the column; or, in the case of a decimal, numeric, or nonzero precision binary column, its precision:
			8 bytes BIGINT
			4 bytes INTEGER
			2 bytes SMALLINT
			Precision of number DECIMAL
			Precision of number NUMERIC
			8 bytes FLOAT, FLOAT(n) where $n = 25 \text{ t}$ 53, or DOUBLE PRECISION
			4 bytes FLOAT(n) where $n = 1$ to 24, or REAL
			8 bytes DECFLOAT(16)
			16 bytes DECFLOAT(34)
			Length of string CHAR
			Maximum length of string VARCHAR or CLOB
			Length of graphic string GRAPHIC
			Maximum length of graphic string VARGRAPHIC or DBCLOB
			Length of string BINARY
			Maximum length of binary string VARBIN or BLOB
			4 bytes DATE
			3 bytes TIME
			10 bytes TIMESTAMP
			Maximum length of datalink URL and comment
			DATALINK
			40 bytes ROWID
			Same value as the source type DISTINCT
NUMERIC_SCALE	SCALE	INTECED	Scale of numeric data.
		INTEGER Nullable	Contains the null value if the column is not decimal, numeric, or binary.
IS_NULLABLE	NULLS	CHAR(1)	If the column can contain null values:
			N No
			Y Yes

SYSCOLUMNS

Table 121. SYSCOLUMNS view (continued)

Column name	System Columi Name	n Data Type	Description If the column can be updated:	
IS_UPDATABLE	UPDATES	CHAR(1)		
			N	No
			Y	Yes
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement. Contains the null value if there is no locomment.	
		Nullable		
HAS_DEFAULT	DEFAULT	CHAR(1)	If the column has a default value (DEFA clause or null capable):	
			N	No
			Y	Yes
			A	The column has a ROWID data type and the GENERATED ALWAYS attribute.
			D	The column has a ROWID data type and the GENERATED BY DEFAULT attribute.
			E	The column is defined with the FOR EACH ROW ON UPDATE and the GENERATED ALWAYS attribute.
			F	The column is defined with the FOR EACH ROW ON UPDATE and the GENERATED BY DEFAULT attribute.
			I	The column is defined with the AS IDENTITY and GENERATED ALWAYS attributes.
			J	The column is defined with the AS IDENTITY and GENERATED BY DEFAULT attributes.
COLUMN_HEADING	LABEL	VARCHAR(60)		racter string supplied with the LABEL ent (column headings)
	Nullable		Contains the null value if there is no column heading.	

Table 121. SYSCOLUMNS view (continued)

	Column nome	System Column		Dogovina	dan.
ı	Column name STORAGE	Name STORAGE	Data Type INTEGER	Descript The stor	age requirements for the column:
i	STORAGE	STORAGE	INTEGER	8 bytes	
i				4 bytes	INTEGER
i				2 bytes	SMALLINT
 				(Precisio	
				Precision	n of number NUMERIC
				8 bytes	FLOAT, FLOAT(n) where n = 25 to 53, or DOUBLE PRECISION
				4 bytes	FLOAT(n) where $n = 1$ to 24, or REAL
I				8 bytes	DECFLOAT(16)
-				16 bytes	DECFLOAT(34)
				Length o	of string CHAR or BINARY
				Maximu	m length of string + 2 VARCHAR or VARBIN
				Maximu	m length of string + 29 CLOB or BLOB
				Length o	of string * 2 GRAPHIC
				Maximu	m length of string * 2 + 2 VARGRAPHIC
				Maximu	m length of string * 2 + 29 DBCLOB
I				4 bytes	DATE
1				3 bytes	TIME
I				10 bytes	TIMESTAMP
 				Maximu commen	m length of datalink URL and t + 24 DATALINK
I				42 bytes	ROWID
					lue as the source type DISTINCT
				requiren	nis column supplies the storage nents for all data types.
	NUMERIC_PRECISION	PRECISION	INTEGER Nullable	Note: The all nume floating-double-p NUMER indicates binary o	cision of all numeric columns. In column supplies the precision of eric data types, including decimal point and single-and precision floating point. The IC_PRECISION_RADIX column is if the value in this column is in r decimal digits.
				numeric	

SYSCOLUMNS

Table 121. SYSCOLUMNS view (continued)

Column name	System Column Name	Data Type	Description
CCSID	CCSID	INTEGER	The CCSID value for CHAR, VARCHAR, CLOB, DATE, TIME, TIMESTAMP,
		Nullable	GRAPHIC, VARGRAPHIC, DBCLOB, and DATALINK columns.
			Contains 65535 if the column is a BINARY, VARBIN, BLOB, or ROWID.
			Contains the null value if the column is a numeric data type.
TABLE_SCHEMA	DBNAME	VARCHAR(128)	The name of the SQL schema containing the table or view.
COLUMN_DEFAULT	DFTVALUE	VARCHAR(2000)	The default value of a column, if one exists. If the default value of the column cannot be
		Nullable	represented without truncation, then the value of the column is the string 'TRUNCATED'. The default value is stored in character form. The following special values also exist:
			CURRENT_DATE The default value is the current date.
			CURRENT_TIME The default value is the current time.
			CURRENT_TIMESTAMP The default value is the current timestamp.
			NULL The default value is the null value and DEFAULT NULL was explicitly specified.
			USER The default value is the current job user.
			Contains the null value if:
			 The column has no default value. For example, if the column has an IDENTITY attribute, is a row ID, or is a row change timestamp column; or
			 A DEFAULT value was not explicitly specified.
CHARACTER_MAXIMUM_LENGTH	CHARLEN	INTEGER	Maximum length of the string for binary, character and graphic string data types.
		Nullable	Contains the null value if the column is not a string.
CHARACTER_OCTET_LENGTH	CHARBYTE	INTEGER	Number of bytes for binary, character and graphic string data types.
		Nullable	Contains the null value if the column is not a string.

Table 121. SYSCOLUMNS view (continued)

Column name	System Column Name	Data Type	Description	
NUMERIC_PRECISION_RADIX	RADIX	INTEGER Nullable	Indicates if the precision specified in on NUMERIC_PRECISION is specified a number of binary or decimal digits	
			Binary; floating-point precis specified in binary digits.	sion is
			Decimal; all other numeric to are specified in decimal dig	
			Contains the null value if the column numeric.	is not
DATETIME_PRECISION	DATPRC	INTEGER	The fractional part of a date, time, or timestamp.	
		Nullable	0 For DATE and TIME data ty	ypes
			6 For TIMESTAMP data types (number of microseconds).	5
			Contains the null value if the column a date, time, or timestamp.	is not
COLUMN_TEXT	LABELTEXT	VARCHAR(50)	A character string supplied with the I statement (column text)	LABEL
		Nullable	Contains the null value if the column column text.	has no
SYSTEM_COLUMN_NAME	SYS_CNAME	CHAR(10)	The system name of the column	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	The system name of the table or view	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	The system name of the schema	
USER_DEFINED_TYPE_SCHEMA	TYPESCHEMA	VARCHAR(128)	The name of the schema if this is a ditype.	istinct
		Nullable	Contains the null value if the column a distinct type.	is not
USER_DEFINED_TYPE_NAME	TYPENAME	VARCHAR(128)	The name of the distinct type.	
		Nullable	Contains the null value if the column a distinct type.	is not
IS_IDENTITY	IDENTITY	VARCHAR(3)	This column identifies whether the co is an identity column.	lumn
			NO The column is not an identi column.	ty
			YES The column is an identity of	olumn.
IDENTITY_GENERATION	GENERATED	VARCHAR(10)	This column identifies whether the co	
		Nullable	BY DEFAULT.	
			ALWAYS The column value is always generated.	5
			BY DEFAULT The column value is genera default.	ted by
			Contains the null value if the column a ROWID, IDENTITY, or row change timestamp column.	is not

SYSCOLUMNS

Table 121. SYSCOLUMNS view (continued)

Column name	System Columr Name	ı Data Type	Description
IDENTITY_START	START	DECIMAL(31,0)	Starting value of the identity column.
		Nullable	Contains the null value if the column is not an IDENTITY column.
IDENTITY_INCREMENT	INCREMENT	DECIMAL(31,0)	Increment value of the identity column.
		Nullable	Contains the null value if the column is not an IDENTITY column.
IDENTITY_MINIMUM	MINVALUE	DECIMAL(31,0)	Minimum value of the identity column.
		Nullable	Contains the null value if the column is not an IDENTITY column.
IDENTITY_MAXIMUM	MAXVALUE	DECIMAL(31,0)	Maximum value of the identity column.
		Nullable	Contains the null value if the column is not an IDENTITY column.
IDENTITY_CYCLE	CYCLE	VARCHAR(3)	This column identifies whether the identity column values will continue to be generated
		Nullable	after the minimum or maximum value has been reached.
			NO Values will not continue to be generated.
			YES Values will continue to be generated.
			Contains the null value if the column is not an IDENTITY column.
IDENTITY_CACHE	CACHE	INTEGER	Specifies the number of identity values that may be preallocated for faster access. Zero
		Nullable	indicates that the values will not be preallocated.
			Contains the null value if the column is not an IDENTITY column.
IDENTITY_ORDER	ORDER	VARCHAR(3)	Specifies whether the identity values must be generated in order of the request.
		Nullable	NO Values do not need to be generated in order of the request.
			YES Values must be generated in order of the request.
			Contains the null value if the column is not an IDENTITY column.
COLUMN_EXPRESSION	EXPRESSION	DBCLOB(2097152)	If the column is an expression, contains the expression.
		CCSID 1200 Nullable	Contains the null value if the column is not an expression.
HIDDEN	HIDDEN	CHAR(1)	Specifies whether the column is included in an implicit column list.
			P Partially hidden.
			N Not hidden.

SYSCOLUMNSTAT

The SYSCOLUMNSTAT view contains one row for every column in a table partition or table member and one row for every column statistics collection. If the table is a distributed table, the partitions that reside on other database nodes are not contained in this catalog view.

They are contained in the catalog views of the other database nodes. The following table describes the columns in the SYSCOLUMNSTAT view:

Table 122. SYSCOLUMNSTAT view

Column name	System Column Name	Data Type	Descrip	otion
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.	
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.	
PARTITION_TYPE	PARTTYPE	CHAR(1)	The typ	pe of the table partitioning:
			blank	The table is not partitioned.
			Н	This is data hash partitioning.
			R	This is data range partitioning.
			D	This is distributed database hash partitioning.
PARTITION_NUMBER	PARTNBR	INTEGER	1	rtition number of this partition. If the a distributed table, contains null.
		Nullable		
NUMBER_DISTRIBUTED_PARTITIONS	DSTPARTS	INTEGER		able is a distributed table, contains all number of partitions. If the table is
		Nullable		istributed table, contains null.
NUMBER_COLUMN_NAMES	NBRCOLS	INTEGER	Number of column names in this collection. If only individual column statistics are wanted, only select rows where NUMBER_COLUMN_NAMES is one.	
				tly, only one name is returned.
COLUMN_NAME	COLNAME	VARCHAR(1280)		of the column(s). Up to 10 columns returned.
			Current	tly, only one name is returned.
NUMBER_DISTINCT_VALUES	COLCARD	BIGINT		or of distinct values in the column. as -1 if statistics are not collected.
HIGH2KEY	HIGH2KEY	VARCHAR(254)	Not appendix	plicable for DB2 for i. Contains the string.
LOW2KEY	LOW2KEY	VARCHAR(254)	Not appendix	plicable for DB2 for i. Contains the string.
AVERAGE_COLUMN_LENGTH	AVGCOLLEN	INTEGER	Not app	plicable for DB2 for i. Will always be
NUMBER_NULLS	NUMNULLS	BIGINT		imated number of NULL values1 if s are not collected.
SUB_COUNT	SUB_COUNT	SMALLINT	Not app	plicable for DB2 for i. Will always be
SUB_DELIM_LENGTH	SUBDLENGTH	SMALLINT	Not app	plicable for DB2 for i. Will always be

SYSCOLUMNSTAT

Table 122. SYSCOLUMNSTAT view (continued)

Column name	System Column Name	Data Type	Descrip	tion
NUMBER_HISTOGRAM_RANGES	NQUANTILES	INTEGER	this stat histogra using th (QDBST	of histogram ranges available for istics collection. The actual m range values can be obtained e List Statistics Collection Details LDS, QdbstListDetailStatistics) API. s -1 if statistics are not collected.
NUMBER_MOST_FREQUENT_VALUES	NMOSTFREQ	INTEGER	The actuobtained Details (QdbstLi	of most frequent values available. It is all most frequent values can be It using the List Statistics Collection (QDBSTLDS, stDetailStatistics) API. Contains -1 if It is are not collected.
AVGDISTINCTPERPAGE	AVGDSTPAGE	DOUBLE	Not app NULL.	licable for DB2 for i. Will always be
		Nullable		
PAGEVARIANCERATIO	PVARRATIO	DOUBLE	Not app NULL.	licable for DB2 for i. Will always be
		Nullable		
STATISTICS_NAME	STATNAME	VARCHAR(128)	this tabl	name of this statistics collection for e partition. NULL if statistics are not
		Nullable	collected	l.
INTERNAL_STATISTICS_ID	STATID	VARCHAR(16) FOR BIT DATA	collectio	statistics identifier of this statistics n for this table partition. NULL if are not collected.
		Nullable		
STATISTIC_CREATED	STATCREATE	TIMESTAMP		mp when the statistics collection was NULL if statistics are not collected.
		Nullable		
STATISTIC_CREATOR	STATCUSER	VARCHAR(128)	User that created the statistic collection. *SY if the system created the statistic collection.	
		Nullable	NULL II	statistics are not collected.
STATISTIC_LAST_UPDATED	UPDATEDTS	TIMESTAMP		mp when the statistics collection was ated. NULL if statistics are not
		Nullable		
STATISTIC_UPDATER	STATUUSER	VARCHAR(128)	*SYS if t	at last updated the statistic collection. The system automatically updated stic collection. NULL if statistics are
		Nullable	not colle	
STATISTICS_SIZE	STATSIZE	BIGINT		he statistics collection for this table n. NULL if statistics are not collected.
		Nullable		
AGING_MODE	AGING_MODE	VARCHAR(10)	automat	s whether the system can ically age or remove statistics ns for this table partition.
			*SYS	The statistic collection will be automatically refreshed or removed by the system when necessary.
			*USER	The statistic collection will only be refreshed or removed when explicitly requested by the user.

Table 122. SYSCOLUMNSTAT view (continued)

Column name	System Column Name	Data Type	Descrip	otion
AGING_STATUS	AGING_STS	CHAR(1)		es how current the statistics collection as table partition.
		Nullable	0	There are no indications that the statistics data needs to be refreshed.
			1	There are indications that the statistics data needs to be refreshed.
	DY Y/ODWYOL	GTT 1 P (1)		f statistics are not collected.
BLOCK_OPTION	BLKOPTION	CHAR(1)		es whether automatic statistics on create requests are allowed for this irtition.
			0	Automatic system initiated statistics collections are not blocked.
			1	Automatic system initiated statistics collections are blocked.
CURRENT_LAST_CHANGE	UPDATED	TIMESTAMP	partitio	mp when the data in the table n was last changed. NULL if statistics collected.
CLIDDENT POLICE	CLIDDOLLIC	Nullable		
CURRENT_ROWS	CURROWS	BIGINT		number of valid rows in the table n. NULL if statistics are not collected.
		Nullable		
CURRENT_DELETED_ROWS	CURDELROWS	BIGINT		number of deleted rows in the table n. NULL if statistics are not collected.
		Nullable		
CURRENT_DATA_CHANGES	CURDATACHG	BIGINT	that hav	mber of inserts, updates, and deletes we occurred to this table partition
		Nullable	collecte	e last IPL. NULL if statistics are not d.
STATISTICS_ROWS	STATROWS	BIGINT	at the ti	r of valid rows in the table partition me the statistic was collected. NULL
		Nullable	if statis	tics are not collected.
STATISTICS_DELETED_ROWS	STATDELROW	BIGINT	partitio	r of deleted rows in the table n at the time the statistic was
		Nullable	collecte	d. NULL if statistics are not collected.
STATISTICS_DATA_CHANGES	STATDATCHG	BIGINT	had occ	r of inserts, updates, and deletes that curred to the table partition since the
		Nullable		at the time the statistic was d. NULL if statistics are not collected.
TRANSLATION_ATTRIBUTES	TRANSATRS	VARCHAR(10)		es the type of translations that were a data values when the statistic was
		Nullable	collecte	d.
			0	Unique weight translation.
			1	Shared weight translation.
				No translation. ple columns are used in this on, multiple translations are possible.
			Current	ly, only one translation is returned.

SYSCOLUMNSTAT

Table 122. SYSCOLUMNSTAT view (continued)

System Column			
Column name	Name	Data Type	Description
TRANSLATION_TABLES	TRANSTBLS	VARCHAR(210)	Qualified names of the translation tables, if translation tables were used on the statistic
		Nullable	collection.
			The empty string is returned if no translation table was used. NULL if statistics are not collected.
			If multiple columns are used in this collection, multiple translation tables are possible.
			Currently, only one translation table is returned.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.
SYSTEM_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System member name.
SYSTEM_COLUMN_NAME	SYS_CNAME	VARCHAR(100)	System column name. An array of up to 10 names are possible.
			Currently, only one name is returned.

SYSCST

The SYSCST view contains one row for each constraint in the SQL schema.

The following table describes the columns in the SYSCST view:

Table 123. SYSCST view

Column Name	System Column Name	Data Type	Description	
CONSTRAINT_SCHEMA	CDBNAME	VARCHAR(128)	Name of the schema containing the constraint.	
CONSTRAINT_NAME	RELNAME	VARCHAR(128)	Name of the constraint.	
CONSTRAINT_TYPE	NSTRAINT_TYPE TYPE VARCHAR(11) Constraint Type • CHECK • UNIQUE • PRIMARY KEY • FOREIGN KEY		CHECKUNIQUEPRIMARY KEY	
TABLE_SCHEMA	TDBNAME	VARCHAR(128)	Name of the schema containing the table.	
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table which the constraint is created over. This will be the SQL table name if it exists; otherwise, it will be the system table name.	
IS_DEFERRABLE	ISDEFER	VARCHAR(3)	Indicates whether the constraint checking can be deferred. Will always be 'NO'.	
INITIALLY_DEFERRED	INITDEFER	VARCHAR(3)	Indicates whether the constraint was defined as initially deferred. Will always be 'NO'.	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System name of the table.	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the table.	
CONSTRAINT_KEYS	COLCOUNT	SMALLINT Nullable	Specifies the number of key columns if this is a UNIQUE, PRIMARY KEY, or FOREIGN KEY constraint. Contains the null value if the constraint is a	
IASP_NUMBER	IASPNUMBER	SMALLINT	CHECK constraint. Specifies the independent auxiliary storage	
CONSTRAINT_STATE	CST_STATE	VARCHAR(11)	pool (IASP) number. Indicates whether the constraint is established or defined:	
			ESTABLISHED The referential constraint is established. The parent table exists.	
			DEFINED The referential constraint is defined. The parent table does not exist.	
ENABLED	ENABLED	VARCHAR(3)	Indicates whether the constraint is enabled:	
		Nullable	NO The constraint is disabled.	
		1 Vallable	YES The constraint is enabled.	
			Contains the null value if the constraint is defined or is a unique constraint.	

SYSCST

Table 123. SYSCST view (continued)

	System Column			
Column Name	Name	Data Type	Descrip	tion
CHECK_PENDING	CHECKFLAG	VARCHAR(3)	Indicate pending	s whether the constraint is in check ; state:
		Nullable	NO	The constraint is not in check pending.
			YES	The constraint is in check pending.
				s the null value if the constraint is disabled, or is a unique constraint.
CONSTRAINT_TEXT	LABEL	VARGRAPHIC(50) CCSID 1200	A character string provided with the LABEI statement.	
		Nullable	Contain	s the null value if there is no label.
LONG_COMMENT	REMARKS	VARGRAPHIC(2000) CCSID 1200		cter string supplied with the ENT statement.
		Nullable	Contain commer	s the null value if there is no long nt.
SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name o	f the system schema containing the nt.

SYSCSTCOL

The SYSCSTCOL view records the columns on which constraints are defined. There is one row for every column in a unique, primary key, and check constraint and the referencing columns of a referential constraint.

The following table describes the columns in the SYSCSTCOL view:

Table 124. SYSCSTCOL view

	System Column		
Column Name	Name	Data Type	Description
TABLE_SCHEMA	TDBNAME	VARCHAR(128)	Name of the SQL schema that contains the table the constraint is dependent on.
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table the constraint is dependent on. This is the SQL table name if it exists; otherwise, it is the system table name.
COLUMN_NAME	COLUMN	VARCHAR(128)	Column that the constraint was created over. This is the SQL column name if it exists; otherwise, it is the system column name.
CONSTRAINT_SCHEMA	CDBNAME	VARCHAR(128)	Name of the schema of the constraint.
CONSTRAINT_NAME	RELNAME	VARCHAR(128)	Name of the constraint.
SYSTEM_COLUMN_NAME	SYS_CNAME	CHAR(10)	System name of the column.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System name of the table.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the table.
SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name of the system schema containing the constraint.

SYSCSTDEP

SYSCSTDEP

The SYSCSTDEP view records the tables on which constraints are defined.

The following table describes the columns in the SYSCSTDEP view:

Table 125. SYSCSTDEP view

	System Column		
Column Name	Name	Data Type	Description
TABLE_SCHEMA	TDBNAME	VARCHAR(128)	Name of the SQL schema that contains the table on which the constraint is dependent
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table on which the constraint is dependent. This is the SQL table name if it exists otherwise it is the system table name.
CONSTRAINT_SCHEMA	CDBNAME	VARCHAR(128)	Name of the schema of the constraint.
CONSTRAINT_NAME	RELNAME	VARCHAR(128)	Name of the constraint.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System name of the table.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the table.
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number.
SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name of the system schema containing the constraint.

SYSFUNCS

The SYSFUNCS view contains one row for each function created by the CREATE FUNCTION statement.

The following table describes the columns in the SYSFUNCS view:

Table 126. SYSFUNCS view

Column Name	System Column Name	Data Type	Description
SPECIFIC_SCHEMA	SPECSCHEMA	VARCHAR(128)	Schema name of the routine (function) instance.
SPECIFIC_NAME	SPECNAME	VARCHAR(128)	Specific name of the routine instance.
ROUTINE_SCHEMA	FUNCSCHEMA	VARCHAR(128)	Name of the SQL schema (schema) that contains the routine.
ROUTINE_NAME	FUNCNAME	VARCHAR(128)	Name of the routine.
ROUTINE_CREATED	RTNCREATE	TIMESTAMP	Identifies the timestamp when the routine was created.
ROUTINE_DEFINER	DEFINER	VARCHAR(128)	Name of the user that defined the routine.
ROUTINE_BODY	BODY	VARCHAR(8)	The type of the routine body:
			EXTERNAL This is an external routine.
			SQL This is an SQL routine.
EXTERNAL_NAME	EXTNAME	VARCHAR(279)	This column identifies the external program name.
		Nullable	 For SQL functions or ILE service programs, the external program name is schema-name/service-program-name(entry- point-name).
			 For Java programs, the external program name is an optional jar-id followed by a fully-qualified-class-name!method-name or fully-qualified-class-name.method-name.
			• For all other languages, the external program name is <i>schema-name/program-name</i> .
			Contains the null value if this is a system-generated function.

SYSFUNCS

Table 126. SYSFUNCS view (continued)

Column Name	System Column Name	Data Type	Descrip	tion
EXTERNAL_LANGUAGE	LANGUAGE	VARCHAR(8)		s an external routine, this column is the external program name.
		Nullable	С	The external program is written in C.
			C++	The external program is written in $C++$.
			CL	The external program is written in CL.
			COBOL	The external program is written in COBOL.
			COBOL	LE The external program is written in ILE COBOL.
			JAVA	The external program is written in JAVA.
			PLI	The external program is written in PL/I.
			RPG	The external program is written in RPG.
			RPGLE	The external program is written in ILE RPG.
				s the null value if this is not an routine.
PARAMETER_STYLE	PARM_STYLE	VARCHAR(7) Nullable		an external routine, this column is the parameter style (calling ion).
			DB2SQ	L This is the DB2SQL calling convention.
			DB2GN	RL This is the DB2GENERAL calling convention.
			GENER	AL This is the GENERAL calling convention.
			JAVA	This is the JAVA calling convention.
			NULLS	This is the GENERAL WITH NULLS calling convention.
			SQL	This is the SQL standard calling convention.
				s the null value if this is not an routine.

Table 126. SYSFUNCS view (continued)

|

Column Name	System Column Name	Data Type	Descript	ion
IS_DETERMINISTIC	DETERMINE	VARCHAR(3)	determin routine v	umn identifies whether the routine is a sistic. That is, whether a call to the with the same arguments will eturn the same result.
			NO	The routine is not deterministic.
			YES	The routine is deterministic.
SQL_DATA_ACCESS	DATAACCESS	VARCHAR(8) Nullable		umn identifies whether a routine SQL and whether it reads or data.
			NONE	The routine does not contain any SQL statements.
			CONTA	INS The routine contains SQL statements.
			READS	The routine possibly reads data from a table or view.
			MODIFI	The routine possibly modifies data in a table or view or issues SQL DDL statements.
SQL_PATH	SQL_PATH	VARCHAR(3483)		an SQL routine, this column s the path.
		Nullable	Contains routine.	the null value if this is an external
PARM_SIGNATURE	SIGNATURE	VARCHAR(2048)	This colu	umn identifies the routine signature.
NUMBER_OF_RESULTS	NUMRESULTS	SMALLINT	Identifies	s the number of results.
		Nullable		
IN_PARMS	IN_PARMS	SMALLINT		s the number of input parameters. 0 that there are no input parameters.
LONG_COMMENT	REMARKS	VARCHAR(2000)		ter string supplied with the NT statement.
		Nullable	Contains	the null value if there is no long t.
ROUTINE_DEFINITION	ROUTINEDEF	VARCHAR(23887)		an SQL routine, this column the SQL routine body.
		Nullable	routine o	the null value if this is not an SQL or if the routine body cannot be d in this column without truncation.
FUNCTION_ORIGIN	ORIGIN	CHAR(1)		s the type of function. If this is a re, this column contains a blank.
			В	This is a built-in function (defined by DB2 for i).
			E	This is a user-defined function.
			U	This is a user-defined function that is based on another function.
			S	This is a system-generated function.

SYSFUNCS

Table 126. SYSFUNCS view (continued)

Column Name	System Column Name	Data Type	Description
FUNCTION_TYPE	TYPE	CHAR(1)	Identifies the form of the function. If this is a procedure, this column contains a blank.
			S This is a scalar function.
			C This is a column function.
			T This is a table function.
EXTERNAL_ACTION	EXT_ACTION	CHAR(1)	Identifies the whether the invocation of the function has external effects.
		Nullable	E This function has external side effects.
			N This function does not have any external side effects.
IS_NULL_CALL	NULL_CALL	VARCHAR(3) Nullable	Identifies whether the function needs to be called if an input parameter is the null value.
			NO This function need not be called it an input parameter is the null value. If this is a scalar function, the result of the function is implicitly null if any of the operands are null. If this is a table function, the result of the function is an empty table if any of the operands are the null value.
			YES This function must be called even if an input operand is null.
SCRATCH_PAD	SCRATCHPAD	INTEGER Nullable	Identifies whether the address of a static memory area (scratch pad) is passed to the function.
			The function does not have a scratch pad.
			integer Indicates the size of the scratch pad passed to the function.
FINAL_CALL	FINAL_CALL	VARCHAR(3) Nullable	Indicates whether a final call to the function should be made to allow the function to clean up its work areas (scratch pads).
		runable	NO No final call is made.
			YES A final call to the function is mad when the statement is complete.
PARALLELIZABLE	PARALLEL	VARCHAR(3)	Identifies whether the function can be run i parallel.
		Nullable	NO The function must be synchronous.
			YES The function can be run in parallel.
DBINFO	DBINFO	VARCHAR(3)	Identifies whether information about the database is passed to the function.
		Nullable	NO No database information is passed to the function.
			YES Information about the database is passed to the function.

Table 126. SYSFUNCS view (continued)

Column Name	System Column Name	Data Type	Descrip	tion
SOURCE_ SPECIFIC_SCHEMA	SRCSCHEMA	VARCHAR(128)		s sourced function and the source is fined, this column contains the name
		Nullable	function	ource schema. If this is a sourced n and the source is built-in, this contains 'QSYS2'.
				s the null value if this is not a function.
SOURCE_SPECIFIC_NAME	SRCNAME	VARCHAR(128)	user-de	s sourced function and the source is fined, this column contains the
		Nullable	specific	name of the source function name.
				is the null value if this is not a function.
IS_USER_DEFINED_CAST	CAST_FUNC	VARCHAR(3)	function	es whether this function is a cast n created when a distinct type was
		Nullable	created.	
			NO	This function is not a cast function.
			YES	This function is a cast function.
CARDINALITY	CARD	BIGINT	Specifie	s the cardinality for a table function.
		Nullable		s the null value if the function is not function or if cardinality was not d.
FENCED	FENCED	VARCHAR(3)	Identifie	es whether the function is fenced.
		Nullable	NO	The function is not fenced.
		Nullable	YES	The function is fenced.
IASP_NUMBER	IASPNUMBER	SMALLINT		s the independent auxiliary storage ASP) number.
ROUNDING_MODE	DECFLTRND	CHAR(1)		s an SQL function, identifies the OAT rounding mode.
		Nullable	С	ROUND_CEILING
			D	ROUND_DOWN
			F	ROUND_FLOOR
			G	ROUND_HALF_DOWN
			E	ROUND_HALF_EVEN
			Н	ROUND_HALF_UP
			U	ROUND_UP
				is the null value if the function is not function.

SYSINDEXES

The SYSINDEXES view contains one row for every index in the SQL schema created using the SQL CREATE INDEX statement, including indexes on the SQL catalog.

The following table describes the columns in the SYSINDEXES view:

Table 127. SYSINDEXES view

Column Name	System Column Name	Data Type	Description
INDEX_NAME	NAME	VARCHAR(128)	Name of the index. This will be the SQL index name if one exists; otherwise, it will be the system index name.
INDEX_OWNER	CREATOR	VARCHAR(128)	Owner of the index
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table on which the index is defined. This will be the SQL table name if one exists; otherwise, it will be the system table name.
TABLE_OWNER	TBCREATOR	VARCHAR(128)	Owner of the table
TABLE_SCHEMA	TBDBNAME	VARCHAR(128)	Name of the SQL schema that contains the table on which the index is defined
IS_UNIQUE	UNIQUERULE	CHAR(1)	If the index is unique:
			D No (duplicates are allowed)
			V Yes (duplicate NULL values are allowed)
			U Yes
			E Encoded vector index
COLUMN_COUNT	COLCOUNT	INTEGER	Number of columns in the key
INDEX_SCHEMA	DBNAME	VARCHAR(128)	Name of the SQL schema that contains the index
SYSTEM_INDEX_NAME	SYS_IXNAME	CHAR(10)	System index name
SYSTEM_INDEX_SCHEMA	SYS_IDNAME	CHAR(10)	System index schema name
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System table schema name
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
		Nullable	Contains the null value if there is no long comment.
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number.
INDEX_TEXT	LABEL	CHAR(50)	A character string supplied with the LABE statement.
IS_SPANNING_INDEX	SPANNING	VARCHAR(3)	Indicates whether the index is built over multiple partitions or members:
		Nullable	NO The index is not built over multiple partitions or members.
			YES The index is built over multiple partitions or members.
			Contains the null value if the base table is not a partitioned table.
INDEX_DEFINER	DEFINER	VARCHAR(128)	Name of the user that defined the index.

Table 127. SYSINDEXES view (continued)

Column Name	System Column Name	Data Type	Descri	ption
ROUNDING_MODE	DECFLTRND	CHAR(1)	Indicates the DECFLOAT rounding mode of the index:	
		Nullable	C	ROUND_CEILING
			D	ROUND_DOWN
			F	ROUND_FLOOR
			G	ROUND_HALF_DOWN
			E	ROUND_HALF_EVEN
			Н	ROUND_HALF_UP
			U	ROUND_UP
			have a	ns the null value if the index does not n expression that references a LOAT column, function, or constant.
INDEX_HAS_SEARCH_CONDITION	IXHASWHERE	CHAR(1)	If the i	index has a search condition:
			N	The index does not have a search condition.
			Y	The index has a search condition.
SEARCH_CONDITION_HAS_UDF	IXWHEREUDF	CHAR(1)		index search condition contains a efined function:
			N	The index is not sparse or does not contain a user-defined function.
			Y	The index is sparse and the search condition contains a UDF.
SEARCH_CONDITION	IXWHERECON	DBCLOB(2M)	If the i	index is sparse, contains the search ion.
		CCSID 1200 Nullable	Contai sparse	ns the null value if the index is not

SYSINDEXSTAT

SYSINDEXSTAT

The SYSINDEXSTAT view contains one row for every SQL index.

Use this view when you want to see information for a specific SQL index or set of SQL indexes. The information is similar to that returned via Show Indexes in System i Navigator.

The following table describes the columns in the SYSINDEXSTAT view:

Table 128. SYSINDEXSTAT view

Column name	System Column Name	Data Type	Description	
INDEX_SCHEMA	INDSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the SQL index.	
INDEX_NAME	INDNAME	VARCHAR(128)	Name of the SQL index.	
INDEX_PARTITION	INDPART	VARCHAR(128)	Partition or member name of the SQL index	
INDEX_OWNER	INDOWNER	VARCHAR(128)	SQL index owner.	
INDEX_TEXT	LABEL	VARGRAPHIC(50) CCSID 1200	Text of the SQL index. Contains null if text does not exist for the SQL index.	
		Nullable		
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.	
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.	
INDEX_VALID	VALID	VARCHAR(3)	An indication or whether the SQL index is invalid and needs to be rebuilt:	
			NO The SQL index is invalid.	
			YES The SQL index is valid.	
CREATE_TIMESTAMP	CREATED	TIMESTAMP	The timestamp when the SQL index was created.	
LAST_BUILD_TIMESTAMP	LASTBUILD	TIMESTAMP Nullable	The timestamp when the SQL index was larebuilt. Contains null if the SQL index has never been built.	
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP	The timestamp of the last time the SQL	
		Nullable	index was used in a query since the last time the usage statistics were reset. If the SQL index has never been used in a query since the last time the usage statistics were reset, contains null.	
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP	The timestamp of the last time the SQL	
		Nullable	index was used by the optimizer for statistics since the last time the usage statistics were reset. If the SQL index has never been used for statistics since the last time the usage statistics were reset, contain null.	
QUERY_USE_COUNT	QRYUSECNT	BIGINT	The number of times the SQL index was used in a query since the last time the usag statistics were reset. If the SQL index has never been used in a query since the last time the usage statistics were reset, contains 0.	

| Table 128. SYSINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	The number of times the SQL index was used by the optimizer for statistics since the last time the usage statistics were reset. If the SQL index has never been used for statistics since the last time the usage statistics were reset, contains 0.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP Nullable	The timestamp of the last time the SQL index was used directly by an application for native record I/O or SQL operations. If the SQL index has never been used, contain null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the SQL index was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If the SQL index has never been used since the last time the usage statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	The timestamp of the last time the usage statistics were reset for the SQL index. For more information see the Change Object Description (CHGOBJD) command. If the SQL index's last used timestamp has never been reset, contains null.
NUMBER_KEY_COLUMNS	INDKEYS	BIGINT	Number of columns that define the SQL index key.
COLUMN_NAMES	COLNAMES	VARCHAR(1024)	A comma separated list of column names that define the SQL index key. If the length of all the column names exceeds 1024, '' is returned at the end of the column value.
NUMBER_KEYS	NUMRIDS	BIGINT	Number of keys in the SQL index. If the SQL index is invalid or is an encoded vecto index, -1 is returned.
INDEX_SIZE	SIZE	BIGINT	Size (in bytes) of the binary tree or encoded vector index of the SQL index.
NUMBER_PAGES	PAGES	BIGINT Nullable	Number of pages in the SQL index. If the SQL index is invalid or is an encoded vecto index, contains null.
LOGICAL_PAGE_SIZE	PAGE_SIZE	INTEGER Nullable	The logical page size of the index. If the index is an encoded vector index, contains null.
UNIQUE	UNIQUE	VARCHAR(21)	Indicates whether an SQL index is unique: UNIQUE The SQL index is a UNIQUE index.
			UNIQUE WHERE NOT NULL The SQL index is a UNIQUE WHERE NOT NULL index.
			FIFO The SQL index is a non-unique first-in-first-out (FIFO) index.
			LIFO The SQL index is a non-unique last-in-last-out (LIFO) index.
			FCFO The SQL index is a non-unique first-change-first-out (FCFO) index

SYSINDEXSTAT

Table 128. SYSINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Descrip	otion
MAXIMUM_KEY_LENGTH	KEY_LENGTH	INTEGER		um key length of an SQL index. If the dex is an encoded vector index,
		Nullable	contains	s null.
UNIQUE_PARTIAL_KEY_VALUES	KEYCARDS	VARCHAR(96)	index. I	que partial key values for the SQL f the SQL index is an encoded vector
		Nullable	index, c	contains null.
OVERFLOW_VALUES	OVERFLOW	INTEGER	The number of distinct key values that overflowed the encoded vector index.	
		Nullable	SQL inc	dex is not an encoded vector index, s null.
EVI_CODE_SIZE	CODE_SIZE	INTEGER	vector i	e of the byte code of the encoded ndex. If the SQL index is not an
		Nullable	encoded	d vector index, contains null.
SPARSE	SPARSE	VARCHAR(3)		es whether the SQL index contains r all the rows of its depended on
			NO	The index contains keys for all the rows of its depended on table.
			YES	The SQL index includes a WHERI clause and does not contain keys for all the rows of its depended of table.
DERIVED_KEY	DERIVED	VARCHAR(3)		es whether the any key columns in L index are expressions:
			NO	No key columns of the SQL index are expressions.
			YES	At least one key column is an expression.
PARTITIONED	PARTITION	VARCHAR(3)		es whether the SQL index is ned or not partitioned:
			NO	The SQL index is not partitioned (spans multiple partitions).
			YES	The SQL index is not built over a partitioned table or built over a partitioned table and is partitioned (does not span multiple partitions).
ACCPTH_TYPE	ACCPTHTYPE	VARCHAR(4)	Indicate	es the type of SQL index:
			1 TB	The SQL index is a maximum 1 terabyte (*MAX1TB) binary radix index.
			4 GB	The SQL index is a maximum 4 gigabyte (*MAX4GB) binary radix index.
			EVI	The SQL index is an encoded vector index.

| Table 128. SYSINDEXSTAT view (continued)

Column name	System Columr Name	ı Data Type	Description
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the SQL index uses a collating sequence:
			BY HEX VALUE The SQL index does not use a collating table.
			*LANGIDSHR The SQL index uses a shared weight collating sequence (SRTSEQ).
			*LANGIDUNQ The SQL index uses a unique weight collating sequence (SRTSEQ).
			collating-sequence-table The SQL index uses an alternate collating sequence (ALTSEQ).
LANGUAGE_IDENTIFIER	LANGID	CHAR(3)	The language ID of the SQL index. Contains null if the collating sequence is hex.
		Nullable	
ESTIMATED_BUILD_TIME	ESTBLDTIME	INTEGER	Estimated time (in milliseconds) required to rebuild the SQL index.
INDEX_HELD	HELD	VARCHAR(3)	An indication of whether a pending rebuild of the SQL index is currently held by the user:
			NO A rebuild of the SQL index is not pending or is not held.
			YES A pending rebuild of the SQL index is held.
MAINTENANCE	MAINT	VARCHAR(11)	The maintenance of the SQL index:
		Nullable	REBUILD The SQL index is not maintained and is rebuilt at open time.
			DELAYED The SQL index maintenance is delayed until the index is opened.
			DO NOT WAIT The SQL index is immediately maintained. If the SQL index is an encoded vector index, contains null.
DELAYED_MAINT_KEYS	DLYKEYS	INTEGER	Number of keys that need to be inserted into the binary tree of a delayed
		Nullable	maintenance index. If the SQL index is not a delayed maintenance index, contains null.

SYSINDEXSTAT

| Table 128. SYSINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
RECOVERY	RECOVERY	VARCHAR(10)	The recovery attribute of the SQL index:
		Nullable	DURING IPL The SQL index is recovered, if necessary, at IPL.
			AFTER IPL The SQL index is recovered, if necessary, after IPL.
			NEXT OPEN The SQL index is recovered, if necessary, on the next open. If the SQL index is an encoded vector index, contains null.
ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates the DECFLOAT rounding mode of the index:
		Nullable	CEILING ROUND_CEILING
			DOWN ROUND_DOWN
			FLOOR ROUND_FLOOR
			HALFDOWN ROUND_HALF_DOWN
			HALFEVEN ROUND_HALF_EVEN
			HALFUP ROUND_HALF_UP
			UP ROUND_UP
			Contains the null value if the index does no have an expression that references a DECFLOAT column, function, or constant.
DECFLOAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates whether DECFLOAT warnings are returned:
		Nullable	NO DECFLOAT warnings are not returned.
			YES DECFLOAT warnings are returned.
			Contains the null value if the index does not have an expression that references a DECFLOAT column, function, or constant.
LOGICAL_READS	LGLREADS	BIGINT	Number of logical read operations for the SQL index since the last IPL.
SEARCH_CONDITION	IXWHERECON	VARGRAPHIC(1024) CCSID 1200	If an index is sparse, the search condition of the index. If the length of the search condition exceeds 1024, '' is returned at the
		Nullable	end of the column value. Contains null if the index is not sparse.

| Table 128. SYSINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description	
SEARCH_CONDITION_HAS_UDF	IXWHEREUDF	VARCHAR(3) Nullable	If an index is sparse, indicates whether the search condition of the index contains a user-defined function. Contains null if the index is not sparse.	
			NO The index search condition does not contain a UDF.	
			YES The index search condition contains a UDF.	
OWNING_INDEX_SCHEMA	OWNINDSCH	VARCHAR(128)	Name of the schema of the object that own the index.	
OWNING_INDEX_NAME	OWNINDNAME	VARCHAR(128)	Name of the object that owns the index.	
OWNING_INDEX_TYPE	OWNINDTYPE	VARCHAR(11)	The type of the object that owns the index:	
			INDEX The owner is an SQL index.	
			LOGICAL The owner is part of a logical file	
			PHYSICAL The owner is a part of a keyed physical file.	
			PRIMARY KEY The owner is a primary key constraint.	
			UNIQUE The owner is a unique constraint	
			FOREIGN KEY The owner is a foreign key constraint.	
OWNING_INDEX_OWNER	OWNINDOWN	VARCHAR(128)	The owner of the object that owns the inde	
OWNING_SYSTEM_INDEX_SCHEMA	OWNSYS_IXD	CHAR(10) Nullable	System index schema name of the owner of the index. Contains null if the owner is a constraint.	
OWNING_SYSTEM_INDEX_NAME	OWNSYS_IXN	CHAR(10)	The system name of the owner of the index	
OWNING_5151EW_INDEX_NAME	OWINS 15_IXIN	Nullable	Contains null if the owner is a constraint.	
OWNING_INDEX_TEXT	OWNLABEL	VARGRAPHIC(50) CCSID 1200	Text of the object that owns the index. Contains null if text does not exist for the object.	
		Nullable	object.	
OWNING_INDEX_PARTITION	OWNINDMMBR	VARCHAR(128)	Partition or member name of the object that owns the index. Contains null if the owner	
		Nullable	is a constraint.	
SYSTEM_INDEX_SCHEMA	SYS_IXDNAM	CHAR(10)	System index schema name.	
SYSTEM_INDEX_NAME	SYS_IXNAME	CHAR(10)	System index name.	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System table schema name.	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.	
SYSTEM_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System member name.	

SYSJARCONTENTS

SYSJARCONTENTS

The SYSJARCONTENTS table contains one row for each class defined by a jarid in the SQL schema.

The following table describes the columns in the SYSJARCONTENTS table.

Table 129. SYSJARCONTENTS table

	System Column		
Column Name	Name	Data Type	Description
JARSCHEMA	JARSCHEMA	VARCHAR(128)	Name of the schema containing the jar_id.
JAR_ID	JAR_ID	VARCHAR(128)	Name of the jar_id.
CLASS	CLASS	VARCHAR(128)	Name of the class.
CLASS_SOURCE	CLASSSRC	DBCLOB(10485760) CCSID 13488	Reserved. Contains the null value.
		Nullable	
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number.

SYSJAROBJECTS

The SYSJAROBJECTS table contains one row for each jarid in the SQL schema.

The following table describes the columns in the SYSJAROBJECTS table.

Table 130. SYSJAROBJECTS table

	System Column			
Column Name	Name	Data Type	Descr	iption
JARSCHEMA	JARSCHEMA	VARCHAR(128)	Name	of the schema containing the jar_id.
JAR_ID	JAR_ID	VARCHAR(128)	Name	of the jar_id.
DEFINER	DEFINER	VARCHAR(128)	Name	of the owner of the jarid.
JAR_DATA	JAR_DATA	BLOB(104857600)	Byte-c	codes for the jar.
		Nullable		
IASP_NUMBER	IASPNUMBER	SMALLINT		ies the independent auxiliary storage IASP) number.
	CREATEDTS	TIMESTAMP	Jar cre	eated timestamp
JAR_CREATED				
LAST_ALTERED	ALTEREDTS	TIMESTAMP	Reserv	ved. Contains the null value.
		Nullable		
DEBUG_MODE	DEBUG_MODE	CHAR(1)	Identi	fies whether the routine is debuggable.
			0	The routine is not debuggable.
			1	The routine is debuggable by the Unified Debugger.
			2	The routine is debuggable by the system debugger.
			N	The routine is disabled from being debugged by the Unified Debugger.
DEBUG_DATA	DEBUG_DATA	CLOB(1048576)	Reserv	ved. Contains the null value.
		Nullable		

SYSKEYCST

The SYSKEYCST view contains one or more rows for each UNIQUE KEY, PRIMARY KEY, or FOREIGN KEY in the SQL schema. There is one row for each column in every unique or primary key constraint and the referencing columns of a referential constraint.

The following table describes the columns in the SYSKEYCST view:

Table 131. SYSKEYCST view

	System Column		
Column Name	Name	Data Type	Description
CONSTRAINT_SCHEMA	CDBNAME	VARCHAR(128)	Name of the schema containing the constraint.
CONSTRAINT_NAME	RELNAME	VARCHAR(128)	Name of the constraint.
TABLE_SCHEMA	TDBNAME	VARCHAR(128)	Name of the schema containing the table.
TABLE_NAME	TBNAME	VARCHAR(128)	Name of the table.
COLUMN_NAME	COLNAME	VARCHAR(128)	Name of the column.
ORDINAL_POSITION	COLSEQ	INTEGER	The position of the column within the key
COLUMN_POSITION	COLNO	INTEGER	The position of the column within the row
TABLE_OWNER	CREATOR	VARCHAR(128)	Owner of the table.
SYSTEM_COLUMN_NAME	SYS_CNAME	CHAR(10)	System name of the column.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System name of the table.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the schema table.
SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name of the system schema containing the constraint.

SYSKEYS

The SYSKEYS view contains one row for every column of an index in the SQL schema, including the keys for the indexes on the SQL catalog.

The following table describes the columns in the SYSKEYS view:

Table 132. SYSKEYS view

Column Name	System Column Name	Data Type	Description
INDEX_NAME	IXNAME	VARCHAR(128)	Name of the index. This will be the SQL index name if one exists; otherwise, it will be the system index name.
INDEX_OWNER	IXCREATOR	VARCHAR(128)	Owner of the index
COLUMN_NAME	COLNAME	VARCHAR(128)	Name of the column of the key. This will be the SQL column name if one exists; otherwise, it will be the system column name.
COLUMN_POSITION	COLNO	INTEGER	Numeric position of the column in the row.
		Nullable	Contains the null value if the key column is an expression.
ORDINAL_POSITION	COLSEQ	INTEGER	Numeric position of the column in the key
ORDERING	ORDERING	CHAR(1)	Order of the column in the key:
			A Ascending
			D Descending
INDEX_SCHEMA	IXDBNAME	VARCHAR(128)	Name of the schema containing the index.
SYSTEM_COLUMN_NAME	SYS_CNAME	CHAR(10)	System name of the column
SYSTEM_INDEX_NAME	SYS_IXNAME	CHAR(10)	System name of the index
SYSTEM_INDEX_SCHEMA	SYS_IDNAME	CHAR(10)	System name of the schema containing the index
COLUMN_IS_EXPRESSION	IXISEXP	CHAR(1)	If the key column is an expression:
			Y The key column is not an expression.
			N The key column is an expression.
EXPRESSION_HAS_UDF	IXEXPUDF	CHAR(1)	If the key column is an expression and the expression contains a user-defined function:
		Nullable	N The key column is not an expression or the expression does not contain a user-defined function.
			Y The key column is an expression and the expression contains a UDF.
KEY_EXPRESSION	IXKEYEXP	DBCLOB(2097152)	If the key column is an expression, contains the expression.
		CCSID 1200 Nullable	Contains the column name if the key column is not an expression.

SYSMQTSTAT

SYSMQTSTAT

The SYSMQTSTAT view contains one row for every materialized table.

Use this view when you want to see information about a specified materialized query table or set of materialized query tables. The information is similar to that returned via Show Materialized Query Tables in System i Navigator.

The following table describes the columns in the SYSMQTSTAT view:

Table 133. SYSMQTSTAT view

Column name	System Column Name	Data Type	Descrij	ption
MQT_SCHEMA	MQTSCHEMA	VARCHAR(128)		of the SQL schema that contains the alized query table.
MQT_NAME	MQTNAME	VARCHAR(128)	Name	of the materialized query table.
MQT_PARTITION	MQTMEMBER	VARCHAR(128)		on or member name of the alized query table.
MQT_OWNER	MQTOWNER	VARCHAR(128)	Materia	alized query table owner.
MQT_TEXT	LABEL	VARGRAPHIC(50) CCSID 1200 Nullable	Contair	the materialized query table. ns null if text does not exist for the alized query table.
ENABLED	ENABLED	VARCHAR(3)		ication of whether the materialized table is enabled:
			NO	The materialized query table is not enabled for use.
			YES	The materialized query table is enabled for use by the database manager.
CREATE_TIMESTAMP	CREATED	TIMESTAMP		nestamp when the materialized query vas created.
REFRESH_TIME	REFRESHDTS	TIMESTAMP Nullable	table w	nestamp when the materialized query vas last refreshed. Contains null if the alized query table has never been ed.
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP Nullable	materia query s were re has nev	nestamp of the last time the alized query table was used in a since the last time the usage statistics eset. If the materialized query table wer been used in a query since the last is usage statistics were reset, contains
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP Nullable	materia optimiz usage s materia used fo	nestamp of the last time the alized query table was used by the zer for statistics since the last time the statistics were reset. If the alized query table has never been or statistics since the last time the statistics were reset, contains null.
QUERY_USE_COUNT	QRYUSECNT	BIGINT	table w the usa materia used in	mber of times the materialized query vas used in a query since the last time age statistics were reset. If the alized query table has never been a query since the last time the usage as were reset, contains 0.

| Table 133. SYSMQTSTAT view (continued)

Column name	System Colum Name	n Data Type	Description
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	The number of times the materialized query table was used by the optimizer for statistics since the last time the usage statistics were reset. If the materialized query table has never been used for statistics since the last time the usage statistics were reset, contains 0.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP Nullable	The timestamp of the last time the materialized query table was used directly by an application for native record I/O or SQL operations. If the materialized query table has never been used, contains null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the materialized query table was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If the materialized query table has never been used since the last time the usage statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	The timestamp of the last time the usage statistics were reset for the materialized query table. For more information see the Change Object Description (CHGOBJD) command. If the materialized query table's last used timestamp has never been reset, contains null.
NUMBER_ROWS	CARD	BIGINT	Number of rows in the materialized query table.
MQT_SIZE	SIZE	BIGINT	Size (in bytes) of the materialized query table.
LAST_CHANGE_TIMESTAMP	LASTCHG	TIMESTAMP Nullable	The timestamp of the last time the materialized query table was changed. If the materialized query table has never been changed since the last time the usage statistics were reset, contains null.
MAINTENANCE	MAINTAIN	VARCHAR(6)	Indicates the maintenance for the materialized query table: SYSTEM The materialized query table is system maintained.
INITIAL_DATA	INITIAL	VARCHAR(19)	USER The materialized query table is user maintained. Indicates the initial data for the materialized query table:
			INITIALLY DEFERRED Data is not inserted into the materialized query table when it is created.
			INITIALLY IMMEDIATE Data is inserted into the materialized query table when it is created.

SYSMQTSTAT

I Table 133. SYSMQTSTAT view (continued)

Column name	System Colum Name	n Data Type	Description
REFRESH	REFRESH	VARCHAR(9)	Indicates when the data in the materialized query table can be refreshed:
			DEFERRED Data in the materialized query table can be refreshed at any tim using the REFRESH TABLE statement.
			IMMEDIATE Data in the materialized query table is immediately refreshed.
ISOLATION	ISOLATION	VARCHAR(27)	Indicates the isolation level used to refresh the materialized query table:
			NO COMMIT The isolation level is NO COMMIT.
			UNCOMMITTED READ The isolation level is UNCOMMITTED READ.
			CURSOR STABILITY The isolation level is CURSOR STABILITY.
			CURSOR STABILITY KEEP LOCKS The isolation level is CURSOR STABILITY KEEP LOCKS.
			READ STABILITY The isolation level is READ STABILITY.
			REPEATABLE READ The isolation level is REPEATABLE READ.
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the materialize query table uses a collating sequence:
			BY HEX VALUE The materialize query table does not use a collating table.
			*LANGIDSHR The materialize query table uses shared weight sort sequence (SRTSEQ).
			*LANGIDUNQ The materialize query table uses unique weight sort sequence (SRTSEQ).
			collating-sequence-table The materialize query table uses an alternate collating sequence (ALTSEQ).
LANGUAGE_IDENTIFIER	LANGID	CHAR(3)	The language ID of the materialize query table. Contains null if the sort sequence is
		Nullable	hex.

Table 133. SYSMQTSTAT view (continued)

Column name	System Column Name	Data Type	Description
MQT_RESTORE_DEFERRED	MQTRSTDFR	VARCHAR(3)	An indication of whether a restore of the MQT is pending the restore of one of its dependents:
			NO The restore of the MQT is not deferred pending the restore of one of its dependent tables.
			YES The restore of the MQT is deferred pending the restore of one of its dependent tables.
ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates the DECFLOAT rounding mode the materialized query table:
		Nullable	CEILING ROUND_CEILING
			DOWN ROUND_DOWN
			FLOOR ROUND_FLOOR
			HALFDOWN ROUND_HALF_DOWN
			HALFEVEN ROUND_HALF_EVEN
			HALFUP ROUND_HALF_UP
			UP ROUND_UP
			Contains the null value if the materialized query table does not have an expression the references a DECFLOAT column, function or constant.
DECFLOAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates whether DECFLOAT warnings a returned:
		Nullable	NO DECFLOAT warnings are not returned.
			YES DECFLOAT warnings are returned.
			Contains the null value if the materialized query table does not have an expression the references a DECFLOAT column, function or constant.
MQT_DEFINITION	MQTDEF	VARGRAPHIC(5000) CCSID 1200	The query of the materialized query table the length of the query exceeds 5000, '' is returned at the end of the column value.
SYSTEM_MQT_SCHEMA	SYS_MQDNAM	CHAR(10)	System materialized query table schema name.
SYSTEM_MQT_NAME	SYS_MQNAME	CHAR(10)	System materialized query table name.

SYSPACKAGE

The SYSPACKAGE view contains one row for each SQL package in the SQL schema.

The following table describes the columns in the SYSPACKAGE view:

Table 134. SYSPACKAGE view

Column Name	System Column Name		Description
		Data Type	*
PACKAGE_CATALOG	LOCATION	VARCHAR(128)	Relational database name (RDBNAME) of the SQL package
PACKAGE_SCHEMA	COLLID	VARCHAR(128)	Name of the schema
PACKAGE_NAME	NAME	VARCHAR(128)	Name of the SQL package
PACKAGE_OWNER	OWNER	VARCHAR(128)	Owner of the SQL package
PACKAGE_CREATOR	CREATOR	VARCHAR(128)	Creator of the SQL package
CREATION_TIMESTAMP	TIMESTAMP	CHAR(26)	Timestamp of when the SQL package was created
DEFAULT_SCHEMA	QUALIFIER	VARCHAR(128)	Implicit name for unqualified tables, views, and indexes
PROGRAM_NAME	PROGNAME	VARCHAR(128)	Name of program the package was created from
PROGRAM_SCHEMA	LIBRARY	VARCHAR(128)	Name of schema containing the program
PROGRAM_CATALOG	RDB	VARCHAR(128)	Name of the relational database where the program resides
ISOLATION	ISOLATION	CHAR(2)	Isolation option specification: RR Repeatable Read (*RR) RS Read Stability (*ALL) CS Cursor Stability (*CS) UR Uncommitted Read (*CHG) NO None (*NONE)
QUOTE	QUOTE	CHAR(1)	Escape character specification (Y/N): Y = Quotation mark N = Apostrophe
COMMA	COMMA	CHAR(1)	
			Comma option specification (Y/N) : Y = Comma N = Period
PACKAGE_TEXT	LABEL	VARCHAR(50)	A character string you supply with the LABEL statement.
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
			Contains the null value if there is no long comment.
CONSISTENCY_TOKEN	CONTOKEN	CHAR(8) FOR BIT DATA	Consistency token of package
SYSTEM_PACKAGE_NAME	SYS_NAME	CHAR(10)	System name of the package.
SYSTEM_PACKAGE_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the package.
SYSTEM_DEFAULT_SCHEMA	SYS_DDNAME	CHAR(10)	System name of the implicit qualifier for unqualified table, views, indexes, and packages.
SYSTEM_PROGRAM_NAME	SYS_PNAME	CHAR(10)	System name of the program.

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Table 134. SYSPACKAGE view (continued)

		System Column			
	Column Name	Name	Data Type	Descrip	tion
	SYSTEM_PROGRAM_SCHEMA	SYS_PDNAME	CHAR(10)	System 1 program	name of the schema containing the
	IASP_NUMBER	IASPNUMBER	SMALLINT		s the independent auxiliary storage SP) number.
I	ROUNDING_MODE	DECFLTRND	CHAR(1)	The rou	nding mode for the package:
I				C	ROUND_CEILING
I				D	ROUND_DOWN
I				F	ROUND_FLOOR
I				G	ROUND_HALF_DOWN
I				E	ROUND_HALF_EVEN
I				Н	ROUND_HALF_UP
Ī				U	ROUND_UP

SYSPACKAGESTAT

SYSPACKAGESTAT

The SYSPACKAGESTAT view contains one row for each SQL package in the SQL schema.

The following table describes the columns in the SYSPACKAGESTAT view:

Table 135. SYSPACKAGESTAT view

Column Name	System Column Name	Data Type	Description
PACKAGE_SCHEMA	COLLID	VARCHAR(128)	Name of the schema
PACKAGE_NAME	NAME	VARCHAR(128)	Name of the SQL package
PACKAGE_OWNER	OWNER	VARCHAR(128)	Owner of the SQL package
PACKAGE_CREATOR	CREATOR	VARCHAR(128)	Creator of the SQL package
CREATION_TIMESTAMP	TIMESTAMP	CHAR(26)	Timestamp of when the SQL package was created
DEFAULT_SCHEMA	QUALIFIER	VARCHAR(128)	Implicit name for unqualified tables, view and indexes
ISOLATION	ISOLATION	CHAR(2)	Isolation option specification:
			RR Repeatable Read (*RR)
			RS Read Stability (*ALL)
			CS Cursor Stability (*CS)
			UR Uncommitted Read (*CHG)
			NO None (*NONE)
SECONDARY_SPACE_COUNT	PKG_SPACES	INTEGER	Number of spaces in the package.
PENDING_FULL	PENDFULL	VARCHAR(3)	Indicates whether the package is pending full.
		Nullable	NO The package is not pending full.
			YES The package is pending full.
			Contains null for a DRDA package.
PACKAGE_TYPE	PKG_TYPE	VARCHAR(16)	Indicates the type of package.
			EXTENDED DYNAMIC The package is an extended dynamic package.
			DRDA The package is a DRDA package
NUMBER_STATEMENTS	NBRSTMTS	INTEGER	Number of SQL statements in the package
PACKAGE_USED_SIZE	PKSIZE	INTEGER	Number of bytes that are used for SQL statements and access plans in the packag
NUMBER_DUMMIES	NBRDUMMIES	INTEGER	Number of dummy statements in the package.
		Nullable	Contains null for a DRDA package.
NUMBER_COMPRESSIONS	PGM_CMP	INTEGER	Number of times the package has been compressed.
		Nullable	Contains null for a DRDA package.
STATEMENT_CONTENTION_COUNT	CONTENTION	BIGINT	Number of times contention occurred whe attempting to store a new access plan.

Table 135. SYSPACKAGESTAT view (continued)

Column Name	System Column Name	Data Type	Description		
 C_NUL_REQUIRED	CNULRQD	VARCHAR(10)	Indicates the CNULRQD attribute:		
			*CNULRQD C nuls are required.		
			*NOCNULRQD		
			C nuls are not required.		
NAMING	NAMING	VARCHAR(4)	Indicates the NAMING attribute:		
			*SYS This is system naming.		
			*SQL This is SQL naming.		
TARGET_RELEASE	TGTRLS	VARCHAR(6)	Indicates the target release of the pack (VxRxMx).	kage	
RDB	RDB	VARCHAR(18)	Indicates the RDB specified for the pa	ckage	
			rdb-name The name of the relational database.		
			*NONE A relational database was n specified.	ot	
ALLOW_COPY_DATA	ALWCPYDTA	VARCHAR(9)	Indicates the ALWCPYDTA attribute:		
			*NO A copy of the data is not all	lowed	
			*OPTIMIZE		
			A copy of the data is allowe whenever it might result in performance.		
			*YES A copy of the data is allowed only when necessary.	ed, bu	
DATE_FORMAT	DATFMT	VARCHAR(4)	Indicates the DATFMT attribute:		
			*JOB The date format specified ir job at runtime is used.	the	
			*USA The date format is *USA.		
			*ISO The date format is *ISO.		
			*EUR The date format is *EUR.		
			*JIS The date format is *JIS.		
			*MDY The date format is *MDY.		
			*DMY The date format is *DMY.		
			*YMD The date format is *YMD.		
			*JUL The date format is *JUL.		
DATE_SEPARATOR	DATSEP	CHAR(1)	Indicates the date separator.		
TIME_FORMAT	TIMFMT	VARCHAR(4)	Indicates the TIMFMT attribute:		
			*JOB The time format specified in job at runtime is used.	the	
			*USA The time format is *USA.		
			*ISO The time format is *ISO.		
			*EUR The time format is *EUR.		
			*JIS The time format is *JIS.		
			*HMS The date format is *HMS.		
TIME_SEPARATOR	TIMSEP	CHAR(1)	Indicates the time separator.		

SYSPACKAGESTAT

| Table 135. SYSPACKAGESTAT view (continued)

Column Name	System Column Name	Data Type	Descript	ion
DYNAMIC_DEFAULT_SCHEMA	DYNDFTCOL	VARCHAR(4) Nullable	DFTRDE	whether the value for COL should be used for implicit tion on dynamic SQL statements:
		Nullable	*NO	The schema specified in DFTDRBCOL is not used for dynamic SQL statements.
			*YES	The schema specified in DFTDRBCOL is used for dynamic SQL statements. null if a default schema was not
				(DFTRDBCOL).
CURRENT_RULES	SQLCURRULE	VARCHAR(4)	Indicates	the SQLCURRULE attribute:
			*DB2	The semantics of all SQL statements will default to the rules established for DB2.
			*STD	The semantics of all SQL statements will default to the rules established by the ISO and ANSI SQL standards.
ALLOW_BLOCK	ALWBLK	VARCHAR(8)	Indicates	the ALWBLK attribute:
			*ALLRE	AD Rows are blocked for read-only cursors.
			*NONE	Rows are not blocked for retrieval of data for cursors.
			*READ	Records are blocked for read-only retrieval of data for cursors when:
				 *NONE is specified for the Commitment control (COMMIT) parameter.
				 The cursor is declared with a FOR READ ONLY clause or there are no dynamic statements that could run a positioned UPDATE or DELETE statement for the cursor.
 DELAY_PREPARE	DLYPRP	VARCHAR(4)	Indicates	the DLYPRP attribute:
			*NO	Dynamic statement validation is performed when the dynamic statements are prepared.
			*YES	Dynamic statement validation is delayed until the dynamic statements are used.

Table 135. SYSPACKAGESTAT view (continued)

Column Name	System Column Name	Data Type	Description
USER_PROFILE	USRPRF	VARCHAR(7)	Specifies the user profile used for authority checking:
			*USER The profile of the user running statements in the package is used
			*OWNER
			The profiles of both the owner o the package and the user runnin statements in the package is used
			*NAMING If the naming convention is *SQI *OWNER is used. If the naming convention is *SYS, *USER is use
DYNAMIC_USER_PROFILE	DYNUSRPRF	VARCHAR(6)	Specifies the user profile used for dynamic SQL statements:
			*USER Local dynamic SQL statements a run under the profile of the job of thread. Distributed dynamic SQI statements are run under the profile of the application server job.
			*OWNER
			Local dynamic SQL statements a run under the profile of the package's owner. Distributed dynamic SQL statements are run under the profile of the SQL package's owner.
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the package uses a collating sequence:
			BY HEX VALUE The package does not use a collating table.
			*LANGIDSHR The package uses a shared weigl sort sequence (SRTSEQ).
			*LANGIDUNQ The package uses a unique weig sort sequence (SRTSEQ).
			collating-sequence-table The package uses an alternate collating sequence (ALTSEQ).
LANGUAGE_IDENTIFIER	LANGID	CHAR(3)	The language ID sort sequence.
		Nullable	Contains null if the sort sequence is not *LANGIDSHR or *LANGIDUNQ.
RDB_CONNECTION_METHOD	RDBCNNMTH	VARCHAR(4)	Specifies the semantics used for CONNEC statements:
			*RUW CONNECT (Type 1) semantics as used to support remote unit of work.
			*DUW CONNECT (Type 2) semantics as used to support distributed unit work.

SYSPACKAGESTAT

| Table 135. SYSPACKAGESTAT view (continued)

Column Name	System Column Name	Data Type	Description	
DECRESULT_MAXIMUM_PRECISION	DECMAXPRC	SMALLINT	Specifies	the maximum precision.
			31	The maximum precision is 31.
			63	The maximum precision is 63.
DECRESULT_MAXIMUM_SCALE	DECMAXSCL	SMALLINT	positions	imum scale (number of decimal to the right of the decimal point) ald be returned for result data type:
DECRESULT_MINIMUM_DIVIDE_SCALE	DECMINDIV	SMALLINT	The minimum divide scale (number of decimal positions to the right of the decir point) that should be returned for both intermediate and result data types.	
DECFLOAT_ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates	the DECFLOAT rounding mode:
		Nullable	CEILING	G ROUND_CEILING
			DOWN	ROUND_DOWN
			FLOOR	ROUND_FLOOR
			HALFDO	DWN ROUND_HALF_DOWN
			HALFEV	'EN ROUND_HALF_EVEN
			HALFUF	ROUND_HALF_UP
			UP	ROUND_UP
DECFLOAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates returned.	whether DECFLOAT warnings are
			NO	DECFLOAT warnings are not returned.
			YES	DECFLOAT warnings are returned.
SQLPATH	SQLPATH	VARCHAR(3483)	Identifies	s the SQL path.
		Nullable	Contains specified	the null value if an SQL path is no.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP		stamp of the last time the package
		Nullable		l. If the package has never been ntains null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the package was used since the last time the usage statistics were reset. If the package has never been used since the last time the usage statistics were reset, contains 0.	
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP	statistics	stamp of the last time the usage were reset. If the statistics have
CVCTEM DACKAGE NAME	CVC NIANTE	Nullable		en reset, contains null.
SYSTEM_PACKAGE_NAME SYSTEM_PACKAGE_SCHEMA	SYS_NAME SYS_DNAME	CHAR(10)		name of the package.
SYSTEM_PACKAGE_SCHEMA	SYS_DNAME	CHAR(10)	package.	ame of the schema containing the
IASP_NUMBER	IASPNUMBER	SMALLINT		the independent auxiliary storage SP) number.

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SYSPARMS

The SYSPARMS table contains one row for each parameter of a procedure created by the CREATE PROCEDURE statement or function created by the CREATE FUNCTION statement. The result of a scalar function and the result columns of a table function are also returned.

The following table describes the columns in the SYSPARMS table:

Table 136. SYSPARMS table

Column Name	System Column Name	Data Type	Description	
SPECIFIC_SCHEMA	SPECSCHEMA	VARCHAR(128)	Schema name of the routine instance.	
SPECIFIC_NAME	SPECNAME	VARCHAR(128)	Specific name of the routine instance.	
ORDINAL_POSITION	PARMNO	INTEGER	Numeric place of the parameter in the parameter list, ordered from left to right from 1 (leftmost parameter) to <i>n</i> (<i>n</i> th parameter).	
			For scalar functions, the result of the function has a value of $n+1$.	
			For table functions, the result columns are numbered from $n+1$ (leftmost result column) to $n+m$ (m th result column).	
PARAMETER_MODE	PARMMODE	VARCHAR(5)	Type of the parameter:	
			IN This is an input parameter.	
			OUT This is an output parameter.	
			INOUT This is an input/output parameter.	
PARAMETER_NAME	PARMNAME	VARCHAR(128)	Name of the parameter.	
		Nullable	Contains the null value if the parameter does not have a name.	

SYSPARMS

Table 136. SYSPARMS table (continued)

Column Name	System Colum Name	n Data Type	Description
DATA_TYPE	DATA_TYPE	VARCHAR(128)	Type of column:
			BIGINT Big number
			INTEGER
			Large number
			SMALLINT Small number
			DECIMAL Packed decimal
			NUMERIC Zoned decimal
			DOUBLE PRECISION Floating point; DOUBLE PRECISION
			REAL Floating point; REAL
			DECFLOAT Decimal floating-point
			CHARACTER Fixed-length character string
			CHARACTER VARYING Varying-length character string
			CHARACTER LARGE OBJECT Character large object string
			GRAPHIC Fixed-length graphic string
			GRAPHIC VARYING Varying-length graphic string
			DOUBLE-BYTE CHARACTER LARGE OBJECT
			Double-byte character large objestring
			BINARY Fixed-length binary string
			BINARY VARYING Varying-length binary string
			BINARY LARGE OBJECT Binary large object string
			DATE Date
			TIME Time
			TIMESTAMP Timestamp
			DATALINK Datalink
			ROWID Row ID
			DISTINCT Distinct type
NUMERIC_SCALE	SCALE	INTEGER	Scale of numeric data.
		Nullable	Contains the null value if the parameter is not decimal, numeric, or binary.

Table 136. SYSPARMS table (continued)

Column Name	System Colum Name	n Data Type	Description
NUMERIC_PRECISION	PRECISION	INTEGER Nullable	The precision of all numeric parameters. Note: This column supplies the precision of all numeric data types, including decimal floating-point and single-and double-precision floating point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.
			Contains the null value if the parameter is not numeric.
CCSID	CCSID	INTEGER Nullable	The CCSID value for CHAR, VARCHAR, CLOB, DATE, TIME, TIMESTAMP, GRAPHIC, VARGRAPHIC, DBCLOB and DATALINK parameters.
			A CCSID of 0 indicates that the CCSID of the job at run time is used.
			Contains the null value if the parameter is numeric.
CHARACTER_MAXIMUM_LENGTH	CHARLEN	INTEGER	Maximum length of the string for binary, character, and graphic string data types.
		Nullable	Contains the null value if the parameter is not a string.
CHARACTER_OCTET_LENGTH	CHARBYTE	INTEGER	Number of bytes for binary, character, and graphic string data types.
		Nullable	Contains the null value if the parameter is not a string.
NUMERIC_PRECISION_RADIX	RADIX	INTEGER	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or decimal digits:
		Nullable	 Binary; floating-point precision is specified in binary digits.
			Decimal; all other numeric types are specified in decimal digits.
			Contains the null value if the parameter is not numeric.
DATETIME_PRECISION	DATPRC	INTEGER	The fractional part of a date, time, or timestamp.
		Nullable	0 For DATE and TIME data types
			6 For TIMESTAMP data types (number of microseconds).
			Contains the null value if the parameter is not date, time, or timestamp.
IS_NULLABLE	NULLS	VARCHAR(3)	Indicates whether the parameter is nullable.
			NO The parameter does not allow nulls.
			YES The parameter does allow nulls.
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
		Nullable	Contains the null value if there is no long comment.

SYSPARMS

Table 136. SYSPARMS table (continued)

Column Name	System Column Name	Data Type	Description	
ROW_TYPE	ROWTYPE	CHAR(1)	Indicat	tes the type of row.
		Nullable	P	Parameter.
		Nullable	R	If the function is a table function, this indicates a result column. Otherwise, the result before casting.
			С	Result after casting.
DATA_TYPE_SCHEMA	TYPESCHEMA	VARCHAR(128)	Schem type.	a of the data type if this is a distinct
		Nullable	Nullable Contains the null value not a distinct type.	
DATA_TYPE_NAME	TYPENAME	VARCHAR(128)	Name of the data type if this is a distinct type.	
		Nullable	Contains the null value if the parameter is not a distinct type.	
AS_LOCATOR	ASLOCATOR	VARCHAR(3)	Indicates whether the parameter was specified as a locator.	
			NO	The parameter was not specified as a locator.
			YES	The parameter was specified as a locator.
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number.	
NORMALIZE_DATA	NORMALIZE	VARCHAR(3) Nullable	should	tes whether the parameter value be normalized or not. This attribute pplies to UTF-8 and UTF-16 data.
			NO	The value should not be normalized.
			YES	The value should be normalized.

The SYSPARTITIONINDEXES view contains one row for every index built over a table partition or table member. If the table is a distributed table, the indexes over partitions that reside on other database nodes are not contained in this catalog view. They are contained in the catalog views of the other database nodes.

Use this view when you want to see index information for indexes built on a specified table or set of tables. The information is similar to that returned via Show Indexes in System i Navigator.

The following table describes the columns in the SYSPARTITIONINDEXES view:

Table 137. SYSPARTITIONINDEXES view

Column name	System Column Name	Data Type	Description
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.
INDEX_NAME	INDNAME	VARCHAR(128)	Name of the index, logical file, or constraint If the index type indicates one or more temporary indexes, INDEX_NAME contains the number of maintained temporary indexes that currently exist on the table followed by the string 'MAINTAINED TEMPORARY INDEXES'.
INDEX_TYPE	INDTYPE	VARCHAR(11)	The type of the index:
			INDEX The index is an SQL index.
			LOGICAL The index is part of a logical file.
			PHYSICAL The index is a part of a keyed physical file.
			PRIMARY KEY The index is a primary key constraint.
			UNIQUE The index is a unique constraint.
			REFERENTIAL The index is a foreign key constraint.
			TEMPORARY Indicates one or more temporary indexes exist on the table.
INDEX_SCHEMA	INDSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the index, logical file, or constraint. Contains
		Nullable	null if the row indicates one or more maintained temporary indexes.
INDEX_OWNER	INDOWNER	VARCHAR(128)	Index owner. Contains null if the row indicates one or more maintained temporary
		Nullable	indexes.
SYSTEM_INDEX_SCHEMA	SYS_IXDNAM	CHAR(10)	System index schema name. Contains null unless the index type is INDEX or
		Nullable	LOGICAL.

Table 137. SYSPARTITIONINDEXES view (continued)

Column name	System Column Name	Data Type	Description
SYSTEM_INDEX_NAME	SYS_IXNAME	CHAR(10) Nullable	System index name. Contains null unless the index type is INDEX or LOGICAL.
INDEX_TEXT	LABEL	VARGRAPHIC(50) CCSID 1200	Text of the index, logical file, or constraint. Contains null if text does not exist for the index.
		Nullable	
INDEX_PARTITION	INDMEMBER	VARCHAR(128)	Partition or member name of the index. Contains null if the row indicates one or
		Nullable	more maintained temporary indexes.
INDEX_VALID	VALID	VARCHAR(3)	An indication or whether the index is invalid and needs to be rebuilt:
			NO The index is invalid.
			YES The index is valid.
CREATE_TIMESTAMP	CREATED	TIMESTAMP	The timestamp when the index was created. Contains null if the row indicates one or
		Nullable	more maintained temporary indexes.
LAST_BUILD_TIMESTAMP	LASTBUILD	TIMESTAMP	The timestamp when the index was last rebuilt. Contains null if the row indicates
		Nullable	one or more maintained temporary indexes.
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP	The timestamp of the last time the index was used in a query since the last time the
		Nullable	usage statistics were reset. If the index has never been used in a query since the last time the usage statistics were reset or if the row indicates one or more maintained temporary indexes, contains null.
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP	The timestamp of the last time the index was used by the optimizer for statistics since
		Nullable	the last time the usage statistics were reset. If the index has never been used for statistics since the last time the usage statistics were reset or if the row indicates one or more maintained temporary indexes, contains null.
QUERY_USE_COUNT	QRYUSECNT	BIGINT	The number of times the index was used in a query since the last time the usage statistics were reset. If the index has never been used in a query since the last time the usage statistics were reset, contains 0.
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	The number of times the index was used by the optimizer for statistics since the last time the usage statistics were reset. If the index has never been used for statistics since the last time the usage statistics were reset, contains 0.
LAST_USED_TIMESTAMP		TIMESTAMP	The timestamp of the last time the index
		Nullable	was used directly by an application for native record I/O or SQL operations. If the index has never been used or if the row indicates one or more maintained temporary indexes, contains null.

1 Table 137. SYSPARTITIONINDEXES view (continued)

Column name	System Column Name	Data Type	Description	
	DAYSUSED	INTEGER		
DAYS_USED_COUNT	DATSUSED	INTEGER	The number of days the index was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If the index has never been used since the last time the usage statistics were reset, contains 0.	
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	The timestamp of the last time the usage statistics were reset for the index. For more information see the Change Object Description (CHGOBJD) command. If the index's last used timestamp has never been reset, contains null.	
NUMBER_KEY_COLUMNS	INDKEYS	BIGINT Nullable	Number of columns that define the index key. Contains null if the row indicates one or more maintained temporary indexes.	
 COLUMN_NAMES	COLNAMES			
COLUMN_INAMES	COLINAIMES	VARCHAR(1024) Nullable	A comma separated list of column names that define the index key. If the length of al the column names exceeds 1024, '' is returned at the end of the column value. Contains null if the row indicates one or more maintained temporary indexes.	
NUMBER_KEYS	NUMRIDS	BIGINT	Number of keys in the index. If the index is invalid or is an encoded vector index, -1 is	
		Nullable	returned. Contains null if the row indicates one or more maintained temporary indexes	
INDEX_SIZE	SIZE	BIGINT	Size (in bytes) of the binary tree or encod vector index of the index.	
NUMBER_PAGES	PAGES	BIGINT	Number of pages in the index. If the inde is invalid or is an encoded vector index,	
		Nullable	contains null.	
LOGICAL_PAGE_SIZE	PAGE_SIZE	INTEGER Nullable	The logical page size of the index. If the index is an encoded vector index or if the row indicates one or more maintained temporary indexes, contains null.	
UNIQUE	UNIQUE	VARCHAR(21)	Indicates whether an index is unique:	
		Nullable	UNIQUE The index is a UNIQUE index.	
			UNIQUE WHERE NOT NULL The index is a UNIQUE WHERE NOT NULL index.	
			FIFO The index is a non-unique first-in-first-out (FIFO) index.	
			LIFO The index is a non-unique last-in-last-out (LIFO) index.	
			FCFO The index is a non-unique first-change-first-out (FCFO) index	
			Contains null if the row indicates one or more maintained temporary indexes.	
MAXIMUM_KEY_LENGTH	KEY_LENGTH	INTEGER	Maximum key length of an index. If the index is an encoded vector index, contains	
IN HOLE BARRIES AND THE STATE OF THE STATE O	I/TV/C: TTC	Nullable	null.	
UNIQUE_PARTIAL_KEY_VALUES	KEYCARDS	VARCHAR(96)	The unique partial key values for the index. If the index is an encoded vector index or one or more maintained temporary indexes,	
		Nullable	contains null.	

1 Table 137. SYSPARTITIONINDEXES view (continued)

Column name	System Column Name	Data Type	Descrip	otion
OVERFLOW_VALUES	OVERFLOW	INTEGER Nullable	overflo	mber of distinct key values that have wed the encoded vector index. If the s not an encoded vector index, s null.
EVI_CODE_SIZE	CODE_SIZE	INTEGER		e of the byte code of the encoded index. If the index is not an encoded
		Nullable	vector i	index, contains null.
SPARSE	SPARSE	VARCHAR(3)		es whether the index contains keys the rows of its depended on table:
		Nullable	NO	The index contains keys for all the rows of its depended on table.
				The index is a select/omit logical file or an SQL index with a WHERE clause and does not contain keys for all the rows of its depended on table. Is null if the row indicates one or naintained temporary indexes.
DERIVED_KEY	DERIVED	VARCHAR(3)		es whether the any key columns in ex are expressions:
		Nullable	NO	No key columns of the index are expressions.
			YES	At least one key column is an
				expression. ns null if the row indicates one or naintained temporary indexes.
PARTITIONED	PARTITION	VARCHAR(20)		es whether the index is partitioned or titioned:
		Nullable	NO	An SQL index is not partitioned (spans multiple partitions).
			YES	The index is not built over a partitioned table or built over a partitioned table and is partitioned (does not span multiple partitions or members).
			Contair	The index is a logical file built over multiple partitions or members. In multiple partitions or members. In multiple partitions or members. In multiple partitions or members.
ACCPTH_TYPE	ACCPTHTYPE	VARCHAR(4)	Indicate	es the type of index:
		Nullable	1 TB	The index is a maximum 1 terabyte (*MAX1TB) binary radix index.
			4 GB	The index is a maximum 4 gigabyte (*MAX4GB) binary radix index.
				The index is an encoded vector index. s null if the row indicates one or naintained temporary indexes.

1 Table 137. SYSPARTITIONINDEXES view (continued)

Column name	System Columr Name	n Data Type	Description
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the index uses a collating sequence:
		Nullable	BY HEX VALUE The index does not use a collating table.
			*LANGIDSHR The index uses a shared weight sort sequence (SRTSEQ).
			*LANGIDUNQ The index uses a unique weight sort sequence (SRTSEQ).
			collating-sequence-table The index uses an alternate collating sequence (ALTSEQ). Contains null if the row indicates one or more maintained temporary indexes.
LANGUAGE_IDENTIFIER	LANGID	CHAR(3) Nullable	The language ID of the index. Contains null if the sort sequence is hex or if the row indicates one or more maintained temporary indexes.
ESTIMATED_BUILD_TIME	ESTBLDTIME	INTEGER Nullable	Estimated time (in milliseconds) required to rebuild the index. Contains null if the row indicates one or more maintained temporary indexes.
INDEX_HELD	HELD	VARCHAR(3)	An indication or whether a pending rebuild of the index is currently held by the user:
			NO A rebuild of the index is not pending or is not held.
			YES A pending rebuild of the index is held.
MAINTENANCE	MAINT	VARCHAR(11)	The maintenance of the index:
		Nullable	REBUILD The index is not maintained and i rebuilt at open time.
			DELAYED The index maintenance is delayed until the index is opened.
			DO NOT WAIT The index is immediately maintained. If the index is an encoded vector index or if the row indicates one or more maintained temporary indexes, contains null.
DELAYED_MAINT_KEYS	DLYKEYS	INTEGER	Number of keys that need to be inserted into the binary tree of a delayed
		Nullable	maintenance index. If the index is not a delayed maintenance index, contains null.

1 Table 137. SYSPARTITIONINDEXES view (continued)

Column name	System Column Name	Data Type	Description
RECOVERY	RECOVERY	VARCHAR(10)	The recovery attribute of the index:
		Nullable	DURING IPL The index is recovered, if necessary, at IPL.
			AFTER IPL The index is recovered, if necessary, after IPL.
			NEXT OPEN The index is recovered, if necessary, on the next open. If the index is an encoded vector index or if the row indicates one or more maintained temporary indexes, contains null.
ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates the DECFLOAT rounding mode of the index:
		Nullable	CEILING ROUND_CEILING
			DOWN ROUND_DOWN
			FLOOR ROUND_FLOOR
			HALFDOWN ROUND_HALF_DOWN
			HALFEVEN ROUND_HALF_EVEN
			HALFUP ROUND_HALF_UP
			UP ROUND_UP
			Contains the null value if the index does not have an expression that references a DECFLOAT column, function, or constant; or if the row indicates one or more maintained temporary indexes.
DECFLOAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates whether DECFLOAT warnings are returned:
		Nullable	NO DECFLOAT warnings are not returned.
			YES DECFLOAT warnings are returned.
			Contains the null value if the index does not have an expression that references a DECFLOAT column, function, or constant; or if the row indicates one or more maintained temporary indexes.
LOGICAL_READS	LGLREADS	BIGINT Nullable	Number of logical read operations for the index since the last IPL. Contains null if the row indicates one or more maintained
			temporary indexes.
SEARCH_CONDITION	IXWHERECON	VARGRAPHIC(1024) CCSID 1200	If an index is sparse, the search condition of the index. If the length of the search condition exceeds 1024, '' is returned at the
		Nullable	end of the column value. Contains null if

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Table 137. SYSPARTITIONINDEXES view (continued)

 	Column name	System Column Name	Data Type	Descript	tion
	SEARCH_CONDITION_HAS_UDF	IXWHEREUDF	VARCHAR(3) Nullable	search co user-def	lex is sparse, indicates whether the ondition of the index contains a ined function. Contains null if the not sparse.
				NO	The index search condition does not contain a UDF.
				YES	The index search condition contains a UDF.
I	SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System s	schema name.
I	SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System t	table name.
	SYSTEM_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System 1	member name.

SYSPARTITIONINDEXSTAT

The SYSPARTITIONINDEXSTAT view contains one row for every index built over a table partition or table member. If the table is a distributed table, the indexes over partitions that reside on other database nodes are not contained in this catalog view. They are contained in the catalog views of the other database nodes.

The following table describes the columns in the SYSPARTITIONINDEXSTAT view:

Table 138. SYSPARTITIONINDEXSTAT view

Column name	System Column Name	Data Type	Description
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.
PARTITION_TYPE	PARTTYPE	CHAR(1)	The type of the table partitioning:
			blank The table is not partitioned.
			H This is data hash partitioning.
			R This is data range partitioning.
			D This is distributed database hash partitioning.
PARTITION_NUMBER	PARTNBR	INTEGER	The partition number of this partition. If the table is a distributed table, contains null.
		Nullable	
NUMBER_DISTRIBUTED_PARTITIONS	DSTPARTS	INTEGER	If the table is a distributed table, contains the total number of partitions. If the table is
		Nullable	not a distributed table, contains null.
INDEX_SCHEMA	INDSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the index, logical file, or constraint.
INDEX_NAME	INDNAME	VARCHAR(128)	Name of the index, logical file, or constraint
INDEX_MEMBER	INDMEMBER	VARCHAR(128)	Name of the member of the index or logical file. If the index type is a constraint, the
		Nullable	member name is null.
INDEX_TYPE	INDTYPE	VARCHAR(11)	The type of the index:
			INDEX The index is an SQL index.
			LOGICAL The index is part of a logical file.
			PHYSICAL The index is part of a keyed physical file.
			PRIMARY KEY The index is a primary key constraint.
			UNIQUE
			The index is a unique constraint.
			REFERENTIAL The index is a foreign key constraint.
NUMBER_KEY_COLUMNS	INDKEYS	BIGINT	Number of columns that define the index key.

Table 138. SYSPARTITIONINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
COLUMN_NAMES	COLNAMES	VARCHAR(1024)	A comma separated list of column names that define the index key. If the length of all the column names exceeds 1024, '' is returned at the end of the column value.
NUMBER_LEAF_PAGES	NLEAF	BIGINT	Not applicable for DB2 for i. Will always be -1.
NUMBER_LEVELS	NLEVELS	SMALLINT	Not applicable for DB2 for i. Will always be -1.
FIRSTKEYCARD	KEYCARD1	BIGINT	Number of distinct first key values. If the index is an encoded vector index, -1 is returned.
FIRST2KEYCARD	KEYCARD2	BIGINT	Number of distinct keys using the first two columns of the index. If the index is an encoded vector index, -1 is returned.
FIRST3KEYCARD	KEYCARD3	BIGINT	Number of distinct keys using the first three columns of the index. If the index is an encoded vector index, -1 is returned.
FIRST4KEYCARD	KEYCARD4	BIGINT	Number of distinct keys using the first four columns of the index. If the index is an encoded vector index, -1 is returned.
FULLKEYCARD	KEYCARDF	BIGINT	Number of distinct full key values. If the index has more than 4 key columns or is an encoded vector index, -1 is returned.
CLUSTERRATIO	CLSRATIO	SMALLINT	Not applicable for DB2 for i. Will always be -1.
CLUSTERFACTOR	CLSFACTOR	DOUBLE	Not applicable for DB2 for i. Will always be -1.
SEQUENTIAL_PAGES	SEQPAGES	BIGINT	Not applicable for DB2 for i. Will always be -1.
DENSITY	DENSITY	INTEGER	Not applicable for DB2 for i. Will always be -1.
PAGE_FETCH_PAIRS	FETCHPAIRS	VARCHAR(520)	Not applicable for DB2 for i. Will always be an empty string.
NUMBER_KEYS	NUMRIDS	BIGINT	Number of keys in the index. If the index is invalid or is an encoded vector index, -1 is returned.
NUMRIDS_DELETED	NUMRIDSDLT	BIGINT	Not applicable for DB2 for i. Will always be 0.
NUM_EMPTY_LEAFS	EMPTYLEAFS	BIGINT	Not applicable for DB2 for i. Will always be 0.
AVERAGE_RANDOM_FETCH_PAGES	AVGRNDFTCH	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_RANDOM_PAGES	AVGRNDPAGE	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_GAP	AVGSEQGAP	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_FETCH_GAP	AVGSEQFGAP	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_PAGES	AVGSEQPAGE	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_FETCH_PAGES	AVGSEQFPAG	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVGPARTITION_CLUSTERRATIO	PCLSRATIO	SMALLINT	Not applicable for DB2 for i. Will always be -1.

SYSPARTITIONINDEXSTAT

Table 138. SYSPARTITIONINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
AVGPARTITION_CLUSTERFACTOR	PCLSFACTOR	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVGPARTITION_PAGE_FETCH_PAIRS	PFETCHPAIR	VARCHAR(520)	Not applicable for DB2 for i. Will always be an empty string.
DATAPARTITION_CLUSTERFACTOR	DCLSFACTOR	DOUBLE	A statistic measuring the "clustering" of the index keys with regard to data partitions. It is a number between 0 and 1, with 1 representing perfect clustering and 0 representing no clustering.
INDCARD	INDCARD	BIGINT	Number of keys in the index. If the index is invalid or is an encoded vector index, -1 is returned.
INDEX_VALID	VALID	CHAR(1)	An indication or whether the index is invalid and needs to be rebuilt:
			0 The index is invalid.
			1 The index is valid.
INDEX_HELD	HELD	CHAR(1)	An indication or whether a pending rebuild of the index is currently held by the user:
			O A rebuild of the index is not pending or is not held.
			1 A pending rebuild of the index is held.
CREATE_TIMESTAMP	CREATED	TIMESTAMP	The timestamp when the index was created.
LAST_BUILD_TIMESTAMP	LASTBUILD	TIMESTAMP	The timestamp when the index was last rebuilt.
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP Nullable	The timestamp of the last time the index was used in a query since the last time the usage statistics were reset. If the index has never been used in a query since the last time the usage statistics were reset, contains null.
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP	The timestamp of the last time the index
		Nullable	was used by the optimizer for statistics since the last time the usage statistics were reset. If the index has never been used for statistics since the last time the usage statistics were reset, contains null.
QUERY_USE_COUNT	QRYUSECNT	BIGINT	The number of times the index was used in a query since the last time the usage statistics were reset. If the index has never been used in a query since the last time the usage statistics were reset, contains 0.
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	The number of times the index was used by the optimizer for statistics since the last time the usage statistics were reset. If the index has never been used for statistics since the last time the usage statistics were reset, contains 0.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP	The timestamp of the last time the index was used directly by an application for
		Nullable	native record I/O or SQL operations. If the index has never been used, contains null.

Table 138. SYSPARTITIONINDEXSTAT view (continued)

Column name	System Columr Name	n Data Type	Descr	iption
DAYS_USED_COUNT	DAYSUSED	INTEGER	direct I/O o the us has no	umber of days the index was used ly by an application for native record r SQL operations since the last time sage statistics were reset. If the index ever been used since the last time the statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	statist inforn Descri index'	mestamp of the last time the usage ics were reset for the index. For more nation see the Change Object iption (CHGOBJD) command. If the 's last used timestamp has never been
INDEX_SIZE	SIZE	BIGINT	Size (i	contains null. in bytes) of the binary tree or encoded index of the index.
ESTIMATED_BUILD_TIME	ESTBLDTIME	INTEGER	Estima	ated time (in milliseconds) required to d the index.
DELAYED_MAINT_KEYS	DLYKEYS	INTEGER Nullable	into tl	per of keys that need to be inserted the binary tree of a delayed enance index. If the index is not a
SPARSE	SPARSE	CHAR(1)	Indica	tes whether the index contains keys the rows of its depended on table:
			0	The index contains keys for all the rows of its depended on table.
			1	The index is a select/omit logical file or SQL index with a WHERE clause and does not contain keys for all the rows of its depended on table.
DERIVED_KEY	DERIVED	CHAR(1)		ttes whether the any key columns in dex are expressions:
			0	No key columns of the index are expressions.
			1	At least one key column is an expression. Currently, this is only possible in a DDS-created logical file or temporary index.
PARTITIONED	PARTITION	CHAR(1)		ites whether the index is partitioned or artitioned:
			0	An SQL index is not partitioned (spans multiple partitions).
			1	The index is not built over a partitioned table or built over a partitioned table and is partitioned (does not span multiple partitions or members).
			2	The index is a logical file built over multiple partitions or members.

SYSPARTITIONINDEXSTAT

Table 138. SYSPARTITIONINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Descri	ption
ACCPTH_TYPE	ACCPTHTYPE	CHAR(1)	Indicat	res the type of index:
			0	The index is a maximum 1 terabyte (*MAX1TB) binary radix index.
			1	The index is a maximum 4 gigabyte (*MAX4GB) binary radix index.
			2	The index is an encoded vector index.
UNIQUE	UNIQUE	CHAR(1)	Indicat	es whether an index is unique:
			0	The index is a UNIQUE index.
			1	The index is a UNIQUE WHERE NOT NULL index.
			2	The index is a non-unique first-in-first-out (FIFO) index.
			3	The index is a non-unique last-in-last-out (LIFO) index.
			4	The index is a non-unique first-change-first-out (FCFO) index.
SRTSEQ_TYPE	SRTSEQ	CHAR(1)	Indicat sequen	es whether the index uses a collating ice:
			0	The index does not use a collating table.
			1	The index uses an alternate collating sequence (ALTSEQ).
			2	The index uses a sort sequence (SRTSEQ).
LOGICAL_PAGE_SIZE	PAGE_SIZE	INTEGER	index i	gical page size of the index. If the s an encoded vector index, contains
		Nullable	null.	
OVERFLOW_VALUES	OVERFLOW	INTEGER		imber of distinct key values that have wed the encoded vector index. If the
		Nullable		s not an encoded vector index, ns null.
EVI_CODE_SIZE	CODE_SIZE	INTEGER	vector	te of the byte code of the encoded index. If the index is not an encoded index contains well
		Nullable		index, contains null.
LOGICAL_READS	LGLREADS	BIGINT		er of logical read operations for the since the last IPL.
PHYSICAL_READS	PHYREADS	BIGINT	Not ap	plicable for DB2 for i. Will always be
SEARCH_CONDITION	IXWHERECON	VARGRAPHIC(1024) CCSID 1200	the ind	ndex is sparse, the search condition of lex. If the length of the search on exceeds 1024, '' is returned at the the column value.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System	schema name.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System	table name.
SYSTEM_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System	member name.

SYSPARTITIONMQTS

The SYSPARTITIONMQTS view contains one row for every materialized table built over a table partition or table member. If the table is a distributed table, the materialized tables over partitions that reside on other database nodes are not contained in this catalog view. They are contained in the catalog views of the other database nodes.

Use this view when you want to see materialized query table information for materialized tables built on a specified table or set of tables. The information is similar to that returned via Show Materialized Query Tables in System i Navigator.

The following table describes the columns in the SYSPARTITIONMQTS view:

Table 139. SYSPARTITIONMQTS view

Column name	System Column Name	Data Type	Description
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.
MQT_NAME	MQTNAME	VARCHAR(128)	Name of the materialized query table.
MQT_SCHEMA	MQTSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the materialized query table.
MQT_PARTITION	MQTMEMBER	VARCHAR(128)	Partition or member name of the materialized query table.
MQT_OWNER	MQTOWNER	VARCHAR(128)	Materialized query table owner.
SYSTEM_MQT_SCHEMA	SYS_MQDNAM	CHAR(10)	System materialized query table schema name.
SYSTEM_MQT_NAME	SYS_MQNAME	CHAR(10)	System materialized query table name.
ENABLED	ENABLED	VARCHAR(3)	An indication or whether the materialized query table is enabled:
			NO The materialized query table is not enabled for use.
			YES The materialized query table is enabled for use by the database manager.
CREATE_TIMESTAMP	CREATED	TIMESTAMP	The timestamp when the materialized query table was created.
REFRESH_TIME	REFRESHDTS	TIMESTAMP	The timestamp when the materialized query table was last refreshed. Contains null if the
		Nullable	materialized query table has never been refreshed.
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP	The timestamp of the last time the materialized query table was used in a
		Nullable	query since the last time the usage statistics were reset. If the materialized query table has never been used in a query since the last time the usage statistics were reset, contains null.
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP	The timestamp of the last time the materialized query table was used by the
		Nullable	optimizer for statistics since the last time the usage statistics were reset. If the materialized query table has never been used for statistics since the last time the usage statistics were reset, contains null.

SYSPARTITIONMQTS

Table 139. SYSPARTITIONMQTS view (continued)

Column name	System Columr Name	n Data Type	Description
QUERY_USE_COUNT	QRYUSECNT	BIGINT	The number of times the materialized query table was used in a query since the last time the usage statistics were reset. If the materialized query table has never been used in a query since the last time the usage statistics were reset, contains 0.
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	The number of times the materialized query table was used by the optimizer for statistics since the last time the usage statistics were reset. If the materialized query table has never been used for statistics since the last time the usage statistics were reset, contains 0.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP Nullable	The timestamp of the last time the materialized query table was used directly by an application for native record I/O or SQL operations. If the materialized query table has never been used, contains null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the materialized query table was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If the materialized query table has never been used since the last time the usage statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	The timestamp of the last time the usage statistics were reset for the materialized query table. For more information see the Change Object Description (CHGOBJD) command. If the materialized query table's last used timestamp has never been reset, contains null.
NUMBER_ROWS	CARD	BIGINT	Number of rows in the materialized query table.
MQT_SIZE	SIZE	BIGINT	Size (in bytes) of the materialized query table.
LAST_CHANGE_TIMESTAMP	LASTCHG	TIMESTAMP Nullable	The timestamp of the last time the materialized query table was changed. If the materialized query table has never been changed since the last time the usage
MAINTENANCE	MAINTAIN	VARCHAR(6)	statistics were reset, contains null. Indicates the maintenance for the
			materialized query table:
			SYSTEM The materialized query table is system maintained.
			USER The materialized query table is user maintained.

Table 139. SYSPARTITIONMQTS view (continued)

 Column name	System Colum Name	n Data Type	Description
I INITIAL_DATA	INITIAL	VARCHAR(19)	Indicates the initial data for the materialized query table:
 			INITIALLY DEFERRED Data is not inserted into the materialized query table when it is created.
 			INITIALLY IMMEDIATE Data is inserted into the materialized query table when it is created.
REFRESH	REFRESH	VARCHAR(9)	Indicates when the data in the materialized query table can be refreshed:
 			Deferred Data in the materialized query table can be refreshed at any time using the REFRESH TABLE statement.
 			IMMEDIATE Data in the materialized query table is immediately refreshed.
ISOLATION	ISOLATION	VARCHAR(27)	Indicates the isolation level used to refresh the materialized query table:
 			NO COMMIT The isolation level is NO COMMIT.
 			UNCOMMITTED READ The isolation level is UNCOMMITTED READ.
 			CURSOR STABILITY The isolation level is CURSOR STABILITY.
 			CURSOR STABILITY KEEP LOCKS The isolation level is CURSOR STABILITY KEEP LOCKS.
 			READ STABILITY The isolation level is READ STABILITY.
 			REPEATABLE READ The isolation level is REPEATABLE READ.

SYSPARTITIONMQTS

Table 139. SYSPARTITIONMQTS view (continued)

Column name	System Columi Name	ı Data Type	Description
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the materialize query table uses a collating sequence:
			BY HEX VALUE The materialize query table does not use a collating table.
			*LANGIDSHR The materialize query table uses shared weight sort sequence (SRTSEQ).
			*LANGIDUNQ The materialize query table uses unique weight sort sequence (SRTSEQ).
			collating-sequence-table The materialize query table uses an alternate collating sequence (ALTSEQ).
LANGUAGE_IDENTIFIER	LANGID	CHAR(3) Nullable	The language ID of the materialize query table. Contains null if the sort sequence is hex.
MQT_RESTORE_DEFERRED	MQTRSTDFR	VARCHAR(3)	An indication of whether a restore of the MQT is pending the restore of one of its dependents:
			NO The restore of the MQT is not deferred pending the restore of one of its dependent tables.
			YES The restore of the MQT is deferred pending the restore of one of its dependent tables.
ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates the DECFLOAT rounding mode of the materialized query table:
		Nullable	CEILING
			ROUND_CEILING
			DOWN ROUND_DOWN
			FLOOR ROUND_FLOOR
			HALFDOWN ROUND_HALF_DOWN
			HALFEVEN ROUND_HALF_EVEN
			HALFUP ROUND_HALF_UP
			UP ROUND_UP
			Contains the null value if the materialized query table does not have an expression the references a DECFLOAT column, function, or constant.

SYSPARTITIONMQTS

1 Table 139. SYSPARTITIONMQTS view (continued)

Columr	n name	System Column Name	Data Type	Descrip	tion
DECFLO	OAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates whether DECFLOAT warnings a returned:	
			Nullable	NO	DECFLOAT warnings are not returned.
				YES	DECFLOAT warnings are returned.
				query ta	s the null value if the materialized able does not have an expression that es a DECFLOAT column, function, ant.
MQT_D	DEFINITION	MQTDEF	VARGRAPHIC(5000) CCSID 1200	The query of the materialized query table. the length of the query exceeds 5000, '' is returned at the end of the column value.	
MQT_T	EXT	LABEL	VARGRAPHIC(50) CCSID 1200	Text of the materialized query table. Contains null if text does not exist for the materialized query table.	
			Nullable		
SYSTEN	/_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System	schema name.
SYSTEN	/_TABLE_NAME	SYS_TNAME	CHAR(10)	System	table name.
SYSTEN	/_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System	member name.

SYSPARTITIONSTAT

The SYSPARTITIONSTAT view contains one row for every table partition or table member. If the table is a distributed table, the partitions that reside on other database nodes are not contained in this catalog view. They are contained in the catalog views of the other database nodes.

The following table describes the columns in the SYSPARTITIONSTAT view:

Table 140. SYSPARTITIONSTAT view

Column name	System Column Name	Data Type	Description	
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.	
TABLE_PARTITION	TABPART	VARCHAR(128)	Name of the table partition or member.	
PARTITION_TYPE	PARTTYPE	CHAR(1)	The type of the table partitioning:	
			blank The table is not partitioned.	
			H This is data hash partitioning.	
			R This is data range partitioning.	
			D This is distributed database hash partitioning.	
PARTITION_NUMBER	PARTNBR	INTEGER	The partition number of this partition. If	
		Nullable	the table is a distributed table, contains null.	
NUMBER_DISTRIBUTED_PARTITIONS	DSTPARTS	INTEGER	If the table is a distributed table, contains	
		Nullable	the total number of partitions. If the table is not a distributed table, contains null.	
NUMBER_ROWS	CARD	BIGINT	Number of valid rows in the table partition or member.	
NUMBER_ROW_PAGES	NPAGES	BIGINT	Number of 64K pages in the partition's data.	
NUMBER_PAGES	FPAGES	BIGINT	Same as NUMBER_ROW_PAGES.	
OVERFLOW	OVERFLOW	BIGINT	The estimated number of rows that have overflowed to variable length segments. If the table does not contain variable length o LOB columns, contains 0.	
CLUSTERED	CLUSTERED	CHAR(1)	Not applicable for DB2 for i. Will always be null.	
		Nullable		
ACTIVE_BLOCKS	ACTBLOCKS	BIGINT	Not applicable for DB2 for i. Will always be -1.	
AVGCOMPRESSEDROWSIZE	ACROWSIZE	BIGINT	Not applicable for DB2 for i. Will always be -1.	
AVGROWCOMPRESSIONRATIO	ACROWRATIO	REAL	Not applicable for DB2 for i. Will always be -1.	
AVGROWSIZE	AVGROWSIZE	BIGINT	Average length (in bytes) of a row in this table. If the table has variable length or LOB columns, contains -1.	
PCTROWSCOMPRESSED	PCTCROWS	REAL	Not applicable for DB2 for i. Will always be -1.	
PCTPAGESSAVED	PCTPGSAVED	SMALLINT	Not applicable for DB2 for i. Will always be -1.	
NUMBER_DELETED_ROWS	DELETED	BIGINT	Number of deleted rows in the table partition or member.	

Table 140. SYSPARTITIONSTAT view (continued)

Column name	System Columi Name	ı Data Type	Description
DATA_SIZE	SIZE	BIGINT	Total size (in bytes) of the data space in the partition or member.
VARIABLE_LENGTH_SIZE	VLSIZE	BIGINT	Size (in bytes) of the variable-length data space segments in the partition or member.
FIXED_LENGTH_EXTENTS	FLEXTENTS	BIGINT	Number of fixed-length data space segment extents in the partition or member.
VARIABLE_LENGTH_EXTENTS	VLEXTENTS	BIGINT	Number of variable-length data space segment extents in the partition or member.
COLUMN_STATS_SIZE	CSTATSSIZE	BIGINT	Size (in bytes) of the column statistics in the partition or member.
MAINTAINED_TEMPORARY_INDEX_SIZE	MTISIZE	BIGINT	Size (in bytes) of all maintained temporary indexes over the partition or member.
NUMBER_DISTINCT_INDEXES	DISTINCTIX	INTEGER	The number of distinct indexes built over the partition or member. This does not include maintained temporary indexes.
OPEN_OPERATIONS	OPENS	BIGINT	Number of full opens of the partition or member since the last IPL.
CLOSE_OPERATIONS	CLOSES	BIGINT	Number of full closes of the partition or member since the last IPL.
INSERT_OPERATIONS	INSERTS	BIGINT	Number of inserts operations for the partition or member since the last IPL.
UPDATE_OPERATIONS	UPDATES	BIGINT	Number of update operations for the partition or member since the last IPL.
DELETE_OPERATIONS	DELETES	BIGINT	Number of delete operations for the partition or member since the last IPL.
CLEAR_OPERATIONS	DSCLEARS	BIGINT	Number of clear operations (CLRPFM operations) for the partition or member since the last IPL.
COPY_OPERATIONS	DSCOPIES	BIGINT	Number of data space copy operations (certain CPYxxx operations) for the partition or member since the last IPL.
REORGANIZE_OPERATIONS	DSREORGS	BIGINT	Number of data space reorganize operations (non-interruptible RGZPFM operations) for the partition or member since the last IPL.
INDEX_BUILDS	DSINXBLDS	BIGINT	Number of creates or rebuilds of indexes that reference the partition or member since the last IPL.
LOGICAL_READS	LGLREADS	BIGINT	Number of logical read operations for the partition or member since the last IPL.
PHYSICAL_READS	PHYREADS	BIGINT	Number of physical read operations for the partition or member since the last IPL.
LAST_CHANGE_TIMESTAMP	LASTCHG	TIMESTAMP	Timestamp of the last change that occurred to the partition or member.
LAST_SAVE_TIMESTAMP	LASTSAVE	TIMESTAMP Nullable	Timestamp of the last save of the partition or member. If the partition or member has never been saved, contains null.
LAST_RESTORE_TIMESTAMP	LASTRST	TIMESTAMP	Timestamp of the last restore of the
		Nullable	partition or member. If the partition or member has never been restored, contains null.

SYSPARTITIONSTAT

Table 140. SYSPARTITIONSTAT view (continued)

	System Column	3			
Column name	Name	Data Type	Description		
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP Nullable	Timestamp of the last time the partition or member was used directly by an application for native record I/O or SQL operations. If the partition or member has never been used, contains null.		
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the partition or member was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If the partition or member has never been used since the last time the usage statistics were reset, contains 0.		
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP Nullable	The timestamp of the last time the usage statistics were reset for the table. For more information see the Change Object Description (CHGOBJD) command. If the partition or member's last used timestamp has never been reset, contains null.		
NEXT_IDENTITY_VALUE	NEXTVALUE	DECIMAL(31,0) Nullable	The next identity value. In some cases, this value may be an estimate. If the table does not have an identity value, contains null.		
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name.		
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.		
SYSTEM_TABLE_MEMBER	SYS_MNAME	CHAR(10)	System member name.		

SYSPROCS

The SYSPROCS view contains one row for each procedure created by the CREATE PROCEDURE statement.

The following table describes the columns in the SYSPROCS view:

Table 141. SYSPROCS view

Column Name	System Column Name	Data Type	Description
SPECIFIC_SCHEMA	SPECSCHEMA	VARCHAR(128)	Schema name of the routine (procedure) instance.
SPECIFIC_NAME	SPECNAME	VARCHAR(128)	Specific name of the routine instance.
ROUTINE_SCHEMA	PROCSCHEMA	VARCHAR(128)	Name of the SQL schema (schema) that contains the routine.
ROUTINE_NAME	PROCNAME	VARCHAR(128)	Name of the routine.
ROUTINE_CREATED	RTNCREATE	TIMESTAMP	Identifies the timestamp when the routine was created.
ROUTINE_DEFINER	DEFINER	VARCHAR(128)	Name of the user that defined the routine.
ROUTINE_BODY	BODY	VARCHAR(8)	The type of the routine body:
			EXTERNAL This is an external routine. SQL This is an SQL routine.
EXTERNAL_NAME	EXTNAME	VARCHAR(279)	This column identifies the external program name.
		Nullable	• For ILE service programs, the external program name is <i>schema-name/service-program-name(entry-point-name)</i> .
			• For REXX, the external program name is <i>schema-name/source-file-name(member-name)</i> .
			• For Java programs, the external program name is an optional jar-id followed by a fully-qualified-class-name!method-name or fully-qualified-class-name.method-name.
			• For all other languages, the external program name is <i>schema-name/program-name</i> .

SYSPROCS

Table 141. SYSPROCS view (continued)

Column Name	System Column Name	ı Data Type	Descript	ion
EXTERNAL_LANGUAGE	LANGUAGE	VARCHAR(8)		an external routine, this column s the external program name.
		Nullable	С	The external program is written in C.
			C++	The external program is written in C++.
			CL	The external program is written in CL.
			COBOL	The external program is written in COBOL.
			COBOL	LE The external program is written in ILE COBOL.
			FORTR	AN The external program is written in FORTRAN.
			JAVA	The external program is written in JAVA.
			PLI	The external program is written in PL/I.
			REXX	The external program is a REXX procedure.
			RPG	The external program is written in RPG.
			RPGLE	The external program is written in ILE RPG.
			Contains external	the null value if this is not an routine.
PARAMETER_STYLE	PARM_STYLE	VARCHAR(7) Nullable		an external routine, this column is the parameter style (calling on).
			DB2GN	RL This is the DB2GENERAL calling convention.
			DB2SQI	This is the DB2SQL calling convention.
			GENER	AL This is the GENERAL calling convention.
			JAVA	This is the JAVA calling convention.
			NULLS	This is the GENERAL WITH NULLS calling convention.
			SQL	This is the SQL standard calling convention.
			Contains external	the null value if this is not an routine.

Table 141. SYSPROCS view (continued)

Column Name	System Column Name	Data Type	Description	
IS_DETERMINISTIC	DETERMINE	VARCHAR(3)	This column identifies we deterministic. That is, wh routine with the same are always return the same r	ether a call to the guments will
			NO The routine is a	not deterministic.
			YES The routine is o	deterministic.
SQL_DATA_ACCESS	DATAACCESS	VARCHAR(8)	This column identifies we contains SQL and whether modifies data.	
			NONE The routine do SQL statements	es not contain any
			CONTAINS The routine constatements.	ntains SQL
			READS The routine por from a table or	,
			-	ssibly modifies data ew or issues SQL s.
SQL_PATH	SQL_PATH	VARCHAR(3483)	If this is an SQL routine, this column identifies the path.	
		Nullable	Contains the null value is routine.	this is not an SQL
PARM_SIGNATURE	SIGNATURE	VARCHAR(2048)	This column identifies the routine signature	
RESULT_SETS	RESULTS	SMALLINT	Identifies the maximum number of result sets returned. 0 indicates that there are no result sets.	
IN_PARMS	IN_PARMS	SMALLINT	Identifies the number of input parameters. 0 indicates that there are no input parameters.	
OUT_PARMS	OUT_PARMS	SMALLINT	Identifies the number of output parameters. 0 indicates that there are no output parameters.	
INOUT_PARMS	INOUT_PARM	SMALLINT	Identifies the number of input/output parameters. 0 indicates that there are no input/output parameters.	
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplication COMMENT statement.	ed with the
		Nullable	Contains the null value is comment.	there is no long
ROUTINE_DEFINITION	ROUTINEDEF	VARCHAR(24000)	If this is an SQL routine, contains the SQL routine	
		Nullable	Contains the null value is routine or if the routine le contained in this column	ody cannot be
DBINFO	DBINFO	VARCHAR(3)	Identifies whether inform database is passed to the	
		Nullable	NO No database in to the procedure	formation is passed e.
			YES Information about passed to the p	out the database is rocedure.

SYSPROCS

Table 141. SYSPROCS view (continued)

Column Name	System Column Name	Data Type	Descrip	otion		
COMMIT_ON_RETURN	CMTONRET	VARCHAR(3) Nullable	procedi	This column identifies whether the procedure commits on a successful return from the procedure.		
			NO	A commit is not performed on successful return from the procedure.		
			YES	A commit is performed on successful return from the procedure.		
IASP_NUMBER	IASPNUMBER	SMALLINT		es the independent auxiliary storage ASP) number.		
NEW_SAVEPOINT_LEVEL	NEWSAVEPTL	VARCHAR(3)		lumn identifies whether the routine new savepoint level.		
		Nullable	NO	A new savepoint level is not started.		
			YES	A new savepoint level is started.		
ROUNDING_MODE	DECFLTRND	CHAR(1)		s an SQL procedure, identifies the OAT rounding mode.		
		Nullable	C	ROUND_CEILING		
			D	ROUND_DOWN		
			F	ROUND_FLOOR		
			G	ROUND_HALF_DOWN		
			E	ROUND_HALF_EVEN		
			Н	ROUND_HALF_UP		
			U	ROUND_UP		
				ns the null value if the procedure is SQL procedure.		

SYSPROGRAMSTAT

The SYSPROGRAMSTAT view contains one row for each program, service program, and module that contains SQL statements.

The following table describes the columns in the SYSPROGRAMSTAT view:

Table 142. SYSPROGRAMSTAT view

Column Name	System Column Name	Data Type	Description	
PROGRAM_SCHEMA	COLLID	VARCHAR(128)	Name of the schema	
PROGRAM_NAME	NAME	VARCHAR(128)	Name of the program, service program, omodule	
PROGRAM_TYPE	PGMTYPE	VARCHAR(128)	Type of the object	
			*PGM The object is a program.	
			*MODULE The object is a module.	
			*SRVPGM The object is a service program.	
PROGRAM_OWNER	OWNER	VARCHAR(128)	Owner of the program, service program, o module	
PROGRAM_CREATOR	CREATOR	VARCHAR(128)	Creator of the program, service program, o module	
CREATION_TIMESTAMP	TIMESTAMP	TIMESTAMP	Timestamp of when the program, service program, or module was created	
DEFAULT_SCHEMA	QUALIFIER	VARCHAR(128)	Implicit name for unqualified tables, views and indexes. Contains null if a default	
		Nullable	schema was not specified (DFTRDBCOL).	
ISOLATION	ISOLATION	CHAR(2)	Isolation option specification:	
			RR Repeatable Read (*RR)	
			RS Read Stability (*ALL)	
			CS Cursor Stability (*CS)	
			UR Uncommitted Read (*CHG)	
			NC No Commit (*NONE)	
NUMBER_STATEMENTS	NBRSTMTS	INTEGER	Number of SQL statements in the program service program or module	
PROGRAM_USED_SIZE	PGMSIZE	INTEGER	Number of bytes that are used for SQL statements and access plans in the program service program or module.	
NUMBER_COMPRESSIONS	PGM_CMP	INTEGER	Number of times the program or service program has been compressed.	
		Nullable	Contains null for modules.	
STATEMENT_CONTENTION_COUNT	CONTENTION	BIGINT	Number of times contention occurred whe attempting to store a new access plan.	
		Nullable	Contains null for modules.	
ORIGINAL_SOURCE_FILE	SOURCE	VARCHAR(128)	The fully qualified source file and member that was used to create the program or	
		Nullable	module.	
			Contains null for SQL routines.	

SYSPROGRAMSTAT

| Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Columi Name	n Data Type	Description
ROUTINE_TYPE	RTNTYPE	VARCHAR(9)	Type of the routine.
		Nullable	PROCEDURE This is a procedure.
			FUNCTION This is a function.
			TRIGGER This is a trigger.
			Contains null for modules or if the program or service program is not a procedure, function, or trigger. An external procedure will not be identified as PROCEDURE unless NUMBER_EXTERNAL_ROUTINES i greater than zero.
ROUTINE_BODY	BODY	VARCHAR(8)	The type of the routine body:
		Nullable	EXTERNAL This is an external routine.
			SQL This is an SQL routine.
			Contains null for modules or if the program or service program is not a procedure or function.
FUNCTION_ORIGIN	ORIGIN	CHAR(1)	Identifies the type of function. If this is a procedure, this column contains a blank.
		Nullable	B This is a built-in function (defined by DB2 for i).
			E This is a user-defined function.
			U This is a user-defined function that is sourced on another function.
			S This is a system-generated function.
			Contains null for modules or if the program or service program is not a procedure or function.
FUNCTION_TYPE	TYPE	CHAR(1)	Identifies the form of the function. If this is a procedure, this column contains a blank.
		Nullable	S This is a scalar function.
			C This is a column function.
			T This is a table function.
			Contains null for modules or if the program or service program is not a procedure, function, or trigger.
NUMBER_EXTERNAL_ROUTINES	NBREXTRTN	SMALLINT	Indicates the number of procedure and function definitions stored in the program of
		Nullable	service program.
			Contains null for modules, triggers, or SQL routines.

Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Column Name	ı Data Type	Description
C_NUL_REQUIRED	CNULRQD	VARCHAR(10)	Indicates the CNULRQD attribute:
			*CNULRQD C nuls are required.
			*NOCNULRQD C nuls are not required.
NAMING	NAMING	VARCHAR(4)	Indicates the NAMING attribute:
			*SYS This is system naming.
			*SQL This is SQL naming.
TARGET_RELEASE	TGTRLS	VARCHAR(6)	Indicates the target release of the program, service program, or module (VxRxMx).
RDB	RDB	VARCHAR(18)	Indicates the RDB specified for the program, service program, or module.
			rdb-name The name of the relational
			database.
			*NONE A relational database was not specified.
ALLOW_COPY_DATA	ALWCPYDTA	VARCHAR(9)	Indicates the ALWCPYDTA attribute:
			*NO A copy of the data is not allowed.
			*OPTIMIZE A copy of the data is allowed whenever it might result in better performance.
			*YES A copy of the data is allowed, but only when necessary.
CLOSE_SQL_CURSOR	CLOSQLCSR	VARCHAR(10)	Indicates the CLOSQLCSR attribute:
			*ENDACTGRP SQL cursors are closed and SQL prepared statements are implicitly discarded, and LOCK TABLE locks are released when the activation group ends.
			*ENDJOB SQL cursors are closed and SQL prepared statements are implicitly discarded, and LOCK TABLE locks are released when the job ends.
			*ENDMOD SQL cursors are closed and SQL prepared statements are implicitly discarded when the module is exited. LOCK TABLE locks are released when the first SQL program on the call stack ends.
			*ENDPGM SQL cursors are closed and SQL prepared statements are implicitly discarded when the program ends. LOCK TABLE locks are released when the first SQL program on the call stack ends.

SYSPROGRAMSTAT

Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Column Name	Data Type	Descript	ion
DATE_FORMAT	DATFMT	VARCHAR(4)	Indicates	s the DATFMT attribute:
			*ЈОВ	The date format specified in the job at runtime is used.
			*USA	The date format is *USA.
			*ISO	The date format is *ISO.
			*EUR	The date format is *EUR.
			*JIS	The date format is *JIS.
			*MDY	The date format is *MDY.
			*DMY	The date format is *DMY.
			*YMD	The date format is *YMD.
			*JUL	The date format is *JUL.
DATE_SEPARATOR	DATSEP	CHAR(1)	Indicates	s the date separator.
TIME_FORMAT	TIMFMT	VARCHAR(4)	Indicates	s the TIMFMT attribute:
			*ЈОВ	The time format specified in the job at runtime is used.
			*USA	The time format is *USA.
			*ISO	The time format is *ISO.
			*EUR	The time format is *EUR.
			*JIS	The time format is *JIS.
			*HMS	The date format is *HMS.
TIME_SEPARATOR	TIMSEP	CHAR(1)	Indicates	s the time separator.
DYNAMIC_DEFAULT_SCHEMA	DYNDFTCOL	VARCHAR(4) Nullable	Indicates whether the value for DFTRDBCOL should be used for implicit qualification on dynamic SQL statement:	
			*NO	The schema specified in DFTDRBCOL is not used for dynamic SQL statements.
			*YES	The schema specified in DFTDRBCOL is used for dynamic SQL statements.
				s null if a default schema was not (DFTRDBCOL).
CURRENT_RULES	SQLCURRULE	VARCHAR(4)	Indicates	the SQLCURRULE attribute:
			*DB2	The semantics of all SQL statements will default to the rules established for DB2.
			*STD	The semantics of all SQL statements will default to the rules established by the ISO and ANSI SQL standards.

Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Columi Name	n Data Type	Descript	ion
ALLOW_BLOCK	ALWBLK	VARCHAR(8)	Indicates	the ALWBLK attribute:
			*ALLRE	AD Rows are blocked for read-only cursors.
			*NONE	Rows are not blocked for retrieval of data for cursors.
			*READ	Records are blocked for read-only retrieval of data for cursors when *NONE is specified for the Commitment control (COMMIT parameter.
				 The cursor is declared with a FOR READ ONLY clause or there are no dynamic statement that could run a positioned UPDATE or DELETE statement for the cursor.
 DELAY_PREPARE	DLYPRP	VARCHAR(4)	Indicates	the DLYPRP attribute:
			*NO	Dynamic statement validation is performed when the dynamic statements are prepared.
			*YES	Dynamic statement validation is delayed until the dynamic statements are used.
USER_PROFILE	USRPRF	VARCHAR(7)	Specifies checking	the user profile used for authority:
			*USER	The profile of the user running the program is used.
			*OWNE	R The profiles of both the owner of the program and the user running the program is used.
			*NAMIN	NG If the naming convention is *SQL, *OWNER is used. If the naming convention is *SYS, *USER is used.
DYNAMIC_USER_PROFILE	DYNUSRPRF	VARCHAR(6)	Specifies SQL state	the user profile used for dynamic ements:
			*USER	Local dynamic SQL statements ar run under the profile of the job of thread. Distributed dynamic SQL statements are run under the profile of the application server job.
			*OWNE	Local dynamic SQL statements ar run under the profile of the program's owner. Distributed dynamic SQL statements are run under the profile of the SQL package's owner.

SYSPROGRAMSTAT

| Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Column Name	Data Type	Description
SORT_SEQUENCE	SRTSEQ	VARCHAR(21)	Indicates whether the program, service program, or module uses a collating sequence:
			BY HEX VALUE The SQL index does not use a collating table.
			*LANGIDSHR The SQL index uses a shared weight sort sequence (SRTSEQ).
			*LANGIDUNQ The SQL index uses a unique weight sort sequence (SRTSEQ).
			collating-sequence-table The SQL index uses an alternate collating sequence (ALTSEQ).
LANGUAGE_IDENTIFIER	LANGID	CHAR(3)	The language ID sort sequence.
		Nullable	Contains null if the sort sequence is not *LANGIDSHR or *LANGIDUNQ.
RDB_CONNECTION_METHOD	RDBCNNMTH	VARCHAR(4)	Specifies the semantics used for CONNECT statements:
			*RUW CONNECT (Type 1) semantics are used to support remote unit of work.
			*DUW CONNECT (Type 2) semantics are used to support distributed unit of work.
DECRESULT_MAXIMUM_PRECISION	DECMAXPRC	SMALLINT	Specifies the maximum precision.
			The maximum precision is 31.
			The maximum precision is 63.
DECRESULT_MAXIMUM_SCALE	DECMAXSCL	SMALLINT	The maximum scale (number of decimal positions to the right of the decimal point) that should be returned for result data types.
DECRESULT_MINIMUM_DIVIDE_SCALE	DECMINDIV	SMALLINT	The minimum divide scale (number of decimal positions to the right of the decimal point) that should be returned for both intermediate and result data types.
DECFLOAT_ROUNDING_MODE	DECFLTRND	VARCHAR(8)	Indicates the DECFLOAT rounding mode:
			CEILING ROUND_CEILING
			DOWN ROUND_DOWN
			FLOOR ROUND_FLOOR
			HALFDOWN ROUND_HALF_DOWN
			HALFEVEN ROUND_HALF_EVEN
			HALFUP ROUND_HALF_UP
			UP ROUND_UP

Table 142. SYSPROGRAMSTAT view (continued)

Column Name	System Column Name	ı Data Type	Description
DECFLOAT_WARNING	DECFLTWRN	VARCHAR(3)	Indicates whether DECFLOAT warnings ar returned.
			NO DECFLOAT warnings are not returned.
			YES DECFLOAT warnings are returned.
SQLPATH	SQLPATH	VARCHAR(3483)	Identifies the SQL path.
		Nullable	Contains the null value if an SQL path is r specified.
DBGVIEW	DBGVIEW	VARCHAR(9)	Specifies the type of source debug information:
			*NONE No debug.
			*SOURCE Debug view includes source and SQL INCLUDE statements.
			*STMT Debug view includes precompile generated statements.
			*LIST Debug view includes the compile listing.
			*ALLOW Source debug allowed by the Unified Debugger.
			*DISALLOW Source debug not allowed by the Unified Debugger.
			*DISABLE Source debug not allowed by the Unified Debugger and the DEBU MODE cannot be altered.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP	The timestamp of the last time the program service program, or module was used. If the
		Nullable	program, service program, or module has never been used, contains null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	The number of days the program, service program, or module was used since the last time the usage statistics were reset. If the program, service program, or module has never been used since the last time the usage statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP	The timestamp of the last time the usage statistics were reset. If the statistics have
CVCTEM DDOCDANANIANAE	CVC NIAME	Nullable	never been reset, contains null.
SYSTEM_PROGRAM_NAME	SYS_NAME	CHAR(10)	System name of the program, service program, or module.
SYSTEM_PROGRAM_SCHEMA	SYS_DNAME	CHAR(10)	System name of the schema containing the program, service program, or module.

SYSREFCST

SYSREFCST

The SYSREFCST view contains one row for each foreign key in the SQL schema.

The following table describes the columns in the SYSREFCST view:

Table 143. SYSREFCST view

Column Name	System Column Name	Data Type	Description
CONSTRAINT_SCHEMA	CDBNAME	VARCHAR(128)	Name of the schema containing the constraint.
CONSTRAINT_NAME	RELNAME	VARCHAR(128)	Name of the constraint.
UNIQUE_CONSTRAINT_SCHEMA	UNQDBNAME	VARCHAR(128) Nullable	Name of the SQL schema containing the unique constraint referenced by the referential constraint.
		Nullable	Contains the null value if the unique constraint does not exist. This is usually caused by restoring the table without its parent table.
UNIQUE_CONSTRAINT_NAME	UNQNAME	VARCHAR(128)	Name of the unique constraint referenced by the referential constraint.
		Nullable	Contains the null value if the unique constraint does not exist. This is usually caused by restoring the table without its parent table.
MATCH_OPTION	MATCH	VARCHAR(7)	Match option. Will always be NONE.
UPDATE_RULE	UPDATE	VARCHAR(11)	Update Rule.
			NO ACTION
			• RESTRICT
DELETE_RULE	DELETE	VARCHAR(11)	Delete Rule
			NO ACTION
			• CASCADE
			SET NULL
			SET DEFAULT
			• RESTRICT
COLUMN_COUNT	COLCOUNT	INTEGER	Number of columns in the foreign key.
SYSTEM_CONSTRAINT_SCHEMA	SYS_CDNAME	CHAR(10)	Name of the system schema containing the constraint.
SYSTEM_UNIQUE_CONSTRAINT_SCHEMA	SYS_UDNAME	CHAR(10)	Name of the system schema containing the constraint.
		Nullable	Contains the null value if the unique constraint does not exist. This is usually caused by restoring the table without its parent table.

SYSROUTINEDEP

The SYSROUTINEDEP view records the dependencies of routines.

The following table describes the columns in the SYSROUTINEDEP view:

Table 144. SYSROUTINEDEP view

Column name	System Column Name	Data Type	Descripti	on
SPECIFIC_SCHEMA	SPECSCHEMA	VARCHAR(128)	Schema n	name of the routine instance.
SPECIFIC_NAME	SPECNAME	VARCHAR(128)	Specific n	name of the routine instance.
OBJECT_SCHEMA	BSCHEMA	VARCHAR(128)	Name of object.	the SQL schema that contains the
OBJECT_NAME	BNAME	VARCHAR(128)	Name of on.	the object the routine is dependent
OBJECT_TYPE	BTYPE	CHAR(24)		the object type of the object d in the routine:
			ALIAS	The object is an alias.
			FUNCTIO	ON The object is a function.
			INDEX	The object is an index.
			MATERIA	ALIZED QUERY TABLE The object is a materialized query table.
			PROCED	OURE The object is a procedure.
			SCHEMA	A The object is a schema.
			SEQUEN	CE The object is a sequence.
			TABLE	The object is a table.
				If the object does not exist at the time the routine is created or the OBJECT_SCHEMA is *LIBL, TABLE may be returned even though the actual object used at run time may be an alias, materialized query table, or view.
			TYPE	The object is a distinct type.
			VIEW	The object is a view.
PARM_SIGNATURE	SIGNATURE	VARCHAR(10000)	This colu	mn identifies the routine signature.
		Nullable	Contains routine.	the null value if the object is not a
IASP_NUMBER	IASPNUMBER	SMALLINT		the independent auxiliary storage P) number of the object.
NUMBER_OF_PARMS	NUMPARMS	SMALLINT	Identifies	the number of parameters.
		Nullable	Contains routine.	the null value if the object is not a

The SYSROUTINES table contains one row for each procedure created by the CREATE PROCEDURE statement and each function created by the CREATE FUNCTION statement.

The following table describes the columns in the SYSROUTINES table:

Table 145. SYSROUTINES table

Column Name	System Column Name	Data Type	Description
	SPECSCHEMA		Schema name of the routine instance.
SPECIFIC_SCHEMA		VARCHAR(128)	
SPECIFIC_NAME	SPECNAME	VARCHAR(128)	Specific name of the routine instance.
ROUTINE_SCHEMA	RTNSCHEMA	VARCHAR(128)	Name of the SQL schema (schema) that contains the routine.
ROUTINE_NAME	RTNNAME	VARCHAR(128)	Name of the routine.
ROUTINE_TYPE	RTNTYPE	VARCHAR(9)	Type of the routine.
			PROCEDURE This is a procedure.
			FUNCTION This is a function.
ROUTINE_CREATED	RTNCREATE	TIMESTAMP	Identifies the timestamp when the routine was created.
ROUTINE_DEFINER	DEFINER	VARCHAR(128)	Name of the user that defined the routine.
ROUTINE_BODY	BODY	VARCHAR(8)	The type of the routine body:
			EXTERNAL This is an external routine.
			SQL This is an SQL routine.
EXTERNAL_NAME	EXTNAME	VARCHAR(279)	This column identifies the external program name.
		Nullable	• For SQL functions or ILE service programs, the external program name is <i>schema-name/service-program-name(entry-point-name)</i> .
			• For REXX, the external program name is <i>schema-name/source-file-name(member-name)</i> .
			• For Java programs, the external program name is an optional jar-id followed by a fully-qualified-class-name!method-name or fully-qualified-class-name.method-name.
			 For all other languages, the external program name is schema-name/program- name.
			Contains the null value if this is a system-generated function.

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	ı Data Type	Descript	tion
EXTERNAL_LANGUAGE	LANGUAGE	VARCHAR(8)	If this is	an external routine, this column s the external program name.
		Nullable	С	The external program is written in C.
			C++	The external program is written in $C++$.
			CL	The external program is written in CL.
			COBOL	The external program is written in COBOL.
			COBOL	LE The external program is written in ILE COBOL.
			FORTR.	AN The external program is written in FORTRAN.
			JAVA	The external program is written in JAVA.
			PLI	The external program is written in $\ensuremath{\text{PL/I}}.$
			REXX	The external program is a REXX procedure.
			RPG	The external program is written in RPG.
			RPGLE	The external program is written in ILE RPG.
			Contains external	s the null value if this is not an routine.
PARAMETER_STYLE	PARM_STYLE	VARCHAR(7) Nullable	If this is an external routine, this coidentifies the parameter style (calli convention).	
			DB2GN	RL This is the DB2GENERAL calling convention.
			DB2SQI	This is the DB2SQL calling convention.
			GENER	AL This is the GENERAL calling convention.
			JAVA	This is the JAVA calling convention.
			NULLS	This is the GENERAL WITH NULLS calling convention.
			SQL	This is the SQL standard calling convention.
			Contains external	s the null value if this is not an routine.

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	Data Type	Description
IS_DETERMINISTIC	DETERMINE	VARCHAR(3)	This column identifies whether the routine is deterministic. That is, whether a call to the routine with the same arguments will always return the same result.
			NO The routine is not deterministic.
			YES The routine is deterministic.
SQL_DATA_ACCESS	DATAACCESS	VARCHAR(8) Nullable	This column identifies whether a routine contains SQL and whether it reads or modifies data.
			NONE The routine does not contain any SQL statements.
			CONTAINS The routine contains SQL statements.
			READS The routine possibly reads data from a table or view.
			MODIFIES The routine possibly modifies data in a table or view or issues SQL DDL statements.
SQL_PATH	SQL_PATH	VARCHAR(3483)	If this is an SQL routine, this column identifies the path.
		Nullable	Contains the null value if this is not an SQL routine.
PARM_SIGNATURE	SIGNATURE	VARCHAR(2048)	This column identifies the routine signature.
NUMBER_OF_RESULTS	NUMRESULTS	SMALLINT	Identifies the number of results.
MAX_DYNAMIC_RESULT_SETS	RESULTS	SMALLINT	Identifies the maximum number of result sets returned. 0 indicates that there are no result sets.
IN_PARMS	IN_PARMS	SMALLINT	Identifies the number of input parameters. 0 indicates that there are no input parameters.
OUT_PARMS	OUT_PARMS	SMALLINT	Identifies the number of output parameters. 0 indicates that there are no output parameters.
INOUT_PARMS	INOUT_PARM	SMALLINT	Identifies the number of input/output parameters. 0 indicates that there are no input/output parameters.
PARSE_TREE	PARSE_TREE	VARCHAR(1024) FOR BIT DATA	If this is a routine, this column identifies the parse tree of the CREATE FUNCTION or CREATE PROCEDURE statement. It is only used internally.
PARM_ARRAY	PARM_ARRAY	BLOB(320000)	If this is an external routine, this column identifies the parameter array built from the CREATE FUNCTION or CREATE PROCEDURE statement. It is only used internally.
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
		Nullable	Contains the null value if there is no long comment.

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	ı Data Type	Descri	otion
ROUTINE_DEFINITION	ROUTINEDEF	DBCLOB(2M) CCSID 13488	If this i	s an SQL routine, this column is the SQL routine body.
		Nullable	routine	ns the null value if this is not an SQL or if the routine body cannot be led in this column without truncation.
FUNCTION_ORIGIN	ORIGIN	CHAR(1)		es the type of function. If this is a ure, this column contains a blank.
			В	This is a built-in function (defined by DB2 for i).
			E	This is a user-defined function.
			U	This is a user-defined function that is sourced on another function.
			S	This is a system-generated function.
FUNCTION_TYPE	TYPE	CHAR(1)	Identifies the form of the function. If a procedure, this column contains a l	
			S	This is a scalar function.
			C	This is a column function.
			T	This is a table function.
EXTERNAL_ACTION	EXTACTION	CHAR(1)		es whether the invocation of the n has external effects.
		Nullable	E	This function has external side effects.
			N	This function does not have any external side effects.
			Contain proced	ns the null value if the routine is a ure.
IS_NULL_CALL	NULL_CALL	VARCHAR(3)	called i	es whether the function needs to be f an input parameter is the null
		Nullable	value.	
			NO	This function need not be called if an input parameter is the null value. If this is a scalar function, the result of the function is implicitly null if any of the operands are null. If this is a table function, the result of the function is an empty table if any of the operands are the null value.
			YES	This function must be called even if an input operand is null.
			Contain proced	ns the null value if the routine is a ure.

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	Data Type	Descrip	otion
SCRATCH_PAD	SCRATCHPAD	INTEGER Nullable		es whether the address of a static y area (scratch pad) is passed to the n.
			0	The function does not have a scratch pad.
			integer	Indicates the size of the scratch pad passed to the function.
			Contair procedu	s the null value if the routine is a ure.
FINAL_CALL	FINAL_CALL	VARCHAR(3) Nullable	should	es whether a final call to the function be made to allow the function to p its work areas (scratch pads).
			NO	No final call is made.
			YES	A final call to the function is made when the statement is complete.
			Contair procedu	is the null value if the routine is a ure.
PARALLELIZABLE	PARALLEL	VARCHAR(3)	Identifi parallel	es whether the function can be run in .
		Nullable	NO	The function must be synchronous.
			YES	The function can be run in parallel.
			Contair procedu	as the null value if the routine is a ure.
DBINFO	DBINFO	VARCHAR(3)		es whether information about the e is passed to the routine.
		Nullable	NO	No database information is passed to the routine.
			YES	Information about the database is passed to the routine.
			Contair procedu	as the null value if the routine is a ure.
SOURCE_SPECIFIC_SCHEMA	SRCSCHEMA	VARCHAR(128)		s sourced function and the source is fined, this column contains the name
		Nullable	of the s function	ource schema. If this is a sourced n and the source is built-in, this contains 'QSYS2'.
				as the null value if the routine is not ed function.
SOURCE_SPECIFIC_NAME	SRCNAME	VARCHAR(128)	user-de	s sourced function and the source is fined, this column contains the
		Nullable	_	name of the source function name.
				as the null value if the routine is not ed function.

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	Data Type	Descrip	otion	
IS_USER_ DEFINED_CAST	CAST_FUNC	VARCHAR(3) Nullable	Identifies whether the this function is a cast function created when a distinct type was created.		
			NO	This function is not a cast function.	
			YES	This function is a cast function.	
			Contair procedu	as the null value if the routine is a ure.	
CARDINALITY	CARD	BIGINT	Specifie	s the cardinality for a table function.	
		Nullable		ns the null value if the function is not function or if cardinality was not d.	
FENCED	FENCED	VARCHAR(3)	Identifi	es whether a function is fenced.	
		Nullable	NO	The function is not fenced.	
		- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	YES	The function is fenced.	
			Contair procedu	as the null value if the routine is a ure.	
COMMIT_ON_RETURN	CMTONRET	VARCHAR(3) Nullable	This column identifies whether the procedure commits on a successful refrom the procedure.		
			NO	A commit is not performed on successful return from the procedure.	
			YES	A commit is performed on successful return from the procedure.	
			Contair function	as the null value if the routine is a n.	
IASP_NUMBER	IASPNUMBER	SMALLINT		s the independent auxiliary storage ASP) number.	
NEW_SAVEPOINT_LEVEL	NEWSAVEPTL	VARCHAR(3)		lumn identifies whether the routine new savepoint level.	
		Nullable	NO	A new savepoint level is not started.	
			YES	A new savepoint level is started.	
			Contair function	is the null value if the routine is a n.	
LAST_ALTERED	ALTEREDTS	TIMESTAMP	Contair	mp when routine was last altered. as null if the routine has never been	
		Nullable	altered.		

Table 145. SYSROUTINES table (continued)

Column Name	System Column Name	Data Type	Descrip	Description	
DEBUG_MODE	DEBUG_MODE	CHAR(1)	Identifi	es whether the routine is debuggable.	
			0	The routine is not debuggable.	
			1	The routine is debuggable by the Unified Debugger.	
			2	The routine is debuggable by the system debugger.	
			N	The routine is disabled from being debugged by the Unified Debugger.	
DEBUG_DATA	DEBUG_DATA	CLOB(1048576)	Reserve	ed. Contains the null value.	
		Nullable			
ROUNDING_MODE	DECFLTRND	CHAR(1)		s an SQL routine, identifies the OAT rounding mode.	
		Nullable	C	ROUND_CEILING	
			D	ROUND_DOWN	
			F	ROUND_FLOOR	
			G	ROUND_HALF_DOWN	
			E	ROUND_HALF_EVEN	
			Н	ROUND_HALF_UP	
			U	ROUND_UP	
				as the null value if the routine is not routine.	
ROUTINE_TEXT	LABEL	CHAR(50)		ns the label for a routine. Contains the lue if a label does not exist.	
		Nullable			

SYSSCHEMAS

The SYSSCHEMAS view contains one row for every schema in the relational database.

The following table describes the columns in the SYSSCHEMAS view:

Table 146. SYSSCHEMAS view

		System Column		
I	Column Name	Name	Data Type	Description
I	SCHEMA_NAME	NAME	VARCHAR(128)	Name of the SQL schema.
I	SCHEMA_OWNER	OWNER	VARCHAR(128)	Owner of the schema.
I	SCHEMA_CREATOR	CREATOR	VARCHAR(128)	Name of the user that created the schema.
I	CREATION_TIMESTAMP	TIMESTAMP	TIMESTAMP	Timestamp when the schema was created.
I	SCHEMA_SIZE	SIZE	DECIMAL(15,0)	Size of the schema (in bytes).
 	SCHEMA_TEXT	LABEL	VARCHAR(50)	A character string supplied with the LABEL statement.
			Nullable	Contains the null value if the schema has no text.
 -	SYSTEM_SCHEMA_NAME	SYS_NAME	CHAR(10)	System schema name.

SYSSEQUENCES

The SYSSEQUENCES view contains one row for every sequence object in the SQL schema.

The following table describes the columns in the SYSSEQUENCES view:

Table 147. SYSSEQUENCES view

Column name	System Column Name	Data Type	Description	
SEQUENCE_SCHEMA	SEQSCHEMA	VARCHAR(128)	The name of the SQL schema containing the sequence.	
SEQUENCE_NAME	SEQNAME	VARCHAR(128)	Name of the sequence.	
MAXIMUM_VALUE	MAXVALUE	DECIMAL(63,0)	Maximum value of the sequence.	
MINIMUM_VALUE	MINVALUE	DECIMAL(63,0)	Minimum value of the sequence.	
INCREMENT	INCREMENT	INTEGER	Increment value of the sequence.	
CYCLE_OPTION	CYCLE	VARCHAR(3)	Identifies whether the sequence values will continue to be generated after the minimum or maximum value has been reached.	
			NO Values will not continue to be generated.	
			YES Values will continue to be generated.	
CACHE	CACHE	INTEGER	Specifies the number of sequence values that may be preallocated for faster access. Zero indicates that the values will not be preallocated.	
ORDER	ORDER	VARCHAR(3)	Specifies whether the sequence values must be generated in order of the request.	
			NO Values do not need to be generated in order of the request.	
			YES Values must be generated in order of the request.	
DATA_TYPE	DATA_TYPE	VARCHAR(128)	Type of sequence:	
			BIGINT Big number	
			INTEGER Large number	
			SMALLINT Small number	
			DECIMAL Packed decimal	
			NUMERIC Zoned decimal	
			DISTINCT Distinct type	
NUMERIC_PRECISION	PRECISION	INTEGER	The precision of all numeric columns.	
USER_DEFINED_TYPE_SCHEMA	TYPESCHEMA	VARCHAR(128)	The name of the schema if this is a distinct type.	
		Nullable	Contains the null value if the sequence is not a distinct type.	
USER_DEFINED_TYPE_NAME	TYPENAME	VARCHAR(128)	The name of the distinct type.	
		Nullable	Contains the null value if the sequence is not a distinct type.	

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Table 147. SYSSEQUENCES view (continued)

	System Column				
Column name	Name	Data Type	Description		
START	START	DECIMAL(63,0)	Starting value of the sequence.		
MAXASSIGNEDVAL	MAXASNVAL	DECIMAL(63,0)	Last possible assigned sequence value. This value includes any values that were cached,		
		Nullable	but not used.		
			Contains the null value when the sequence is created. Is not null after the first value is assigned.		
SEQUENCE_DEFINER	DEFINER	VARCHAR(128)	The authorization ID under which the sequence was created.		
SEQUENCE_CREATED	CREATEDTS	TIMESTAMP	Timestamp when the sequence was created.		
LAST_ALTERED_TIMESTAMP	ALTEREDTS	TIMESTAMP	Timestamp when the sequence was last altered.		
SEQUENCE_TEXT	LABEL	VARCHAR(50)	A character string supplied with the LABEL statement (sequence text).		
		Nullable	Contains the null value if the sequence has no sequence text.		
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.		
		Nullable	Contains the null value if there is no long comment.		
SYSTEM_SEQ_SCHEMA	SYSSSCHEMA	CHAR(10)	The system name of the schema		
SYSTEM_SEQ_NAME	SYSSNAME	CHAR(10)	The system name of the sequence		
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number.		

SYSTABLEDEP

SYSTABLEDEP

The SYSTABLEDEP view records the dependencies of materialized query tables.

The following table describes the columns in the SYSTABLEDEP view:

Table 148. SYSTABLEDEP view

Column name	System Column Name	Data Type	Description	
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table, view or alias	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table, view or alias. This is the SQL table, view or alias name if it exists; otherwise, it is the system table, view or alias name.	
OBJECT_SCHEMA	BSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the object.	
OBJECT_NAME	BNAME	VARCHAR(128)	Name of the object the materialized query table is dependent on.	
OBJECT_TYPE	ВТҮРЕ	CHAR(24)	Indicates the object type of the object referenced in the materialized query table:	
			FUNCTION The object is a function.	
			TABLE The object is a table.	
			TYPE The object is a distinct type.	
			VIEW The object is a view.	
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary storage pool (IASP) number of the object.	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.	
PARM_SIGNATURE	SIGNATURE	VARCHAR(10000)	This column identifies the routine signature.	
		Nullable	Contains the null value if the object is not a routine.	

The SYSTABLEINDEXSTAT view contains one row for every index that has at least one partition or member built over a table. If the index is over more than one partition or member, the statistics include all those partitions and members. If the table is a distributed table, the partitions that reside on other database nodes are not included. They are contained in the catalog views of the other database nodes.

The following table describes the columns in the SYSTABLEINDEXSTAT view:

Table 149. SYSTABLEINDEXSTAT view

Column name	System Column Name	Data Type	Description
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.
PARTITION_TYPE	PARTTYPE	CHAR(1)	The type of the table partitioning:
			blank The table is not partitioned.
			H This is data hash partitioning.
			R This is data range partitioning.
			D This is distributed database hash partitioning.
NUMBER_PARTITIONS	NBRPARTS	INTEGER	Number of partitions or members of the table.
		If the table is a distributed table, contains the total number of partitions. If the table is	
		Nullable	not a distributed table, contains null.
INDEX_SCHEMA	INDSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the index, logical file, or constraint.
INDEX_NAME	INDNAME	VARCHAR(128)	Name of the index, logical file, or constraint
INDEX_TYPE	INDTYPE	VARCHAR(11)	The type of the index:
			INDEX The index is an SQL index.
			LOGICAL The index is part of a logical file.
			PRIMARY KEY The index is a primary key constraint.
			UNIQUE The index is a unique constraint.
			REFERENTIAL The index is a foreign key constraint.
NUMBER_KEY_COLUMNS	INDKEYS	BIGINT	Number of columns that define the index key.
COLUMN_NAMES	COLNAMES	VARCHAR(1024)	A comma separated list of column names that define the index key. If the length of all the column names exceeds 1024, '' is returned at the end of the column value.
NUMBER_LEAF_PAGES	NLEAF	BIGINT	Not applicable for DB2 for i. Will always be -1.
NUMBER_LEVELS	NLEVELS	SMALLINT	Not applicable for DB2 for i. Will always be -1.

Table 149. SYSTABLEINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
FIRSTKEYCARD	KEYCARD1	BIGINT	The total number of distinct first key values for all index partitions. If the index is an encoded vector index, -1 is returned.
FIRST2KEYCARD	KEYCARD2	BIGINT	The total number of distinct keys using the first two columns for all index partitions. If the index is an encoded vector index, -1 is returned.
FIRST3KEYCARD	KEYCARD3	BIGINT	The total number of distinct keys using the first three columns for all index partitions. If the index is an encoded vector index, -1 is returned.
FIRST4KEYCARD	KEYCARD4	BIGINT	The total number of distinct keys using the first four columns for all index partitions. If the index is an encoded vector index, -1 is returned.
FULLKEYCARD	KEYCARDF	BIGINT	The total number of distinct full key values for all index partitions. If the index has more than 4 key columns or is an encoded vector index, -1 is returned.
CLUSTERRATIO	CLSRATIO	SMALLINT	Not applicable for DB2 for i. Will always be -1.
CLUSTERFACTOR	CLSFACTOR	DOUBLE	Not applicable for DB2 for i. Will always be -1.
SEQUENTIAL_PAGES	SEQPAGES	BIGINT	Not applicable for DB2 for i. Will always be -1.
DENSITY	DENSITY	INTEGER	Not applicable for DB2 for i. Will always be -1.
PAGE_FETCH_PAIRS	FETCHPAIRS	VARCHAR(520)	Not applicable for DB2 for i. Will always be -1.
NUMBER_KEYS	NUMRIDS	BIGINT	The total number of keys for all index partitions. If the index is invalid or is an encoded vector index, -1 is returned.
NUMRIDS_DELETED	NUMRIDSDLT	BIGINT	Not applicable for DB2 for i. Will always be 0.
NUM_EMPTY_LEAFS	EMPTYLEAFS	BIGINT	Not applicable for DB2 for i. Will always be 0.
AVERAGE_RANDOM_FETCH_PAGES	AVGRNDFTCH	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_RANDOM_PAGES	AVGRNDPAGE	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_GAP	AVGSEQGAP	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_FETCH_GAP	AVGSEQFGAP	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_PAGES	AVGSEQPAGE	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVERAGE_SEQUENCE_FETCH_PAGES	AVGSEQFPAG	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVGPARTITION_CLUSTERRATIO	PCLSRATIO	SMALLINT	Not applicable for DB2 for i. Will always be -1.
AVGPARTITION_CLUSTERFACTOR	PCLSFACTOR	DOUBLE	Not applicable for DB2 for i. Will always be -1.
AVGPARTITION_PAGE_FETCH_PAIRS	PFETCHPAIR	VARCHAR(520)	Not applicable for DB2 for i. Will always be an empty string.

Table 149. SYSTABLEINDEXSTAT view (continued)

Column name	System Column lumn name Name Data Type Description		Description	
DATAPARTITION_CLUSTERFACTOR	DCLSFACTOR	DOUBLE	A statistic measuring the "clustering" of the index keys with regard to data partitions. It is a number between 0 and 1, with 1 representing perfect clustering and 0 representing no clustering.	
INDCARD	INDCARD	BIGINT	Number of keys in the index. If the index is invalid or is an encoded vector index, -1 is returned.	
INDEX_VALID	VALID	CHAR(1)	An indication or whether any index is invalid and needs to be rebuilt:	
			O At least one partition or member for the index is invalid.	
			1 All partitions or members for the index are valid.	
INDEX_HELD	HELD	CHAR(1)	An indication or whether a pending rebuild of the index is currently held by the user:	
			No rebuilds are pending or held for any partition or member of the index.	
			 A pending rebuild for at least one partition or member for the index is held. 	
CREATE_TIMESTAMP	CREATED	TIMESTAMP	Maximum timestamp when any partition or member of the index was created.	
LAST_BUILD_TIMESTAMP	LASTBUILD	TIMESTAMP	Maximum timestamp when any partition or member of the index was last rebuilt.	
LAST_QUERY_USE	LASTQRYUSE	TIMESTAMP Nullable	Maximum timestamp of the last time any partition or member of the index was use in a query since the last time the usage statistics were reset. If no partition or member of the index has ever been used a query since the last time the usage statistics were reset, contains null.	
LAST_STATISTICS_USE	LASTSTUSE	TIMESTAMP Nullable	Maximum timestamp of the last time any partition or member of the index was used by the optimizer for statistics since the last time the usage statistics were reset. If no partition or member of the index has ever been used for statistics since the last time the usage statistics were reset, contains nul	
QUERY_USE_COUNT	QRYUSECNT	BIGINT	Total number of times any partition or member of the index was used in a query since the last time the usage statistics were reset. If no partition or member of the index has ever been used in a query since the last time the usage statistics were reset, contains 0.	
QUERY_STATISTICS_COUNT	QRYSTCNT	BIGINT	Total number of times any partition or member of the index was used by the optimizer for statistics since the last time the usage statistics were reset. If no partition or member of the index has ever been used for statistics since the last time the usage statistics were reset, contains 0.	

Table 149. SYSTABLEINDEXSTAT view (continued)

	System Column		-	
Column name	Name	Data Type	Descr	
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP Nullable	partiti directl I/O o memb	on or member of the last time any on or member of the index was used by by an application for native record or SQL operations. If no partition or or of the index has ever been used, ns null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	memb an app operat statist memb since t	num number of days any partition or per of the index was used directly by plication for native record I/O or SQL tions since the last time the usage ics were reset. If no partition or per of the index has ever been used the last time the usage statistics were contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP		num timestamp of the last time the
		Nullable	usage statistics were reset for the index more information see the Change Obje Description (CHGOBJD) command. If index's last used timestamp has never reset, contains null.	
INDEX_SIZE	SIZE	BIGINT	Total size (in bytes) of the binary trees or encoded vector indexes of all partitions or members of the index.	
ESTIMATED_BUILD_TIME	ESTBLDTIME	INTEGER	Maximum estimated time (in milliseconds) required to rebuild any partition or member of the index.	
DELAYED_MAINT_KEYS	DLYKEYS	INTEGER	Maximum number of keys that need to be inserted into the binary tree of any partitio or member of a delayed maintenance index. If the index is not a delayed maintenance index, contains null.	
		Nullable		
SPARSE	SPARSE	CHAR(1)		tes whether the index contains keys the rows of its depended on table:
			0	The index contains keys for all the rows of its depended on table.
			1	The index is a select/omit logical file and does not contain keys for all the rows of its depended on table.
DERIVED_KEY	DERIVED	CHAR(1)		tes whether the any key columns in dex are expressions:
			0	No key columns of the index are expressions.
			1	At least one key column is an expression. Currently, this is only possible in a DDS-created logical file or temporary index.

Table 149. SYSTABLEINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Descri	ption
PARTITIONED	PARTITION	CHAR(1)		tes whether the index is partitioned or rtitioned:
 			0	An SQL index is not partitioned (spans multiple partitions).
 			1	The index is not built over a partitioned table or built over a partitioned table and is partitioned (does not span multiple partitions or members).
 			2	The index is a logical file built over multiple partitions or members.
ACCPTH_TYPE	ACCPTHTYPE	CHAR(1)	Indicat	tes the type of index:
			0	The index is a maximum 1 terabyte (*MAX1TB) binary radix index.
			1	The index is a maximum 4 gigabyte (*MAX4GB) binary radix index.
			2	The index is an encoded vector index.
UNIQUE	UNIQUE	CHAR(1)	Indica	res whether an index is unique:
			0	The index is a UNIQUE index.
			1	The index is a UNIQUE WHERE NOT NULL index.
			2	The index is a non-unique first-in-first-out (FIFO) index.
			3	The index is a non-unique last-in-last-out (LIFO) index.
			4	The index is a non-unique first-change-first-out (FCFO) index.
SRTSEQ_TYPE	SRTSEQ	CHAR(1)	Indicat sequer	tes whether the index uses a collating ace:
			0	The index does not use a collating table.
			1	The index uses an alternate collating sequence (ALTSEQ).
			2	The index uses a sort sequence (SRTSEQ).
LOGICAL_PAGE_SIZE	PAGE_SIZE	INTEGER	index	gical page size of the index. If the is an encoded vector index, contains
		Nullable	null.	
OVERFLOW_VALUES	OVERFLOW	INTEGER Nullable	that ha	num number of distinct key values ave overflowed any partition or er of the encoded vector index. If the
				is not an encoded vector index, ns null.
EVI_CODE_SIZE	CODE_SIZE	INTEGER	The siz	ze of the byte code of the encoded index. If the index is not an encoded
		Nullable	vector	index, contains null.

Table 149. SYSTABLEINDEXSTAT view (continued)

Column name	System Column Name	Data Type	Description
LOGICAL_READS	LGLREADS	BIGINT	Total number of logical read operations for any partition or member of the index since the last IPL.
PHYSICAL_READS	PHYREADS	BIGINT	Not applicable for DB2 for i. Will always be 0.
SEARCH_CONDITION	IXWHERECON	VARGRAPHIC(1024) CCSID 1200	If an index is sparse, the search condition of the index. If the length of the search condition exceeds 1024, '' is returned at the end of the column value.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.

SYSTABLES

The SYSTABLES view contains one row for every table, view or alias in the SQL schema, including the tables and views of the SQL catalog.

The following table describes the columns in the SYSTABLES view:

Table 150. SYSTABLES view

Column name	System Column Name	Data Type	Description	
TABLE_NAME	NAME	VARCHAR(128)	Name of the table, view or alias. This is the SQL table, view or alias name if it exists; otherwise, it is the system table, view or alias name.	
TABLE_OWNER	CREATOR	VARCHAR(128)	Owner of the table, view or alias	
TABLE_TYPE	TYPE	CHAR(1)	If the row describes a table, view, or alias:	
			A Alias	
			L Logical file	
			M Materialized query table	
			P Physical file	
			T Table	
			V View	
COLUMN_COUNT	COLCOUNT	INTEGER	Number of columns in the table or view. Zero for an alias.	
ROW_LENGTH	RECLENGTH ¹³⁵	INTEGER	Maximum length of any record in the table. Zero for an alias.	
TABLE_TEXT	LABEL	CHAR(50)	A character string provided with the LABEI statement.	
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.	
		Nullable	Contains the null value if there is no long comment.	
TABLE_SCHEMA	DBNAME	VARCHAR(128)	Name of the SQL schema that contains the table, view or alias	
LAST_ALTERED_TIMESTAMP	ALTEREDTS	TIMESTAMP	Timestamp when the table was last altered or created.	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name	
FILE_TYPE	FILETYPE	CHAR(1)	File type	
			D Data file or alias	
			S Source file	
BASE_TABLE_SCHEMA	TBDBNAME	VARCHAR(128)	For an alias, this is the name of the SQL schema that contains the table or view the	
		Nullable	alias is based on. Contains the null value if the table is not an alias.	
BASE_TABLE_NAME	TBNAME	VARCHAR(128)	For an alias, this is the name of the table or view the alias is based on.	
		Nullable	Contains the null value if the table is not an alias.	

SYSTABLES

Table 150. SYSTABLES view (continued)

Column name	System Column Name	Data Type	Descrip	otion
BASE_TABLE_MEMBER	TBMEMBER	VARCHAR(10) Nullable	membe *FIRST	alias, this is the name of the file r the alias is based on. Contains if this is an alias, but a member vas not specified.
			Contair alias.	ns the null value if the table is not an
SYSTEM_TABLE	SYSTABLE	CHAR(1)	System	table
			N	The table is not a system table.
			Y	The table is a system table.
SELECT_OMIT	SELECTOMIT	CHAR(1)	Select/o	omit logical file
			D	The table is a dynamic select/omit logical file.
			N	The table is not a select/omit logical file.
			Y	The table is a select/omit logical file.
IS_INSERTABLE_INTO	INSERTABLE	VARCHAR(3)	Identifi the tabl	es whether an INSERT is allowed on e.
			NO	An INSERT is not allowed on this table.
			YES	An INSERT is allowed on this table.
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independent auxiliary stor- pool (IASP) number.	
ENABLED	ENABLED	VARCHAR(3)		es whether the materialized query enabled for optimization:
		Nullable	NO	The materialized query table is not enabled for optmization.
			YES	The materialized query table is enabled for optmization.
				ns the null value if the table is not a lized query table.
MAINTENANCE	MAINTAIN	VARCHAR(6)		es whether the materialized query user or system maintained:
		Nullable	USER	The materialized query table is user maintained.
				ns the null value if the table is not a lized query table.
REFRESH	REFRESH	VARCHAR(9)		es the materialized query table SH option:
		Nullable	DEFER	RED
				The materialized query table is REFRESH DEFERRED.
				ns the null value if the table is not a lized query table.

Table 150. SYSTABLES view (continued)

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Column name	System Column Name	Data Type	Descrip	otion
REFRESH_TIME	REFRESHDTS	TIMESTAMP		es the timestamp of the last ulized query table REFRESH:
		Nullable	materia	ns the null value if the table is not a dized query table or if the table has been refreshed.
MQT_DEFINITION	MQTDEF	DBCLOB(2M) CCSID 13488		es the query expression of the alized query table:
		Nullable	Contains the null value if the table i materialized query table.	
ISOLATION	ISOLATION	CHAR(2) Nullable	select-st	es the isolation level used for the atement when refreshing the lilized query table:
			RR	Repeatable Read (*RR)
			RS	Read Stability (*ALL)
			CS	Cursor Stability (*CS)
			UR	Uncommitted Read (*CHG)
			NC	No Commit (*NONE)
				ns the null value if the table is not a alized query table.
PARTITION_TABLE	PART_TABLE	VARCHAR(3)		es whether the table is a partitioned
			NO	The table is not a partitioned table
			YES	The table is a partitioned table.
TABLE_DEFINER	DEFINER	VARCHAR(128)	Name o	of the user that defined the table.
MQT_RESTORE_DEFERRED	MQTRSTDFR	CHAR(1)	If the table is a materialized query table:	
			Y	The MQT is deferred as the result of a restore.
			N	The MQT is not deferred.
				ns the null value if the table is not a allized query table.
ROUNDING_MODE	DECFLTRND	CHAR(1)		es the DECFLOAT rounding mode of terialized query table or view:
			C	ROUND_CEILING
			D	ROUND_DOWN
			F	ROUND_FLOOR
			G	ROUND_HALF_DOWN
			E	ROUND_HALF_EVEN
			Н	ROUND_HALF_UP
			U	ROUND_UP
			view or table or that ref	ns the null value if the table is not a r MQT, or if the materialized query r view does not have an expression erences a DECFLOAT column, n, or constant.

SYSTABLESTAT

SYSTABLESTAT

The SYSTABLESTAT view contains one row for every table that has at least one partition or member. If the table has more than one partition or member, the statistics include all partitions and members. If the table is a distributed table, the partitions that reside on other database nodes are not included. They are contained in the catalog views of the other database nodes.

The following table describes the columns in the SYSTABLESTAT view:

Table 151. SYSTABLESTAT view

Column name	System Column Name	Data Type	Description	
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table.	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table.	
PARTITION_TYPE	PARTTYPE	CHAR(1)	The type of the table partitioning:	
			blank The table is not partitioned.	
			H This is data hash partitioning.	
			R This is data range partitioning.	
			D This is distributed database hash partitioning.	
NUMBER_PARTITIONS	NBRPARTS	INTEGER	Number of partitions or members of the table.	
NUMBER_DISTRIBUTED_PARTITIONS	DSTPARTS	INTEGER	If the table is a distributed table, contains the total number of partitions. If the table is	
		Nullable	not a distributed table, contains null.	
NUMBER_ROWS	CARD	BIGINT	Number of valid rows in all partitions or members of the table.	
NUMBER_ROW_PAGES	NPAGES	BIGINT	Number of 64K pages in all partitions or members of the table.	
NUMBER_PAGES	FPAGES	BIGINT	Same as NUMBER_ROW_PAGES.	
OVERFLOW	OVERFLOW	BIGINT	The estimated number of rows that have overflowed to variable length segments. If the table does not contain variable length or LOB columns, contains 0.	
CLUSTERED	CLUSTERED	CHAR(1)	Not applicable for DB2 for i. Will always be null.	
		Nullable		
ACTIVE_BLOCKS	ACTBLOCKS	BIGINT	Not applicable for DB2 for i. Will always be -1.	
AVGCOMPRESSEDROWSIZE	ACROWSIZE	BIGINT	Not applicable for DB2 for i. Will always be -1.	
AVGROWCOMPRESSIONRATIO	ACROWRATIO	REAL	Not applicable for DB2 for i. Will always be -1.	
AVGROWSIZE	AVGROWSIZE	BIGINT	Average length (in bytes) of a row in this table. If the table has variable length or LOB columns, contains -1.	
PCTROWSCOMPRESSED	PCTCROWS	REAL	Not applicable for DB2 for i. Will always be -1.	
PCTPAGESSAVED	PCTPGSAVED	SMALLINT	Not applicable for DB2 for i. Will always be -1.	

^{135.} The length is the number of bytes passed in database buffers, not the internal storage length.

Table 151. SYSTABLESTAT view (continued)

Column name	System Column Name	Data Type	Description
NUMBER_DELETED_ROWS	DELETED	BIGINT	Number of deleted rows in all partitions or members of the table.
DATA_SIZE	SIZE	BIGINT	Total size (in bytes) of the data spaces in all partitions or members of the table.
VARIABLE_LENGTH_SIZE	VLSIZE	BIGINT	Size (in bytes) of the variable-length data space segments in all partitions or members of the table.
FIXED_LENGTH_EXTENTS	FLEXTENTS	BIGINT	Number of fixed-length data space segment extents in all partitions or members of the table.
VARIABLE_LENGTH_EXTENTS	VLEXTENTS	BIGINT	Number of variable-length data space segment extents in all partitions or member of the table.
COLUMN_STATS_SIZE	CSTATSSIZE	BIGINT	Size (in bytes) of the column statistics in all partitions or members of the table.
MAINTAINED_TEMPORARY_INDEX_SIZE	MTISIZE	BIGINT	Size (in bytes) of all maintained temporary indexes over any partitions or members of the table.
NUMBER_DISTINCT_INDEXES	DISTINCTIX	INTEGER	The number of distinct indexes built over any partitions or members of the table. This does not include maintained temporary indexes.
OPEN_OPERATIONS	OPENS	BIGINT	Number of full opens of all partitions or members of the table since the last IPL.
CLOSE_OPERATIONS	CLOSES	BIGINT	Number of full closes of all partitions or members of the table since the last IPL.
INSERT_OPERATIONS	INSERTS	BIGINT	Number of insert operations of all partition or members of the table since the last IPL.
UPDATE_OPERATIONS	UPDATES	BIGINT	Number of update operations of all partitions or members of the table since the last IPL.
DELETE_OPERATIONS	DELETES	BIGINT	Number of delete operations of all partition or members of the table since the last IPL.
CLEAR_OPERATIONS	DSCLEARS	BIGINT	Number of clear operations (CLRPFM operations) of all partitions or members of the table since the last IPL.
COPY_OPERATIONS	DSCOPIES	BIGINT	Number of data space copy operations (certain CPYxxx operations) of all partitions or members of the table since the last IPL.
REORGANIZE_OPERATIONS	DSREORGS	BIGINT	Number of data space reorganize operation (non-interruptible RGZPFM operations) of all partitions or members of the table since the last IPL.
INDEX_BUILDS	DSINXBLDS	BIGINT	Number of creates or rebuilds of indexes that reference any partition or member of the table since the last IPL.
LOGICAL_READS	LGLREADS	BIGINT	Number of logical read operations of all partitions or members of the table since the last IPL.
PHYSICAL_READS	PHYREADS	BIGINT	Number of physical read operations of all partitions or members of the table since the last IPL.
LAST_CHANGE_TIMESTAMP	LASTCHG	TIMESTAMP	Maximum timestamp of the last change the occurred to any partition or member of the table.

SYSTABLESTAT

Table 151. SYSTABLESTAT view (continued)

	System Columi	ı	
Column name	Name	Data Type	Description
LAST_SAVE_TIMESTAMP	LASTSAVE	TIMESTAMP Nullable	Minimum timestamp of the last save of any partition or member of the table. If no partition or member has been saved,
			contains null.
LAST_RESTORE_TIMESTAMP	LASTRST	TIMESTAMP	Maximum timestamp of the last restore any partition or member of the table. If no
		Nullable	partition or member has been restored, contains null.
LAST_USED_TIMESTAMP	LASTUSED	TIMESTAMP	Maximum timestamp of the last time any partition or member was used directly by an
		Nullable	application for native record I/O or SQL operations. If no partition or member has ever been used, contains null.
DAYS_USED_COUNT	DAYSUSED	INTEGER	Maximum number of days any partition or member was used directly by an application for native record I/O or SQL operations since the last time the usage statistics were reset. If no partition or member has been used since the last time the usage statistics were reset, contains 0.
LAST_RESET_TIMESTAMP	LASTRESET	TIMESTAMP	Maximum timestamp of the last time the usage statistics were reset for the table. For
		Nullable	more information see the Change Object Description (CHGOBJD) command. If no partition or member's last used timestamp has ever been reset, contains null.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name.
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System table name.

SYSTRIGCOL

The SYSTRIGCOL view contains one row for each column either implicitly or explicitly referenced in the WHEN clause or the triggered SQL statements of a trigger.

The following table describes the columns in the SYSTRIGCOL view:

Table 152. SYSTRIGCOL view

I

Column Name	System Column Name	Data Type	Description	
TRIGGER_SCHEMA	TRIGSCHEMA	VARCHAR(128)	Name of the schema containing the trigger.	
TRIGGER_NAME	TRIGNAME	VARCHAR(128)	Name of the trigger.	
TABLE_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the schema containing the table or view that contains the column that is referenced in the trigger.	
TABLE_NAME	TABNAME	VARCHAR(128)	Name of the table or view that contains the column that is referenced in the trigger.	
COLUMN_NAME	TABCOLUMN	VARCHAR(128)	Name of the column that is referenced in th trigger.	
OBJECT_TYPE	ВТҮРЕ	CHAR(24)	Indicates the object type of the object that contains the column referenced in the trigger:	
			FUNCTION The object is a function.	
			MATERIALIZED QUERY TABLE The object is a materialized query table.	
			TABLE The object is a table.	
			VIEW The object is a view.	
SYSTEM_TRIGGER_SCHEMA	SYS_TDNAME	CHAR(10)	System schema name.	
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System schema name of the table or view that contains the column that is referenced	
		Nullable	in the trigger.	
			Contains the null value if the referenced table does not exist or if the referenced object is a table function.	
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10) Nullable	System table name of the table or view that contains the column that is referenced in the trigger.	
		runable	Contains the null value if the referenced table does not exist or if the referenced object is a table function.	

SYSTRIGDEP

The SYSTRIGDEP view contains one row for each object referenced in the WHEN clause or the triggered SQL statements of a trigger.

The following table describes the columns in the SYSTRIGDEP view:

Table 153. SYSTRIGDEP view

Column Name	System Column Name	Data Type	Description
TRIGGER_SCHEMA	TRIGSCHEMA	VARCHAR(128)	Name of the schema containing the trigger.
TRIGGER_NAME	TRIGNAME	VARCHAR(128)	Name of the trigger.
OBJECT_SCHEMA	BSCHEMA	VARCHAR(128)	Name of the schema containing the object referenced in the trigger.
OBJECT_NAME	BNAME	VARCHAR(128)	Name of the object referenced in the trigger.
OBJECT_TYPE	BTYPE	CHAR(24)	Indicates the object type of the object referenced in the trigger:
			ALIAS The object is an alias.
			FUNCTION The object is a function.
			INDEX The object is an index.
			MATERIALIZED QUERY TABLE The object is a materialized query table.
			PACKAGE The object is a package.
			PROCEDURE The object is a procedure.
			SCHEMA The object is a schema.
			SEQUENCE The object is a sequence.
			TABLE The object is a table.
			TYPE The object is a distinct type.
			VIEW The object is a view.
PARM_SIGNATURE	SIGNATURE	VARCHAR(10000)	This column identifies the routine signature.
		Nullable	Contains the null value if the object is not a routine.
SYSTEM_TRIGGER_SCHEMA	SYS_TDNAME	CHAR(10)	System schema name.
SYSTEM_OBJECT_SCHEMA	SYS_DNAME	CHAR(10)	System schema name of the object referenced in the trigger.
		Nullable	Contains the null value if the referenced object does not exist or if the referenced object is not an alias, index, materialized query table, table, or view.
SYSTEM_OBJECT_NAME	SYS_ONAME	CHAR(10)	System object name of the object referenced in the trigger.
		Nullable	Contains the null value if the referenced object does not exist or if the referenced object is not an alias, index, materialized query table, table, or view.

SYSTRIGGERS

The SYSTRIGGERS view contains one row for each trigger in an SQL schema.

The following table describes the columns in the SYSTRIGGERS view:

Table 154. SYSTRIGGERS view

Column Name	System Column Name	Data Type	Description
TRIGGER_SCHEMA	TRIGSCHEMA	VARCHAR(128)	Name of the schema containing the trigger.
TRIGGER_NAME	TRIGNAME	VARCHAR(128)	Name of the trigger.
EVENT_MANIPULATION	TRIGEVENT	VARCHAR(6)	Indicates the event that causes the trigger to fire:
			DELETE Trigger fires on a DELETE.
			INSERT Trigger fires on a INSERT.
			UPDATE
			Trigger fires on a DELETE.
			READ Trigger fires when a row is read. This is only valid for triggers created via the ADDPFTRG command.
EVENT_OBJECT_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the schema containing the subject table or view of the trigger.
EVENT_OBJECT_TABLE	TABNAME	VARCHAR(128)	Name of the subject table or view of the trigger.
ACTION_ORDER	ORDERSEQNO	INTEGER	The ordinal position of this trigger in the list of triggers for the table or view. This indicates the order in which the trigger will be fired.
ACTION_CONDITION	CONDITION	DBCLOB(2097152) CCSID 13488	Text of the WHEN clause for the trigger.
		Nullable	Contains the null value if there is no WHEN clause.
ACTION_STATEMENT	TEXT	DBCLOB(2097152) CCSID 13488	Text of the SQL statements in the trigger action.
		Nullable	Contains the null value if this is a trigger created via the ADDPFTRG command.
ACTION_ORIENTATION	GRANULAR	VARCHAR(9)	Indicates whether this is a ROW or STATEMENT trigger:
			ROW Trigger fires for each ROW.
			STATEMENT Trigger fires for each statement.
ACTION_TIMING	TRIGTIME	VARCHAR(7)	Indicates whether this is a BEFORE, AFTER, or INSTEAD OF trigger:
			BEFORE Trigger fires before the triggering event.
			AFTER Trigger fires after the triggering event.
			INSTEAD Trigger fires instead of the triggering event.

SYSTRIGGERS

Table 154. SYSTRIGGERS view (continued)

Column Name	System Column Name	Data Type	Description	
TRIGGER_MODE	TRIGMODE	VARCHAR(6)	Indicates the firing mode for the trigger:	
			DB2SQL The trigger mode is DB2SQL.	
			DB2ROW The trigger mode is DB2ROW.	
ACTION_REFERENCE_OLD_ROW	OLD_ROW	VARCHAR(128)	Name of the OLD ROW correlation name.	
		Nullable	Contains the null value if an OLD ROW correlation name was not specified.	
ACTION_REFERENCE_NEW_ROW	NEW_ROW	VARCHAR(128)	Name of the NEW ROW correlation name.	
		Nullable	Contains the null value if a NEW ROW correlation name was not specified.	
ACTION_REFERENCE_OLD_TABLE	OLD_TABLE	VARCHAR(128)	Name of the OLD TABLE correlation name.	
		Nullable	Contains the null value if an OLD TABLE correlation name was not specified.	
ACTION_REFERENCE_NEW_TABLE	NEW_TABLE	VARCHAR(128)	Name of the NEW TABLE correlation name.	
		Nullable	Contains the null value if a NEW TABLE correlation name was not specified.	
SQL_PATH	SQL_PATH	VARCHAR(3483)	SQL path used when the trigger was created.	
		Nullable	Contains the null value if the trigger was created via the ADDPFTRG command.	
CREATED	CREATE_DTS	TIMESTAMP	Timestamp when the trigger was created.	
TRIGGER_PROGRAM_NAME	TRIGPGM	VARCHAR(128)	Name of the trigger program.	
TRIGGER_PROGRAM_LIBRARY	TRIGPGMLIB	VARCHAR(128)	System name of the schema containing the trigger program.	
OPERATIVE	OPERATIVE	VARCHAR(1)	Indicates whether the trigger is operative. A table or view that has a trigger that contains a reference to that same table or view in its <i>triggered–action</i> is self-referencing. If a self-referencing trigger is duplicated into another library, restored into another library,	
			moved into another library, or renamed; the trigger is marked inoperative since the table references in the <i>triggered</i> —action are unchanged and still reference the original schema and table name.	
			Y The trigger is operative.	
			N The trigger is inoperative.	
ENABLED	ENABLED	VARCHAR(1)	Indicates whether the trigger is enabled (see the CL command CHGPFTRG)	
			Y The trigger is enabled.	
			N The trigger is disabled.	
THREADSAFE	THDSAFE	VARCHAR(8)	Indicates whether the trigger is thread safe.	
			YES The trigger is thread safe.	
			NO The trigger is not thread safe.	
			UNKNOWN The thread safety of the trigger is	

unknown.

Table 154. SYSTRIGGERS view (continued)

Column Name	System Column Name	Data Type	Description
MULTITHREADED_JOB_ACTION	MLTTHDACN	VARCHAR(8)	Indicates the action to take when the trigger program is called in a multithreaded job.
			SYSVAL Use the QMLTTHDACN system value to determine the action to take.
			MSG Run the trigger program in a multithreaded job, but send a diagnostic message.
			NORUN
			Do not run the trigger program in a multithreaded job.
			RUN Run the trigger program in a multithreaded job.
ALLOW_REPEATED_CHANGE	ALWREPCHG	VARCHAR(8)	Indicates the condition under which an update event fires the trigger.
			YES The trigger allows repeated changes to the same row.
			NO The trigger does not allow repeated changes to the same row
TRIGGER_UPDATE_CONDITION	TRGUPDCND	CHAR(8)	Indicates whether an UPDATE trigger is always fired on an update event or only
		Nullable	when a column value is actually changed.
			ALWAYS The trigger is always fired on an update event.
			CHANGE The trigger is only fired on an update event if a column value is actually changed.
			Contains the null value if the trigger is not an UPDATE trigger.
TRIGGER_DEFINER	DEFINER	VARCHAR(128)	Name of the user that defined the trigger.
TRIGGER_TEXT	LABEL	VARGRAPHIC(50) CCSID 1200	A character string provided with the LABEI statement.
		Nullable	Contains the null value if there is no label.
LONG_COMMENT	REMARKS	VARGRAPHIC(2000) CCSID 13488	A character string supplied with the COMMENT statement.
		Nullable	Contains the null value if there is no long comment.

SYSTRIGGERS

Table 154. SYSTRIGGERS view (continued)

System Column					
	Column Name	Name	Data Type	Descrip	tion
I	ROUNDING_MODE	DECFLTRND	CHAR(1)	The rou	nding mode for the trigger:
-			Nullable	C	ROUND_CEILING
İ			Tumuero	D	ROUND_DOWN
I				F	ROUND_FLOOR
I				G	ROUND_HALF_DOWN
I				E	ROUND_HALF_EVEN
I				Н	ROUND_HALF_UP
I				U	ROUND_UP
 					s the null value if the trigger was via the ADDPFTRG command.
I	SYSTEM_TRIGGER_SCHEMA	SYS_TDNAME	CHAR(10)	System	schema name.
 	SYSTEM_EVENT_OBJECT_SCHEMA	SYS_DNAME	CHAR(10)	System schema name of the schema containing the subject table or view of the trigger.	
 	SYSTEM_EVENT_OBJECT_TABLE	SYS_TNAME	CHAR(10)	System table name of the table or view that contains the subject table or view of the trigger.	

SYSTRIGUPD

The SYSTRIGUPD view contains one row for each column identified in the UPDATE column list, if any.

The following table describes the columns in the SYSTRIGUPD view:

Table 155. SYSTRIGUPD view

Column Name	System Column Name	Data Type	Description
TRIGGER_SCHEMA	TRIGSCHEMA	VARCHAR(128)	Name of the schema containing the trigger.
TRIGGER_NAME	TRIGNAME	VARCHAR(128)	Name of the trigger.
EVENT_OBJECT_SCHEMA	TABSCHEMA	VARCHAR(128)	Name of the schema containing the subject table of the trigger.
EVENT_OBJECT_TABLE	TABNAME	VARCHAR(128)	Name of the subject table of the trigger.
TRIGGERED_UPDATE_COLUMNS	TABCOLUMN	VARCHAR(128)	Name of a column specified in the UPDATE column list of the trigger.
SYSTEM_TRIGGER_SCHEMA	SYS_TDNAME	CHAR(10)	System schema name.
SYSTEM_EVENT_OBJECT_SCHEMA	SYS_DNAME	CHAR(10)	System schema name of the schema containing the subject table or view of the trigger.
SYSTEM_EVENT_OBJECT_TABLE	SYS_TNAME	CHAR(10)	System table name of the table or view that contains the subject table or view of the trigger.

SYSTYPES

SYSTYPES

The SYSTYPES table contains one row for each built-in data type and each distinct type created by the CREATE TYPE statement.

The following table describes the columns in the SYSTYPES table:

Table 156. SYSTYPES table

Column Name	System Column Name	Data Type	Descrij	ption	
USER_DEFINED_TYPE_SCHEMA	TYPESCHEMA	VARCHAR(128)	Schema	a name of the data type.	
USER_DEFINED_TYPE_NAME	TYPENAME	VARCHAR(128)	Name	of the data type.	
USER_DEFINED_TYPE_DEFINER	DEFINER	VARCHAR(128)	Name	of the user that created the data type.	
SOURCE_SCHEMA	SRCSCHEMA	VARCHAR(128)	The schema for the source data type of this data type.		
		Nullable	Contair data ty	ns the null value if this is a built-in pe.	
SOURCE_TYPE	SRCTYPE	VARCHAR(128)	Name of the source data type of this data type.		
		Nullable	Contair data ty	ns the null value if this is a built-in pe.	
SYSTEM_TYPE_SCHEMA	SYSTSCHEMA	CHAR(10)	System	schema name of the data type.	
SYSTEM_TYPE_NAME	SYSTNAME	CHAR(10)	System	System name of the data type.	
METATYPE	METATYPE	CHAR(1)	Indicates the type of data type.		
			S	System predefined data type.	
			T	User-defined distinct type.	

Table 156. SYSTYPES table (continued)

Column Name	System Colu Name	mn Data Type	Description
LENGTH	LENGTH	INTEGER	The length attribute of the data type; or, in the case of a decimal, numeric, or nonzero precision binary column, its precision:
			8 bytes BIGINT
			4 bytes INTEGER
			2 bytes SMALLINT
			Precision of number DECIMAL
			Precision of number NUMERIC
			8 bytes FLOAT, FLOAT(n) where n = 25 to 53, or DOUBLE PRECISION
			4 bytes FLOAT(n) where n = 1 to 24, or REAL
			8 bytes DECFLOAT(16)
			16 bytes DECFLOAT(34)
			Length of string CHARACTER
			Maximum length of string VARCHAR or CLOB
			Length of graphic string GRAPHIC
			Maximum length of graphic string VARGRAPHIC or DBCLOB
			Length of binary string BINARY
			Maximum length of binary string VARBINARY or BLOB
			4 bytes DATE
			3 bytes TIME
			10 bytes TIMESTAMP
			Maximum length of datalink URL and comment
			DATALINK
			40 bytes ROWID
			Same value as the source type DISTINCT
NUMERIC_SCALE	SCALE	SMALLINT	Scale of numeric data.
		Nullable	Contains the null value if the data type is not decimal, numeric, or binary.
CCSID	CCSID	INTEGER	The CCSID value for CHAR, VARCHAR,
		Nullable	CLOB, DATE, TIME, TIMESTAMP, GRAPHIC, VARGRAPHIC, DBCLOB and DATALINK data types.
			Contains the null value if the data type is numeric.

SYSTYPES

Table 156. SYSTYPES table (continued)

	Column Name	System Column Name	Data Type	Description
1	STORAGE	STORAGE	INTEGER	The storage requirements for the column:
I				8 bytes BIGINT
I				4 bytes INTEGER
I				2 bytes SMALLINT
1				(Precision/2) + 1 DECIMAL
 				Precision of number NUMERIC
1				8 bytes FLOAT, FLOAT(n) where n = 25 to 53, or DOUBLE PRECISION
 				4 bytes FLOAT(n) where n = 1 to 24, or REAL
I				8 bytes DECFLOAT(16)
I				16 bytes DECFLOAT(34)
				Length of string CHAR
 				Maximum length of string + 2 VARCHAR
 				Maximum length of string + 29 CLOB
1				Length of string * 2 GRAPHIC
 				Maximum length of string * 2 + 2 VARGRAPHIC
 				Maximum length of string * 2 + 29 DBCLOB
 				Length of binary string BINARY
 				Maximum length of binary string + 2 VARBINARY
 				Maximum length of string + 29 BLOB
I				4 bytes DATE
I				3 bytes TIME
Ι				10 bytes TIMESTAMP
 				Maximum length of datalink URL and comment + 24 DATALINK
ı				42 bytes ROWID
 				Same value as the source type DISTINCT Note: This column supplies the storage requirements for all data types.
				requirements for an eath types.

Table 156. SYSTYPES table (continued)

Column Name	System Column Name	Data Type	Description	
NUMERIC_PRECISION	PRECISION	INTEGER Nullable	The precision of all nur Note: This column sup all numeric data types, floating-point and singl double-precision floatin NUMERIC_PRECISION indicates if the value in binary or decimal digits	plies the precision of including decimal e-and g point. The [_RADIX column this column is in
			Contains the null value not numeric.	if the data type is
CHARACTER_MAXIMUM_LENGTH	CHARLEN	INTEGER	Maximum length of the character, and graphic s	
		Nullable	Contains the null value not a string.	if the data type is
CHARACTER_OCTET_LENGTH	CHARBYTE	INTEGER	Number of bytes for biggraphic string data type	
		Nullable	Contains the null value not a string.	
ALLOCATE	ALLOCATE	INTEGER	Allocated length of the varying-length characte	
		Nullable	graphic string data type Contains the null value numeric or fixed-length	if the data type is
NUMERIC_PRECISION_RADIX	RADIX	INTEGER	Indicates if the precision NUMERIC_PRECISION number of binary or de	n specified in column is specified as a
		Nullable	ŕ	ng-point precision is
				ther numeric types in decimal digits.
			Contains the null value not numeric.	if the data type is
DATETIME_PRECISION	DATPRC	INTEGER	The fractional part of a timestamp.	date, time, or
		Nullable	1	d TIME data types
			6 For TIMESTA (number of m	MP data types icroseconds).
			Contains the null value not date, time, or times	
CREATE_TIME	CRTTIME	TIMESTAMP	Identifies the timestamp was created.	when the data type
		Nullable		
LONG_COMMENT	REMARKS	VARCHAR(2000)	A character string supp COMMENT statement.	lied with the
		Nullable	Contains the null value comment.	if there is no long
IASP_NUMBER	IASPNUMBER	SMALLINT	Specifies the independe pool (IASP) number of	

SYSTYPES

Table 156. SYSTYPES table (continued)

	System Columi	ı	
Column Name	Name	Data Type	Description
LAST_ ALTERED	ALTEREDTS	TIMESTAMP	Reserved. Contains the null value.
		Nullable	
NORMALIZE_DATA	NORMALIZE	VARCHAR(3)	Indicates whether the parameter value should be normalized or not. This attribute
		Nullable	only applies to UTF-8 and UTF-16 data.
			NO The value should not be normalized.
			YES The value should be normalized.
TYPE_TEXT	LABEL	CHAR(50)	A character string supplied with the LABEL statement (type text).
		Nullable	Contains the null value if the type has no text.

SYSVIEWDEP

The SYSVIEWDEP view records the dependencies of views on tables, including the views of the SQL catalog.

Table 157. SYSVIEWDEP view

Column name	System Column Name	Data Type	Description
VIEW_NAME	DNAME	VARCHAR(128)	Name of the view. This is the SQL view name if it exists; otherwise, it is the system view name.
VIEW_OWNER	DCREATOR	VARCHAR(128)	Owner of the view
OBJECT_NAME	ONAME	VARCHAR(128)	Name of the object the view is dependent on.
OBJECT_SCHEMA	OSCHEMA	VARCHAR(128)	Name of the SQL schema that contains the object the view is dependent on.
OBJECT_TYPE	OTYPE	CHAR(24)	Type of object the view was based on:
			FUNCTION Function
			MATERIALIZED QUERY TABLE The object is a materialized query table.
			TABLE Table
			TYPE Distinct type
			VIEW View
VIEW_SCHEMA	DDBNAME	VARCHAR(128)	Name of the schema of the view.
SYSTEM_VIEW_NAME	SYS_VNAME	CHAR(10)	System View name
SYSTEM_VIEW_SCHEMA	SYS_VDNAME	CHAR(10)	System View schema
SYSTEM_TABLE_NAME	SYS_TNAME	CHAR(10)	System Table name.
		Nullable	Contains the null value if the object is a function or distinct type.
SYSTEM_TABLE_SCHEMA	SYS_DNAME	CHAR(10)	System Table schema.
		Nullable	Contains the null value if the object is a function or distinct type.
TABLE_NAME	BNAME	VARCHAR(128)	Name of the table or view the view is
		Nullable	dependent on. This is the SQL view name if it exists; otherwise, it is the system view name.
			Contains the null value if the object is a function or distinct type.
TABLE_OWNER	BCREATOR	VARCHAR(128)	Owner of the table or view the view is dependent on.
		Nullable	Contains the null value if the object is a function or distinct type.
TABLE_SCHEMA	BDBNAME	VARCHAR(128)	Name of the SQL schema that contains the table or view the view is dependent on.
		Nullable	Contains the null value if the object is a function or distinct type.

SYSVIEWDEP

Table 157. SYSVIEWDEP view (continued)

	System Column			
Column name	Name	Data Type	Descr	iption
TABLE_TYPE	BTYPE	CHAR(1)	Туре	of object the view was based on:
		Nullable	T	Table
		TVUILUDIC	P	Physical file
			M	Materialized query table
			\mathbf{v}	View
			L	Logical file
				ins the null value if the object is a on or distinct type.
IASP_NUMBER	IASPNUMBER	SMALLINT		ies the independent auxiliary storage IASP) number.
PARM_SIGNATURE	SIGNATURE	VARCHAR(10000)	This c	olumn identifies the routine signature.
		Nullable	Conta- routin	ins the null value if the object is not a e.

SYSVIEWS

The SYSVIEWS view contains one row for each view in the SQL schema, including the views of the SQL catalog.

Table 158. SYSVIEWS view

Column Name	System Column Name	Data Type	Descrip	otion
TABLE_NAME	NAME	VARCHAR(128)		of the view. This is the SQL view f it exists; otherwise, it is the system name.
VIEW_OWNER	CREATOR	VARCHAR(128)	Owner	of the view
SEQNO	SEQNO	INTEGER	Sequen 1.	ce number of this row; will always be
CHECK_OPTION	CHECK	CHAR(1)	The che	eck option used on the view
			N	No check option was specified
			Y	The local option was specified
			C	The cascaded option was specified
VIEW_DEFINITION	TEXT	VARCHAR(10000)		ery expression portion of the E VIEW statement.
		Nullable	definiti	ns the null value if the view on cannot be contained in the column t truncation.
IS_UPDATABLE	UPDATES	CHAR(1)	Specifie	es if the view is updatable:
			Y	The view is updatable
			N	The view is not updatable
TABLE_SCHEMA	DBNAME	VARCHAR(128)	Name o	of the SQL schema that contains the
SYSTEM_VIEW_NAME	SYS_VNAME	CHAR(10)	System view name	
SYSTEM_VIEW_SCHEMA	SYS_VDNAME	CHAR(10)	System	view schema name
IS_INSERTABLE_INTO	INSERTABLE	VARCHAR(3)	Identifi the view	es whether an INSERT is allowed on w.
			NO	An INSERT is not allowed on this view.
			YES	An INSERT is allowed on this view.
IASP_NUMBER	IASPNUMBER	SMALLINT		es the independent auxiliary storage ASP) number.
IS_DELETABLE	DELETES	CHAR(1)	Specifie	es if the view is deletable:
		Nullable	Y	The view is deletable
		1 valiable	N	The view is read-only
VIEW_DEFINER	DEFINER	VARCHAR(128)	Name o	of the user that defined the view.

SYSVIEWS

Table 158. SYSVIEWS view (continued)

		System Column			
	Column Name	Name	Data Type	Descript	tion
1	ROUNDING_MODE	DECFLTRND	CHAR(1)	Indicates the view	s the DECFLOAT rounding mode of
			Nullable	C	ROUND_CEILING
I				D	ROUND_DOWN
I				F	ROUND_FLOOR
I				G	ROUND_HALF_DOWN
İ				E	ROUND_HALF_EVEN
İ				Н	ROUND_HALF_UP
I				U	ROUND_UP
				have an	s the null value if the view does not expression that references a DAT column, function, or constant.

ODBC and **JDBC** catalog views

The catalog includes the views and tables in the SYSIBM library displayed in this section.

İ	View Name	Description
I	"SQLCOLPRIVILEGES" on page 1396	Information about privileges granted on columns
I	"SQLCOLUMNS" on page 1397	Information about column attributes
I	"SQLFOREIGNKEYS" on page 1403	Information about foreign keys
I	"SQLFUNCTIONCOLS" on page 1404	Information about function parameters
I	"SQLFUNCTIONS" on page 1411	Information about functions
	"SQLPRIMARYKEYS" on page 1412	Information about primary keys
	"SQLPROCEDURECOLS" on page 1413	Information about procedure parameters
	"SQLPROCEDURES" on page 1419	Information about procedures
	"SQLSCHEMAS" on page 1420	Information about schemas
	"SQLSPECIALCOLUMNS" on page 1421	Information about columns of a table that can be used to uniquely identify a row
	"SQLSTATISTICS" on page 1424	Statistical information about tables
	"SQLTABLEPRIVILEGES" on page 1425	Information about privileges granted on tables
	"SQLTABLES" on page 1426	Information about tables
	"SQLTYPEINFO" on page 1427	Information about the types of tables
	"SQLUDTS" on page 1434	Information about built-in data types and distinct types

SQLCOLPRIVILEGES

SQLCOLPRIVILEGES

The SQLCOLPRIVILEGES view contains one row for every privileges granted on a column. Note that this catalog view cannot be used to determine whether a user is authorized to a column because the privilege to use a column could be acquired through a group user profile or special authority (such as *ALLOBJ). Furthermore, the privilege to use a column is also acquired through privileges granted on the table.

Table 159. SQLCOLPRIVILEGES view

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	Relational database name.
TABLE_SCHEM	VARCHAR(128)	Name of the SQL schema that contains the table.
TABLE_NAME	VARCHAR(128)	Table name.
COLUMN_NAME	VARCHAR(128)	Column name.
GRANTOR	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
GRANTEE	VARCHAR(128)	The user profile to which the privilege is granted.
PRIVILEGE	VARCHAR(10)	The privilege granted:
		UPDATE The privilege to update the column.
		REFERENCES
		The privilege to reference the column in a referential constraint.
IS_GRANTABLE	VARCHAR(3)	Indicates whether the privilege is grantable to other users.
		NO The privilege is not grantable.
		YES The privilege is grantable.
DBNAME	VARCHAR(8)	Reserved. The column contains the null value.
	Nullable	

The SQLCOLUMNS view contains one row for every column in a table, view, or alias.

Table 160. SQLCOLUMNS view

	Column Name	Data Type	Descrip	tion
	TABLE_CAT	VARCHAR(128)	Relation	al database name.
	TABLE_SCHEM	VARCHAR(128)	Name o	f the SQL schema that contains the table.
	TABLE_NAME	VARCHAR(128)	Table na	nme.
	COLUMN_NAME	VARCHAR(128)	Column	
	DATA_TYPE	SMALLINT	The data	a type of the column:
			-5	BIGINT
			4	INTEGER
			5	SMALLINT
			3	DECIMAL
			2	NUMERIC
			8	DOUBLE PRECISION
			7	REAL
-			-360	DECFLOAT
			1	CHARACTER
-			-2	CHARACTER FOR BIT DATA or BINARY
			12	VARCHAR
-			-3	VARCHAR FOR BIT DATA or VARBINARY
-			-99	CLOB
			-95	GRAPHIC
			-96	VARGRAPHIC
			-350	DBCLOB
Ι			-8	NCHAR
-			-9	NVARCHAR
-			-10	NCLOB
-			-98	BLOB
			91	DATE
			92	TIME
			93	TIMESTAMP
			70	DATALINK
			-100	ROWID
			17	DISTINCT

Table 160. SQLCOLUMNS view (continued)

Column Name	Data Type	Description
TYPE_NAME	VARCHAR(261)	The name of the data type of the column:
		BIGINT BIGINT
		INTEGER INTEGER
		SMALLINT SMALLINT
		DECIMAL DECIMAL
		NUMERIC NUMERIC
		FLOAT DOUBLE PRECISION
		REAL REAL
		DECFLOAT DECFLOAT
		CHARacter CHARACTER
		CHARACTER FOR BIT DATA CHARACTER FOR BIT DATA
		VARCHAR VARCHAR
		VARCHAR FOR BIT DATA VARCHAR FOR BIT DATA
		CLOB CLOB
		GRAPHIC GRAPHIC
		VARGRAPHIC VARGRAPHIC
		DBCLOB DBCLOB
		NCHAR NCHAR
		NVARCHAR NVARCHAR
		NCLOB NCLOB
		BINARY BINARY
		VARBINARY VARBINARY
		BLOB BLOB
		DATE DATE
		TIME TIME
		TIMESTAMP TIMESTAMP
		DATALINK DATALINK
		ROWID ROWID
		Qualified Type Name DISTINCT

Table 160. SQLCOLUMNS view (continued)

Column Name	Data Type	Description
COLUMN_SIZE	INTEGER	The length of the column.
BUFFER_LENGTH	INTEGER	Indicates the length of the column in a buffer.
DECIMAL_DIGITS	SMALLINT	Indicates the number of digits for a numeric column.
	Nullable	Contains the null value if the object is not numeric.
NUM_PREC_RADIX	SMALLINT	Indicates the radix of a numeric column.
	Nullable	Contains the null value if the object is not numeric.
NULLABLE	SMALLINT	Indicates whether the column can contain the null value.
		0 The column does not allow nulls.
		1 The column does allow nulls.
REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
	Nullable	Contains the null value if there is no long comment.
COLUMN_DEF	VARCHAR(2000)	The default value of the column.
	Nullable	Contains the null value if there is no default value.

Table 160. SQLCOLUMNS view (continued)

Column Name	Data Type	Description	
SQL_DATA_TYPE	SMALLINT	Indicate	es the SQL data type of the column.
		-5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
		-360	DECFLOAT
		1	CHARACTER
		-2	CHARACTER FOR BIT DATA or BINARY
		12	VARCHAR
		-3	VARCHAR FOR BIT DATA or VARBINARY
		-99	CLOB
		-95	GRAPHIC
		-96	VARGRAPHIC
		-350	DBCLOB
		-8	NCHAR
		-9	NVARCHAR
		-10	NCLOB
		-98	BLOB
		9	DATE
		9	TIME
		9	TIMESTAMP
		70	DATALINK
		-100	ROWID
		17	DISTINCT
SQL_DATETIME_SUB	SMALLINT	The dat	etime subtype of the data type:
	Nullable	1	DATE
		2	TIME
		3	TIMESTAMP
		Contain type.	s the null value if the column is not a datetime data
CHAR_OCTET_LENGTH	INTEGER	Indicate	es the length in characters of the column.
	Nullable	Contain	s the null value if the column is not a string.
ORDINAL_POSITION	INTEGER	Indicate	es the ordinal position of the column in the table.
IS_NULLABLE	VARCHAR(3)		s whether the column can contain the null value.
		NO	The column is not nullable.
		YES	The column is nullable.

Table 160. SQLCOLUMNS view (continued)

	Column Name	Data Type	Descrip	tion	
	JDBC_DATA_TYPE	SMALLINT	Indicates the JDBC data type of the column.		
			-5	BIGINT	
			4	INTEGER	
			5	SMALLINT	
			3	DECIMAL	
			2	NUMERIC	
			8	DOUBLE PRECISION	
			7	REAL	
I			1111	DECFLOAT	
			1	CHARACTER or GRAPHIC or NCHAR	
			-2	CHARACTER FOR BIT DATA or BINARY	
			12	VARCHAR or VARGRAPHIC or NVARCHAR	
			-3	VARCHAR FOR BIT DATA or VARBINARY	
I			2005	CLOB or DBCLOB or NCLOB	
			2004	BLOB	
			91	DATE	
			92	TIME	
			93	TIMESTAMP	
			70	DATALINK	
			1111	ROWID	
			2001	DISTINCT	
	SCOPE_CATALOG	VARCHAR(128)	Reserve	d. Contains the null value.	
		Nullable			
	SCOPE_SCHEMA	VARCHAR(128)	Reserve	d. Contains the null value.	
		Nullable			
	SCOPE_TABLE	VARCHAR(128)	Reserve	d. Contains the null value.	
	_				
1	COLIDCE DATA TVDE	Nullable SMALLINT	The cour	rce data type if the data type of the column is a distinct	
i	SOURCE_DATA_TYPE	SMALLINI		r values see JDBC_DATA_TYPE.	
ı		Nullable	Contains the null value if the data type is not a distinct type.		
	DBNAME	VARCHAR(8)		d. Contains the null value.	
		NT 11 1 1			
ı	PSEUDO_COLUMN	Nullable SMALLINT	Indicate	s whether this is a ROWID, identity, or row change	
i	13E0DO_COLONIN	SWIALLINI		np column.	
			1	The column is not a ROWID, identity, or row change timestamp column.	
 			2	The column is a ROWID, identity, or row change timestamp column.	
	COLUMN_TEXT	VARCHAR(50)	The text	of the column.	
		Nullable	Contains	s the null value if the column has no column text.	

Table 160. SQLCOLUMNS view (continued)

Column Name	Data Type	Descrij	Description	
SYSTEM_COLUMN_NAME	CHAR(10)	The sys	stem name of the column.	
I_DATA_TYPE	SMALLINT	Indicat	es the IBM i CLI data type of the column.	
		19	BIGINT	
		4	INTEGER	
		5	SMALLINT	
		3	DECIMAL	
		2	NUMERIC	
		8	DOUBLE PRECISION	
		7	REAL	
I		-360	DECFLOAT	
		1	CHARACTER	
I		-2	CHARACTER FOR BIT DATA or BINARY	
		12	VARCHAR	
I		-3	VARCHAR FOR BIT DATA or VARBINARY	
		14	CLOB	
I		95	GRAPHIC or NCHAR	
1		96	VARGRAPHIC or NVARCHAR	
1		15	DBCLOB or NCLOB	
		13	BLOB	
		91	DATE	
		92	TIME	
		93	TIMESTAMP	
		16	DATALINK	
		1111	ROWID	
		2001	DISTINCT	

SQLFOREIGNKEYS

The SQLFOREIGNKEYS view contains one row for every referential constraint key on a table.

The following table describes the columns in the view:

Table 161. SQLFOREIGNKEYS view

Column Name	Data Type	Description		
PKTABLE_CAT	VARCHAR(128)	Relational database name		
PKTABLE_SCHEM	VARCHAR(128)	Name of	f the SQL schema containing the parent table.	
PKTABLE_NAME	VARCHAR(128)	Parent ta	able name.	
PKCOLUMN_NAME	VARCHAR(128)	Parent k	ey column name.	
FKTABLE_CAT	VARCHAR(128)	Relation	al database name	
FKTABLE_SCHEM	VARCHAR(128)		f the SQL schema containing the dependent table of the al constraint.	
FKTABLE_NAME	VARCHAR(128)	Depende	ent table name of the referential constraint.	
FKCOLUMN_NAME	VARCHAR(128)	Dependent key name.		
KEY_SEQ	SMALLINT	The posi	ition of the column within the key.	
UPDATE_RULE	SMALLINT	Update Rule.		
		1	RESTRICT	
		3	NO ACTION	
DELETE_RULE	SMALLINT	Delete R	dule:	
		0	CASCADE	
		1	RESTRICT	
		2	SET NULL	
		3	NO ACTION	
		4	SET DEFAULT	
FK_NAME	VARCHAR(128)	Name of	f the referential constraint	
PK_NAME	VARCHAR(128)	Name of	f the unique constraint	
DEFERRABILITY	SMALLINT	Indicates always b	s whether the constraint checking can be deferred. Will be 7.	
UNIQUE_OR_PRIMARY	CHAR(7)	Indicates	s the type of parent constraint:	
		PRIMAI	RY	

The parent constraint is a primary key.

UNIQUE

The parent constraint is a unique constraint.

SQLFUNCTIONCOLS

SQLFUNCTIONCOLS

The SQLFUNCTIONCOLS view contains one row for every parameter of a function. The result of a scalar function and the result columns of a table function are also returned.

The following table describes the columns in the view:

Table 162. SQLFUNCTIONCOLS view

I	Column Name	Data Type	Descript	ion
I	FUNCTION_CAT	VARCHAR(128)	Relational database name	
I	FUNCTION_SCHEM	VARCHAR(128)	Schema name of the function instance.	
I	FUNCTION_NAME	VARCHAR(128)	Name of the function instance.	
I	COLUMN_NAME	VARCHAR(128)	Name of a function parameter.	
		Nullable	Contains	the null value if the parameter does not have a name.
I	COLUMN_TYPE	SMALLINT	Type of t	he parameter:
I			1	IN
I			4	RETURN value
I			5	Result column of a table function

1 Table 162. SQLFUNCTIONCOLS view (continued)

I	Column Name	Data Type	Description	
-	DATA_TYPE	SMALLINT	The data	type of the parameter:
-			-5	BIGINT
I			4	INTEGER
I			5	SMALLINT
-			3	DECIMAL
I			2	NUMERIC
I			8	DOUBLE PRECISION
I			7	REAL
-			-360	DECFLOAT
I			1	CHARACTER
I			-2	CHARACTER FOR BIT DATA or BINARY
I			12	VARCHAR
-			-3	VARCHAR FOR BIT DATA or VARBINARY
I			-99	CLOB
-			-95	GRAPHIC or
-			-96	VARGRAPHIC
I			-350	DBCLOB
-			-8	NCHAR
I			-9	NVARCHAR
I			-10	NCLOB
I			-98	BLOB
I			91	DATE
I			92	TIME
I			93	TIMESTAMP
I			70	DATALINK
I			-100	ROWID
I			17	DISTINCT

SQLFUNCTIONCOLS

Table 162. SQLFUNCTIONCOLS view (continued)

Column Name	Data Type	Description
TYPE_NAME	VARCHAR(261)	The name of the data type of the parameter:
		BIGINT BIGINT
		INTEGER INTEGER
		SMALLINT SMALLINT
		DECIMAL DECIMAL
		NUMERIC NUMERIC
		FLOAT DOUBLE PRECISION
		REAL REAL
		DECFLOAT DECFLOAT
		CHARACTER CHARACTER
		CHARACTER FOR BIT DATA CHARACTER FOR BIT DATA
		VARCHAR VARCHAR
		VARCHAR FOR BIT DATA VARCHAR FOR BIT DATA
		CLOB CLOB
		GRAPHIC GRAPHIC
		VARGRAPHIC VARGRAPHIC
		DBCLOB DBCLOB
		NCHAR
		NCHAR
		NVARCHAR NVARCHAR
		NCLOB NCLOB
		BINARY
		BINARY
		VARBINARY Varbinary
		BLOB BLOB
		DATE DATE
		TIME TIME
		TIMESTAMP TIMESTAMP
		DATALINK DATALINK
		ROWID ROWID

Table 162. SQLFUNCTIONCOLS view (continued)

	Column Name	Data Type	Description	
Ι	COLUMN_SIZE	INTEGER	Length o	of the parameter.
Ι	BUFFER_LENGTH	INTEGER	Indicate	s the length of the parameter in a buffer.
Ι	DECIMAL_DIGITS	SMALLINT	Scale of	numeric or datetime data.
		Nullable	Contains the null value if the parameter is not decimal, numeric, binary, time or timestamp.	
Ţ	NUM_PREC_RADIX	SMALLINT		s if the precision specified in column
i		Nullable	NUMERIC_PRECISION is specified as a number of bidecimal digits:	
			2	Binary; floating-point precision is specified in binary digits.
			10	Decimal; all other numeric types are specified in decimal digits.
			Contains	s the null value if the parameter is not numeric.
Ι	NULLABLE	SMALLINT	Indicate	s whether the parameter is nullable.
I			0	The parameter does not allow nulls.
I			1	The parameter does allow nulls.
I	REMARKS	VARCHAR(2000)	A charac	cter string supplied with the COMMENT statement.
		Nullable	Contains	s the null value if there is no long comment.
I	COLUMN_DEF	VARCHAR(1)	The defa	ault value for the column.
		Nullable	Contains	s the null value if there is no default value.

SQLFUNCTIONCOLS

Table 162. SQLFUNCTIONCOLS view (continued)

Column Name	Data Type	Description		
SQL_DATA_TYPE	SMALLINT	The SQL data ty	he SQL data type of the parameter:	
		–5 BIGIN	JT	
		4 INTE	GER	
		5 SMAI	LLINT	
		3 DECI	MAL	
		2 NUM	ERIC	
		8 DOUI	BLE PRECISION	
		7 REAL		
		-360 DECF	LOAT	
		1 CHAI	RACTER	
		-2 CHAI	RACTER FOR BIT DATA or BINARY	
		12 VARC	CHAR	
		-3 VARC	CHAR FOR BIT DATA or VARBINARY	
		-99 CLOE	3	
		-95 GRAI	PHIC	
		-96 VARO	GRAPHIC	
		-350 DBCI	OB	
		-8 NCH.	AR	
		-9 NVAI	RCHAR	
		-10 NCLC	OB	
		-98 BLOB		
		9 DATE		
		9 TIME		
		9 TIME	STAMP	
		70 DATA	LINK	
		-100 ROW	ID	
		17 DISTI	NCT	
SQL_DATETIME_SUB	SMALLINT	The datetime su	obtype of the parameter:	
	Nullable	1 DATE		
	- 1 - 1 - 1 - 1 - 1	2 TIME		
		3 TIME	STAMP	
		Contains the nutype.	ıll value if the data type is not a datetime da	
CHAR_OCTET_LENGTH	INTEGER	Indicates the lea	ngth in characters of the parameter.	
	Nullable	Contains the nu	all value if the column is not a string.	
ORDINAL_POSITION	INTEGER	Numeric place of from left to righ	of the parameter in the parameter list, orderent.	
		For scalar funct	ions, the result of the function has a value of	
			ons, the result columns are numbered from 1 column) to n (n th result column).	

1 Table 162. SQLFUNCTIONCOLS view (continued)

I	Column Name	Data Type	Description	
I	IS_NULLABLE	VARCHAR(3)	Indicate	s whether the parameter is nullable.
I			NO	The parameter does not allow nulls.
I			YES	The parameter does allow nulls.
I	SPECIFIC_NAME	VARCHAR(128)	-	name of the function instance
I	JDBC_DATA_TYPE	INTEGER	The JDB	C data type of the parameter:
I			-5	BIGINT
			4	INTEGER
I			5	SMALLINT
-			3	DECIMAL
-			2	NUMERIC
-			8	DOUBLE PRECISION
-			7	REAL
-			1111	DECFLOAT
-			1	CHARACTER or GRAPHIC or NCHAR
I			-2	CHARACTER FOR BIT DATA or BINARY
I			12	VARCHAR or VARGRAPHIC or NVARCHAR
I			-3	VARCHAR FOR BIT DATA or VARBINARY
I			2005	CLOB or DBCLOB or NCLOB
-			2004	BLOB
I			91	DATE
-			92	TIME
I			93	TIMESTAMP
I			70	DATALINK
I			1111	ROWID
I			2001	DISTINCT

SQLFUNCTIONCOLS

Table 162. SQLFUNCTIONCOLS view (continued)

1	Column Name	Data Type	Description	
-1	I_DATA_TYPE	INTEGER	Indicates	the IBM i CLI data type of the column.
-1			19	BIGINT
I			4	INTEGER
-			5	SMALLINT
I			3	DECIMAL
I			2	NUMERIC
I			8	DOUBLE PRECISION
-			7	REAL
I			-360	DECFLOAT
I			1	CHARACTER
-1			-2	CHARACTER FOR BIT DATA or BINARY
I			12	VARCHAR
-			-3	VARCHAR FOR BIT DATA or VARBINARY
I			14	CLOB
-1			95	GRAPHIC or NCHAR
-1			96	VARGRAPHIC or NVARCHAR
-1			15	DBCLOB or NCLOB
-			13	BLOB
-			91	DATE
-			92	TIME
-			93	TIMESTAMP
-1			16	DATALINK
-1			1111	ROWID
Ţ			2001	DISTINCT
l I				

SQLFUNCTIONS

The SQLFUNCTIONS view contains one row for every function.

The following table describes the columns in the view:

Table 163. SQLFUNCTIONS view

ı	Column Name	Data Type	Description	
-	FUNCTION_CAT	VARCHAR(128)	Relational database name	
-	FUNCTION_SCHEM	VARCHAR(128)	Name of the schema of the function instance.	
-	FUNCTION_NAME	VARCHAR(128)	Name of the function.	
-	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.	
		Nullable	Contains the null value if there is no long comment.	
I	FUNCTION_TYPE	SMALLINT	Type of function:	
I			1 Column or scalar function	
1			2 Table function	
	SPECIFIC_NAME	VARCHAR(128)	Specific name of the function instance	

SQLPRIMARYKEYS

SQLPRIMARYKEYS

The SQLPRIMARYKEYS view contains one row for every primary constraint key on a table.

Table 164. SQLPRIMARYKEYS view

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	Relational database name
TABLE_SCHEM	VARCHAR(128)	Name of the schema containing the table with the primary key.
TABLE_NAME	VARCHAR(128)	Name of the table with the primary key.
COLUMN_NAME	VARCHAR(128)	Name of a primary key column.
KEY_SEQ	SMALLINT	The position of the column within the key.
PK_NAME	VARCHAR(128)	Name of the primary key constraint.

The SQLPROCEDURECOLS view contains one row for every parameter of a procedure.

The following table describes the columns in the view:

Table 165. SQLPROCEDURECOLS view

I

Column Name	Data Type	Descrip	otion
PROCEDURE_CAT	VARCHAR(128)	Relational database name	
PROCEDURE_SCHEM	VARCHAR(128)	Schema name of the procedure instance.	
PROCEDURE_NAME	VARCHAR(128)		of the procedure instance.
COLUMN_NAME	VARCHAR(128)	Name o	of a procedure parameter.
	Nullable	Contair	ns the null value if the parameter does not have a name.
COLUMN_TYPE	SMALLINT	Type of	f the parameter:
		1	IN
		2	INOUT
		4	OUT
DATA_TYPE	SMALLINT	The da	ta type of the parameter:
		-5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
		-360	DECFLOAT
		1	CHARACTER
		-2	CHARACTER FOR BIT DATA or BINARY
		12	VARCHAR
		-3	VARCHAR FOR BIT DATA or VARBINARY
		-99	CLOB
		-95	GRAPHIC
		-96	VARGRAPHIC
		-350	DBCLOB
		-8	NCHAR
		- 9	NVARCHAR
		-10	NCLOB
		-98	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		70	DATALINK
		-100	ROWID

Table 165. SQLPROCEDURECOLS view (continued)

Column Name	Data Type	Description	
TYPE_NAME	VARCHAR(261)	The name of the data type of the parameter:	
		BIGINT BIGINT	
		INTeger INTEGER	
		SMALLINT SMALLINT	
		DECIMAL DECIMAL	
		NUMERIC NUMERIC	
		FLOAT DOUBLE PRECISION	
		REAL REAL	
		DECFLOAT DECFLOAT	
		CHARACTER	
		CHARACTER FOR BIT DATA CHARACTER FOR BIT DATA	
		VARCHAR VARCHAR	
		VARCHAR FOR BIT DATA VARCHAR FOR BIT DATA	
		CLOB CLOB	
		GRAPHIC GRAPHIC	
		VARGRAPHIC VARGRAPHIC	
		DBCLOB DBCLOB	
		NCHAR NCHAR	
		NVARCHAR NVARCHAR	
		NCLOB NCLOB	
		BINARY BINARY	
		VARBINARY VARBINARY	
		BLOB BLOB	
		DATE DATE	
		TIME TIME	
		TIMESTAMP TIMESTAMP	
		DATALINK DATALINK	
		ROWID ROWID	
		Qualified Type Name DISTINCT	

Table 165. SQLPROCEDURECOLS view (continued)

Column N	ame	Data Type	Description	
COLUMN	SIZE	INTEGER	Length o	of the parameter.
BUFFER_L	ENGTH	INTEGER	Indicates	s the length of the parameter in a buffer.
DECIMAL.	_DIGITS	SMALLINT	Scale of	numeric or datetime data.
	Nullable M_PREC_RADIX SMALL		Contains the null value if the parameter is not decimal, numeric, binary, time or timestamp. Indicates if the precision specified in column	
NUM_PRE				
		Nullable	decimal	IC_PRECISION is specified as a number of binary or digits:
			2	Binary; floating-point precision is specified in binary digits.
			10	Decimal; all other numeric types are specified in decimal digits.
			Contains the null value if the parameter is not numeric.	
NULLABL	Е	SMALLINT	Indicates	s whether the parameter is nullable.
			0	The parameter does not allow nulls.
			1	The parameter does allow nulls.
REMARKS		VARCHAR(2000)	A charac	cter string supplied with the COMMENT statement.
		Nullable	Contains	s the null value if there is no long comment.
COLUMN	_DEF	VARCHAR(1)	The defa	ault value for the column.
		Nullable	Contains	s the null value if there is no default value.

Table 165. SQLPROCEDURECOLS view (continued)

	Column Name Data Type		Description		
	SQL_DATA_TYPE	SMALLINT	The SQI	L data type of the parameter:	
			-5	BIGINT	
			4	INTEGER	
			5	SMALLINT	
			3	DECIMAL	
			2	NUMERIC	
			8	DOUBLE PRECISION	
			7	REAL	
I			-360	DECFLOAT	
			1	CHARACTER	
I			-2	CHARACTER FOR BIT DATA or BINARY	
			12	VARCHAR	
I			-3	VARCHAR FOR BIT DATA or VARBINARY	
			-99	CLOB	
			-95	GRAPHIC	
			-96	VARGRAPHIC	
			-350	DBCLOB	
I			-8	NCHAR	
I			-9	NVARCHAR	
I			-10	NCLOB	
			-98	BLOB	
			9	DATE	
I			9	TIME	
I			9	TIMESTAMP	
			70	DATALINK	
			-100	ROWID	
			17	DISTINCT	
	SQL_DATETIME_SUB	SMALLINT	The date	etime subtype of the parameter:	
		Nullable	1	DATE	
		Tullubic	2	TIME	
			3	TIMESTAMP	
			Contain type.	s the null value if the data type is not a datetime data	
	CHAR_OCTET_LENGTH	INTEGER	Indicates the length in characters of the parameter.		
		Nullable	Contain	s the null value if the column is not a string.	
	ORDINAL_POSITION	INTEGER		c place of the parameter in the parameter list, ordered to right.	
	IS_NULLABLE	VARCHAR(3)	Indicate	s whether the parameter is nullable.	
			NO	The parameter does not allow nulls.	
_			YES	The parameter does allow nulls.	
ı	SPECIFIC_NAME	VARCHAR(128)	Specific	name of the procedure instance.	

Table 165. SQLPROCEDURECOLS view (continued)

Column Name	Data Type	Descrip	tion
JDBC_DATA_TYPE	INTEGER	The JDB	C data type of the parameter:
		-5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
I		1111	DECFLOAT
1		1	CHARACTER or GRAPHIC or NCHAR
I		-2	CHARACTER FOR BIT DATA or BINARY
I		12	VARCHAR or VARGRAPHIC or NVARCHAR
I		-3	VARCHAR FOR BIT DATA or VARBINARY
I		2005	CLOB or DBCLOB or NCLOB
		2004	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		70	DATALINK
		1111	ROWID
		2001	DISTINCT

Table 165. SQLPROCEDURECOLS view (continued)

Column Name	Data Type	Descrip	ption
I_DATA_TYPE	INTEGER	Indicat	es the IBM i CLI data type of the column.
		19	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
		-360	DECFLOAT
		1	CHARACTER
		-2	CHARACTER FOR BIT DATA or BINARY
		12	VARCHAR
		-3	VARCHAR FOR BIT DATA or VARBINARY
		14	CLOB
		95	GRAPHIC or NCLOB
		96	VARGRAPHIC or NVARCHAR
		15	DBCLOB or NCLOB
		13	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		16	DATALINK
		1111	ROWID
		2001	DISTINCT

SQLPROCEDURES

The SQLPROCEDURES view contains one row for every procedure.

Table 166. SQLPROCEDURES view

	Column Name	Data Type	Description
	PROCEDURE_CAT	VARCHAR(128)	Relational database name
	PROCEDURE_SCHEM	VARCHAR(128)	Name of the schema of the procedure instance.
	PROCEDURE_NAME	VARCHAR(128)	Name of the procedure.
I	NUM_INPUT_PARAMS	INTEGER	Identifies the number of input parameters. 0 indicates that there are no input parameters.
I	NUM_OUTPUT_PARAMS	INTEGER	Identifies the number of output parameters. 0 indicates that there are no output parameters.
	NUM_RESULT_SETS	SMALLINT	Identifies the maximum number of result sets returned. 0 indicates that there are no result sets.
	REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
		Nullable	Contains the null value if there is no long comment.
	PROCEDURE_TYPE	SMALLINT	Reserved. Contains 0.
I	NUM_INOUT_PARAMS	INTEGER	Identifies the number of input/output parameters. 0 indicates that there are no input/output parameters.
I	SPECIFIC_NAME	VARCHAR(128)	Specific name of the procedure instance.

SQLSCHEMAS

SQLSCHEMAS

The SQLSCHEMAS view contains one row for every schema.

Table 167. SQLSCHEMAS view

Column Name	Data Type	Description			
TABLE_CAT	VARCHAR(128)	Relational database name			
TABLE_SCHEM	VARCHAR(128)	Name of the schema.			
TABLE_NAME	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
TABLE_TYPE	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
REMARKS	VARCHAR(2000)	Reserved. Contains the null value.			
	Nullable				
TYPE_CAT	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
TYPE_SCHEM	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
TYPE_NAME	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
SELF_REFERENCING_COL_NAME	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
REF_GENERATION	VARCHAR(128)	Reserved. Contains the null value.			
	Nullable				
DBNAME	VARCHAR(8)	Reserved. Contains the null value.			
	Nullable				
SCHEMA_TEXT	VARCHAR(50)	A character string that describes the schema.			
	Nullable	Contains the empty string if there is no text.			
SYSTEM_TABLE_SCHEMA	CHAR(10)	System schema name.			

SQLSPECIALCOLUMNS

The SQLSPECIALCOLUMNS view contains one row for every column of a primary key, unique constraint, or unique index that can identify a row of the table.

Table 168. SQLSPECIALCOLUMNS view

Column Name	Data Type	Descrip	
SCOPE	SMALLINT		d. Contains 0.
COLUMN_NAME	VARCHAR(128)	Column	
DATA_TYPE	SMALLINT		a type of the column:
		- 5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
		-360	DECFLOAT
		1	CHARACTER
		-2	CHARACTER FOR BIT DATA
		12	VARCHAR
		-3	VARCHAR FOR BIT DATA
		40	CLOB
		-95	GRAPHIC
		-96	VARGRAPHIC
		-350	DBCLOB
		-2	BINARY
		-3	VARBINARY
		30	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		70	DATALINK
		-100	ROWID
		17	DISTINCT
TYPE_NAME	VARCHAR(260)	The nan	ne of the data type of the column.
COLUMN_SIZE	INTEGER	The leng	gth of the column.
BUFFER_LENGTH	INTEGER	Indicate	es the length of the column in a buffer.
DECIMAL_DIGITS	SMALLINT	Indicate	es the number of digits for a numeric column.
	Nullable	Contain	is the null value if the column is not numeric.
DECIMAL_DIGITS			_

SQLSPECIALCOLUMNS

Table 168. SQLSPECIALCOLUMNS view (continued)

Column Name	Data Type	Descri	ption	
PSEUDO_COLUMN	SMALLINT	Indicates whether this is a ROWID, identity, or row change timestamp column.		
		1	The column is not a ROWID, identity, or row change timestamp column.	
		2	The column is a ROWID, identity, or row change timestamp column.	
TABLE_CAT	VARCHAR(128)	Relatio	nal database name	
TABLE_SCHEM	VARCHAR(128)	Name	of the SQL schema that contains the table.	
TABLE_NAME	VARCHAR(128)	Name	of the table.	
NULLABLE	SMALLINT	Indicat	es whether the column can contain the null value.	
		0	The column is not nullable.	
		1	The column is nullable.	
JDBC_DATA_TYPE	SMALLINT	Indicat	es the JDBC data type of the column.	
		-5	BIGINT	
		4	INTEGER	
		5	SMALLINT	
		3	DECIMAL	
		2	NUMERIC	
		8	DOUBLE PRECISION	
		7	REAL	
		1111	DECFLOAT	
		1	CHARACTER	
		-2	CHARACTER FOR BIT DATA	
		12	VARCHAR	
		-3	VARCHAR FOR BIT DATA	
		2005	CLOB	
		1	GRAPHIC	
		12	VARGRAPHIC	
		2005	DBCLOB	
		-2	BINARY	
		-3	VARBINARY	
		2004	BLOB	
		91	DATE	
		92	TIME	
		93	TIMESTAMP	
		70	DATALINK	
		1111	ROWID	
		2001	DISTINCT	
		2001	DIGITING	

SQLSPECIALCOLUMNS

Table 168. SQLSPECIALCOLUMNS view (continued)

Column Name	Data Type	Descrip	otion	
I_DATA_TYPE	SMALLINT	Indicate	Indicates the IBM i CLI data type of the column.	
		19	BIGINT	
		4	INTEGER	
		5	SMALLINT	
		3	DECIMAL	
		2	NUMERIC	
		8	DOUBLE PRECISION	
		7	REAL	
1		-360	DECFLOAT	
		1	CHARACTER	
		-2	CHARACTER FOR BIT DATA	
		12	VARCHAR	
		-3	VARCHAR FOR BIT DATA	
		14	CLOB	
		95	GRAPHIC	
		96	VARGRAPHIC	
		15	DBCLOB	
		-2	BINARY	
		-3	VARBINARY	
		13	BLOB	
		91	DATE	
		92	TIME	
		93	TIMESTAMP	
		16	DATALINK	
		1111	ROWID	
		2001	DISTINCT	

SQLSTATISTICS

The SQLSTATISTICS view contains statistic information about a table.

Table 169. SQLSTATISTICS view

Data Type	Description	
VARCHAR(128)	Relational database name	
VARCHAR(128)	Name of the SQL schema of the table.	
VARCHAR(128)	Name of the table.	
SMALLINT	Indicates whether an index prohibits duplicate keys on the table.	
Nullable	Contains the null value if the TYPE is 0.	
VARCHAR(128)	Name of the schema of the index.	
Nullable	Contains the null value if the TYPE is 0.	
VARCHAR(128)	Name of the index.	
Nullable	Contains the null value if the TYPE is 0.	
SMALLINT	Indicates the type of information returned:	
	0 The number of rows in the table.	
	3 An index on the table.	
SMALLINT	Indicates the ordinal position of the key in the index.	
Nullable	Contains the null value if the TYPE is 0.	
DBCLOB(2097152) CCSID 1200	If the key column is an expression, contains the expression. Contains the column name if the key column is not an expression.	
Nullable	Contains the null value if the TYPE is 0.	
CHAR(1)	Order of the column in the key:	
Nullable	A Ascending	
	D Descending	
	Contains the null value if the TYPE is 0.	
BIGINT	Reserved. Contains the null value.	
Nullable		
BIGINT	Reserved. Contains the null value.	
Nullable		
	Indicates whether the index is a sparse index.	
CCSID 1200	search-condition	
Nullable	This is an SQL index with a WHERE clause.	
runable	empty-string	
	This is a DDS-created select/omit index.	
	Contains the null value if the TYPE is 0 or this is not a sparse index.	
	VARCHAR(128) VARCHAR(128) VARCHAR(128) VARCHAR(128) SMALLINT Nullable VARCHAR(128) Nullable VARCHAR(128) Nullable SMALLINT SMALLINT Nullable DBCLOB(2097152) CCSID 1200 Nullable CHAR(1) Nullable BIGINT Nullable BIGINT Nullable DBCLOB(2097152)	

SQLTABLEPRIVILEGES

The SQLTABLEPRIVILEGES view contains one row for every privilege granted on a table. Note that this catalog view cannot be used to determine whether a user is authorized to a table or view because the privilege to use a table or view could be acquired through a group user profile or special authority (such as *ALLOBJ).

Table 170. SQLTABLEPRIVILEGES view

Column Name	Data Type	Description	
TABLE_CAT	VARCHAR(128)	Relational database name	
TABLE_SCHEM	VARCHAR(128)	Name of the SQL schema of the table.	
TABLE_NAME	VARCHAR(128)	Name of the table.	
GRANTOR	VARCHAR(128)	Reserved. Contains the null value.	
	Nullable		
GRANTEE	VARCHAR(128)	The user profile to which the privilege is granted.	
PRIVILEGE	VARCHAR(10)	The privilege granted:	
		ALTER The privilege to alter the table.	
		DELETE	
		The privilege to delete rows from the table.	
		INDEX The privilege to create an index on the table.	
		INSERT The privilege to insert rows into the table.	
		REFERENCES	
		The privilege to reference the table in a referential constraint.	
		SELECT The privilege to select rows from the table.	
		UPDATE	
		The privilege to update the table.	
IS_GRANTABLE	VARCHAR(3)	Indicates whether the privilege is grantable to other users.	
		NO The privilege is not grantable.	
		YES The privilege is grantable.	
DBNAME	VARCHAR(8)	Reserved. Contains the null value.	
	Nullable		

SQLTABLES

SQLTABLES

The SQLTABLES view contains one row for every table, view, and alias.

Table 171. SQLTABLES view

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	Relational database name
TABLE_SCHEM	VARCHAR(128)	Name of the schema containing the table.
TABLE_NAME	VARCHAR(128)	Name of the table.
TABLE_TYPE	VARCHAR(24)	Indicates the type of the table:
		ALIAS The table is an alias.
		MATERIALIZED QUERY TABLE The object is a materialized query table.
		SYSTEM TABLE The table is a system table.
		TABLE The table is an SQL table or physical file.
		VIEW The table is an SQL view or logical file.
REMARKS	VARCHAR(2000)	A character string supplied with the COMMENT statement.
	Nullable	Contains the null value if there is no long comment.
TYPE_CAT	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
TYPE_SCHEM	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
TYPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SELF_REF_COL_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
REF_GENERATION	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
DBNAME	VARCHAR(8)	Reserved. Contains the null value.
	Nullable	
TABLE_TEXT	VARCHAR(50)	A character string provided with the LABEL statement.

The SQLTYPEINFO table contains one row for every built-in data type.

Table 172. SQLTYPEINFO table

Column Name	Data Type	Description
TYPE_NAME	VARCHAR(128)	Name of the built-in data type:
		BIGINT BIGINT
		INTeger INTEGER
		SMALLINT SMALLINT
		DECIMAL DECIMAL
		NUMERIC NUMERIC
		FLOAT DOUBLE PRECISION
		REAL REAL
		DECFLOAT DECFLOAT
		CHARacter CHARACTER
		CHARacter FOR BIT DATA CHARACTER FOR BIT DATA
		VARCHAR VARCHAR
		VARCHAR FOR BIT DATA VARCHAR FOR BIT DATA
		CLOB CLOB
		GRAPHIC GRAPHIC
		VARGRAPHIC VARGRAPHIC
		DBCLOB DBCLOB
		NCHAR NCHAR
		NVARCHAR NVARCHAR
		NCLOB NCLOB
		BINARY BINARY
		VARBINARY VARBINARY
		BLOB BLOB
		DATE DATE
		TIME TIME
		TIMESTAMP TIMESTAMP
		DATALINK DATALINK
		ROWID ROWID

Table 172. SQLTYPEINFO table (continued)

Column Name	Data Type	Description
DATA_TYPE	SMALLINT	The data type of the column:
		-5 BIGINT
		4 INTEGER
		5 SMALLINT
		3 DECIMAL
		2 NUMERIC
		8 DOUBLE PRECISION
		7 REAL
		-360 DECFLOAT
		1 CHARACTER
		-2 CHARACTER FOR BIT DATA or BINARY
		12 VARCHAR
		-3 VARCHAR FOR BIT DATA or VARBINARY
		-99 CLOB
		-95 GRAPHIC
		-96 VARGRAPHIC
		-350 DBCLOB
		-8 NCHAR
		-9 NVARCHAR
		-10 NCLOB
		-99 BLOB
		91 DATE
		92 TIME
		93 TIMESTAMP
		70 DATALINK
		-100 ROWID
		2001 DISTINCT
COLUMN_SIZE	INTEGER	The maximum length of the data type.
	Nullable	
LITERAL_PREFIX	VARCHAR(128)	Indicates the prefix for a string literal.
	Nullable	Contains the null value if the data type is not a string.
LITERAL_SUFFIX	VARCHAR(128)	Indicates the suffix for a string literal.
	Nullable	Contains the null value if the data type is not a string.
CREATE_PARAMS	VARCHAR(128)	Indicates the parameters supported with the data type.
	Nullable	length The parameter is a length. Returned for all string data types and DATALINK.
		precision,scale The parameters include precision and scale. Return for the DECIMAL and NUMERIC data types.
		Contains the null value for all other data types.
		Comains the num value for all other data types.

Table 172. SQLTYPEINFO table (continued)

Column Name	Data Type	Description
NULLABLE	SMALLINT	Indicates whether the data type is nullable.
	Nullable	0 The data type does not allow nulls.
	rvanable	1 The data type does allow nulls.
CASE_SENSITIVE	SMALLINT	Indicates whether the data type is case sensitive.
	Nullable	0 The data type is not case sensitive.
	Tunuble	1 The data type is case sensitive.
SEARCHABLE	SMALLINT	Indicates whether the data type can be used in a predicate.
	Nullable	0 The data type cannot be used in predicates.
	Number	2 The data type can be used in all predicates except the LIKE predicate.
		The data type can be used in all predicates including the LIKE predicate.
UNSIGNED_ATTRIBUTE	SMALLINT	Indicates whether the numeric data type is signed or unsigned.
	Nullable	0 The data type is signed.
		1 The data type is unsigned.
		Contains the null value if the data type is not numeric.
FIXED_PREC_SCALE	SMALLINT	Indicates whether the data type has a fixed precision and scale.
		The data type does not have a fixed precision and scale.
		1 The data type does have a fixed precision and scale.
AUTO_UNIQUE_VALUE	SMALLINT	Indicates whether the numeric data type is auto-incrementing:
	Nullable	0 The data type is not auto-incrementing.
	Tunuble	1 The data type is auto-incrementing.
		Contains the null value if the data type is not numeric.
LOCAL_TYPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
MINIMUM_SCALE	SMALLINT	Indicates the minimum scale of numeric data types.
	Nullable	Contains the null value if the data type is not numeric.
MAXIMUM_SCALE	SMALLINT	Indicates the maximum scale of numeric data types.
	Nullable	Contains the null value if the data type is not numeric.

Table 172. SQLTYPEINFO table (continued)

Column Name	Data Type	Description		
SQL_DATA_TYPE	SMALLINT	Indicates the SQL data type value of the data type:		
	Nullable	-5 BIGINT		
		4 INTEGER		
		5 SMALLINT		
		3 DECIMAL		
		2 NUMERIC		
		8 DOUBLE PRECISION		
		7 REAL		
		-360 DECFLOAT		
		1 CHARACTER		
		-2 CHARACTER FOR BIT DATA or BINARY		
		12 VARCHAR		
		-3 VARCHAR FOR BIT DATA or VARBINARY		
		-99 CLOB		
		-95 GRAPHIC		
		-96 VARGRAPHIC		
		-350 DBCLOB		
		-8 NCHAR		
		-9 NVARCHAR		
		-10 NCLOB		
		-98 BLOB		
		9 DATE		
		9 TIME		
		9 TIMESTAMP		
		70 DATALINK		
		-100 ROWID		
		17 DISTINCT		
SQL_DATETIME_SUB	SMALLINT	The datetime subtype of the data type:		
	Nullable	1 DATE		
	ivuliable	2 TIME		
		3 TIMESTAMP		
		Contains the null value if the data type is not a datetime type.	e data	
NUM_PREC_RADIX	INTEGER	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or		
	Nullable	decimal digits: 2 Binary; floating-point precision is specified in digits.	binar	
		Decimal; all other numeric types are specified decimal digits.	in	
		Contains the null value if the parameter is not numeric.		

Table 172. SQLTYPEINFO table (continued)

Column Name	Data Type	Description	
INTERVAL_PRECISION	SMALLINT	Reserved	d. Contains the null value.
	Nullable		
JDBC_DATA_TYPE	SMALLINT	The JDB	C data type value of the data type:
		-5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
1		1111	DECFLOAT
I		1	CHARACTER or GRAPHIC or NCHAR
I		-2	CHARACTER FOR BIT DATA or BINARY
I		12	VARCHAR or VARGRAPHIC or NVARCHAR
I		-3	VARCHAR FOR BIT DATA or VARBINARY
1		2005	CLOB or DBCLOB or NCLOB
		2004	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		70	DATALINK
		1111	ROWID
		2001	DISTINCT

Table 172. SQLTYPEINFO table (continued)

Column Name	Data Type	Description	
I_DATA_TYPE	SMALLINT	Indicate	es the IBM i CLI data type of the column.
		19	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
1		-360	DECFLOAT
		1	CHARACTER
1		-2	CHARACTER FOR BIT DATA or BINARY
		12	VARCHAR
1		-3	VARCHAR FOR BIT DATA or VARBINARY
		14	CLOB
1		95	GRAPHIC or NCHAR
1		96	VARGRAPHIC or NVARCHAR
1		15	DBCLOB or NCLOB
		13	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		16	DATALINK
		1111	ROWID
		2001	DISTINCT

SQLUDTS

SQLUDTS

The SQLUDTS view contains one row for every distinct type.

The following table describes the columns in the view:

Table 173. SQLUDTS view

Column Name	Data Type	Description
TYPE_CAT	VARCHAR(128)	Relational database name
TYPE_SCHEM	VARCHAR(128)	Name of the schema containing the user-defined type.
TYPE_NAME	VARCHAR(128)	Name of the user-defined type.

Table 173. SQLUDTS view (continued)

Column Name	Data Type	Description
CLASS_NAME	VARCHAR(20)	Java class name of the user-defined type.
		java.math.BigInteger BIGINT
		java.lang.Integer INTEGER
		java.lang.Short SMALLINT
		java.math.BigDecimal DECIMAL
		java.sql.BigDecimal NUMERIC
		java.lang.Double DOUBLE PRECISION
		java.lang.Float REAL
		java.math.BigDecimal DECFLOAT
		java.lang.String CHARACTER
		byte[] CHARACTER FOR BIT DATA
		java.lang.String VARCHAR
		byte[] VARCHAR FOR BIT DATA
		java.sql.Clob CLOB
		java.lang.String GRAPHIC
		java.lang.String VARGRAPHIC
		java.sql.Clob DBCLOB
		byte[] BINARY
		byte[] VARBINARY
		java.sql.Blob BLOB
		java.sql.Date DATE
		java.sql.Time TIME
		java.sql.Timestamp TIMESTAMP
		java.net.URL DATALINK
		byte[] ROWID
DATA_TYPE	SMALLINT	Reserved. Contains 2001.

SQLUDTS

Table 173. SQLUDTS view (continued)

Column Name	Data Type	Descrip	otion
BASE_TYPE	SMALLINT	The sou	arce data type of the user-defined data type:
		-5	BIGINT
		4	INTEGER
		5	SMALLINT
		3	DECIMAL
		2	NUMERIC
		8	DOUBLE PRECISION
		7	REAL
		1111	DECFLOAT
		1	CHARACTER
		-2	CHARACTER FOR BIT DATA
		12	VARCHAR
		-3	VARCHAR FOR BIT DATA
		2005	CLOB
		1	GRAPHIC
		12	VARGRAPHIC
		2005	DBCLOB
		-2	BINARY
		-3	VARBINARY
		2004	BLOB
		91	DATE
		92	TIME
		93	TIMESTAMP
		70	DATALINK
		1111	ROWID
REMARKS	VARCHAR(2000)	A chara	acter string supplied with the COMMENT statement.
	Nullable	Contair	as the null value if there is no comment.

ANS and ISO catalog views

There are two versions of some of the ANS and ISO catalog views. The version documented is the normal set of ANS and ISO views. A second set of views have names that are limited to no more than 18 characters and other than the view names are not documented in this book.

The ANS and ISO catalog includes the following tables in the QSYS2 library:

View Name	Shorter View Name	Description
"SQL_FEATURES" on page 1462		Information about features supported by the database manager
"SQL_LANGUAGES" on page 1463	SQL_LANGUAGES_S	Information about the supported languages
"SQL_SIZING" on page 1464		Information about the limits supported by the database manager

The ANS and ISO catalog includes the following views and tables in the ${\sf SYSIBM}$ and QSYS2 libraries:

View Name	Shorter View Name	Description
"AUTHORIZATIONS" on page 1438		Information about authorization IDs
"CHARACTER_SETS" on page 1439	CHARACTER_SETS_S	Information about supported CCSIDs
"CHECK_CONSTRAINTS" on page 1440		Information about check constraints
"COLUMNS" on page 1441	COLUMNS_S	Information about columns
"INFORMATION_SCHEMA_CATALOG_NAME" on page 1445	CATALOG_NAME	Information about the relational database
"PARAMETERS" on page 1446	PARAMETERS_S	Information about procedure parameters
"REFERENTIAL_CONSTRAINTS" on page 1450	REF_CONSTRAINTS	Information about referential constraints
"ROUTINES" on page 1451	ROUTINES_S	Information about routines
"SCHEMATA" on page 1461	SCHEMATA_S	Statistical information about schemas
"TABLE_CONSTRAINTS" on page 1465		Information about constraints
"TABLES" on page 1466	TABLES_S	Information about tables
"USER_DEFINED_TYPES" on page 1467	UDT_S	Information about distinct types
"VIEWS" on page 1471		Information about views

AUTHORIZATIONS

AUTHORIZATIONS

The AUTHORIZATIONS view contains one row for every authorization ID.

The following table describes the columns in the view:

Table 174. AUTHORIZATIONS view

Column Name	Data Type	Description
AUTHORIZATION_NAME	VARCHAR(128)	Authorization ID name
AUTHORIZATION_TYPE	VARCHAR(4)	The type of authorization ID. Contains 'USER'.

CHARACTER_SETS

The CHARACTER_SETS view contains one row for every CCSID supported.

The following table describes the columns in the view:

Table 175. CHARACTER_SETS view

Column Name	Data Type	Description
CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name
CHARACTER_SET_SCHEMA	VARCHAR(128)	The schema name of the character set. Contains 'SYSIBM'.
CHARACTER_SET_NAME	VARCHAR(128)	The character set name.
FORM_OF_USE	VARCHAR(128)	Reserved. Contains the null value.
NUMBER OF CHARACTERS	Nullable	
NUMBER_OF_CHARACTERS	INTEGER	Reserved. Contains the null value.
	Nullable	
DEFAULT_COLLATE_CATALOG	VARCHAR(128)	Reserved. Contains the relational database name.
DEFAULT_COLLATE_SCHEMA	VARCHAR(128)	Reserved. Contains SYSIBM.
DEFAULT_COLLATE_NAME	VARCHAR(128)	Reserved. Contains IBMDEFAULT.

CHECK_CONSTRAINTS

CHECK_CONSTRAINTS

The CHECK_CONSTRAINTS view contains one row for every check constraint.

Table 176. CHECK_CONSTRAINTS view

Column Name	Data Type	Description
CONSTRAINT_CATALOG	VARCHAR(128)	Relational database name
CONSTRAINT_SCHEMA	VARCHAR(128)	Name of the schema containing the constraint
CONSTRAINT_NAME	VARCHAR(128)	Name of the constraint
CHECK_CLAUSE	VARCHAR(2000)	Text of the check constraint clause
	Nullable	Contains the null value if the check clause cannot be contained in the column without truncation.

COLUMNS

The COLUMNS view contains one row for every column.

Table 177. COLUMNS view

Column Name	Data Type	Description
TABLE_CATALOG	VARCHAR(128)	Relational database name
TABLE_SCHEMA	VARCHAR(128)	Name of the SQL schema containing the table or view
TABLE_NAME	VARCHAR(128)	Name of the table or view that contains the column
COLUMN_NAME	VARCHAR(128)	Name of the column
ORDINAL_POSITION	INTEGER	Numeric place of the column in the table or view, ordered from left to right
COLUMN_DEFAULT	VARCHAR(2000)	The default value of a column, if one exists. If the default
	Nullable	value of the column cannot be represented without truncation, then the value of the column is the string 'TRUNCATED'. The default value is stored in character form. The following special values also exist:
		CURRENT_DATE The default value is the current date.
		CURRENT_TIME The default value is the current time.
		CURRENT_TIMESTAMP The default value is the current timestamp.
		NULL The default value is the null value and DEFAULT NULL was explicitly specified.
		USER The default value is the current job user.
		Contains the null value if:
		• The column has no default value. For example, if the column has an IDENTITY attribute or is a row ID, or
		• A DEFAULT value was not explicitly specified.
IS_NULLABLE	VARCHAR(3)	Indicates whether the column can contain null values:
		NO The column cannot contain null values.
		YES The column can contain null values.

COLUMNS

Table 177. COLUMNS view (continued)

Column Name	Data Type	Description
DATA_TYPE	VARCHAR(128)	Type of column:
		BIGINT Big number
		INTEGER Large number
		SMALLINT Small number
		DECIMAL Packed decimal
		NUMERIC Zoned decimal
		DOUBLE PRECISION Double-precision floating point
		REAL Single-precision floating point
		DECFLOAT Decimal floating-point
		CHARACTER Fixed-length character string
		CHARACTER VARYING Varying-length character string
		CHARACTER LARGE OBJECT Character large object string
		GRAPHIC Fixed-length graphic string
		GRAPHIC VARYING Varying-length graphic string
		DOUBLE-BYTE CHARACTER LARGE OBJECT Double-byte character large object string
		NATIONAL CHARACTER National character
		NATIONAL CHARACTER VARYING Varying-length national character
		NATIONAL CHARACTER LARGE OBJECT National character large object
		BINARY Fixed-length binary string
		BINARY VARYING Varying-length binary string
		BINARY LARGE OBJECT Binary large object string
		DATE Date
		TIME Time
		TIMESTAMP Timestamp
		DATALINK Datalink
		ROWID Row ID
		USER-DEFINED Distinct type

Table 177. COLUMNS view (continued)

Column Name	Data Type	Description	
CHARACTER_MAXIMUM_LENGTH	INTEGER	Maximum length of the string for binary, character and graphic string data types.	
	Nullable	Contains the null value if the column is not a string.	
CHARACTER_OCTET_LENGTH	INTEGER	Number of bytes for binary, character and graphic string data types.	
	Nullable	Contains the null value if the column is not a string.	
NUMERIC_PRECISION	INTEGER Nullable	The precision of all numeric columns. Note: This column supplies the precision of all numeric data types, including single-and double-precision floating point and decimal floating-point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.	
		Contains the null value if the column is not numeric.	
NUMERIC_PRECISION_RADIX	INTEGER Nullable	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or decimal digits	
		Binary; floating-point precision is specified in binary digits.	
		Decimal; all other numeric types are specified in decimal digits.	
		Contains the null value if the column is not numeric.	
NUMERIC_SCALE	INTEGER	Scale of numeric data.	
	Nullable	Contains the null value if the column is not decimal, numeric, or binary.	
DATETIME_PRECISION	INTEGER	The fractional part of a date, time, or timestamp.	
	Nullable	0 For DATE and TIME data types	
		6 For TIMESTAMP data types (number of microseconds).	
		Contains the null value if the column is not a date, time, or timestamp.	
INTERVAL_TYPE	VARCHAR(128)	Reserved. Contains the null value.	
	Nullable		
INTERVAL_PRECISION	INTEGER	Reserved. Contains the null value.	
	Nullable		
 CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name	
	,	Contains the null value if the column is not a string.	
CHARACTER_SET_SCHEMA	Nullable VARCHAR(128)	The schema name of the character set. Contains SYSIBM.	
	, ,	Contains the null value if the column is not a string.	
CHARACTER_SET_NAME	Nullable VARCHAR(128)	The character set name.	
CHARACIER_SET_IVAIVIE	VANCHAN(128)		
	Nullable	Contains the null value if the column is not a string.	
COLLATION_CATALOG	VARCHAR(128)	Relational database name	
	Nullable	Contains the null value if the column is not a string.	

COLUMNS

Table 177. COLUMNS view (continued)

Column Name	Data Type	Description
COLLATION_SCHEMA	VARCHAR(128)	The schema of the collation. Contains SYSIBM.
	Nullable	Contains the null value if the column is not a string.
COLLATION_NAME	VARCHAR(128)	The collation name. Contains IBMBINARY.
	Nullable	Contains the null value if the column is not a string.
DOMAIN_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
DOMAIN_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
DOMAIN_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
UDT CATALOG	VARCHAR(128)	The relational database name if this is a distinct type.
021_0.11.1200	(120)	
	Nullable	Contains the null value if this is not a distinct type.
UDT_SCHEMA	VARCHAR(128)	The name of the schema if this is a distinct type.
	Nullable	Contains the null value if this is not a distinct type.
UDT_NAME	VARCHAR(128)	The name of the distinct type.
	Nullable	Contains the null value if this is not a distinct type.
SCOPE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	NT 11 1 1	
MAXIMUM_CARDINALITY	Nullable INTEGER	Reserved. Contains the null value.
WINDING CANDINALITI	HVILGER	reserved. Contains the nun value.
	Nullable	
DTD_IDENTIFIER	VARCHAR(128)	A unique internal identifier for the column.
	Nullable	
IS_SELF_REFERENCING	VARCHAR(3)	Reserved. Contains 'NO'.

INFORMATION_SCHEMA_CATALOG_NAME

INFORMATION_SCHEMA_CATALOG_NAME

The INFORMATION_SCHEMA_CATALOG_NAME view contains one row for the relational database.

The following table describes the columns in the view:

Table 178. INFORMATION_SCHEMA_CATALOG_NAME view

Column Name	Data Type	Description
CATALOG_NAME	VARCHAR(128)	Relational database name

PARAMETERS

PARAMETERS

The PARAMETERS view contains one row for each parameter of a routine in the relational database.

Table 179. PARAMETERS view

Column Name	Data Type	Description
SPECIFIC_CATALOG	VARCHAR(128)	Relational database name
SPECIFIC_SCHEMA	VARCHAR(128)	Schema name of the routine instance
SPECIFIC_NAME	VARCHAR(128)	Specific name of the routine instance
ORDINAL_POSITION	INTEGER	Numeric place of the parameter in the parameter list, ordered from left to right.
PARAMETER_MODE	VARCHAR(5)	The type of the parameter:
		IN This is an input parameter.
		OUT This is an output parameter.
		INOUT This is an input/output parameter.
IS_RESULT	VARCHAR(3)	Reserved. Contains 'NO'.
AS_LOCATOR	VARCHAR(3)	Indicates whether the parameter was specified as a locator.
		NO The parameter was not specified as a locator.
		YES The parameter was specified as a locator.
PARAMETER_NAME	VARCHAR(128)	The name of the parameter
	Nullable	Contains the null value if the parameter does not have a name.
FROM_SQL_SPECIFIC_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
FROM_SQL_SPECIFIC_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
FROM_SQL_SPECIFIC_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
TO_SQL_SPECIFIC_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
TO_SQL_SPECIFIC_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
TO_SQL_SPECIFIC_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	

Table 179. PARAMETERS view (continued)

Column Name	Data Type	Description
DATA_TYPE	VARCHAR(128)	Type of the parameter:
	Nullable	BIGINT Big number
	rvanabie	INTEGER
		Large number
		SMALLINT Small number
		DECIMAL
		Packed decimal
		NUMERIC
		Zoned decimal
		DOUBLE PRECISION Floating point; DOUBLE PRECISION
		REAL Floating point; REAL
		DECFLOAT
		Decimal floating-point
		CHARACTER Fixed-length character string
		CHARACTER VARYING
		Varying-length character string
		CHARACTER LARGE OBJECT Character large object string
		GRAPHIC Fixed-length graphic string
		GRAPHIC VARYING
		Varying-length graphic string
		DOUBLE-BYTE CHARACTER LARGE OBJECT Double-byte character large object string
		NATIONAL CHARACTER
		National character
		NATIONAL CHARACTER VARYING Varying-length national character
		NATIONAL CHARACTER LARGE OBJECT National character large object
		BINARY
		Fixed-length binary string
		BINARY VARYING Varying-length binary string
		BINARY LARGE OBJECT Binary large object string
		DATE Date
		TIME Time
		TIMESTAMP
		Timestamp
		DATALINK Datalink
		ROWID Row ID
		USER-DEFINED
		Distinct type

PARAMETERS

Table 179. PARAMETERS view (continued)

Column Name	Data Type	Description
CHARACTER_MAXIMUM_LENGTH	INTEGER	Maximum length of the string for binary, character, and graphic string data types.
	Nullable	Contains the null value if the parameter is not a string.
CHARACTER_OCTET_LENGTH	INTEGER	Number of bytes for binary, character, and graphic string data types.
	Nullable	Contains the null value if the parameter is not a string.
CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name
	Nullable	Contains the null value if the column is not a string.
CHARACTER_SET_SCHEMA	VARCHAR(128)	The schema name of the character set. Contains 'SYSIBM'.
	Nullable	Contains the null value if the column is not a string.
CHARACTER_SET_NAME	VARCHAR(128)	The character set name.
	, ,	Contains the null value if the column is not a string.
COLLATION_CATALOG	Nullable VARCHAR(128)	Relational database name
COLLATION_CATALOG	VARCHAR(126)	
	Nullable	Contains the null value if the column is not a string.
COLLATION_SCHEMA	VARCHAR(128)	The schema of the collation. SYSIBM is returned.
	Nullable	Contains the null value if the column is not a string.
COLLATION_NAME	VARCHAR(128)	The collation name. IBMBINARY is returned.
	Nullable	Contains the null value if the column is not a string.
NUMERIC_PRECISION	INTEGER	The precision of all numeric parameters.
	Nullable	Note: This column supplies the precision of all numeric data types, including single-and double-precision floating point and decimal floating-point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.
		Contains the null value if the parameter is not numeric.
NUMERIC_PRECISION_RADIX	INTEGER Nullable	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or decimal digits:
	runuore	Binary; floating-point precision is specified in binary digits.
		Decimal; all other numeric types are specified in decimal digits.
		Contains the null value if the parameter is not numeric.
NUMERIC_SCALE	INTEGER	Scale of numeric data.
	Nullable	Contains the null value if not decimal, numeric, or binary parameter.
DATETIME_PRECISION	INTEGER	The fractional part of a date, time, or timestamp.
	Nullable	0 For DATE and TIME data types
	ivanabie	6 For TIMESTAMP data types (number of microseconds).
		Contains the null value if the parameter is not a date, time, or timestamp.

Table 179. PARAMETERS view (continued)

Column Name	Data Type	Description
INTERVAL_TYPE	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
INTERVAL_PRECISION	INTEGER	Reserved. Contains the null value.
	Nullable	
UDT_CATALOG	VARCHAR(128)	The relational database name if this is a distinct type.
	Nullable	Contains the null value if this is not a distinct type.
UDT_SCHEMA	VARCHAR(128)	The name of the schema if this is a distinct type.
	Nullable	Contains the null value if this is not a distinct type.
UDT_NAME	VARCHAR(128)	The name of the distinct type.
	Nullable	Contains the null value if this is not a distinct type.
SCOPE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
MAXIMUM_CARDINALITY	INTEGER	Reserved. Contains the null value.
	Nullable	
DTD_IDENTIFIER	VARCHAR(128)	A unique internal identifier for the parameter.
	Nullable	

REFERENTIAL_CONSTRAINTS

REFERENTIAL_CONSTRAINTS

The REFERENTIAL_CONSTRAINTS view contains one row for each referential constraint.

Table 180. REFERENTIAL_CONSTRAINTS view

Column Name	Data Type	Description	
CONSTRAINT_CATALOG	VARCHAR(128)	Relational database name	
CONSTRAINT_SCHEMA	VARCHAR(128)	Name of the schema containing the constraint.	
CONSTRAINT_NAME	VARCHAR(128)	Name of the constraint.	
UNIQUE_CONSTRAINT_CATALOG	VARCHAR(128)	Relational database name containing the unique constraint referenced by the referential constraint.	
UNIQUE_CONSTRAINT_SCHEMA	VARCHAR(128)	Name of the SQL schema containing the unique constraint referenced by the referential constraint.	
UNIQUE_CONSTRAINT_NAME	VARCHAR(128)	Name of the unique constraint referenced by the referential constraint.	
MATCH_OPTION	VARCHAR(7)	Reserved. Contains 'NONE'.	
UPDATE_RULE	VARCHAR(11)	Update Rule.	
		 NO ACTION 	
		• RESTRICT	
DELETE_RULE	VARCHAR(11)	Delete Rule	
		 NO ACTION 	
		• CASCADE	
		SET NULL	
		SET DEFAULT	
		• RESTRICT	
COLUMN_COUNT	INTEGER	Count of columns in the constraint.	

The ROUTINES view contains one row for each routine.

Table 181. ROUTINES view

Column Name	Data Type	Description
SPECIFIC_CATALOG	VARCHAR(128)	Relational database name
SPECIFIC_SCHEMA	VARCHAR(128)	Schema name of the routine instance.
SPECIFIC_NAME	VARCHAR(128)	Specific name of the routine.
ROUTINE_CATALOG	VARCHAR(128)	Relational database name
ROUTINE_SCHEMA	VARCHAR(128)	Name of the SQL schema that contains the routine.
ROUTINE_NAME	VARCHAR(128)	Name of the routine.
ROUTINE_TYPE	VARCHAR(15)	Type of the routine.
		PROCEDURE This is a procedure.
		FUNCTION This is a function.
		INSTANCE METHOD This is a built-in data type function created for a distinct type.
MODULE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
MODULE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
MODULE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
UDT_CATALOG	VARCHAR(128)	Relational database name.
	Nullable	Contains the null value if this is not an INSTANCE METHOD.
UDT_SCHEMA	VARCHAR(128)	Name of the SQL schema that contains the distinct type related to this function.
	Nullable	Contains the null value if this is not an INSTANCE METHOD.
UDT_NAME	VARCHAR(128)	Name of the distinct type name related to this function.
	Nullable	Contains the null value if this is not an INSTANCE METHOD.

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description	
DATA_TYPE	VARCHAR(128)	Type of the result of the function:	
	Nullable	BIGINT Big number	
	ivullable	INTEGER	
		Large number	
		SMALLINT	
		Small number	
		DECIMAL Packed decimal	
		NUMERIC Zoned decimal	
		DOUBLE PRECISION	
		Floating point; DOUBLE PRECISION	
		REAL Floating point; REAL	
		DECFLOAT	
		Decimal floating-point	
		CHARACTER	
		Fixed-length character string	
		CHARACTER VARYING Varying-length character string	
		CHARACTER LARGE OBJECT Character large object string	
		GRAPHIC Fixed-length graphic string	
		GRAPHIC VARYING Varying-length graphic string	
		DOUBLE-BYTE CHARACTER LARGE OBJECT Double-byte character large object string	
		NATIONAL CHARACTER National character	
		NATIONAL CHARACTER VARYING Varying-length national character	
		NATIONAL CHARACTER LARGE OBJECT National character large object	
		BINARY Fixed-length binary string	
		BINARY VARYING Varying-length binary string	
		BINARY LARGE OBJECT Binary large object string	
		DATE Date	
		TIME Time	
		TIMESTAMP Timestamp	
		DATALINK Datalink	
		ROWID Row ID	
		USER-DEFINED Distinct Type	
		Contains the null value if this is not a scalar function.	

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description
CHARACTER_MAXIMUM_LENGTH	INTEGER	Maximum length of the result string of the function for binary, character, and graphic string data types.
	Nullable	Contains the null value if this is not a scalar function or the parameter is not a string.
CHARACTER_OCTET_LENGTH	INTEGER	Number of bytes for the result string of the function for binary, character, and graphic string data types.
	Nullable	Contains the null value if this is not a scalar function or the parameter is not a string.
CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name of the result of the function.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
CHARACTER_SET_SCHEMA	VARCHAR(128)	The schema name of the character set of the result of the function. Contains 'SYSIBM'.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
CHARACTER_SET_NAME	VARCHAR(128)	The character set name of the result of the function.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
COLLATION_CATALOG	VARCHAR(128)	Relational database name of the result of the function.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
COLLATION_SCHEMA	VARCHAR(128)	The schema of the collation of the result of the function. SYSIBM is returned.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
COLLATION_NAME	VARCHAR(128)	The collation name of the result of the function. IBMBINARY is returned.
	Nullable	Contains the null value if this is not a scalar function or the result is not a string.
NUMERIC_PRECISION	INTEGER	The precision of the result of the function.
	Nullable	Note: This column supplies the precision of all numeric data types, including single-and double-precision floating point and decimal floating-point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.
		Contains the null value if this is not a scalar function or the result is not numeric.
NUMERIC_PRECISION_RADIX	INTEGER	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or decimal digits:
	Nullable	2 Binary; floating-point precision is specified in binary digits.
		Decimal; all other numeric types are specified in decimal digits.
		Contains the null value if this is not a scalar function or the result is not numeric.
NUMERIC_SCALE	INTEGER	Scale of numeric result of the function.
	Nullable	Contains the null value if this is not a scalar function or the result is not numeric.
DATETIME_PRECISION	INTEGER	The fractional part of a date, time, or timestamp result of the function.
	Nullable	0 For DATE and TIME data types
	. Tanabit	6 For TIMESTAMP data types (number of microseconds).
		Contains the null value if this is not a scalar function or the result is not a date, time, or timestamp.

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description
INTERVAL_TYPE	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
INTERVAL_PRECISION	INTEGER	Reserved. Contains the null value.
	Nullable	
TYPE_UDT_CATALOG	VARCHAR(128)	The relational database name if the result of the function is a distinct type.
	Nullable	Contains the null value if this is not a scalar function or the result is not a distinct type.
TYPE_UDT_SCHEMA	VARCHAR(128)	The name of the schema if the result of the function is a distinct type.
	Nullable	Contains the null value if this is not a scalar function or the result is not a distinct type.
TYPE_UDT_NAME	VARCHAR(128)	The name of the distinct type if the result of the function is a distinct type.
	Nullable	Contains the null value if this is not a scalar function or the result is not a distinct type.
SCOPE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
SCOPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
MAXIMUM_CARDINALITY	INTEGER	Reserved. Contains the null value.
	Nullable	
DTD_IDENTIFIER	VARCHAR(128)	A unique internal identifier for the result of the function.
	Nullable	
ROUTINE_BODY	VARCHAR(8)	The type of the routine body:
_	(1)	EXTERNAL
		This is an external routine.
		SQL This is an SQL routine.
ROUTINE_DEFINITION	DBCLOB(2M) CCSID 13488	If this is an SQL routine, this column contains the SQL routine body.
	Nullable	Contains the null value if this is not an SQL routine or if the routine body cannot be contained in this column without truncation.
EXTERNAL_NAME	VARCHAR(279)	If this is an external routine, this column identifies the external program name.
	Nullable	• For REXX, the external program name is schema-name/source-file-name(member-name).
		• For ILE service programs, the external program name is schema-name/service-program-name(entry-point-name).
		• For Java programs, the external program name is an optional jar-id followed by a fully-qualified-class-name!method-name or fully-qualified-class-name.method-name.
		• For all other languages, the external program name is <i>schema-name/program-name</i> .
		Contains the null value if this is a system-generated function or a function sourced on a built-in function.

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description		
EXTERNAL_LANGUAGE	VARCHAR(8)	If this is an external routine, this column identifies the external program name.		
	Nullable	C The external program is written in C.		
		C++ The external program is written in C++.		
		CL The external program is written in CL.		
		COBOL The external program is written in COBOL.		
		COBOLLE		
		The external program is written in ILE COBOL.		
		FORTRAN The external program is written in FORTRAN.		
		JAVA The external program is written in JAVA.		
		RPG The external program is written in RPG.		
		RPGLE The external program is written in ILE RPG.		
		Contains the null value if this is not an external routine.		
PARAMETER_STYLE	VARCHAR(18)	If this is an external routine, this column identifies the parameter style (calling convention).		
	Nullable	DB2GENERAL		
		This is the DB2GENERAL calling convention.		
		DB2SQL This is the DB2SQL calling convention.		
		GENERAL This is the CENERAL colling convention		
		This is the GENERAL calling convention.		
		JAVA This is the JAVA calling convention.		
		GENERAL WITH NULLS This is the GENERAL WITH NULLS calling convention.		
		SQL This is the SQL standard calling convention.		
		Contains the null value if this is not an external routine.		
IS_DETERMINISTIC	VARCHAR(3)	This column identifies whether the routine is deterministic. That is, whether a call to the routine with the same arguments will always return the same result.		
		NO The routine is not deterministic.		
		YES The routine is deterministic.		
SQL_DATA_ACCESS	VARCHAR(17)	This column identifies whether a routine contains SQL and whether it reads or modifies data.		
		NO SQL The routine does not contain any SQL statements.		
		CONTAINS SQL The routine contains SQL statements.		
		READS SQL DATA The routine possibly reads data from a table or view.		
		MODIFIES SQL DATA The routine possibly modifies data in a table or view or issues SQL DDL statements.		

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description	
IS_NULL_CALL	VARCHAR(3)	Identifies whether the function needs to be called if an input parameter is the null value.	
	Nullable	NO This function need not be called if an input parameter is the null value. If this is a scalar function, the result of the function is implicitly null if any of the operands are null. If this is a table function, the result of the function is an empty table if any of the operands are the null value.	
		YES This function must be called even if an input operand is null.	
		Contains the null value if this is not a function.	
SQL_PATH	VARCHAR(3483)	If this is an SQL routine, this column identifies the path.	
	Nullable	Contains the null value if this is not an SQL routine.	
SCHEMA_LEVEL_ROUTINE	VARCHAR(3)	Reserved. Contains 'YES'.	
MAX_DYNAMIC_RESULT_SETS	SMALLINT	Identifies the maximum number of result sets returned. 0 indicates that there are no result sets.	
IS_USER_DEFINED_CAST	VARCHAR(3)	Identifies whether the this function is a cast function created when a distinct type was created.	
	Nullable	NO This function is not a cast function.	
		YES This function is a cast function.	
		Contains the null value if the routine is not a function.	
IS_IMPLICITLY_INVOCABLE	VARCHAR(3)	Identifies whether the this function is a cast function created when a distinct type was created and can be implicitly invoked.	
	Nullable	NO This function is not a cast function.	
		YES This function is a cast function and can be implicitly invoked.	
		Contains the null value if the routine is not a function.	
SECURITY_TYPE	VARCHAR(22)	Reserved. Contains 'IMPLEMENTATION DEFINED' if this is an external routine.	
	Nullable	Contains the null value if the routine is not an external routine.	
TO_SQL_SPECIFIC_CATALOG	VARCHAR(128)	Reserved. Contains the null value.	
	Nullable		
TO_SQL_SPECIFIC_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.	
	Nullable		
TO_SQL_SPECIFIC_NAME	VARCHAR(128)	Reserved. Contains the null value.	
	Nullable		
AS_LOCATOR	VARCHAR(3)	Indicates whether the result was specified as a locator.	
	NT11-1-1-	NO The parameter was not specified as a locator.	
	Nullable	YES The parameter was specified as a locator.	
		Contains the null value if this is not a scalar function.	
CREATED	TIMESTAMP	Identifies the timestamp when the routine was created.	
LAST_ALTERED	TIMESTAMP	Timestamp when routine was last altered. Contains null if the routine has never been altered.	
	Nullable		

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description	
NEW_SAVEPOINT_LEVEL	VARCHAR(3)	Indicates whether the routine starts a new savepoint level.	
	Nullable	NO	A new savepoint level is not started when the procedure is called.
		YES	A new savepoint level is started when the procedure is called.
		Contains	the null value if this is not a function.
IS_UDT_DEPENDENT	VARCHAR(3)	Indicates	whether the routine is dependent on a UDT.
		NO	The routine is not dependent on a UDT.
		YES	The routine is dependent on a UDT.

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description
RESULT_CAST_FROM_DATA_TYPE	VARCHAR(128)	Type of the parameter:
	Nullable	BIGINT Big number
		INTEGER Large number
		SMALLINT Small number
		DECIMAL Packed decimal
		NUMERIC Zoned decimal
		DOUBLE PRECISION Floating point; DOUBLE PRECISION
		REAL Floating point; REAL
		DECFLOAT Decimal floating-point
		CHARACTER Fixed-length character string
		CHARACTER VARYING Varying-length character string
		CHARACTER LARGE OBJECT Character large object string
		GRAPHIC Fixed-length graphic string
		GRAPHIC VARYING Varying-length graphic string
		DOUBLE-BYTE CHARACTER LARGE OBJECT Double-byte character large object string
		NATIONAL CHARACTER National character
		NATIONAL CHARACTER VARYING Varying-length national character
		NATIONAL CHARACTER LARGE OBJECT National character large object
		BINARY Fixed-length binary string
		BINARY VARYING Varying-length binary string
		BINARY LARGE OBJECT Binary large object string
		DATE Date
		TIME Time
		TIMESTAMP Timestamp
		DATALINK Datalink
		ROWID Row ID
		USER-DEFINED Distinct Type
RESULT_CAST_AS_LOCATOR	VARCHAR(3)	Indicates whether the result is cast from a locator.
	Nullable	NO The result is not cast from a locator.
		YES The result is cast from a locator.

Table 181. ROUTINES view (continued)

Table To L. HOUTINES VIEW (Continued)		
Column Name	Data Type	Description
RESULT_CAST_CHAR_MAX_LENGTH	INTEGER	Maximum length of the string for binary, character, and graphic string data types.
	Nullable	Contains the null value if the parameter is not a string.
RESULT_CAST_CHAR_OCTET_LENGTH	INTEGER	Number of bytes for binary, character, and graphic string data types.
	Nullable	Contains the null value if the parameter is not a string.
RESULT_CAST_CHAR_SET_CATALOG	VARCHAR(128)	Relational database name
	Nullable	Contains the null value if the column is not a string.
RESULT_CAST_CHAR_SET_SCHEMA	VARCHAR(128)	The schema name of the character set. Contains 'SYSIBM'.
	. ,	Contains the null value if the column is not a string.
DECLINE CACE CHAR OF NAME	Nullable	
RESULT_CAST_CHAR_SET_NAME	VARCHAR(128)	The character set name.
	Nullable	Contains the null value if the column is not a string.
RESULT_CAST_COLLATION_CATALOG	VARCHAR(128)	Relational database name
	Nullable	Contains the null value if the column is not a string.
RESULT_CAST_COLLATION_SCHEMA	VARCHAR(128)	The schema of the collation. SYSIBM is returned.
	Nullable	Contains the null value if the column is not a string.
RESULT_CAST_COLLATION_NAME	VARCHAR(128)	The collation name. IBMBINARY is returned.
	Nullable	Contains the null value if the column is not a string.
RESULT_CAST_NUMERIC_PRECISION	INTEGER	The precision of all numeric parameters.
	Nullable	Note: This column supplies the precision of all numeric data types, including single-and double-precision floating point and decimal floating-point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.
		Contains the null value if the parameter is not numeric.
RESULT_CAST_NUMERIC_RADIX	INTEGER	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary or decimal digits:
	Nullable	2 Binary; floating-point precision is specified in binary digits.
		Decimal; all other numeric types are specified in decimal digits.
		Contains the null value if the parameter is not numeric.
RESULT_CAST_NUMERIC_SCALE	INTEGER	Scale of numeric data.
	Nullable	Contains the null value if not decimal, numeric, or binary parameter.
RESULT_CAST_DATETIME_PRECISION	INTEGER	The fractional part of a date, time, or timestamp.
	NT 11 1 1	0 For DATE and TIME data types
	Nullable	6 For TIMESTAMP data types (number of microseconds).
		Contains the null value if the parameter is not a date, time, or timestamp.
RESULT_CAST_INTERVAL_TYPE	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_INTERVAL_PRECISION	INTEGER	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_TYPE_UDT_CATALOG	VARCHAR(128)	The relational database name if this is a distinct type.
	Nullable	Contains the null value if this is not a distinct type.

ROUTINES

Table 181. ROUTINES view (continued)

Column Name	Data Type	Description
RESULT_CAST_TYPE_UDT_SCHEMA	VARCHAR(128)	The name of the schema if this is a distinct type.
	Nullable	Contains the null value if this is not a distinct type.
RESULT_CAST_TYPE_UDT_NAME	VARCHAR(128)	The name of the distinct type
	Nullable	Contains the null value if this is not a distinct type.
RESULT_CAST_SCOPE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_SCOPE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_SCOPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_MAX_CARDINALITY	INTEGER	Reserved. Contains the null value.
	Nullable	
RESULT_CAST_DTD_IDENTIFIER	VARCHAR(128)	A unique internal identifier for the parameter.
	Nullable	

SCHEMATA

The SCHEMATA view contains one row for each schema.

The following table describes the columns in the view:

Table 182. SCHEMATA view

Column Name	Data Type	Description
CATALOG_NAME	VARCHAR(128)	Relational database name
SCHEMA_NAME	VARCHAR(128)	Name of the schema
SCHEMA_OWNER	VARCHAR(128)	Owner of the schema
DEFAULT_CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name
DEFAULT_CHARACTER_SET_SCHEMA	VARCHAR(128)	The schema name of the default character set. Contains 'SYSIBM'.
DEFAULT_CHARACTER_SET_NAME	VARCHAR(128)	The default character set name.
SQL_PATH	VARCHAR(4096)	Reserved. Contains the null value.

Nullable

SQL_FEATURES

SQL_FEATURES

The SQL_FEATURES table contains one row for each feature supported by the database manager.

The following table describes the columns in the table:

Table 183. SQL_FEATURES table

Column Name	Data Type	Description
FEATURE_ID	VARCHAR(7)	ANS and ISO feature ID
	Nullable	
FEATURE_NAME	VARCHAR(128)	The name of the ANS and ISO feature.
SUB_FEATURE_ID	VARCHAR(7)	ANS and ISO subfeature ID
	Nullable	
SUB_FEATURE_NAME	VARCHAR(256)	The name of the ANS and ISO subfeature.
IS_SUPPORTED	VARCHAR(3)	Indicates whether the feature is supported:
		YES This feature is supported.
		NO This feature is not supported.
IS_VERIFIED_BY	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
COMMENTS	VARCHAR(2000)	Reserved. Contains the null value.
	Nullable	

SQL LANGUAGES

The SQL_LANGUAGES table contains one row for every SQL language binding and programming language for which conformance is claimed.

The following table describes the columns in the SQL_LANGUAGES table:

Table 184. SQL_LANGUAGES table

Column Name	Data Type	Descrip	tion
SQL_LANGUAGE_SOURCE	VARCHAR(254)	Name of the standard.	
SQL_LANGUAGE_YEAR	VARCHAR(254)	Year in which the standard was approved.	
SQL_LANGUAGE_CONFORMANCE	VARCHAR(254)	Level of	conformance.
	Nullable	2	For the 1987 and 1989 standards, indicates that Level 2 conformance is claimed.
		ENTRY	For the 1992 standard, indicates that Entry Level conformance is claimed.
		CORE	For the 1999 standard, indicates that Core Level is conformance is claimed.
		Contains	s the null value if conformance is not yet claimed.
SQL_LANGUAGE_INTEGRITY	VARCHAR(254)	Support	of the integrity feature.
	Nullable	YES	conformance is claimed to the integrity feature
	Nunable	NO	conformance is not claimed to the integrity feature
			s the null value if the standard does not have a integrity feature.
SQL_LANGUAGE_IMPLEMENTATION	VARCHAR(254)	Reserved	d. Contains the null value.
	Nullable		
SQL_LANGUAGE_BINDING_STYLE	VARCHAR(254)	The style	e of binding of the SQL language
		EMBED	DED
			support for embedded SQL for the language in
			SQL_LANGUAGE_PROGRAMMING_LANG
		DIRECT	ſ
			DIRECT SQL is supported (for example Interactive SQL)
		CLI	Support for CLI for the language in
			SQL_LANGUAGE_PROGRAMMING_LANG
SQL_LANGUAGE_PROGRAMMING_LANG	VARCHAR(254)	The lang	guage supported by EMBEDDED or CLI.
	Nullable	C	The C language is supported.
	Nullable	COBOL	The COBOL language is supported.
		PLI	The PL/I language is supported.
			s the null value if the NGUAGE_BINDING_STYLE is DIRECT.

SQL_SIZING

SQL_SIZING

The SQL_SIZING table contains one row for each limit supported by the database manager.

The following table describes the columns in the table:

Table 185. SQL_SIZING table

Column Name	Data Type	Description
SIZING_ID	INTEGER	ANS and ISO sizing ID
SIZING_NAME	VARCHAR(128)	Name of the ANS and ISO sizing.
SUPPORTED_VALUE	BIGINT	Indicates the sizing limit.
	Nullable	Contains the null value if the sizing limit is not applicable.
COMMENTS	VARCHAR(2000)	Reserved. Contains the null value.
	Nullable	

TABLE_CONSTRAINTS

The TABLE_CONSTRAINTS view contains one row for each constraint.

The following table describes the columns in the view:

Table 186. TABLE_CONSTRAINTS view

Column Name	Data Type	Description
CONSTRAINT_CATALOG	VARCHAR(128)	Relational database name
CONSTRAINT_SCHEMA	VARCHAR(128)	Name of the schema containing the constraint.
CONSTRAINT_NAME	VARCHAR(128)	Name of the constraint.
TABLE_CATALOG	VARCHAR(128)	Relational database name
TABLE_SCHEMA	VARCHAR(128)	Name of the schema containing the table.
TABLE_NAME	VARCHAR(128)	Name of the table which the constraint is created over.
CONSTRAINT_TYPE	VARCHAR(11)	Constraint Type
		• CHECK
		• UNIQUE
		• PRIMARY KEY
		FOREIGN KEY
IS_DEFERRABLE	VARCHAR(3)	Indicates whether the constraint checking can be deferred. Contains 'NO'.
INITIALLY_DEFERRED	VARCHAR(3)	Indicates whether the constraint was defined as initially deferred. Contains 'NO'.

TABLES

TABLES

The TABLES view contains one row for each table, view, and alias.

The following table describes the columns in the view:

Table 187. TABLES view

Column Name	Data Type	Description
TABLE_CATALOG	VARCHAR(128)	Relational database name
TABLE_SCHEMA	VARCHAR(128)	Name of the SQL schema that contains the table, view or alias.
TABLE_NAME	VARCHAR(128)	Name of the table, view or alias.
TABLE_TYPE	VARCHAR(24)	Indicates the type of the table:
		ALIAS The table is an alias.
		BASE TABLE The table is an SQL table or physical file.
		MATERIALIZED QUERY TABLE The object is a materialized query table.
		VIEW The table is an SQL view or logical file.
SELF_REFERENCING_COLUMN_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
REFERENCE_GENERATION	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
USER_DEFINED_TYPE_CATALOG	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
USER_DEFINED_TYPE_SCHEMA	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
USER_DEFINED_TYPE_NAME	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
IS_INSERTABLE_INTO	VARCHAR(3)	Identifies whether an INSERT is allowed on the table.
		NO An INSERT is not allowed on this table.
		YES An INSERT is allowed on this table.

USER_DEFINED_TYPES

The USER_DEFINED_TYPES view contains one row for each distinct type.

The following table describes the columns in the view 136:

Table 188. USER_DEFINED_TYPES view

Column Name	Data Type	Description
USER_DEFINED_TYPE_CATALOG	VARCHAR(128)	Relational database name
USER_DEFINED_TYPE_SCHEMA	VARCHAR(128)	Schema name of the distinct type
USER_DEFINED_TYPE_NAME	VARCHAR(128)	Name of the user that created the distinct type.
USER_DEFINED_TYPE_CATEGORY	VARCHAR(128)	Indicates the type of user-defined type. Contains 'DISTINCT'.
IS_INSTANTIABLE	VARCHAR(3)	Reserved. Contains 'YES'.
IS_FINAL	VARCHAR(3)	Reserved. Contains 'YES'.
ORDERING_FORM	VARCHAR(4)	Indicates what kind of predicates are allowed when this distinct type is a comparand:
		FULL All predicates are allowed.
		NONE No predicates are allowed
ORDERING_CATEGORY	VARCHAR(8)	Reserved. Contains 'MAP'.
ORDERING_ROUTINE_CATALOG	VARCHAR(128)	Relational database name
	Nullable	Contains the null value if the ORDERING_FORM is 'NONE'.
ORDERING_ROUTINE_SCHEMA	VARCHAR(128)	Reserved. Contains 'SYSIBM'.
	Nullable	Contains the null value if the ORDERING_FORM is 'NONE'.
ORDERING_ROUTINE_NAME	VARCHAR(128)	Reserved. Contains a data type name.
	Nullable	Contains the null value if the ORDERING_FORM is 'NONE'.
REFERENCE_TYPE	VARCHAR(16)	Reserved. Contains the null value.
	Nullable	

^{136.} This view does not contain information about built-in data types.

USER_DEFINED_TYPES

Table 188. USER_DEFINED_TYPES view (continued)

Column Name	Data Type	Description
DATA_TYPE	VARCHAR(128)	Source data type of the distinct type:
	Nullable	BIGINT Big number
	Nullable	INTEGER
		Large number
		SMALLINT Small number
		DECIMAL Packed decimal
		NUMERIC Zoned decimal
		DOUBLE PRECISION Floating point; DOUBLE PRECISION
		REAL Floating point; REAL
		DECFLOAT Decimal floating-point
		CHARACTER Fixed-length character string
		CHARACTER VARYING Varying-length character string
		CHARACTER LARGE OBJECT Character large object string
		GRAPHIC Fixed-length graphic string
		GRAPHIC VARYING Varying-length graphic string
		DOUBLE-BYTE CHARACTER LARGE OBJECT Double-byte character large object string
		NATIONAL CHARACTER National character
		NATIONAL CHARACTER VARYING Varying-length national character
		NATIONAL CHARACTER LARGE OBJECT National character large object
		BINARY Fixed-length binary string
		BINARY VARYING Varying-length binary string
		BINARY LARGE OBJECT Binary large object string
		DATE Date
		TIME Time
		TIMESTAMP Timestamp
		DATALINK Datalink
		ROWID Row ID
		USER-DEFINED Distinct Type

Table 188. USER_DEFINED_TYPES view (continued)

Column Name	Data Type	Description
CHARACTER_MAXIMUM_LENGTH	INTEGER	Maximum length of the distinct type for binary, character, and graphic string data types.
	Nullable	Contains the null value if the distinct type is not a string.
CHARACTER_OCTET_LENGTH	INTEGER	Number of bytes of the distinct type for binary, character, and graphic string data types.
	Nullable	Contains the null value if the distinct type is not a string.
CHARACTER_SET_CATALOG	VARCHAR(128)	Relational database name of the distinct type.
	Nullable	Contains the null value if the distinct type is not a string.
CHARACTER_SET_SCHEMA	VARCHAR(128)	The schema name of the character set of the distinct type. Contains 'SYSIBM'.
	Nullable	Contains the null value if the distinct type is not a string.
CHARACTER_SET_NAME	VARCHAR(128)	The character set name of the distinct type.
	Nullable	Contains the null value if the distinct type is not a string.
COLLATION_CATALOG	VARCHAR(128)	Relational database name of the distinct type.
	Nullable	Contains the null value if the distinct type is not a string.
COLLATION_SCHEMA	VARCHAR(128)	The schema of the collation of the distinct type. SYSIBM is returned.
	Nullable	Contains the null value if the distinct type is not a string.
COLLATION_NAME	VARCHAR(128)	The collation name of the distinct type. IBMBINARY is returned.
	Nullable	Contains the null value if the distinct type is not a string.
NUMERIC_PRECISION	INTEGER	The precision of the distinct type.
	Nullable	Note: This column supplies the precision of all numeric data types, including single-and double-precision floating point and decimal floating-point. The NUMERIC_PRECISION_RADIX column indicates if the value in this column is in binary or decimal digits.
		Contains the null value if the distinct type is not numeric.
NUMERIC_PRECISION_RADIX	INTEGER	Indicates if the precision specified in column NUMERIC_PRECISION is specified as a number of binary
	Nullable	or decimal digits:
		Binary; floating-point precision is specified in binary digits.
		Decimal; all other numeric types are specified in decimal digits.
		Contains the null value if the distinct type is not numeric.
NUMERIC_SCALE	SMALLINT	Scale of numeric distinct type.
	Nullable	Contains the null value if the distinct type is not decimal, numeric, or binary.

USER_DEFINED_TYPES

Table 188. USER_DEFINED_TYPES view (continued)

Column Name	Data Type	Description
DATETIME_PRECISION	INTEGER	The fractional part of a date, time, or timestamp distinct type.
	Nullable	0 For DATE and TIME data types
		6 For TIMESTAMP data types (number of microseconds).
		Contains the null value if the distinct type is not date, time, or timestamp.
INTERVAL_TYPE	VARCHAR(128)	Reserved. Contains the null value.
	Nullable	
INTERVAL_PRECISION	INTEGER	Reserved. Contains the null value.
	Nullable	
SOURCE_DTD_IDENTIFIER	VARCHAR(128)	A unique internal identifier for the source data type.
	Nullable	Contains the null value if the distinct type is not sourced on another distinct type.
REF_DTD_IDENTIFIER	VARCHAR(256)	Reserved. Contains the null value.
	Nullable	

VIEWS

The VIEWS view contains one row for each view.

The following table describes the columns in the view:

Table 189. VIEWS view

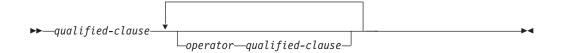
Column Name	Data Type	Description
TABLE_CATALOG	VARCHAR(128)	Relational database name
TABLE_SCHEMA	VARCHAR(128)	Name of the SQL schema that contains the view.
TABLE_NAME	VARCHAR(128)	Name of the view.
VIEW_DEFINITION	DBCLOB(2M) CCSID 13488	The query expression portion of the CREATE VIEW statement.
	Nullable	
CHECK_OPTION	VARCHAR(8)	The check option used on the view
		NONE No check option was specified
		LOCAL The local option was specified
		CASCADED
		The cascaded option was specified
IS_UPDATABLE	VARCHAR(3)	Specifies if the view is updatable:
		YES The view is updatable
		NO The view is read-only

Appendix G. Text search argument syntax

A text search argument is specified when searching for terms in text documents. It consists of search parameters and one or more search terms. The SQL scalar text search functions that use text search arguments are CONTAINS and SCORE.

For information on CONTAINS and SCORE, see "CONTAINS" on page 260 and "SCORE" on page 408.

Syntax



operator:



qualified-clause:

modifier:



clause:

```
- unqualified-term opaque-term
```

boost:



Description

A search argument is a term or sequence of terms, separated by white space, specified when searching in text documents. It consists of one or more search terms and various optional search parameters.

Text search argument syntax

To perform a simple search, you can enter one or more terms. The search engine returns documents that contain all of those terms or variations of those terms. For example, if you perform a search on the term king, documents containing king are returned. By default, the search engine also returns variants of the search term. Thus, documents containing kings are also returned. Similarly, when you search on two terms, the search engine returns documents containing both terms. If you want the terms to be searched as an exact phrase, simply add quotation marks.

The more specific the search term you use, the more precise the results. However, you may also want to refine your searches by using one or more of the following options:

operator

Specifies whether the search for either or both qualified clauses on either side of the *operator* must be satisfied.

The search for both qualified clauses on either side of the operator must be satisfied.

OR

The search for at least one of the qualified clauses on either side of the operator must be satisfied.

Similar to search conditions in SQL, parentheses can be used to determine which qualified clauses and operators are evaluated first. If parentheses are not specified, AND is applied before OR.

modifier

Each clause can have an occurrence modifier. If a modifier is not specified for a clause, the default is plus (+).

The *clause* is required in the document.

The *clause* must not be specified in the document.

The *clause* is optional in the document.

clause

Specifies a search string. In the search string, the question mark and asterisk have special meanings. Use a question mark (?) to represent any single character, and an asterisk (*) to represent a string of zero or more characters. If the search string contains multiple words that should be treated as a phrase, include quotation marks (") around the search string. Blanks within a clause are ignored.

unqualified-term

An unqualified term is simply a term or a phrase. A term can be a word, such as king; an exact word, such as "king"; or a word that includes a question mark (?) to represent any single character, and an asterisk (*) to represent a string of zero or more characters, such as king* or king?. Similarly, a phrase can be a group of words, such as cabbages and kings; an exact phrase, such as "The King and I"; or a phrase that includes a wildcard, such as "all the king's ho*ses" or "all the king's ?".

If a character in *clause* is one of the characters that has a special meaning in the syntax of the search argument, an escape character (\) can be used to indicate that the subsequent character should be treated as a regular character in the clause.

opaque-term

An opaque query term is so called because it is not parsed by the linguistic query parser; opaque terms are identified by their syntax. The opaque term used for text search queries is @xpath, for example: @xpath:'/TagA/TagB[. contains(king)]'

boost

boost can be specified for each *clause*. boost provides a higher or lower importance to occurrences of the *clause*.

number

Specifies a decimal or integer constant that is greater than 0. If *boost* is not specified for a *clause*, the default boost value is 1.

Notes

Case sensitivity: Searches are not case sensitive, so a search in Spanish for the exact term "DOS" could return documents containing DOS or dos.

Examples: Simple text search

The CONTAINS and SCORE functions can be used to perform a simple text search for a single word or multiple words in a text search index.

The search engine ignores white space between characters. An empty search argument, or one that contains only blanks, does not match anything.

The following table shows some examples of simple text search requests.

Table 190. Simple text search examples

Search word types	Examples	Search results
Single word	king	Returns all documents that contain the word king or kings. The search is not case-sensitive.
Multiple words	king lear	Returns all documents that contain king and lear. The default operator is the logical operator AND.

The operators AND and + (plus sign) are implicit in every text search. For example, the text search for King Lear returns the same results as King AND Lear or King + Lear.

You must enter the logical operators NOT, AND, and OR in all uppercase.

Advanced text search operators

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You can use advanced text search operators to refine the search results for the CONTAINS function and the SCORE function.

In the following table, the first column describes the operator that you can use in a text search. (You must enter the logical operators NOT, AND, and OR in all uppercase letters.) The second column shows a sample text search that you might enter. The third column describes the types of results that you might see from the example text search.

Advanced text search operators

I Table 191. Advanced search operators and complex text search examples

Operators	Examples	Search results
AND	"King Lear" AND "Othello" "King Lear" "Othello"	Either text search returns documents that contain both terms King Lear and Othello. The AND operator is the default conjunction operator. If no logical operator is between the two terms, the AND operator is used. For example, the text search King Lear is the same as the text search King AND Lear.
OR	"King Lear" OR Lear	Returns documents that contain either King Lear or just Lear. The OR operator links the two terms and finds a matching document if either of the terms exist in a document.
NOT	"King Lear" NOT "Norman Lear"	Returns documents that contain King Lear but not Norman Lear. The NOT operator cannot be used with only one term. For example, the following search will return no results: NOT "King Lear".
	First text search:	The first text search returns the exact phrase King Lear.
(Exact match)	"King Lear"	
	Second text search: "king"	The second text search returns only the word king and no other forms, such as kings or kingly.
* (Wildcard character)	test* te*t	Returns documents that can match possible combinations, such as test, tests, and tester, or test and text.
? (Wildcard character)	test? te?t	Returns documents that can match possible combinations, such as tests, or test and text.
(Score boost factor)	First text search: "King Lear"^4 "Richard III"	The first text search forces documents with the phrase King Lear to appear higher in the list of search results.
some word or phrase^number	Second text search: title: (software download)^5 pdf viewer -shipping	The second text search forces a document titled software download to appear higher in the list of results.
		Although a boost factor must be positive, the boost factor can be less than 1. For example, 0.2. The boost factor number has no limit.
+	+Lear King	Returns all documents that contain Lear and King, which is the same as the text
(Includes)	"King Lear" -"Lear Jet"	search Lear AND King. Returns documents that contain King Lear but not Lear Jet.
(Excludes)		
()	(King OR Lear) AND plays	Returns documents that contain either King or Lear and plays. The parentheses ensure that plays is found and either term King or Lear is present.

Table 191. Advanced search operators and complex text search examples (continued)

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Operators	Examples	Search results
(Escape character)	\(1\+1\)\:2	Returns documents that contain (1+1):2. Use the \ to clear special characters that are part of the text search syntax. Special characters are + - && ! () {} [] ^ " * ? : \. If a special character is cleared, the special character is analyzed as part of the text search.

Example: Using the CONTAINS function and SCORE function

You can use the CONTAINS function or the SCORE function in the same query to search a text search index and to return if and how frequently the text document matches the search argument criteria.

The example in the following table uses data from the base table BOOKS with the columns ISBN (VARCHAR(20)), ABSTRACT (VARCHAR(10000)), and PRICE (INTEGER).

Table 192. The base table BOOKS

ISBN	ABSTRACT	PRICE	
i1	"a b c"	7	
i2	"a b d"	10	
i3	"a e a"	8	

You run the following query:

SELECT ISBN, SCORE(ABSTRACT,'"b"')

FROM BOOKS

WHERE CONTAINS (ABSTRACT, '"b"') = 1

This query returns the following two rows:

i1, 0.3

i3, 0.4

The score values might differ depending on the content of the text column.

XML text search

By using a subset of the XPath language with extensions for text search, XML text search allows you to index and search XML documents so that structural elements can be used separately or can be combined with free text in queries.

Structural elements are tag names, attribute names, and attribute values.

The following list highlights the key features of XML search:

XML structural search

By including special opaque XML terms in queries, you can search XML documents for structural elements (tag names, attribute names, and attribute values) and text that is scoped by those elements.

XML query tokenization

Free text in XML query terms is tokenized the same way that text in non-XML query terms is tokenized, except that spelling correction, fielded terms, and (nested) opaque terms are not supported. Synonyms, wildcard characters, phrases, and lemmatization are supported.

XML namespaces are disregarded

Namespace prefixes are not retained in the indexing of XML tag and attribute names. XML documents that declare and use namespaces can be indexed and searched, but namespace prefixes are discarded during indexing and removed from XML search queries.

Numeric values

Predicates that compare attribute values to numbers are supported.

Complete match

The = (equal sign) operator with a string argument in a predicate calls for a complete match of all tokens in the string with all tokens in the identified text span. The order is significant.

No UIMA access

Unstructured Information Management Architecture (UIMA) is used for tokenization in XML search, but user-written annotators are not supported.

XML text search configuration

You can configure some of the settings that are used for XML search. All of the parser configuration parameters are in the parser_config.xml file in the XML element that defines the parser com.ibm.es.nuvo.parser.xml.XMLParser.

Each parameter is specified by a parameter element, as shown in the following example:

<Parameter Name="parameter-name">setting</Parameter>

If no parameter elements are present, then the default settings are used. The following table shows the valid parameter names and settings.

Table 193. Valid parameter names and settings for XML search

Parameter name	Setting	Result
handleExternalFiles	ignore	External files are not downloaded. The files are resolved as if they were empty. Parsing is faster, but externally defined entities cannot be indexed. This is the default setting.
	read	External files are downloaded if they are accessible, with a consequent increase in parsing time. If a file is not accessible, an I/O exception is thrown by the parser, and the URI of the affected document is indexed with an error code.
handleSkippedEntities	ignore	Unresolved references are silently ignored during parsing. This is the default setting.
	reject	A document containing an unresolved entity is rejected, and an error entry is stored in the index for its URI.
titleTagNameList	absent	The only tag name that is used to identify the title content is <i>title</i> (not case-sensitive). This is the default setting.
	empty	No tag name is used to identify the title content.
	single tag name	Tag names that match the specified tag name (not case-sensitive) are used to identify document titles.
	comma-separated list	Tag names that match any name in the list (not case-sensitive) are used to identify document titles.

XML text search grammar

A subset of the XPath language, which is defined by an Extended Backus-Naur Form (EBNF) grammar, is supported by the XML search query parser. Queries that do not conform to the supported grammar are rejected by the query parser, which throws an exception.

The EBNF grammar has been simplified in the following ways by:

- Removing the largest-scale structures for specifying iteration and ranges
- Eliminating filter expressions
- Disallowing absolute pathnames in predicate expressions
- · Recognizing only one axis (tag) and only in the forward direction

The following table shows the supported grammar in EBNF notation.

Table 194. Supported search query grammar in EBNF notation

XMLQuery	::=	QueryPrefix QueryString
QueryPrefix	::=	"@xpath:"
QueryString	::=	"'" PathExpr "'"

Table 194. Supported search query grammar in EBNF notation (continued)

::=	RelativePathExpr "/" RelativePathExpr? "//" RelativePathExpr
::=	StepExpr (($"/" \mid "//"$) StepExpr)*
::=	("." AbbrevForwardStep) Predicate?
::=	"@"? (QName "*")
::=	"[" PredicateExpr "]"
::=	Expr PredicateExpr ("and" "or") PredicateExpr "(" PredicateExpr ")"
::=	ComparisonExpr ContainmentExpr
::=	PathExpr ComparisonOp Literal
::=	"=" "<" ">" "!=" "<=" ">="
::=	StringLiteral NumericLiteral
::=	PathExpr "contains" "(" StringLiteral ")" PathExpr "excludes" "(" StringLiteral ")"
::=	"\"" [^"]* "\"" "'" [^']* "'"

For more information about QName, see http://www.w3.org/TR/REC-xmlnames/#NT-QName.

The following information about XML search queries that use XPath notation might not be obvious from the EBNF grammar notations:

- Names not normalized: XML tag and attribute names are not normalized when they are indexed. The names are not changed to lowercase or modified in any way. Case is significant in XML tag and attribute names to get a match. Therefore, the strings that are used for XML tag and attribute names in queries must match exactly the names that appear in the source documents.
- Namespace handling: Documents with XML namespace prefixes can be indexed, but namespace prefixes are not retained in the index. For example, the tag "<nsdoc:heading ...>" is indexed under "heading" only. Namespace prefixes are also removed from element names in XML search queries. As a result, a query that specifies the tag name "nsdoc:heading" is parsed to produce a query that looks for the tag name "heading."
- Free text normalization: Free text in XML documents (text between tags, not inside a tag itself) and attribute values are normalized before indexing. Text in XML search queries (in *contains* or *excludes* operators, or in strings that are surrounded by quotation marks) is normalized, too. Features such as phrases, synonyms, wildcard characters, and lemmas are supported.
- Operator precedence: In XML search predicates, containment operators and comparison operators take precedence over logical operators, and all logical operators have the same precedence. Containment operators are contains and excludes. Comparison operators are =, !=, <, >, <= and >=. Logical operators are "and" and "or." You can use parentheses to ensure the desired precedence.
- **Semantics:** In XML search predicates, the comparison operators can be applied only to attribute values and not to tags.

Examples: XPath text search

All valid XPath queries that are sent to the XML parser must be written in a subset of the XPath language using opaque terms. Opaque terms are not parsed by the linguistic text search parser.

The text search parser recognizes an opaque term by the syntax that is used in the text search. For example:

@xpath:'query'

where *query* is the text shown in the examples in the following table.

Table 195. Examples of valid XPath queries

Query	Description
/	The root node; any document.
/*	Any document with any top-level tag.
//*	Any document with any tag at any level.
/sentences	Any document with a top-level tag called sentences.
//sentences	Any document with a tag at any level called <i>sentences</i> .
sentences	Any document with a tag at any level called sentences.
/sentence/paragraph	Any document with a top-level tag sentence having a direct child tag paragraph.
/sentence/paragraph/	Any document with a top-level tag sentence having a direct child tag paragraph.
/book/@author	Any document with a top-level book tag having an attribute author.
/book//@author	Any document with a top-level <i>book</i> tag having a descendant tag at any level with the attribute <i>author</i> .
/book[@author contains("barnes") and @title = "the lemon table"]	Any document with a top-level <i>book</i> tag with an <i>author</i> attribute containing "barnes" (normalized) and a <i>title</i> attribute that only contains the words "the," "lemon" and "table" (normalized in that order).
/book[@author contains("barnes") and (@title contains("lemon") or @title contains("flaubert"))]	Any document with a top-level <i>book</i> tag with the specified <i>author</i> attribute and either of the two specified <i>title</i> attributes.
/program[. contains("""hello, world.""")	Any document with a top-level <i>program</i> tag containing both the tokens <i>hello</i> and <i>world</i> (normalized) in that order and in consecutive positions.
/book[paragraph contains("foo")]//sentence	Any document with a top-level book tag with a direct child tag paragraph containing "foo" and, referring to the book tag, having a descendant tag sentence at any level.
/auto[@price < 30000.]	Any document with a top-level <i>auto</i> tag having an attribute <i>price</i> with a numeric value that is less than 30000.

Examples: XPath text search

Table 195. Examples of valid XPath queries (continued)

Query	Description
//microbe[@size < 3.0e-06]	Any document containing a <i>microbe</i> tag at any level with a <i>size</i> attribute with a value that is less than .000003.

Text search language options

The text search language option specifies which language rules to use when performing a text search.

If QUERYLANGUAGE is not specified, the default is the language value of the text search index that is used when the CONTAINS or SCORE function is invoked. If the language value of the text search index is AUTO, the default value for QUERYLANGUAGE is en_US. The following table shows the valid language codes that may be used in the QUERYLANGUAGE option.

Language code	Language
ar_AA	Arabic
cs_CZ	Czech
da_DK	Danish
de_CH	German (Switzerland)
de_DE	German (Germany)
el_GR	Greek
en_AU	English (Australia)
en_GB	English (United Kingdom)
en_US	English (United States)
es_ES	Spanish (Spain)
fi_FI	Finnish
fr_CA	French (Canada)
fr_FR	French (France)
it_IT	Italian
ja_JP	Japanese
ko_KR	Korean
nb_NO	Norwegian Bokmal
nl_NL	Dutch
nn_NO	Norwegian Nynorsk
pl_PL	Polish
pt_BR	Portuguese (Brazil)
pt_PT	Portuguese (Portugal)
ru_RU	Russian
sv_SE	Swedish
zh_CN	Simplified Chinese
zh_TW	Traditional Chinese

Text search language options

Appendix H. Terminology differences

Some terminology used in the ANSI and ISO standards differs from the terminology used in this book and other product books.

The following table is a cross reference of the SQL 2003 Core standard terms to DB2 SQL

Table 196. ANSI/ISO term to DB2 SQL term cross-reference

ANSI/ISO Term	DB2 SQL Term
Promi	
literal	constant
comparison predicate	basic predicate
comparison predicate subquery	subquery in a basic predicate
degree of table/cursor	number of items in a select list
grouped table	result table created by a group-by or having clause
grouped view	result view created by a group-by or having clause
grouping column	column in a group-by clause
outer reference	correlated reference
query expression	fullselect
query specification	subselect
result specification	result
set function	aggregate function
table expression	→—from-clause————————————————————————————————————
target specification	host variable followed by an indicator variable
transaction	logical unit of work or unit of work
value expression	arithmetic expression

The following table is a cross reference of DB2 SQL terms to the SQL 2003 Core standard terms.

Terminology differences

Table 197. DB2 SQL term to ANSI/ISO term cross-reference

DP2 SQL Town	ANICHICO Town
DB2 SQL Term	ANSI/ISO Term
aggregate function	set function
arithmetic expression	value expression
basic predicate	comparison predicate
column in a group-by clause	grouping column
correlated reference	outer reference
→ from-clause where-clause having-clause	table expression
fullselect	query expression
host variable followed by an indicator variable	target specification
logical unit of work or unit of work	transaction
interactive SQL	direct SQL
number of items in a select list	degree of table/cursor
result	result specification
result table created by a group-by or having clause	grouped table
result view created by a group-by or having clause	grouped view
subquery in a basic predicate	comparison predicate subquery
subselect	query specification
subselect or fullselect in parenthesis	query term

Appendix I. Reserved schema names and reserved words

This topic describes the restrictions of certain names used by the database manager. In some cases, names are reserved and cannot be used by application programs. In other cases, certain names are not recommended for use by application programs though not prevented by the database manager.

Reserved schema names

This is the list of reserved schema names.

The following schema names are reserved:

- QSYS2
- SYSCAT
- SYSFUN
- SYSIBM
- SYSIBMADM
- SYSPROC
- SYSSTAT
- SYSTEM

In addition, it is strongly recommended that schema names never begin with the Q prefix or SYS prefix, as Q and SYS are by convention used to indicate an area reserved by the system.

It is also recommended not to use SESSION as a schema name.

Reserved words

This is the list of currently reserved DB2 for i words.

Words may be added at any time. For a list of additional words that may become reserved in the future, see the IBM SQL and ANSI reserved words in the IBM SQL Reference Version 1 SC26-3255.

Table 198. SQL Reserved Words

1	ACTION	CONTAINS	DISALLOW	HANDLER
	ACTIVATE	CONTINUE	DISCONNECT	HASH
1	ADD	COPY	DISTINCT	HASHED_VALUE
	ALIAS	COUNT	DO	HAVING
	ALL	COUNT_BIG	DOUBLE	HINT
	ALLOCATE	CREATE	DROP	HOLD
	ALLOW	CROSS	DYNAMIC	HOUR
1	ALTER	CUBE	EACH	HOURS
	AND	CURRENT	ELSE	IDENTITY
	ANY	CURRENT_DATE	ELSEIF	IF
1	APPEND	CURRENT_PATH	ENABLE	IMMEDIATE
i	AS	CURRENT_SCHEMA	ENCRYPTION	IMPLICITLY
i	ASC	CURRENT_SERVER	END	IN
i	ASENSITIVE	CURRENT_TIME	ENDING	INCLUDE
•	AT	CURRENT_TIMESTAMP	END-EXEC (COBOL only)	
1	ATTRIBUTES	CURRENT_TIMEZONE	ENFORCED	INCLUSIVE
	AUTHORIZATION	CURRENT_USER	ESCAPE	INCREMENT
	BEGIN	CURSOR	EVERY	INDEX
1	BETWEEN	CYCLE	EXCEPT	INDEXBP
i	BINARY	DATA	EXCEPTION	INDICATOR
Ì	BIND	DATABASE	EXCLUDING	INF
1	BIT	DATAPARTITIONNAME	EXCLUSIVE	INFINITY
ĺ	BUFFERPOOL	DATAPARTITIONNUM	EXECUTE	INHERIT
	BY	DATE	EXISTS	INNER
	CACHE	DAY	EXIT	INOUT
1	CALL	DAYS	EXTEND	INSENSITIVE
	CALLED	DBINFO	EXTERNAL	INSERT
	CARDINALITY	DBPARTITIONNAME	EXTRACT	INTEGRITY
	CASE	DBPARTITIONNUM	FENCED	INTERSECT
	CAST	DB2GENERAL	FETCH	INTO
	CCSID	DB2GENRL	FILE	IS
	CHAR	DB2SQL	FINAL	ISOLATION
	CHARACTER	DEACTIVATE	FOR	ITERATE
	CHECK	DEALLOCATE	FOREIGN	JAVA
	CLIENT	DECLARE	FREE	JOIN
	CLOSE	DEFAULT	FREEPAGE	KEY
	CLUSTER	DEFAULTS	FROM	LABEL
-	COLLECT	DEFER	FULL	LANGUAGE
	COLLECTION	DEFINE	FUNCTION	LATERAL
	COLUMN	DEFINITION	GBPCACHE	LEAVE
	COMMENT	DELETE	GENERAL	LEFT
	COMMIT	DENSERANK	GENERATED	LEVEL2
	COMPACT	DENSE_RANK	GET	LIKE
ı	COMPRESS	DESC	GLOBAL	LINKTYPE
	CONCAT	DESCRIBE	GO	LOCAL
	CONDITION	DESCRIPTOR	GOTO	LOCALDATE
	CONNECT	DETERMINISTIC	GRANT	LOCALTIME
	CONNECTION	DIAGNOSTICS	GRAPHIC	LOCALTIMESTAMP
	CONSTRAINT	DISABLE	GROUP	LOCK

Table 199. SQL Reserved Words (continued)

ı	LOCKSIZE	OPEN	REPEAT	STARTING
	LOG	OPTIMIZE	RESET	STATEMENT
	LOGGED	OPTION	RESIGNAL	STATIC
Τ	LONG	OR	RESTART	STOGROUP
	LOOP	ORDER	RESULT	SUBSTRING
	MAINTAINED	ORGANIZE	RETURN	SUMMARY
	MATERIALIZED	OUT	RETURNS	SYNONYM
	MAXVALUE	OUTER	REVOKE	SYSTEM_USER
	MICROSECOND	OVER	RID	TABLE
	MICROSECONDS	OVERRIDING	RIGHT	TABLESPACE
	MINPCTUSED	PACKAGE	ROLLBACK	TABLESPACES
I	MINUTE	PADDED	ROLLUP	THEN
Τ	MINUTES	PAGE	ROUTINE	TIME
	MINVALUE	PAGESIZE	ROW	TIMESTAMP
1	MIXED	PARAMETER	ROWNUMBER	TO
	MODE	PART	ROW_NUMBER	TRANSACTION
	MODIFIES	PARTITION	ROWS	TRIGGER
	MONTH	PARTITIONED	RRN	TRIM
	MONTHS	PARTITIONING	RUN	TYPE
	NAN	PARTITIONS	SAVEPOINT	UNDO
Ι	NATIONAL	PASSWORD	SBCS	UNION
	NCHAR	PATH	SCHEMA	UNIQUE
Ι	NCLOB	PCTFREE	SCRATCHPAD	UNTIL
	NEW	PIECESIZE	SCROLL	UPDATE
	NEW_TABLE	PLAN	SEARCH	USAGE
	NEXTVAL	POSITION	SECOND	USER
	NO	PREPARE	SECONDS	USING
	NOCACHE	PREVVAL	SECQTY	VALUE
	NOCYCLE	PRIMARY	SELECT	VALUES
	NODENAME	PRIQTY	SENSITIVE	VARIABLE
	NODENUMBER	PRIVILEGES	SEQUENCE	VARIANT
	NOMAXVALUE	PROCEDURE	SESSION	VCAT
	NOMINVALUE	PROGRAM	SESSION_USER	VERSION
	NONE	QUERY	SET	VIEW
	NOORDER	RANGE	SIGNAL	VOLATILE
	NORMALIZED	RANK	SIMPLE	WHEN
	NOT	RCDFMT	SKIP	WHERE
	NULL	READ	SNAN	WHILE
	NULLS	READS	SOME	WITH
	NVARCHAR	RECOVERY	SOURCE	WITHOUT
	OBID	REFERENCES	SPECIFIC	WRITE
	OF	REFERENCING	SQL	YEAR
	OLD	REFRESH	SQLID	YEARS
	OLD_TABLE	RELEASE	STACKED	YES
	ON	RENAME	START	

Reserved words

Appendix J. Related information

The publications listed here provide additional information about topics described or referred to in this guide.

These manuals are listed with their full titles and order numbers. When these manuals are referred to in this guide, a shortened version of the title is used.

Backup and recovery

The manual contains information about planning a backup and recovery strategy, the different types of media available to save and restore procedures, and disk recovery procedures. It also describes how to install the system again from backup.

ILE COBOL Programmer's Guide



This guide provides information needed to design, write, test, and maintain COBOL programs on the System i products.

ILE RPG Programmer's Guide



This guide provides information you need to design, write, test, and maintain ILE RPG programs on the System i products.

REXX/400 Programmer's Guide



This guide provides information you need to design, write, test, and maintain REXX/400 programs on the System i products.

· CL programming

This guide provides a wide-ranging discussion of the programming topics, including a general discussion of objects and libraries, CL programming, controlling flow and communicating between programs, working with objects in CL programs, and creating CL programs. Other topics include predefined and impromptu messages and handling, defining and creating user-defined commands and menus, application testing, including debug mode, breakpoints, traces, and display functions.

Database file management

This book provides information about using files in application programs.

Database programming

This book provides a detailed description of the IBM i database organization, including information about how to create, describe, and update database files on the system.

Distributed database programming

Provides information about preparing and managing an System i product in a distributed relational database using the Distributed Relational Database Architecture (DRDA). Describes planning, setting up, programming, administering, and operating a distributed relational database on more than one System i product in a like-system environment.

Security reference

This guide provides information about system security concepts, planning for security, and setting up security on the system. It also gives information about protecting the system and data from being used by people who do not have the proper authorization, protecting the data from intentional or unintentional damage or destruction, keeping security up-to-date, and setting up security on the system.

SQL programming

This book provides an overview of how to design, write, run, and test DB2 for i statements. It also describes interactive Structured Query Language (SQL).

Embedded SQL programming

This book provides examples of how to write SQL statements in ILE C, ILE C++, COBOL, ILE COBOL, RPG, ILE RPG, REXX, and PL/I programs.

Database performance and query optimization

This book provides information about optimizing the performance of your queries using available tools and techniques.

• IDDU Use

This book describes how to use IBM i interactive data definition utility (IDDU) to describe data dictionaries, files, and records to the system.

SQL call level interfaces (ODBC)

This book describes how to use X/Open SQL Call Level Interface to access SQL functions directly through procedure calls to a service program provided by DB2 for i.

System i Access category in the i5/OS Information Center

This information describes how to set up and run ODBC applications on a client using System i Access ODBC. Included in this document are chapters on performance, examples, and configuring specific applications to run with System i Access ODBC.

· IBM Toolbox for Java

This book describes how to set up and run JDBC applications on a client using IBM Toolbox for Java. Included in this document are chapters on performance, examples, and configuring specific applications to run with IBM Toolbox for Java.

IBM Developer Kit for Java

This information provides the details you need to design, write, test, and maintain JAVA programs on the System i product. The book also contains information about the IBM Developer Kit for Java JDBC driver.

DB2 Multisystem

This book describes the fundamental concepts of distributed relational database files, nodegroups, and partitioning. The book provides the information you need to create and use database files that are partitioned across multiple systems. Information is provided on how to configure the systems, how to create the files, and how the files can be used in applications.

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