EXECUTE

The EXECUTE statement executes a prepared SQL statement.

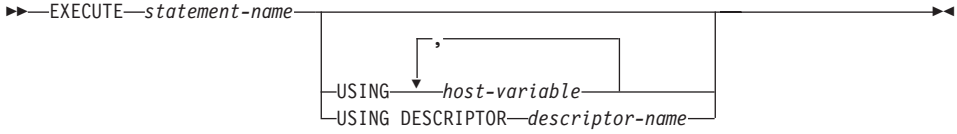
Invocation

This statement can be embedded only in an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

For statements where authorization checking is performed at statement execution time (DDL, GRANT, and REVOKE statements), the privileges held by the authorization ID of the statement must include those required to execute the SQL statement specified by the PREPARE statement. For statements where authorization checking is performed at statement preparation time (DML), no authorization is required to use this statement.

Syntax



Description

statement-name
Identifies the prepared statement to be executed. The *statement-name* must identify a statement that was previously prepared and the prepared statement must not be a SELECT statement.

USING
Introduces a list of host variables for which values are substituted for the parameter markers (question marks) in the prepared statement. (For an explanation of parameter markers, see "PREPARE" on page 954.) If the prepared statement includes parameter markers, USING must be used.

host-variable, **...**
Identifies a host variable that is declared in the program in accordance with the rules for declaring host 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. Locator variables and file reference variables, where appropriate, can be provided as the source of values for parameter markers.

DESCRIPTOR *descriptor-name*
Identifies an input SQLDA that must contain a valid description of host variables.

Before the EXECUTE statement is processed, the user must set the following fields in the input 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 SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(N), where N is the length of an SQLVAR occurrence.

If LOB input data needs to be accommodated, there must be two SQLVAR entries for every parameter marker.

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 C. SQL Descriptor Area (SQLDA)" on page 1113.

Notes

- Before the prepared statement is executed, each parameter marker is effectively replaced by the value of its corresponding host variable. 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. See "Rules" on page 955 for the rules affecting parameter markers.

  Let V denote a host 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 string, its length must not be greater than the length attribute of 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.

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.

- ***Dynamic SQL Statement Caching:***

  The information required to execute dynamic and static SQL statements is placed in the database package cache when static SQL statements are first referenced or when dynamic SQL statements are first prepared. This information stays in the package cache until it becomes invalid, the cache space is required for another statement, or the database is shut down.

  When an SQL statement is executed or prepared, the package information relevant to the application issuing the request is loaded from the system catalog into the package cache. The actual executable section for the individual SQL statement is also placed into the cache: static SQL sections are read in from the system catalog and placed in the package cache when the statement is first referenced; Dynamic SQL sections are placed directly in the cache after they have been created. Dynamic SQL sections can be created by an explicit statement, such as a PREPARE or EXECUTE IMMEDIATE statement. Once created, sections for dynamic SQL statements may be recreated by an implicit prepare of the statement performed by the system if the original section has been deleted for space management reasons or has become invalid due to changes in the environment.

  Each SQL statement is cached at a database level and can be shared among applications. Static SQL statements are shared among applications using the same package; Dynamic SQL statements are shared among applications using the same compilation environment and the exact same statement text. The text of each SQL statement issued by an application is cached locally within the application for use in the event that an implicit prepare is required. Each PREPARE statement in the application program can cache one statement. All EXECUTE IMMEDIATE statements in an application program share the same space and only one cached statement exists for all these EXECUTE IMMEDIATE statements at a time. If the same PREPARE or any EXECUTE IMMEDIATE statement is issued multiple times with a different SQL statement each time, only the last statement will be cached for reuse. The optimal use of the cache is to issue a number of different PREPARE statements once at the start of the application and then to issue an EXECUTE or OPEN statement as required.

  With the caching of dynamic SQL statements, once a statement has been created, it can be reused over multiple units of work without the need to prepare the statement again. The system will recompile the statement as required if environment changes occur.

  The following events are examples of environment or data object changes which can cause cached dynamic statements to be implicitly prepared on the next PREPARE, EXECUTE, EXECUTE IMMEDIATE, or OPEN request:

- ALTER NICKNAME
- ALTER SERVER
- ALTER TABLE
- ALTER TABLESPACE
- ALTER TYPE
- CREATE FUNCTION
- CREATE FUNCTION MAPPING
- CREATE INDEX
- CREATE TABLE
- CREATE TEMPORARY TABLESPACE
- CREATE TRIGGER
- CREATE TYPE
- DROP (all objects)
- RUNSTATS on any table or index
- any action that causes a view to become inoperative
- UPDATE of statistics in any system catalog table
- SET CURRENT DEGREE
- SET PATH
- SET QUERY OPTIMIZATION
- SET SCHEMA
- SET SERVER OPTION

The following list outlines the behavior that can be expected from cached dynamic SQL statements:

- *PREPARE Requests:* Subsequent preparations of the same statement will not incur the cost of compiling the statement if the section is still valid. The cost and cardinality estimates for the current cached section will be returned. These values may differ from the values returned from any previous PREPARE for the same SQL statement.

  There will be no need to issue a PREPARE statement subsequent to a COMMIT or ROLLBACK statement.
- *EXECUTE Requests:* EXECUTE statements may occasionally incur the cost of implicitly preparing the statement if it has become invalid since the original PREPARE. If a section is implicitly prepared, it will use the current environment and not the environment of the original PREPARE statement.
- *EXECUTE IMMEDIATE Requests:* Subsequent EXECUTE IMMEDIATE statements for the same statement will not incur the cost of compiling the statement if the section is still valid.

- *OPEN Requests:* OPEN requests for dynamically defined cursors may occasionally incur the cost of implicitly preparing the statement if it has become invalid since the original PREPARE statement. If a section is implicitly prepared, it will use the current environment and not the environment of the original PREPARE statement.
- *FETCH Requests:* No behavior changes should be expected.
- *ROLLBACK:* Only those dynamic SQL statements prepared or implicitly prepared during the unit of work affected by the rollback operation will be invalidated.
- *COMMIT:* Dynamic SQL statements will not be invalidated but any locks acquired will be freed. Cursors not defined as WITH HOLD cursors will be closed and their locks freed. Open WITH HOLD cursors will hold onto their package and section locks to protect the active section during, and after, commit processing.

If an error occurs during an implicit prepare, an error will be returned for the request causing the implicit prepare (SQLSTATE 56098).

Examples

Example 1: In this C example, an INSERT statement with parameter markers is prepared and executed. `h1 - h4` are host variables that correspond to the format of TDEPT.

```
strcpy (s,"INSERT INTO TDEPT VALUES(?,?,?,?)");
EXEC SQL PREPARE DEPT_INSERT FROM :s;
   .
   .
(Check for successful execution and put values into :h1, :h2, :h3, :h4)
   .
   .
EXEC SQL EXECUTE DEPT_INSERT USING :h1, :h2,
:h3, :h4;
```

Example 2: This EXECUTE statement uses an SQLDA.

```
EXECUTE S3 USING DESCRIPTOR :sqlda3
```

EXECUTE IMMEDIATE

The EXECUTE IMMEDIATE statement:

- Prepares an executable form of an SQL statement from a character string form of the statement.
- Executes the SQL statement.

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 host variables nor parameter markers.

Invocation

This statement can be embedded only in an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

The authorization rules are those defined for the SQL statement specified by EXECUTE IMMEDIATE.

Syntax

Description

host-variable
A host variable must be specified and it must identify a host variable that is described in the program in accordance with the rules for declaring character-string variables. It must be a character-string variable less than the maximum statement size of 65 535. Note that a CLOB(65535) can contain a maximum size statement but a VARCHAR can not.

The value of the identified host variable is called the statement string.

The statement string must be one of the following SQL statements:

- ALTER
- COMMENT ON
- COMMIT
- CREATE
- DELETE
- DECLARE GLOBAL TEMPORARY TABLE
- DROP
- GRANT
- INSERT

- LOCK TABLE
- REFRESH TABLE
- RELEASE SAVEPOINT
- RENAME TABLE
- RENAME TABLESPACE
- REVOKE
- ROLLBACK
- SAVEPOINT
- SET CURRENT DEGREE
- SET CURRENT EXPLAIN MODE
- SET CURRENT EXPLAIN SNAPSHOT
- SET CURRENT QUERY OPTIMIZATION
- SET CURRENT REFRESH AGE
- SET CURRENT TRANSFORM GROUP
- SET EVENT MONITOR STATE
- SET INTEGRITY
- SET PASSTHRU
- SET PATH
- SET SCHEMA
- SET SERVER OPTION
- UPDATE

The statement string must not include parameter markers or references to host variables, and must not begin with EXEC SQL. It must not contain a statement terminator, with the exception of the CREATE TRIGGER statement which can contain a semi-colon (;) to separate triggered SQL statements, or the CREATE PROCEDURE statement to separate SQL statements in the SQL procedure body.

When an EXECUTE IMMEDIATE statement is executed, the specified statement string is parsed and checked for errors. If the SQL statement is invalid, it is not executed and the error condition that prevents its execution is reported in the SQLCA. If the SQL statement is valid, but an error occurs during its execution, that error condition is reported in the SQLCA.

Notes

- Statement caching affects the behavior of an EXECUTE IMMEDIATE statement. See “Dynamic SQL Statement Caching” on page 897 for information.

Example

Use C program statements to move an SQL statement to the host variable qstring (char[80]) and prepare and execute whatever SQL statement is in the host variable qstring.

```
if ( strcmp(accounts,"BIG") == 0 )
  strcpy (qstring,"INSERT INTO WORK_TABLE SELECT *
    FROM EMP_ACT WHERE ACTNO < 100");
else
  strcpy (qstring,"INSERT INTO WORK_TABLE SELECT *
    FROM EMP_ACT WHERE ACTNO >= 100");
  .
  .
  .
EXEC SQL  EXECUTE IMMEDIATE :qstring;
```

EXPLAIN

The EXPLAIN statement captures information about the access plan chosen for the supplied explainable statement and places this information into the Explain tables. (See "Appendix K. Explain Tables and Definitions" on page 1291 for information on the Explain tables and table definitions.)

An *explainable statement* is a DELETE, INSERT, SELECT, SELECT INTO, UPDATE, VALUES, or VALUES INTO SQL statement.

Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

The statement to be explained is not executed.

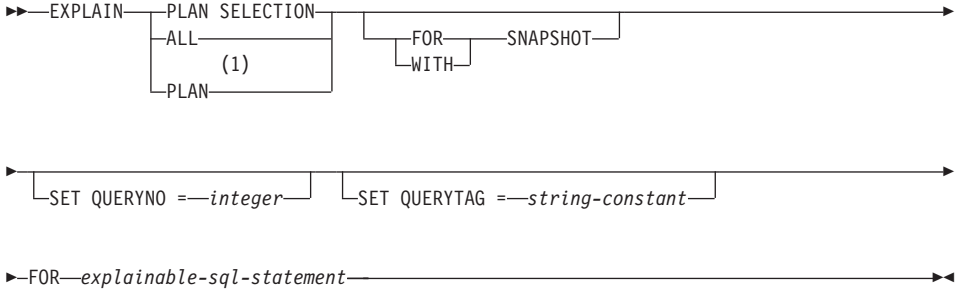
Authorization

The authorization rules are those defined for the SQL statement specified in the EXPLAIN statement. For example, if a DELETE statement was used as the *explainable-sql-statement* (see statement syntax that follows), then the authorization rules for a DELETE statement would be applied when the DELETE statement is explained.

The authorization rules for static EXPLAIN statements are those rules that apply for static versions of the statement passed as the *explainable-sql-statement*. Dynamically prepared EXPLAIN statements use the authorization rules for the dynamic preparation of the statement provided for the *explainable-sql-statement* parameter.

The current authorization ID must have insert privilege on the Explain tables.

Syntax



Notes:

1 The PLAN option is supported only for syntax toleration of existing DB2

for MVS EXPLAIN statements. There is no PLAN table.
Specifying PLAN is equivalent to specifying PLAN SELECTION.

Description

PLAN SELECTION
Indicates that the information from the plan selection phase of SQL compilation is to be inserted into the Explain tables.

ALL
Specifying ALL is equivalent to specifying PLAN SELECTION.

PLAN
The PLAN option provides syntax toleration for existing database applications from other systems. Specifying PLAN is equivalent to specifying PLAN SELECTION.

FOR SNAPSHOT
This clause indicates that only an Explain Snapshot is to be taken and placed into the SNAPSHOT column of the EXPLAIN_STATEMENT table. No other Explain information is captured other than that present in the EXPLAIN_INSTANCE and EXPLAIN_STATEMENT tables.

The Explain Snapshot information is intended for use with Visual Explain.

WITH SNAPSHOT
This clause indicates that, in addition to the regular Explain information, an Explain Snapshot is to be taken.

The default behavior of the EXPLAIN statement is to only gather regular Explain information and not the Explain Snapshot.

The Explain Snapshot information is intended for use with Visual Explain.

default (neither FOR SNAPSHOT nor WITH SNAPSHOT specified)
Puts Explain information into the Explain tables. No snapshot is taken for use with Visual Explain.

SET QUERYNO = *integer*
Associates *integer*, via the QUERYNO column in the EXPLAIN_STATEMENT table, with *explainable-sql-statement*. The integer value supplied must be a positive value.

If this clause is not specified for a dynamic EXPLAIN statement, a default value of one (1) is assigned. For a static EXPLAIN statement, the default value assigned is the statement number assigned by the precompiler.

SET QUERYTAG = *string-constant*
Associates *string-constant*, via the QUERYTAG column in the EXPLAIN_STATEMENT table, with *explainable-sql-statement*. *string-constant*

can be any character string up to 20 bytes in length. If the value supplied is less than 20 bytes in length, the value is padded on the right with blanks to the required length.

If this clause is not specified for an EXPLAIN statement, blanks are used as the default value.

FOR *explainable-sql-statement*
Specifies the SQL statement to be explained. This statement can be any valid DELETE, INSERT, SELECT, SELECT INTO, UPDATE, VALUES, or VALUES INTO SQL statement. If the EXPLAIN statement is embedded in a program, the *explainable-sql-statement* can contain references to host variables (these variables must be defined in the program). Similarly, if EXPLAIN is being dynamically prepared, the *explainable-sql-statement* can contain parameter markers.

The *explainable-sql-statement* must be a valid SQL statement that could be prepared and executed independently of the EXPLAIN statement. It cannot be a statement name or host variable. SQL statements referring to cursors defined through CLP are not valid for use with this statement.

To explain dynamic SQL within an application, the entire EXPLAIN statement must be dynamically prepared.

Notes

The following table shows the interaction of the snapshot keywords and the Explain information.

Keyword Specified	Capture Explain Information?	Take Snapshot for Visual Explain?
none	Yes	No
FOR SNAPSHOT	No	Yes
WITH SNAPSHOT	Yes	Yes

If neither the FOR SNAPSHOT nor WITH SNAPSHOT clause is specified, then no Explain snapshot is taken.

The Explain tables must be created by the user prior to the invocation of EXPLAIN. (See "Appendix K. Explain Tables and Definitions" on page 1291 for information on the Explain tables and table definitions.) The information generated by this statement is stored in these explain tables in the schema designated at the time the statement is compiled.

If any errors occur during the compilation of the *explainable-sql-statement* supplied, then no information is stored in the Explain tables.

The access plan generated for the *explainable-sql-statement* is not saved and thus, cannot be invoked at a later time. The Explain information for the *explainable-sql-statement* is inserted when the EXPLAIN statement itself is compiled.

For a static EXPLAIN SQL statement, the information is inserted into the Explain tables at bind time and during an explicit rebind (see REBIND in the *Command Reference*). During precompilation, the static EXPLAIN statements are commented out in the modified application source file. At bind time, the EXPLAIN statements are stored in the SYSCAT.STATEMENTS catalog. When the package is run, the EXPLAIN statement is not executed. Note that the section numbers for all statements in the application will be sequential and will include the EXPLAIN statements. An alternative to using a static EXPLAIN statement is to use a combination of the EXPLAIN and EXPLSNAP BIND/PREP options. Static EXPLAIN statements can be used to cause the Explain tables to be populated for one specific static SQL statement out of many; simply prefix the target statement with the appropriate EXPLAIN statement syntax and bind the application without using either of the Explain BIND/PREP options. The EXPLAIN statement can also be used when it is advantageous to set the QUERYNO or QUERYTAG field at the time of the actual Explain invocation.

For an incremental bind EXPLAIN SQL statement, the Explain tables are populated when the EXPLAIN statement is submitted for compilation. When the package is run, the EXPLAIN statement performs no processing (though the statement will be successful). When populating the explain tables, the explain table qualifier and authorization ID used during population will be those of the package owner. The EXPLAIN statement can also be used when it is advantageous to set the QUERYNO or QUERYTAG field at the time of the actual Explain invocation.

For dynamic EXPLAIN statements, the Explain tables are populated at the time the EXPLAIN statement is submitted for compilation. An Explain statement can be prepared with the PREPARE statement but, if executed, will perform no processing (though the statement will be successful). An alternative to issuing dynamic EXPLAIN statements is to use a combination of the CURRENT EXPLAIN MODE and CURRENT EXPLAIN SNAPSHOT special registers to explain dynamic SQL statements. The EXPLAIN statement should be used when it is advantageous to set the QUERYNO or QUERYTAG field at the time of the actual Explain invocation.

Examples

Example 1: Explain a simple SELECT statement and tag with QUERYNO = 13.

```
EXPLAIN PLAN SET QUERYNO = 13 FOR SELECT C1 FROM T1;
```

This statement is successful.

Example 2:

Explain a simple SELECT statement and tag with QUERYTAG = 'TEST13'.

```
EXPLAIN PLAN SELECTION SET QUERYTAG = 'TEST13'
  FOR SELECT C1 FROM T1;
```

This statement is successful.

Example 3: Explain a simple SELECT statement and tag with QUERYNO = 13 and QUERYTAG = 'TEST13'.

```
EXPLAIN PLAN SELECTION SET QUERYNO = 13 SET QUERYTAG = 'TEST13'
  FOR SELECT C1 FROM T1;
```

This statement is successful.

Example 4: Attempt to get Explain information when Explain tables do not exist.

```
EXPLAIN ALL FOR SELECT C1 FROM T1;
```

This statement would fail as the Explain tables have not been defined (SQLSTATE 42704).

FETCH

The FETCH statement positions a cursor on the next row of its result table and assigns the values of that row to host variables.

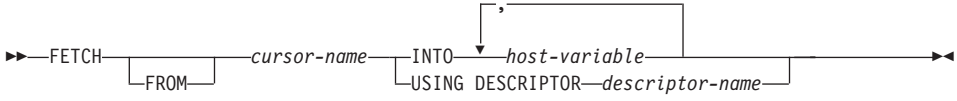
Invocation

Although an interactive SQL facility might provide an interface that gives the appearance of interactive execution, this statement can only be embedded within an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

See "DECLARE CURSOR" on page 841 for an explanation of the authorization required to use a cursor.

Syntax



Description

cursor-name
Identifies the cursor to be used in the fetch operation. The *cursor-name* must identify a declared cursor as explained in "DECLARE CURSOR" on page 841. The DECLARE CURSOR statement must precede the FETCH statement in the source program. When the FETCH statement is executed, the cursor must be in the open state.

If the cursor is currently positioned on or after the last row of the result table:

- SQLCODE is set to +100, and SQLSTATE is set to '02000'.
- The cursor is positioned after the last row.
- Values are not assigned to host variables.

If the cursor is currently positioned before a row, it will be repositioned on that row, and values will be assigned to host variables as specified by INTO or USING.

If the cursor is currently positioned on a row other than the last row, it will be repositioned on the next row and values of that row will be assigned to host variables as specified by INTO or USING.

INTO *host-variable*, **...**
Identifies one or more host variables that must be described in accordance with the rules for declaring host variables. The first value in the result

row is assigned to the first host variable in the list, the second value to the second host variable, and so on. For LOB values in the select-list, the target can be a regular host variable (if it is large enough), a locator variable, or a file-reference variable.

USING DESCRIPTOR *descriptor-name*
Identifies an SQLDA that must contain a valid description of zero or more host variables.

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 SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(N), where N is the length of an SQLVAR occurrence.

If LOB or structured type result columns need to be accommodated, there must be two SQLVAR entries for every select-list item (or column of the result table). See "Effect of DESCRIBE on the SQLDA" on page 1120, which discusses SQLDOUBLED, LOB , and structured type columns.

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 C. SQL Descriptor Area (SQLDA)" on page 1113.

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 rules described in Chapter 3. If the number of variables is less than the number of values in the row, the SQLWARN3 field of the SQLDA is set to 'W'. Note that there is no warning if there are more variables than the number of result columns. 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.

Notes

- An open cursor has three possible positions:
  - Before a row
  - On a row
  - After the last row.
- If a cursor is 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 on a row as a result of a FETCH statement.
- When retrieving into LOB locators in situations where it is not necessary to retain the locator across FETCH statements, it is good practice to issue a FREE LOCATOR statement before issuing the next FETCH statement, as locator resources are limited.
- It is possible for an error to occur that makes the state of the cursor unpredictable.
- It is possible that a warning may not be returned on a FETCH. It is also possible that the returned warning applies to a previously fetched row. This occurs as a result of optimizations such as the use of system temporary tables or pushdown operators (see *Administration Guide*).
- Statement caching affects the behavior of an EXECUTE IMMEDIATE statement. See the "Notes" on page 896 for information.
- DB2 CLI supports additional fetching capabilities. For instance when a cursor's result table is read-only, the SQLFetchScroll() function can be used to position the cursor at any spot within that result table.

Examples

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
```

FLUSH EVENT MONITOR

The FLUSH EVENT MONITOR statement writes current database monitor values for all active monitor types associated with event monitor *event-monitor-name* to the event monitor I/O target. Hence, at any time a partial event record is available for event monitors that have low record generation frequency (such as a database event monitor). Such records are noted in the event monitor log with a *partial record* identifier.

When an event monitor is flushed, its active internal buffers are written to the event monitor output object.

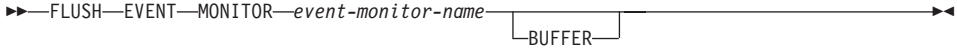
Invocation

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 must include either SYSADM or DBADM authority (SQLSTATE 42502).

Syntax



Description

event-monitor-name
Name of the event monitor. This is a one-part name. It is an SQL identifier.

BUFFER
Indicates that the event monitor buffers are to be written out. If BUFFER is specified, then a partial record is not generated. Only the data already present in the event monitor buffers are written out.

Notes

- Flushing out the event monitor will not cause the event monitor values to be reset. This means that the event monitor record that would have been generated if no flush was performed, will still be generated when the normal monitor event is triggered.

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 is an executable statement that cannot be dynamically prepared.

Authorization

None required.

Syntax

Description

LOCATOR *variable-name,* **...**
Identifies one or more locator variables that must be declared in accordance with the rules for declaring locator variables.

The locator-variable must currently have a locator assigned to it. That is, a locator must have been assigned during this unit of work (by a FETCH statement or a SELECT INTO statement) and must not subsequently have been freed (by a FREE LOCATOR statement); otherwise, an error is raised (SQLSTATE 0F001).

If more than one locator is specified, all locators that can be freed will be freed, regardless of errors detected in other locators in the list.

Example

In a COBOL program, free the BLOB locator variables TKN-VIDEO and TKN-BUF and the CLOB locator variable LIFE-STORY-LOCATOR.

```
EXEC SQL
FREE LOCATOR :TKN-VIDEO, :TKN-BUF, :LIFE-STORY-LOCATOR
END-EXEC.
```

GRANT (Database Authorities)

This form of the GRANT statement grants authorities that apply to the entire database (rather than privileges that apply to specific objects within the database).

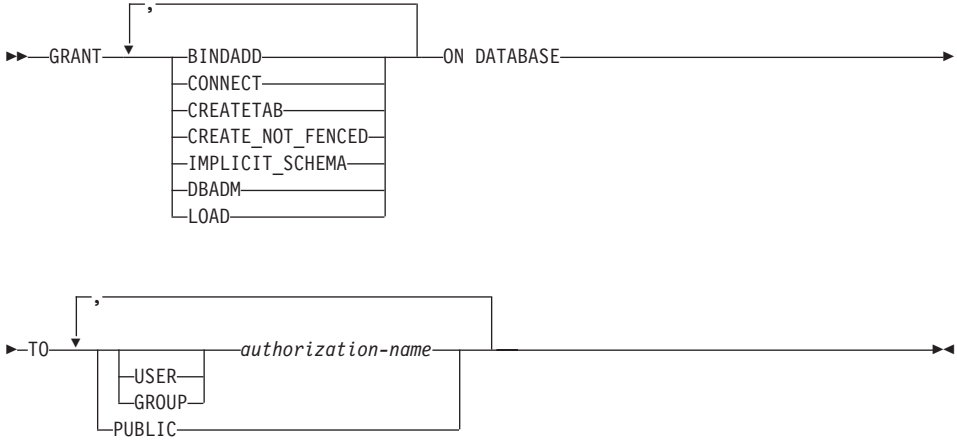
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

To grant DBADM authority, SYSADM authority is required. To grant other authorities, either DBADM or SYSADM authority is required.

Syntax



Description

BINDADD
Grants the authority to create packages. The creator of a package automatically has the CONTROL privilege on that package and retains this privilege even if the BINDADD authority is subsequently revoked.

CONNECT
Grants the authority to access the database.

CREATETAB
Grants the authority to create base tables. The creator of a base table automatically has the CONTROL privilege on that table. The creator retains this privilege even if the CREATETAB authority is subsequently revoked.

There is no explicit authority required for view creation. A view can be created at any time if the authorization ID of the statement used to create the view has either CONTROL or SELECT privilege on each base table of the view.

CREATE_NOT_FENCED
Grants the authority to register functions that execute in the database manager's process. Care must be taken that functions so registered will not have adverse side effects (see the FENCED or NOT FENCED clause on page 601 for more information).

Once a function has been registered as not fenced, it continues to run in this manner even if CREATE_NOT_FENCED is subsequently revoked.

IMPLICIT_SCHEMA
Grants the authority to implicitly create a schema.

DBADM
Grants the database administrator authority. A database administrator has all privileges against all objects in the database and may grant these privileges to others.

BINDADD, CONNECT, CREATETAB, CREATE_NOT_FENCED and IMPLICIT_SCHEMA are automatically granted to an *authorization-name* that is granted DBADM authority.

LOAD
Grants the authority to load in this database. This authority gives a user the right to use the LOAD utility in this database. SYSADM and DBADM also have this authority by default. However, if a user only has LOAD authority (not SYSADM or DBADM), the user is also required to have table-level privileges. In addition to LOAD privilege, the user is required to have:

- INSERT privilege on the table for LOAD with mode INSERT, TERMINATE (to terminate a previous LOAD INSERT), or RESTART (to restart a previous LOAD INSERT)
- INSERT and DELETE privilege on the table for LOAD with mode REPLACE, TERMINATE (to terminate a previous LOAD REPLACE), or RESTART (to restart a previous LOAD REPLACE)
- INSERT privilege on the exception table, if such a table is used as part of LOAD

TO
Specifies to whom the authorities are granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants the authorities to all users. DBADM cannot be granted to PUBLIC.

Rules

- If neither USER nor GROUP is specified, then
  - If the authorization-name is defined in the operating system only as GROUP, then GROUP is assumed.
  - If the authorization-name is defined in the operating system only as USER or if it is undefined, USER is assumed.
  - If the authorization-name is defined in the operating system as both, or DCE authentication is used, an error (SQLSTATE 56092) is raised.

Examples

Example 1: Give the users WINKEN, BLINKEN, and NOD the authority to connect to the database.

```
GRANT CONNECT ON DATABASE TO USER WINKEN, USER BLINKEN, USER NOD
```

Example 2: GRANT BINDADD authority on the database to a group named D024. There is both a group and a user called D024 in the system.

```
GRANT BINDADD ON DATABASE TO GROUP D024
```

Observe that, the GROUP keyword must be specified; otherwise, an error will occur since both a user and a group named D024 exist. Any member of the D024 group will be allowed to bind packages in the database, but the D024 user will not be allowed (unless this user is also a member of the group D024, had been granted BINDADD authority previously, or BINDADD authority had been granted to another group of which D024 was a member).

GRANT (Index Privileges)

This form of the GRANT statement grants the CONTROL privilege on indexes.

Invocation

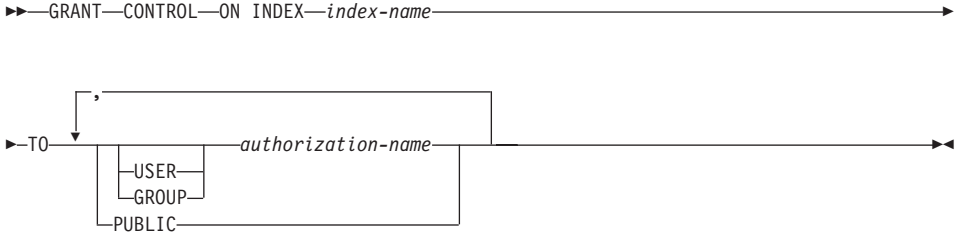
This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- DBADM authority
- SYSADM authority.

Syntax



Description

CONTROL
Grants the privilege to drop the index. This is the CONTROL authority for indexes, which is automatically granted to creators of indexes.

ON INDEX *index-name*
Identifies the index for which the CONTROL privilege is to be granted.

TO
Specifies to whom the privileges are granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants the privileges to all users.

Rules

- If neither USER nor GROUP is specified, then
  - If the authorization-name is defined in the operating system only as GROUP, then GROUP is assumed.
  - If the authorization-name is defined in the operating system only as USER or if it is undefined, USER is assumed.
  - If the authorization-name is defined in the operating system as both, or DCE authentication is used, an error (SQLSTATE 56092) is raised.

Example

```
GRANT CONTROL ON INDEX DEPTIDX TO USER USER4
```

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 through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

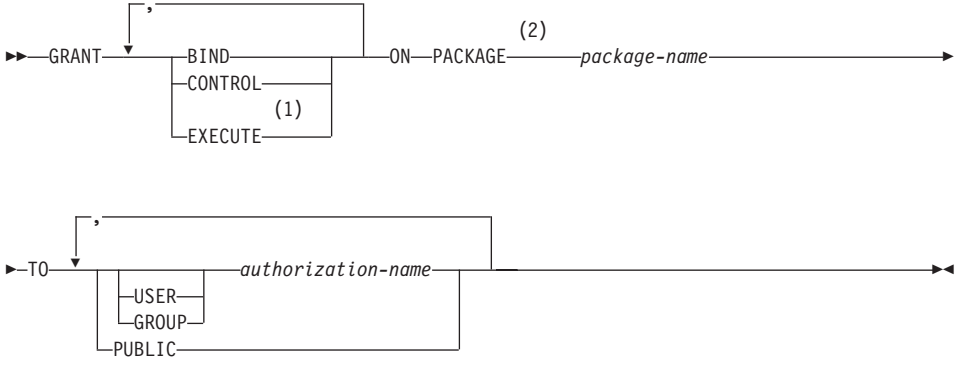
Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- CONTROL privilege on the referenced package
- SYSADM or DBADM authority.

To grant the CONTROL privilege, SYSADM or DBADM authority is required.

Syntax



Notes:

1 RUN can be used as a synonym for EXECUTE.

2 PROGRAM can be used as a synonym for PACKAGE.

Description

BIND
Grants the privilege to bind a package. The BIND privilege is really a rebind privilege, because the package must have already been bound (by someone with BINDADD authority) to have existed at all.

In addition to the BIND privilege, the user must hold the necessary privileges on each table referenced by static DML statements contained in the program. This is necessary because authorization on static DML statements is checked at bind time.

CONTROL
Grants the privilege to rebind, drop, or execute the package, and extend package privileges to other users. The CONTROL privilege for packages is automatically granted to creators of packages. A package owner is the package binder, or the ID specified with the OWNER option at bind/precompile time.

BIND and EXECUTE are automatically granted to an *authorization-name* that is granted CONTROL privilege.

EXECUTE
Grants the privilege to execute the package.

ON PACKAGE *package-name*
Specifies the name of the package on which privileges are to be granted.

TO
Specifies to whom the privileges are granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants the privileges to all users.

Rules

- If neither USER nor GROUP is specified, then
  - If the *authorization-name* is defined in the operating system only as GROUP, then GROUP is assumed.
  - If the *authorization-name* is defined in the operating system only as USER or if it is undefined, USER is assumed.
  - If the *authorization-name* is defined in the operating system as both, or DCE authentication is used, an error (SQLSTATE 56092) is raised.

Examples

Example 1: Grant the EXECUTE privilege on PACKAGE CORPDATA.PKGA to PUBLIC.

```
GRANT EXECUTE
  ON PACKAGE CORPDATA.PKGA
  TO PUBLIC
```

Example 2: GRANT EXECUTE privilege on package CORPDATA.PKGA to a user named EMPLOYEE. There is neither a group nor a user called EMPLOYEE.

```
GRANT EXECUTE ON PACKAGE
   CORPDATA.PKGA TO EMPLOYEE
```

or

```
GRANT EXECUTE ON PACKAGE
   CORPDATA.PKGA TO USER EMPLOYEE
```

GRANT (Schema Privileges)

This form of the GRANT statement grants privileges on a schema.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

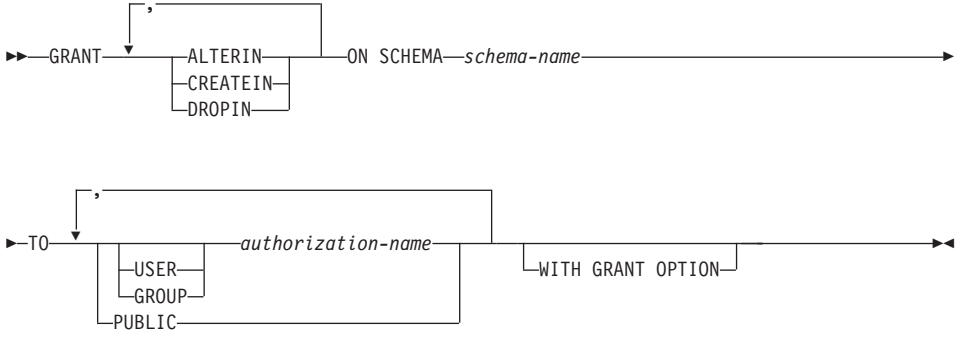
Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- WITH GRANT OPTION for each identified privilege on *schema-name*
- SYSADM or DBADM authority

Privileges cannot be granted on schema names SYSIBM, SYSCAT, SYSFUN and SYSSTAT by any user.

Syntax



Description

ALTERIN
Grants the privilege to alter or comment on all objects in the schema. The owner of an explicitly created schema automatically receives ALTERIN privilege.

CREATEIN
Grants the privilege to create objects in the schema. Other authorities or privileges required to create the object (such as CREATETAB) are still required. The owner of an explicitly created schema automatically receives CREATEIN privilege. An implicitly created schema has CREATEIN privilege automatically granted to PUBLIC.

DROPIN
Grants the privilege to drop all objects in the schema. The owner of an explicitly created schema automatically receives DROPIN privilege.

ON SCHEMA *schema-name*
Identifies the schema on which the privileges are to be granted.

TO
Specifies to whom the privileges are granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants the privileges to all users.

WITH GRANT OPTION
Allows the specified *authorization-name*s to GRANT the privileges to others.

If the WITH GRANT OPTION is omitted, the specified *authorization-name*s can only grant the privileges to others if they:

- have DBADM authority or
- received the ability to grant privileges from some other source.

Rules

- If neither USER nor GROUP is specified, then
  - If the authorization-name is defined in the operating system only as GROUP, then GROUP is assumed.
  - If the authorization-name is defined in the operating system only as USER or if it is undefined, USER is assumed.
  - If the authorization-name is defined in the operating system as both, or DCE authentication is used, an error (SQLSTATE 56092) is raised.
- In general, the GRANT statement will process the granting of privileges that the authorization ID of the statement is allowed to grant, returning a warning (SQLSTATE 01007) if one or more privileges was not granted. If no privileges were granted, an error is returned (SQLSTATE 42501).[98]

98. If the package used for processing the statement was precompiled with LANGLEVEL set to SQL92E for MIA, a warning is returned (SQLSTATE 01007) unless the grantor has NO privileges on the object of the grant.

Examples

Example 1: Grant USER2 to the ability to create objects in schema CORPDATA.

```
GRANT CREATEIN ON SCHEMA CORPDATA TO USER2
```

Example 2: Grant user BIGGUY the ability to create and drop objects in schema CORPDATA.

```
GRANT CREATEIN, DROPIN ON SCHEMA CORPDATA TO BIGGUY
```

GRANT (Server Privileges)

This form of the GRANT statement grants the privilege to access and use a specified data source in pass-through mode.

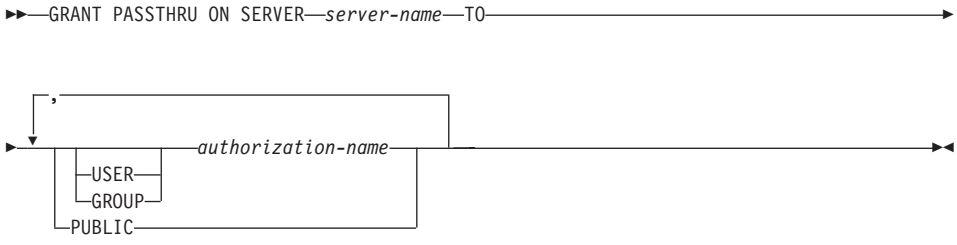
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement must have either SYSADM or DBADM authority.

Syntax



Description

server-name
Names the data source for which the privilege to use in pass-through mode is being granted. *server-name* must identify a data source that is described in the catalog.

TO
Specifies to whom the privilege is granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants to all users the privilege to pass through to *server-name.*

Examples

Example 1: Give R. Smith and J. Jones the privilege to pass through to data source SERVALL. Their authorization IDs are RSMITH and JJONES.

```
GRANT PASSTHRU ON SERVER SERVALL
   TO USER RSMITH,
   USER JJONES
```

Example 2: Grant the privilege to pass through to data source EASTWING to a group whose authorization ID is D024. There is a user whose authorization ID is also D024.

```
GRANT PASSTHRU ON SERVER EASTWING TO GROUP D024
```

The GROUP keyword must be specified; otherwise, an error will occur because D024 is a user's ID as well as the specified group's ID (SQLSTATE 56092). Any member of group D024 will be allowed to pass through to EASTWING. Therefore, if user D024 belongs to the group, this user will be able to pass through to EASTWING.

GRANT (Table, View, or Nickname Privileges)

This form of the GRANT statement grants privileges on a table, view, or nickname.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

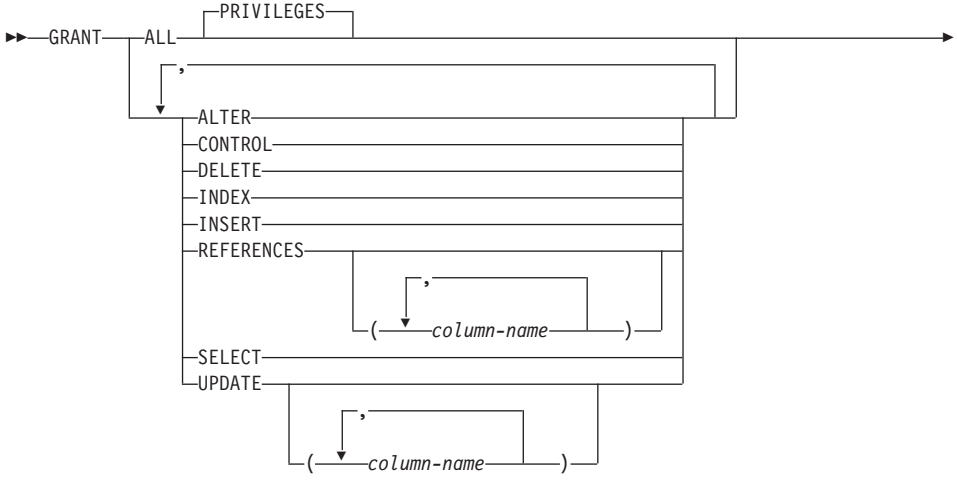
The privileges held by the authorization ID of the statement must include at least one of the following:

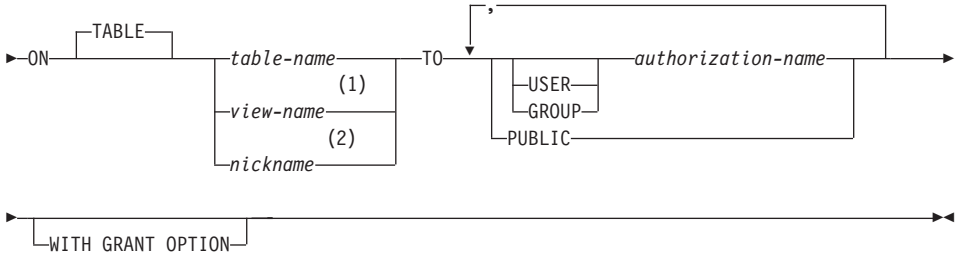
- CONTROL privilege on the referenced table, view, or nickname
- The WITH GRANT OPTION for each identified privilege. If ALL is specified, the authorization ID must have some grantable privilege on the identified table, view, or nickname.
- SYSADM or DBADM authority.

To grant the CONTROL privilege, SYSADM or DBADM authority is required.

To grant privileges on catalog tables and views, either SYSADM or DBADM authority is required.

Syntax





Notes:

1 ALTER, INDEX, and REFERENCES privileges are not applicable to views.

2 DELETE, INSERT, SELECT, and UPDATE privileges are not applicable to nicknames.

Description

ALL or **ALL PRIVILEGES**
Grants all the appropriate privileges, except CONTROL, on the base table, view, or nickname named in the ON clause.

If the authorization ID of the statement has CONTROL privilege on the table, view, or nickname, or DBADM or SYSADM authority, then all the privileges applicable to the object (except CONTROL) are granted. Otherwise, the privileges granted are all those grantable privileges that the authorization ID of the statement has on the identified table, view, or nickname.

If ALL is not specified, one or more of the keywords in the list of privileges must be specified.

ALTER
Grants the privilege to:

- Add columns to a base table definition.
- Create or drop a primary key or unique constraint on a base table. For more information on the authorization required to create or drop a primary key or a unique constraint, see "ALTER TABLE" on page 477.
- Create or drop a foreign key on a base table.

  The REFERENCES privilege on each column of the parent table is also required.
- Create or drop a check constraint on a base table.
- Create a trigger on a base table.
- Add, reset, or drop a column option for a nickname.
- Change a nickname column name or data type.

- Add or change a comment on a base table, a view, or a nickname.

CONTROL
Grants:

- All of the appropriate privileges in the list, that is:
  - ALTER, CONTROL, DELETE, INSERT, INDEX, REFERENCES, SELECT, and UPDATE to base tables
  - CONTROL, DELETE, INSERT, SELECT, and UPDATE to views
  - ALTER, CONTROL, INDEX, and REFERENCES to nicknames
- The ability to grant the above privileges (except for CONTROL) to others.
- The ability to drop the base table, view, or nickname.

  This ability cannot be extended to others on the basis of holding CONTROL privilege. The only way that it can be extended is by granting the CONTROL privilege itself and that can only be done by someone with SYSADM or DBADM authority.
- The ability to execute the RUNSTATS utility on the table and indexes. See the *Command Reference* for information on RUNSTATS.
- The ability to issue SET INTEGRITY statement on the base table or summary table.

The definer of a base table, summary table, or nickname automatically receives the CONTROL privilege.

The definer of a view automatically receives the CONTROL privilege if the definer holds the CONTROL privilege on all tables, views, and nicknames identified in the fullselect.

DELETE
Grants the privilege to delete rows from the table or updatable view.

INDEX
Grants the privilege to create an index on a table, or an index specification on a nickname. The creator of an index or index specification automatically has the CONTROL privilege on the index or index specification (authorizing the creator to drop the index or index specification). In addition, the creator retains the CONTROL privilege even if the INDEX privilege is revoked.

INSERT
Grants the privilege to insert rows into the table or updatable view and to run the IMPORT utility.

REFERENCES
Grants the privilege to create and drop a foreign key referencing the table as the parent.

If the authorization ID of the statement has one of:

- DBADM or SYSADM authority
- CONTROL privilege on the table
- REFERENCES WITH GRANT OPTION on the table

then the grantee(s) can create referential constraints using all columns of the table as parent key, even those added later using the ALTER TABLE statement. Otherwise, the privileges granted are all those grantable column REFERENCES privileges that the authorization ID of the statement has on the identified table. For more information on the authorization required to create or drop a foreign key, see "ALTER TABLE" on page 477.

The privilege can be granted on a nickname although foreign keys cannot be defined to reference nicknames.

REFERENCES (*column-name***,...)**
Grants the privilege to create and drop a foreign key 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 the table identified in the ON clause. Column level REFERENCES privilege cannot be granted on typed tables, typed views, or nicknames (SQLSTATE 42997).

SELECT
Grants the privilege to:

- Retrieve rows from the table or view.
- Create views on the table.
- Run the EXPORT utility against the table or view. See the *Command Reference* for information on EXPORT.

UPDATE
Grants the privilege to use the UPDATE statement on the table or updatable view identified in the ON clause.

If the authorization ID of the statement has one of:

- DBADM or SYSADM authority
- CONTROL privilege on the table or view
- UPDATE WITH GRANT OPTION on the table or view

then the grantee(s) can update all updatable columns of the table or view on which the grantor has with grant privilege as well as those columns added later using the ALTER TABLE statement. Otherwise, the privileges granted are all those grantable column UPDATE privileges that the authorization ID of the statement has on the identified table or view.

UPDATE (*column-name***,...)**
Grants the privilege to use the UPDATE statement to update only those

columns specified in the column list. Each *column-name* must be an unqualified name that identifies a column of the table or view identified in the ON clause. Column level UPDATE privilege cannot be granted on typed tables, typed views, or nicknames (SQLSTATE 42997).

ON TABLE *table-name* or *view-name* or *nickname*
Specifies the table, view, or nickname on which privileges are to be granted.

No privileges may be granted on an inoperative view or an inoperative summary table (SQLSTATE 51024). No privileges may be granted on a declared temporary table (SQLSTATE 42995).

TO
Specifies to whom the privileges are granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.[99]

A privilege granted to a group is not used for authorization checking on static DML statements in a package. Nor is it used when checking authorization on a base table while processing a CREATE VIEW statement.

In DB2 Universal Database, table privileges granted to groups only apply to statements that are dynamically prepared. For example, if the INSERT privilege on the PROJECT table has been granted to group D204 but not UBIQUITY (a member of D204) UBIQUITY could issue the statement:

```
EXEC SQL EXECUTE IMMEDIATE :INSERT_STRING;
```

where the content of the string is:

```
INSERT INTO PROJECT (PROJNO, PROJNAME, DEPTNO, RESPEMP)
VALUES ('AD3114', 'TOOL PROGRAMMING', 'D21', '000260');
```

but could not precompile or bind a program with the statement:

```
EXEC SQL INSERT INTO PROJECT (PROJNO, PROJNAME, DEPTNO, RESPEMP)
VALUES ('AD3114', 'TOOL PROGRAMMING', 'D21', '000260');
```

99. Restrictions in previous versions on grants to authorization ID of the user issuing the statement have been removed.

PUBLIC
Grants the privileges to all users.[100]

WITH GRANT OPTION
Allows the specified *authorization-name*s to GRANT the privileges to others.

If the specified privileges include CONTROL, the WITH GRANT OPTION applies to all the applicable privileges except for CONTROL (SQLSTATE 01516).

Rules

- If neither USER nor GROUP is specified, then
  - If the *authorization-name* is defined in the operating system only as GROUP, then GROUP is assumed.
  - If the *authorization-name* is defined in the operating system only as USER or if it is undefined, USER is assumed.
  - If the *authorization-name* is defined in the operating system as both, or DCE authentication is used, an error (SQLSTATE 56092) is raised.
- In general, the GRANT statement will process the granting of privileges that the authorization ID of the statement is allowed to grant, returning a warning (SQLSTATE 01007) if one or more privileges was not granted. If no privileges were granted, an error is returned (SQLSTATE 42501).[101] If CONTROL privilege is specified, privileges will only be granted if the authorization ID of the statement has SYSADM or DBADM authority (SQLSTATE 42501).

Notes

- Privileges may be granted independently at every level of a table hierarchy. A user with a privilege on a supertable may affect the subtables. For example, an update specifying the supertable *T* may show up as a change to a row in the subtable *S* of *T* done by a user with UPDATE privilege on *T* but without UPDATE privilege on *S*. A user can only operate directly on the subtable if the necessary privilege is held on the subtable.
- Granting nickname privileges has no effect on data source object (table or view) privileges. Typically, data source privileges are required for the table or view that a nickname references when attempting to retrieve data.
- DELETE, INSERT, SELECT, and UPDATE privileges are not defined for nicknames since operations on nicknames depend on the privileges of the authorization ID used at the data source when the statement referencing the nickname is processed.

---

100. Restrictions in previous versions on the use of privileges granted to PUBLIC for static SQL statements and CREATE VIEW statements have been removed.

101. If the package used for processing the statement was precompiled with LANGLEVEL set to SQL92E or MIA, a warning is returned (SQLSTATE 01007) unless the grantor has NO privileges on the object of the grant.

Examples

Example 1: Grant all privileges on the table WESTERN_CR to PUBLIC.

```
GRANT ALL ON WESTERN_CR
 TO PUBLIC
```

Example 2: Grant the appropriate privileges on the CALENDAR table so that users 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 USER  PHIL, USER CLAIRE
```

Example 3: Grant all privileges on the COUNCIL table to user FRANK and the ability to extend all privileges to others.

```
GRANT ALL ON COUNCIL
 TO USER FRANK WITH GRANT OPTION
```

Example 4: GRANT SELECT privilege on table CORPDATA.EMPLOYEE to a user named JOHN. There is a user called JOHN and no group called JOHN.

```
GRANT SELECT ON CORPDATA.EMPLOYEE TO JOHN
```

or

```
GRANT SELECT
  ON CORPDATA.EMPLOYEE TO USER JOHN
```

Example 5: GRANT SELECT privilege on table CORPDATA.EMPLOYEE to a group named JOHN. There is a group called JOHN and no user called JOHN.

```
GRANT SELECT ON CORPDATA.EMPLOYEE TO JOHN
```

or

```
GRANT SELECT ON CORPDATA.EMPLOYEE TO GROUP JOHN
```

Example 6: GRANT INSERT and SELECT on table T1 to both a group named D024 and a user named D024.

```
GRANT INSERT, SELECT ON TABLE T1
   TO GROUP D024, USER D024
```

In this case, both the members of the D024 group and the user D024 would be allowed to INSERT into and SELECT from the table T1. Also, there would be two rows added to the SYSCAT.TABAUTH catalog view.

Example 7: GRANT INSERT, SELECT, and CONTROL on the CALENDAR table to user FRANK. FRANK must be able to pass the privileges on to others.

```
GRANT CONTROL ON TABLE CALENDAR
   TO FRANK WITH GRANT OPTION
```

The result of this statement is a warning (SQLSTATE 01516) that CONTROL was not given the WITH GRANT OPTION. Frank now has the ability to grant any privilege on CALENDAR including INSERT and SELECT as required. FRANK cannot grant CONTROL on CALENDAR to other users unless he has SYSADM or DBADM authority.

Example 8: User JON created a nickname for an Oracle table that had no index. The nickname is ORAREM1. Later, the Oracle DBA defined an index for this table. User SHAWN now wants DB2 to know that this index exists, so that the optimizer can devise strategies to access the table more efficiently. SHAWN can inform DB2 of the index by creating an index specification for ORAREM1. Give SHAWN the index privilege on this nickname, so that he can create the index specification.

```
GRANT INDEX ON NICKNAME ORAREM1
   TO USER SHAWN
```

GRANT (Table Space Privileges)

This form of the GRANT statement grants privileges on a table space.

Invocation

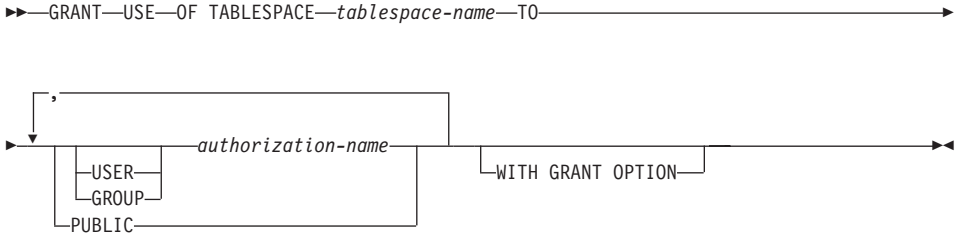
This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- WITH GRANT OPTION for use of the table space
- SYSADM, SYSCTRL, or DBADM authority

Syntax



Description

USE
Grants the privilege to specify or default to the table space when creating a table. The creator of a table space automatically receives USE privilege with grant option.

OF TABLESPACE *tablespace-name*
Identifies the table space on which the USE privilege is to be granted. The table space cannot be SYSCATSPACE (SQLSTATE 42838) or a system temporary table space (SQLSTATE 42809).

TO
Specifies to whom the USE privilege is granted.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name
Lists the authorization IDs of one or more users or groups.

The list of authorization IDs cannot include the authorization ID of the user issuing the statement (SQLSTATE 42502).

PUBLIC
Grants the USE privilege to all users.

WITH GRANT OPTION
Allows the specified *authorization-name* to GRANT the USE privilege to others.

If the WITH GRANT OPTION is omitted, the specified *authorization-name* can only GRANT the USE privilege to others if they:

- have SYSADM or DBADM authority or
- received the ability to GRANT the USE privilege from some other source.

Notes

If neither USER nor GROUP is specified, then

- If the *authorization-name* is defined in the operating system only as GROUP, then GROUP is assumed.
- If the *authorization-name* is defined in the operating system only as USER, or if it is undefined, then USER is assumed.
- If the *authorization-name* is defined in the operating system as both, or DCE authentication is used, an error is returned (SQLSTATE 56092).

Examples

Example 1: Grant user BOBBY the ability to create tables in table space PLANS and to grant this privilege to others.

```
GRANT USE OF TABLESPACE PLANS TO BOBBY WITH GRANT OPTION
```

INCLUDE

The INCLUDE statement inserts declarations into a source program.

Invocation

This statement can only be embedded in an application program. It is not an executable statement.

Authorization

None required.

Syntax

Description

SQLCA
Indicates the description of an SQL communication area (SQLCA) is to be included. For a description of the SQLCA, see "Appendix B. SQL Communications (SQLCA)" on page 1107.

SQLDA
Indicates the description of an SQL descriptor area (SQLDA) is to be included. For a description of the SQLDA, see "Appendix C. SQL Descriptor Area (SQLDA)" on page 1113.

name
Identifies an external file containing text that is to be included in the source program being precompiled. It may be an SQL identifier without a filename extension or a literal in single quotes (' '). An SQL identifier assumes the filename extension of the source file being precompiled. If a filename extension is not provided by a literal in quotes then none is assumed.

For host language specific information, see the *Application Development Guide*.

Notes

- When a program is precompiled, the INCLUDE statement is replaced by source statements. Thus, the INCLUDE statement should be specified at a point in the program such that the resulting source statements are acceptable to the compiler.
- The external source file must be written in the host language specified by the *name*. If it is greater than 18 characters or contains characters not allowed in an SQL identifier then it must be in single quotes. INCLUDE *name* statements may be nested though not cyclical (for example, if A and B

are modules and A contains an INCLUDE *name* statement, then it is not valid for A to call B and then B to call A).

- When the LANGLEVEL precompile option is specified with the SQL92E value, INCLUDE SQLCA should not be specified. SQLSTATE and SQLCODE variables may be defined within the host variable declare section.

Example

Include an SQLCA in a C program.

```
EXEC SQL INCLUDE SQLCA;

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.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

To execute this statement, the privileges held by the authorization ID of the statement must include at least one of the following:

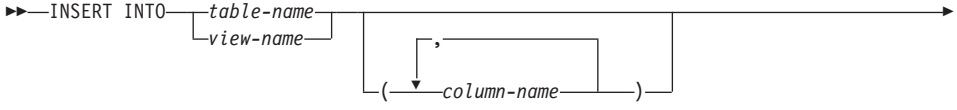
- INSERT privilege on the table or view where rows are to be inserted
- CONTROL privilege on the table or view where rows are to be inserted
- SYSADM or DBADM authority.

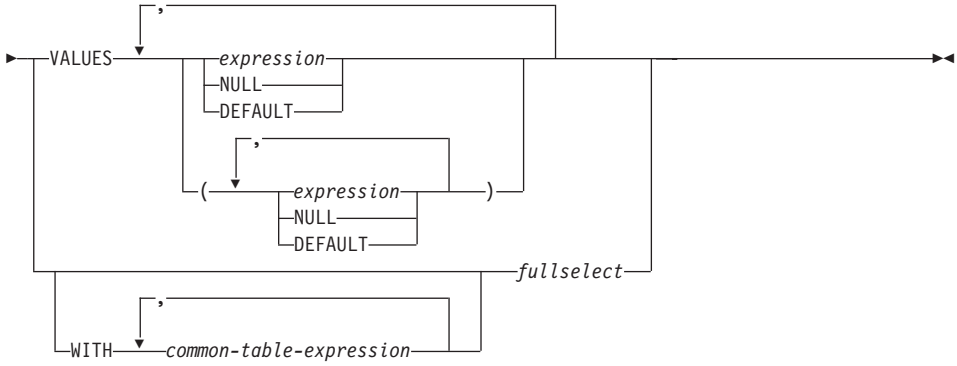
In addition, for each table or view referenced in any fullselect used in the INSERT statement, the privileges held by the authorization ID of the statement must include at least one of the following:

- SELECT privilege
- CONTROL privilege
- SYSADM or DBADM authority.

GROUP privileges are not checked for static INSERT statements.

Syntax





Note: See "Chapter 5. Queries" on page 393 for the syntax of *common-table-expression* and *fullselect*.

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 application server, but it must not identify a catalog table, a summary table, a view of a catalog table, or a read-only view.

A value cannot be inserted into a view column that is derived from:

- A constant, expression, or scalar function
- The same base table column as some other column of the view
- A column derived from a nickname.

If 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 these columns.

(*column-name***,...)**
Specifies the columns for which insert values are provided. Each name must be an unqualified name that identifies a column of the table or view. The same column must not be identified more than once. A view column that cannot accept insert values must not be identified.

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. 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.

The implicit column list is established at prepare time. Hence an INSERT statement embedded in an application program does not use any columns that might have been added to the table or view after prepare time.

VALUES
Introduces one or more rows of values to be inserted.

Each host variable named must be described in the program in accordance with the rules for declaring host variables.

The number of values for each row must equal the number of names in the column list. The first value is inserted in the first column in the list, the second value in the second column, and so on.

expression
An *expression* can be as defined in "Expressions" on page 157.

NULL
Specifies the null value and should only be specified for nullable columns.

DEFAULT
Specifies that the default value is to be used. The result of specifying DEFAULT depends on how the column was defined, as follows:

- If the column was defined as a generated column based on an expression, the column value is generated by the system, based on that expression.
- If the IDENTITY clause is used, the value is generated by the database manager.
- If the WITH DEFAULT clause is used, the value inserted is as defined for the column (see *default-clause* in "CREATE TABLE" on page 712).
- If the WITH DEFAULT clause, GENERATED clause, and the NOT NULL clause are not used, the value inserted is NULL.
- If the NOT NULL clause is used and the GENERATED clause is not used, or the WITH DEFAULT clause is not used or DEFAULT NULL is used, the DEFAULT keyword cannot be specified for that column (SQLSTATE 23502).

WITH *common-table-expression*
Defines a common table expression for use with the fullselect that follows. See "common-table-expression" on page 440 for an explanation of the *common-table-expression*.

fullselect
Specifies a set of new rows in the form of the result table of a fullselect. There may be one, more than one, or none. If the result table is empty, SQLCODE is set to +100 and SQLSTATE is set to '02000'.

When the base object of the INSERT and the base object of the fullselect or any subquery of the fullselect, are the same table, the fullselect is completely evaluated before any rows are inserted.

The number of columns in the result table must equal the number of names in the column 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.

Rules

- ***Default values:*** The value inserted in any column that is not in the column list is either the default value of the column or null. Columns that do not allow null values and are not defined with NOT NULL WITH DEFAULT must be included in the column list. Similarly, if you insert into a view, the value inserted into any column of the base table that is not in the view is either the default value of the column or null. Hence, all columns of the base table that are not in the view must have either a default value or allow null values. The only value that can be inserted into a generated column defined with the GENERATED ALWAYS clause is DEFAULT (SQLSTATE 428C9).
- ***Length:*** If the insert value of a column is a number, the column must be a numeric column with the capacity to represent the integral part of the number. If the insert value of a column is a string, the column must either be a string column with a length attribute at least as great as the length of the string, or a datetime column if the string represents a date, time, or timestamp.
- ***Assignment:*** Insert values are assigned to columns in accordance with the assignment rules described in Chapter 3.
- ***Validity:*** If the table named, or the base table of the view named, has one or more unique indexes, each row inserted into the table must conform to the constraints imposed by those indexes. If a view whose definition includes WITH CHECK OPTION is named, each row inserted into the view must conform to the definition of the view. For an explanation of the rules governing this situation, see "CREATE VIEW" on page 823.
- ***Referential Integrity:*** For each constraint defined on a table, each non-null insert value of the foreign key must be equal to a primary key value of the parent table.
- ***Check Constraint:*** Insert values must satisfy the check conditions of the check constraints defined on the table. An INSERT to a table with check constraints defined has the constraint conditions evaluated once for each row that is inserted.
- ***Triggers:*** Insert statements may cause triggers to be executed. A trigger may cause other statements to be executed or may raise error conditions based on the insert values.

- *Datalinks:* Insert statements that include DATALINK values will result in an attempt to link the file if a URL value is included (not empty string or blanks) and the column is defined with FILE LINK CONTROL. Errors in the DATALINK value or in linking the file will cause the insert to fail (SQLSTATE 428D1 or 57050).

Notes

- After execution of an INSERT statement that is embedded within a program, the value of the third variable of the SQLERRD(3) portion of the SQLCA indicates the number of rows that were inserted. SQLERRD(5) contains the count of all triggered insert, update and delete operations.
- Unless appropriate locks already exist, one or more exclusive locks are acquired at the execution of a successful INSERT statement. Until the locks are released, an inserted row can only be accessed by:
  - The application process that performed the insert.
  - Another application process using isolation level UR through a read-only cursor, SELECT INTO statement, or subselect used in a subquery.
- For further information about locking, see the description of the COMMIT, ROLLBACK, and LOCK TABLE statements.
- If an application is running against a partitioned database, and it is bound with option INSERT BUF, then INSERT with VALUES statements which are not processed using EXECUTE IMMEDIATE may be buffered. DB2 assumes that such an INSERT statement is being processed inside a loop in the application's logic. Rather than execute the statement to completion, it attempts to buffer the new row values in one or more buffers. As a result the actual insertions of the rows into the table are performed later, asynchronous with the application's INSERT logic. Be aware that this asynchronous insertion may cause an error related to an INSERT to be returned on some other SQL statement that follows the INSERT in the application.

  This has the potential to dramatically improve INSERT performance, but is best used with clean data, due to the asynchronous nature of the error handling. See buffered insert in the *Application Development Guide* for further details.
- When a row is inserted into a table that has an identity column, DB2 generates a value for the identity column.
  - For a GENERATED ALWAYS identity column, DB2 always generates the value.
  - For a GENERATED BY DEFAULT column, if a value is not explicitly specified (with a VALUES clause, or subselect), DB2 generates a value.

  The first value generated by DB2 is the value of the START WITH specification for the identity column.

- When a value is inserted for a user-defined distinct type identity column, the entire computation is done in the source type, and the result is cast to the distinct type before the value is actually assigned to the column.[102]
- When inserting into a GENERATED ALWAYS identity column, DB2 will always generate a value for the column, and users must not specify a value at insertion time. If a GENERATED ALWAYS identity column is listed in the column-list of the INSERT statement, with a non-DEFAULT value in the VALUES clause, an error occurs (SQLSTATE 428C9).

  For example, assuming that EMPID is defined as an identity column that is GENERATED ALWAYS, then the command:

  ```
  INSERT INTO T2 (EMPID, EMPNAME, EMPADDR)
    VALUES (:hv_valid_emp_id, :hv_name, :hv_addr)
  ```

  will result in an error.
- When inserting into a GENERATED BY DEFAULT column, DB2 will allow an actual value for the column to be specified within the VALUES clause, or from a subselect. However, when a value is specified in the VALUES clause, DB2 does not perform any verification of the value. In order to guarantee uniqueness of the values, a unique index on the identity column must be created.

  When inserting into a table with a GENERATED BY DEFAULT identity column, without specifying a column list, the VALUES clause can specify the DEFAULT keyword to represent the value for the identity column. DB2 will generate the value for the identity column.

  ```
  INSERT INTO T2 (EMPID, EMPNAME, EMPADDR)
    VALUES (DEFAULT, :hv_name, :hv_addr)
  ```

  In this example, EMPID is defined as an identity column, and thus the value inserted into this column is generated by DB2.
- The rules for inserting into an identity column with a subselect are similar to those for an insert with a VALUES clause. A value for an identity column may only be specified if the identity column is defined as GENERATED BY DEFAULT.

  For example, assume T1 and T2 are tables with the same definition, both containing columns *intcol1* and *identcol2* (both are type INTEGER and the second column has the identity attribute). Consider the following insert:

  ```
  INSERT INTO T2
     SELECT *
     FROM T1
  ```

  This example is logically equivalent to:

102. There is no casting of the previous value to the source type prior to the computation.

```
INSERT INTO T2 (intcol1,identcol2)
   SELECT intcol1, identcol2
   FROM T1
```

In both cases, the INSERT statement is providing an explicit value for the identity column of T2. This explicit specification can be given a value for the identity column, but the identity column in T2 must be defined as GENERATED BY DEFAULT. Otherwise, an error will result (SQLSTATE 428C9).

If there is a table with a column defined as a GENERATED ALWAYS identity, it is still possible to propagate all other columns from a table with the same definition. For example, given the example tables T1 and T2 described above, the intcol1 values from T1 to T2 can be propagated with the following SQL:

```
INSERT INTO T2 (intcol1)
   SELECT intcol1
   FROM T1
```

Note that, because identcol2 is not specified in the column-list, it will be filled in with its default (generated) value.

- When inserting a row into a single column table where the column is defined as a GENERATED ALWAYS identity column, it is possible to specify a VALUES clause with the DEFAULT keyword. In this case, the application does not provide any value for the table, and DB2 generates the value for the identity column.

  ```
  INSERT INTO IDTABLE
     VALUES(DEFAULT)
  ```

  Assuming the same single column table for which the column has the identity attribute, to insert multiple rows with a single INSERT statement, the following INSERT statement could be used:

  ```
  INSERT INTO IDTABLE
     VALUES (DEFAULT), (DEFAULT), (DEFAULT), (DEFAULT)
  ```

- When DB2 generates a value for an identity column, that generated value is consumed; the next time that a value is needed, DB2 will generate a new value. This is true even when an INSERT statement involving an identity column fails or is rolled back.

  For example, assume that a unique index has been created on the identity column. If a duplicate key violation is detected in generating a value for an identity column, an error occurs (SQLSTATE 23505) and the value generated for the identity column is considered to be consumed. This can occur when the identity column is defined as GENERATED BY DEFAULT and the system tries to generate a new value, but the user has explicitly specified values for the identity column in previous INSERT statements. Reissuing the same INSERT statement in this case can lead to success. DB2

will generate the next value for the identity column, and it is possible that this next value will be unique, and that this INSERT statement will be successful.

- If the maximum value for the identity column is exceeded (or minimum value for a descending sequence) in generating a value for an identity column, an error occurs (SQLSTATE 23522). In this situation, the user would have to DROP and CREATE a new table with an identity column having a larger range (that is, change the data type or increment value for the column to allow for a larger range of values).

  For example, an identity column may have been defined with a data type of SMALLINT, and eventually the column runs out of assignable values. To redefine the identity column as INTEGER, the data would need to be unloaded, the table would have to be dropped and recreated with a new definition for the column, and then the data would be reloaded. When the table is redefined, it needs to specify a START WITH value for the identity column such that the next value generated by DB2 will be the next value in the original sequence. To determine the end value, issue a query using MAX of the identity column (for an ascending sequence), or MIN of the identity column (for a descending sequence), before unloading the data.

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: Insert two new departments using one statement into the DEPARTMENT table as in example 2, but do not assign a manager to the new department.

```
INSERT INTO DEPARTMENT (DEPTNO, DEPTNAME, ADMRDEPT)
   VALUES ('B11', 'PURCHASING', 'B01'),
          ('E41', 'DATABASE ADMINISTRATION', 'E01')
```

Example 4: Create a temporary table MA_EMP_ACT with the same columns as the EMP_ACT table. Load MA_EMP_ACT with the rows from the EMP_ACT table with a project number (PROJNO) starting with the letters 'MA'.

```
CREATE TABLE MA_EMP_ACT
      ( EMPNO CHAR(6)  NOT NULL,
        PROJNO CHAR(6)  NOT NULL,
        ACTNO SMALLINT  NOT NULL,
        EMPTIME DEC(5,2),
        EMSTDATE DATE,
        EMENDATE  DATE )
INSERT INTO MA_EMP_ACT
   SELECT * FROM EMP_ACT
     WHERE SUBSTR(PROJNO, 1, 2) = 'MA'
```

Example 5: Use a C program statement to add a skeleton project to the PROJECT table. 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.

```
EXEC SQL  INSERT INTO PROJECT (PROJNO, PROJNAME, DEPTNO, RESPEMP, PRSTDATE)
            VALUES (:PRJNO, :PRJNM, :DPTNO, :REMP, CURRENT DATE);
```

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

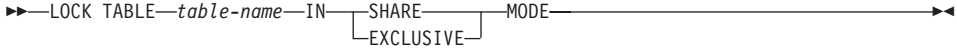
This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- SELECT privilege on the table
- CONTROL privilege on the table
- SYSADM or DBADM authority.

Syntax



Description

table-name
Identifies the table. The *table-name* must identify a table that exists at the application server, but it must not identify a catalog table. It cannot be a nickname (SQLSTATE 42809) or a declared temporary table (SQLSTATE 42995). If the *table-name* is a typed table, it must be the root table of the table hierarchy (SQLSTATE 428DR).

IN SHARE MODE
Prevents concurrent application processes from executing any but read-only operations on the table.

IN EXCLUSIVE MODE
Prevents concurrent application processes from executing any operations on the table. Note that EXCLUSIVE MODE does not prevent concurrent application processes that are running at isolation level Uncommitted Read (UR) from executing read-only operations on the table.

Notes

- Locking is used to prevent concurrent operations. A lock is not necessarily acquired during the execution of the LOCK TABLE statement if a suitable lock already exists. The lock that prevents concurrent operations is held at least until the termination of the unit of work.

- In a partitioned database, a table lock is first acquired at the first partition in the nodegroup (the partition with the lowest number) and then at other partitions. If the LOCK TABLE statement is interrupted, the table may be locked on some partitions but not on others. If this occurs, either issue another LOCK TABLE statement to complete the locking on all partitions, or issue a COMMIT or ROLLBACK statement to release the current locks.
- This statement affects all partitions in the nodegroup.

Example

Obtain a lock on the table EMP. Do not allow other programs either to read or update the table.

```
LOCK TABLE EMP IN EXCLUSIVE MODE
```

OPEN

The OPEN statement opens a cursor so that it can be used to fetch rows from its result table.

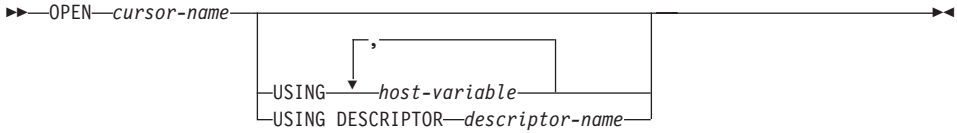
Invocation

Although an interactive SQL facility might provide an interface that gives the appearance of interactive execution, this statement can only be embedded within an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

See "DECLARE CURSOR" on page 841 for the authorization required to use a cursor.

Syntax



Description

cursor-name
Names a cursor that is defined in a DECLARE CURSOR statement that was stated earlier in the program. When the OPEN statement is executed, the cursor must be in the closed state.

The DECLARE CURSOR statement must identify a SELECT statement, in one of the following ways:

- Including the SELECT statement in the DECLARE CURSOR statement
- Including a *statement-name* that names a prepared SELECT statement.

The result table of the cursor is derived by evaluating that SELECT statement, using the current values of any host variables specified in it or in the USING clause of the OPEN statement. The rows of the result table may be derived during the execution of the OPEN statement and a temporary table may be created to hold them; or they may 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 state of the cursor is effectively "after the last row".

USING
Introduces a list of host 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 954.) If the

DECLARE CURSOR statement names a prepared statement that includes parameter markers, USING must be used. If the prepared statement does not include parameter markers, USING is ignored.

host-variable
Identifies a variable described in the program in accordance with the rules for declaring host 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. Where appropriate, locator variables and file reference variables can be provided as the source of values for parameter markers.

DESCRIPTOR *descriptor-name*
Identifies an SQLDA that must contain a valid description of host variables.

Before the OPEN 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 SQLDA must have enough storage to contain all SQLVAR occurrences. Therefore, the value in SQLDABC must be greater than or equal to 16 + SQLN*(N), where N is the length of an SQLVAR occurrence.

If LOB result columns need to be accommodated, there must be two SQLVAR entries for every select-list item (or column of the result table). See "Effect of DESCRIBE on the SQLDA" on page 1120, which discusses SQLDOUBLED and LOB columns.

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 C. SQL Descriptor Area (SQLDA)" on page 1113.

Rules

- When the SELECT statement of the cursor is evaluated, each parameter marker in the statement is effectively replaced by its corresponding host variable. 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. See "Rules" on page 955 for the rules affecting parameter markers.

- Let V denote a host 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 string, its length must not be greater than the length attribute of 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.

  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 host 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 host variables in the SELECT statement. The effect is to override the values of the host variables in the SELECT statement of the cursor with the values of the host variables specified in the USING clause.

Notes

- ***Closed state of cursors:*** All cursors in a program are in the closed state when the program is initiated and when it initiates a ROLLBACK statement.

  All cursors, except open cursors declared WITH HOLD, are in a closed state when a program issues a COMMIT statement.

  A cursor can also be in the closed state because a CLOSE statement was executed or an error was detected that made the position of the cursor unpredictable.
- To retrieve rows from the result table of a cursor, execute a FETCH statement 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:*** In some cases, the result table of a cursor is derived during the execution of FETCH statements. In other cases, the temporary table method is used instead. With this method the entire result

table is transferred to a temporary table during the execution of the OPEN statement. When a temporary table is used, the results of a program can differ in these two ways:

- An error can occur during OPEN that would otherwise not occur until some later FETCH statement.
- INSERT, UPDATE, and DELETE statements executed in the same transaction while the cursor is open cannot affect the result table.

Conversely, if a temporary table is not used, INSERT, UPDATE, and DELETE statements executed while the cursor is open can affect the result table if issued from the same unit of work. The *Application Development Guide* describes how locking can be used to control the effect of INSERT, UPDATE, and DELETE operations executed by concurrent units of work. Your result table can also be affected by operations executed by your own unit of work, and the effect of such operations is not always predictable. For example, if cursor C is positioned on a row of its result table defined as SELECT * FROM T, and a new row is inserted into T, the effect of that insert on the result table is not predictable because its rows are not ordered. Thus a subsequent FETCH C may or may not retrieve the new row of T.

- Statement caching affects cursors declared open by the OPEN statement. See the "Notes" on page 896 for information.

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. Assuming two parameter markers are used in the predicate of the select-statement, two host variable references are supplied with the OPEN statement to pass integer and varchar(64) values between the application and the database. (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 2, but in this case the number and data types of the parameter markers in the WHERE clause 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;
```

PREPARE

The PREPARE statement is used by application programs to dynamically prepare an SQL statement for execution. The PREPARE statement creates an executable SQL statement, called a *prepared statement*, from a character string form of the statement, called a *statement string*.

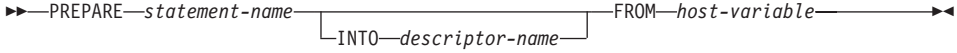
Invocation

This statement can be embedded only in an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

For statements where authorization checking is performed at statement preparation time (DML), the privileges held by the authorization ID of the statement must include those required to execute the SQL statement specified by the PREPARE statement. For statements where authorization checking is performed at statement execution (DDL, GRANT, and REVOKE statements), no authorization is required to use the statement; however, the authorization is checked when the prepared statement is executed.

Syntax



Description

statement-name
Names the prepared statement. If the name identifies an existing prepared statement, that previously prepared statement is destroyed. The name must not identify a prepared statement that is the SELECT statement of an open cursor.

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.

descriptor-name
Is the name of an SQLDA.[103]

FROM
Introduces the statement string. The statement string is the value of the specified host variable.

host-variable
Must identify a host variable that is described in the program in

103. The DESCRIBE statement may be used as an alternative to this clause. See "DESCRIBE" on page 860.

accordance with the rules for declaring character string variables. It must be a character-string variable (either fixed-length or varying-length).

Rules

- ***Rules for statement strings:*** The statement string must be an executable statement that can be dynamically prepared. It must be one of the following SQL statements:
  - ALTER
  - COMMENT ON
  - COMMIT
  - CREATE
  - DECLARE GLOBAL TEMPORARY TABLE
  - DELETE
  - DROP
  - EXPLAIN
  - FLUSH EVENT MONITOR
  - GRANT
  - INSERT
  - LOCK TABLE
  - REFRESH TABLE
  - RELEASE SAVEPOINT
  - RENAME TABLE
  - RENAME TABLESPACE
  - REVOKE
  - ROLLBACK
  - SAVEPOINT
  - select-statement
  - SET CURRENT DEFAULT TRANSFORM GROUP
  - SET CURRENT DEGREE
  - SET CURRENT EXPLAIN MODE
  - SET CURRENT EXPLAIN SNAPSHOT
  - SET CURRENT QUERY OPTIMIZATION
  - SET CURRENT REFRESH AGE
  - SET EVENT MONITOR STATE
  - SET INTEGRITY
  - SET PASSTHRU
  - SET PATH

- SET SCHEMA
- SET SERVER OPTION
- UPDATE

- ***Parameter Markers:*** Although a statement string cannot include references to host variables, it may include *parameter markers*; those can be replaced by the values of host variables when the prepared statement is executed.A parameter marker is a question mark (?) that is declared where a host variable could be stated if the statement string were a static SQL statement. For an explanation of how parameter markers are replaced by values, see "OPEN" on page 949 and "EXECUTE" on page 895.

  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).

  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 host 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 host variables are supported. These locations and the resulting data type are found in Table 28 on page 957. The locations are grouped in this table into expressions, predicates and functions to assist in determining applicability of an untyped parameter marker. When an untyped parameter marker is used in a function (including arithmetic operators, CONCAT and datetime operators) with an unqualified function

name, the qualifier is set to 'SYSIBM' for the purposes of function resolution.

Table 28. Untyped Parameter Marker Usage

Untyped Parameter Marker Location	Data Type
Expressions (including select list, CASE and VALUES)	
Alone in a select list	Error
Both operands of a single arithmetic operator, after considering operator precedence and order of operation rules. Includes cases such as: `? + ? + 10`	Error
One operand of a single operator in an arithmetic expression (not a datetime expression) Includes cases such as: `? + ? * 10`	The data type of the other operand.
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
Both operands of a CONCAT operator	Error
One operand of a CONCAT operator where the other operand is a non-CLOB character data type	If one operand is either CHAR(n) or VARCHAR(n), where n is less than 128, then other is VARCHAR(254 - n). In all other cases the data type is VARCHAR(254).
One operand of a CONCAT operator where the other operand is a non-DBCLOB graphic data type.	If one operand is either GRAPHIC(n) or VARGRAPHIC(n), where n is less than 64, then other is VARCHAR(127 - n). In all other cases the data type is VARCHAR(127).
One operand of a CONCAT operator where the other operand is a large object string.	Same as that of the other operand.

Table 28. Untyped Parameter Marker Usage (continued)

Untyped Parameter Marker Location	Data Type
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. If the column is defined as a user-defined structured type, then it is the structured type, also indicating the returns type of the transform function.
The expression following CASE 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 107 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 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 the 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 107 on all operands that are other than untyped parameter markers.

Table 28. Untyped Parameter Marker Usage (continued)

Untyped Parameter Marker Location	Data Type
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. If the column is defined as a user-defined structured type, then it is the structured type, also indicating the returns type of the transform function.
Alone as a column-expression in a multi-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. If the column is defined as a user-defined structured type, then it is the structured type, also indicating the returns type of the transform function.
As a value on the right side of a SET special register statement	The data type of the special register.
Predicates	
Both operands of a comparison operator	Error
One operand of a comparison operator where the other operand other than an untyped parameter marker.	The data type of the other operand
All operands of a BETWEEN predicate	Error
Either 1st and 2nd, or 1st and 3rd operands of a BETWEEN predicate	Same as that of the only non-parameter marker.
Remaining BETWEEN situations (i.e. one untyped parameter marker only)	Result of applying the "Rules for Result Data Types" on page 107 on all operands that are other than untyped parameter markers.
All operands of an IN predicate	Error
Both the 1st and 2nd operands of an IN predicate.	Result of applying the Rules for Result Data Types on all operands of the IN list (operands to the right of IN keyword) that are other than untyped parameter markers.
The 1st operand of an IN predicate where the right hand side is a fullselect.	Data type of the selected column

Table 28. Untyped Parameter Marker Usage (continued)

Untyped Parameter Marker Location	Data Type
Any or all operands of the IN list of the IN predicate	Results of applying the Rules for Result Data Types on all operands of the IN predicate (operands to the left and right of the IN predicate) that are other than untyped parameter markers.
The 1st operand and zero or more operands in the IN list excluding the 1st operand of the IN list	Result of applying the Rules for Result Data Types on all operands of the IN list (operands to the right of IN keyword) that are other than untyped parameter markers.
All three operands of the LIKE predicate.	Match expression (operand 1) and pattern expression (operand 2) are VARCHAR(32672). Escape expression (operand 3) is VARCHAR(2).
The match expression of the LIKE predicate when either the pattern expression or the escape expression is other than an untyped parameter marker.	Either VARCHAR(32672) or VARGRAPHIC(16336) depending on the data type of the first operand that is not an untyped parameter marker.
The pattern expression of the LIKE predicate when either the match expression or the escape expression is other than an untyped parameter marker.	Either VARCHAR(32672) or VARGRAPHIC(16336) depending on the data type of the first operand that is not an untyped parameter marker. If the data type of the match expression is BLOB, the data type of the pattern expression is assumed to be BLOB(32672).
The escape expression of the LIKE predicate when either the match expression or the pattern expression is other than an untyped parameter marker.	Either VARCHAR(2) or VARGRAPHIC(1) depending on the data type of the first operand that is not an untyped parameter marker. If the data type of the match expression or pattern expression is BLOB, the data type of the escape expression is assumed to be BLOB(1).
Operand of the NULL predicate	error
Functions	
All operands of COALESCE (also called VALUE) or NULLIF	Error
Any operand of COALESCE where at least one operand is other than an untyped parameter marker.	Result of applying the "Rules for Result Data Types" on page 107 on all operands that are other than untyped parameter markers.

Table 28. Untyped Parameter Marker Usage (continued)

Untyped Parameter Marker Location	Data Type
An operand of NULLIF where the other operand is other than an untyped parameter marker.	The data type of the other operand
POSSTR (both operands)	Both operands are VARCHAR(32672).
POSSTR (one operand where the other operand is a character data type).	VARCHAR(32672).
POSSTR (one operand where the other operand is a graphic data type).	VARGRAPHIC(16336).
POSSTR (the search-string operand when the other operand is a BLOB).	BLOB(32672).
SUBSTR (1st operand)	VARCHAR(32672)
SUBSTR (2nd and 3rd operands)	INTEGER
The 1st operand of the TRANSLATE scalar function.	Error
The 2nd and 3rd operands of the TRANSLATE scalar function.	VARCHAR(32672) if the first operand is a character type. VARGRAPHIC(16336) if the first operand is a graphic type.
The 4th operand of the TRANSLATE scalar function.	VARCHAR(1) if the first operand is a character type. VARGRAPHIC(1) if the first operand is a graphic type.
The 2nd operand of the TIMESTAMP scalar function.	TIME
Unary minus	DOUBLE PRECISION
Unary plus	DOUBLE PRECISION
All other operands of all other scalar functions including user-defined functions.	Error
Operand of a column function	Error

Notes

- When a PREPARE statement is executed, the statement string is parsed and checked for errors. If the statement string is invalid, the error condition is reported in the SQLCA. Any subsequent EXECUTE or OPEN statement that references this statement will also receive the same error (due to an implicit prepare done by the system) unless the error has been corrected.
- Prepared statements can be referred to in the following kinds of statements, with the restrictions shown:

In...	The prepared statement ...
DECLARE CURSOR	must be SELECT

EXECUTE	must *not* be SELECT

- A prepared statement can be executed many times. Indeed, 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.
- Statement caching affects repeated preparations. See the "Notes" on page 896 for information.
- See the *Application Development Guide* for examples of dynamic SQL statements in the supported host languages.

Examples

Example 1: Prepare and execute a non-select-statement in a COBOL program. Assume the statement is contained in a host variable HOLDER and that the program will place a statement string into the host 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 code it for a C program. Also assume the statement to be prepared can contain any number of parameter markers.

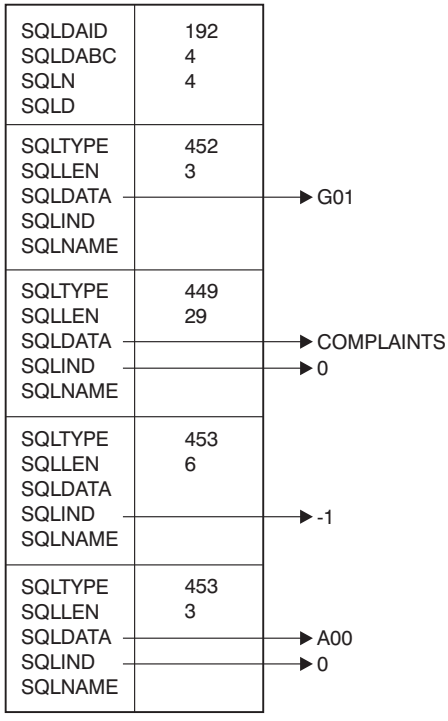
```
EXEC SQL  PREPARE STMT_NAME FROM :holder;
EXEC SQL  EXECUTE STMT_NAME USING DESCRIPTOR :insert_da;
```

Assume that the following statement is to be prepared:

```
INSERT INTO DEPT VALUES(?, ?, ?, ?)
```

The columns in the DEPT table are defined as follows:

```
DEPT_NO   CHAR(3) NOT NULL, -- department number
DEPTNAME  VARCHAR(29), -- department name
MGRNO     CHAR(6), -- manager number
ADMRDEPT  CHAR(3)  -- admin department number
```



To insert department number G01 named COMPLAINTS, which has no manager and reports to department A00, the structure INSERT_DA should have the above values before issuing the EXECUTE statement.

REFRESH TABLE

The REFRESH TABLE statement refreshes the data in a summary table.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. 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:

- SYSADM or DBADM authority
- CONTROL privilege on the table.

Syntax

Description

table-name
Specifies a table name.

The name, including the implicit or explicit schema, must identify a table that already exists at the current server. The table must allow the REFRESH TABLE statement (SQLSTATE 42809). This includes summary tables defined with:

- REFRESH IMMEDIATE
- REFRESH DEFERRED

RELEASE (Connection)

This statement places one or more connections in the release-pending state.

Invocation

Although an interactive SQL facility might provide an interface that gives the appearance of interactive execution, this statement can only be embedded within an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

None Required.

Syntax

Notes:

1 Note that an application server named CURRENT or ALL can only be identified by a host variable.

Description

server-name or *host-variable*
Identifies the application server by the specified *server-name* or a *host-variable* which contains the *server-name*.

If a *host-variable* is specified, it must be a character string variable with a length attribute that is not greater than 8, and it must not include an indicator variable. The *server-name* that is contained within the *host-variable* must be left-justified and must not be delimited by quotation marks.

Note that the *server-name* is a database alias identifying the application server. It must be listed in the application requester's local directory.

The specified database-alias or the database-alias contained in the host variable must identify an existing connection of the application process. If the database-alias does not identify an existing connection, an error (SQLSTATE 08003) is raised.

CURRENT
Identifies the current connection of the application process. The application process must be in the connected state. If not, an error (SQLSTATE 08003) is raised.

ALL
Identifies all existing connections of the application process. This form of the RELEASE statement places all existing connections of the application process in the release-pending state. All connections will therefore be destroyed during the next commit operation. An error or warning does not occur if no connections exist when the statement is executed. The optional keyword SQL is included to be compatible with DB2/MVS SQL syntax.

Notes

Examples

Example 1: The SQL connection to IBMSTHDB is no longer needed by the application. The following statement will cause it to be destroyed during the next commit operation:

```
EXEC SQL RELEASE IBMSTHDB;
```

Example 2: The current connection is no longer needed by the application. The following statement will cause it to be destroyed during the next commit operation:

```
EXEC SQL RELEASE CURRENT;
```

Example 3: If an application has no need to access the databases after a commit but will continue to run for a while, then it is better not to tie up those connections unnecessarily. The following statement can be executed before the commit to ensure all connections will be destroyed at the commit:

```
EXEC SQL RELEASE ALL;
```

RELEASE SAVEPOINT

The RELEASE SAVEPOINT statement is used to indicate that the application no longer wishes to have the named savepoint maintained. After this statement has been invoked, rollback to the savepoint is no longer possible.

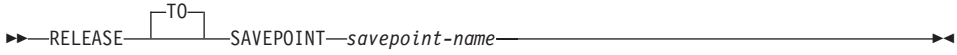
Invocation

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



Description

savepoint-name
The named savepoint is released. Rollback to that savepoint is no longer possible. If the named savepoint does not exist, an error is issued (SQLSTATE 3B001).

Notes

- The name of the savepoint that was released can now 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.

Example

Example 1: Release a savepoint named SAVEPOINT1.

```
RELEASE SAVEPOINT SAVEPOINT1
```

RENAME TABLE

The RENAME TABLE statement renames an existing table.

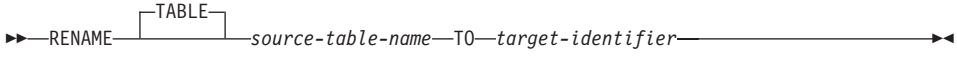
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The privileges held by the authorization ID of the statement must include either SYSADM or DBADM authority or CONTROL privilege.

Syntax



Description

source-table-name
Names the existing table that is to be renamed. The name, including the schema name, must identify a table that already exists in the database (SQLSTATE 42704). It can be an alias identifying the table. It must not be the name of a catalog table (SQLSTATE 42832), a summary table, a typed table (SQLSTATE 42997), a nickname, or an object of other than table or alias (SQLSTATE 42809).

target-identifier
Specifies the new name for the table without a schema name. The schema name of the *source-table-name* is used to qualify the new name for the table. The qualified name must *not* identify a table, view, or alias that already exists in the database (SQLSTATE 42710).

Rules

The source table must not:

- Be referenced in any existing view definitions or summary table definitions
- Be referenced in any triggered SQL statements in existing triggers or be the subject table of an existing trigger
- Be referenced in an SQL function
- Have any check constraints
- Have any generated columns other than the identity column
- Be a parent or dependent table in any referential integrity constraints
- Be the scope of any existing reference column.

An error (SQLSTATE 42986) is returned if the source table violates one or more of these conditions.

Notes

- Catalog entries are updated to reflect the new table name.
- *All* authorizations associated with the source table name are *transferred* to the new table name (the authorization catalog tables are updated appropriately).
- Indexes defined over the source table are *transferred* to the new table (the index catalog tables are updated appropriately).
- Any packages that are dependent on the source table are invalidated.
- If an alias is used for the *source-table-name*, it must resolve to a table name. The table is renamed within the schema of this table. The alias is not changed by the RENAME statement and continues to refer to the old table name.
- A table with primary key or unique constraints may be renamed if none of the primary key or unique constraints are referenced by any foreign key.

Example

Change the name of the EMP table to EMPLOYEE.

```
RENAME TABLE EMP TO EMPLOYEE
```

RENAME TABLESPACE

The RENAME TABLESPACE statement renames an existing table space.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The privileges held by the authorization ID of the statement must include either SYSADM or SYSCTRL authority.

Syntax

Description

source-tablespace-name
Specifies the existing table space that is to be renamed, as a one-part name. It is an SQL identifier (either ordinary or delimited). The table space name must identify a table space that already exists in the catalog (SQLSTATE 42704).

target-tablespace-name
Specifies the new name for the table space, as a one-part name. It is an SQL identifier (either ordinary or delimited). The new table space name must *not* identify a table space that already exists in the catalog (SQLSTATE 42710), and it cannot start with 'SYS' (SQLSTATE 42939).

Rules

- The SYSCATSPACE table space cannot be renamed (SQLSTATE 42832).
- Any table spaces with "rollforward pending" or "rollforward in progress" states cannot be renamed (SQLSTATE 55039)

Notes

- Renaming a table space will update the minimum recovery time of a table space to the point in time when the rename took place. This implies that a roll forward at the table space level must be to at least this point in time.
- The new table space name must be used when restoring a table space from a backup image, where the rename was done after the backup was created. Refer to the *Administrative API Reference* or the *Command Reference* for more information on restoring backups.

Example

Change the name of the table space USERSPACE1 to DATA2000:

```
RENAME TABLESPACE USERSPACE1 TO DATA2000
```

REVOKE (Database Authorities)

This form of the REVOKE statement revokes authorities that apply to the entire database.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

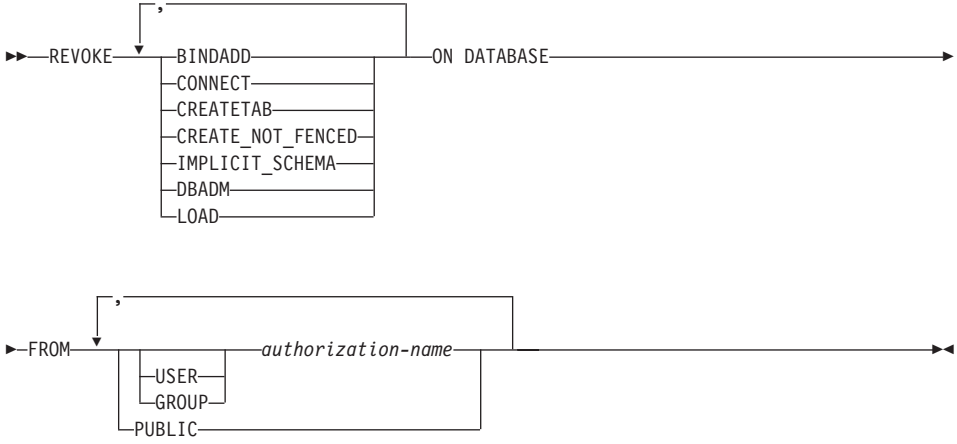
Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- DBADM authority
- SYSADM authority.

To revoke DBADM authority, SYSADM authority is required.

Syntax



Description

BINDADD

Revokes the authority to create packages. The creator of a package automatically has the CONTROL privilege on that package and retains this privilege even if his BINDADD authority is subsequently revoked.

The BINDADD authority cannot be revoked from an *authorization-name* holding DBADM authority without also revoking the DBADM authority.

CONNECT
Revokes the authority to access the database.

Revoking the CONNECT authority from a user does not affect any privileges that were granted to that user on objects in the database. If the user is subsequently granted the CONNECT authority again, all previously held privileges are still valid (assuming they were not explicitly revoked).

The CONNECT authority cannot be revoked from an *authorization-name* holding DBADM authority without also revoking the DBADM authority (SQLSTATE 42504).

CREATETAB
Revokes the authority to create tables. The creator of a table automatically has the CONTROL privilege on that table, and retains this privilege even if his CREATETAB authority is subsequently revoked.

The CREATETAB authority cannot be revoked from an *authorization-name* holding DBADM authority without also revoking the DBADM authority (SQLSTATE 42504).

CREATE_NOT_FENCED
Revokes the authority to register functions that execute in the database manager's process. However, once a function has been registered as not fenced, it continues to run in this manner even if CREATE_NOT_FENCED is subsequently revoked from the authorization ID that registered the function.

The CREATE_NOT_FENCED authority cannot be revoked from an *authorization-name* holding DBADM authority without also revoking the DBADM authority (SQLSTATE 42504).

IMPLICIT_SCHEMA
Revokes the authority to implicitly create a schema. It does not affect the ability to create objects in existing schemas or to process a CREATE SCHEMA statement.

DBADM
Revokes the DBADM authority.

DBADM authority cannot be revoked from PUBLIC (because it cannot be granted to PUBLIC).

Revoking DBADM authority does not automatically revoke any privileges that were held by the authorization-name on objects in the database, nor does it revoke BINDADD, CONNECT, CREATETAB, IMPLICIT_SCHEMA, or CREATE_NOT_FENCED authority.

LOAD
Revoke the authority to LOAD in this database.

FROM
Indicates from whom the authorities are revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists one or more authorization IDs.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the authorities from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the authorities from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  - If all rows for the grantee in the SYSCAT.DBAUTH catalog view have a GRANTEETYPE of U, then USER will be assumed.
  - If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  - If some rows have U and some rows have G, then an error (SQLSTATE 56092) is raised.
  - If DCE authentication is used, then an error is raised (SQLSTATE 56092).

Notes

- Revoking a specific privilege does not necessarily revoke the ability to perform the action. A user may proceed with their task if other privileges are held by PUBLIC or a group, or if they have a higher level authority such as DBADM.

Examples

Example 1: Given that USER6 is only a user and not a group, revoke the privilege to create tables from the user USER6.

```
REVOKE CREATETAB ON DATABASE FROM USER6
```

Example 2: Revoke BINDADD authority on the database from a group named D024. There are two rows in the SYSCAT.DBAUTH catalog view for this grantee; one with a GRANTEETYPE of U and one with a GRANTEETYPE of G.

```
REVOKE BINDADD ON DATABASE FROM GROUP D024
```

In this case, the GROUP keyword must be specified; otherwise an error will occur (SQLSTATE 56092).

REVOKE (Index Privileges)

This form of the REVOKE statement revokes the CONTROL privilege on an index.

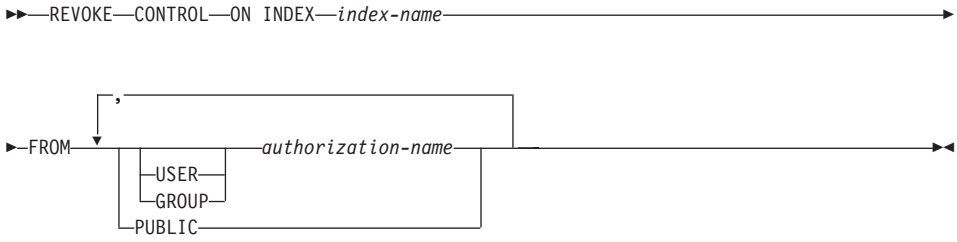
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement must hold either SYSADM or DBADM authority (SQLSTATE 42501).

Syntax



Description

CONTROL
Revokes the privilege to drop the index. This is the CONTROL privilege for indexes, which is automatically granted to creators of indexes.

ON INDEX *index-name*
Specifies the name of the index on which the CONTROL privilege is to be revoked.

FROM
Indicates from whom the privileges are revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists one or more authorization IDs.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the privileges from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  If all rows for the grantee in the SYSCAT.INDEXAUTH catalog view have a GRANTEETYPE of U, then USER will be assumed.
  If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  If some rows have U and some rows have G, then an error (SQLSTATE 56092) is raised.
  If DCE authentication is used, then an error is raised (SQLSTATE 56092).

Notes

- Revoking a specific privilege does not necessarily revoke the ability to perform the action. A user may proceed with their task if other privileges are held by PUBLIC or a group, or if they have authorities such as ALTERIN on the schema of an index.

Examples

Example 1: Given that USER4 is only a user and not a group, revoke the privilege to drop an index DEPTIDX from the user USER4.

```
REVOKE CONTROL ON INDEX DEPTIDX FROM USER4
```

Example 2: Revoke the privilege to drop an index LUNCHITEMS from the user CHEF and the group WAITERS.

```
REVOKE CONTROL ON INDEX LUNCHITEMS
   FROM USER CHEF, GROUP WAITERS
```

REVOKE (Package Privileges)

This form of the REVOKE statement revokes CONTROL, BIND, and EXECUTE privileges against a package.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

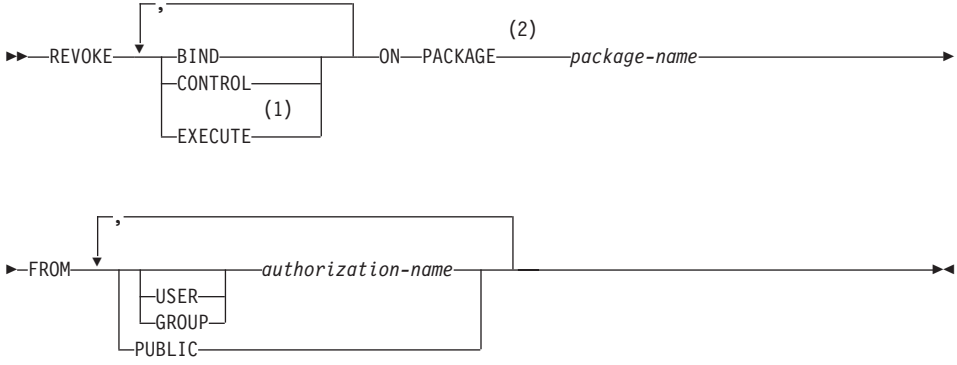
Authorization

The privileges held by the authorization ID of the statement must include at least one of the following:

- CONTROL privilege on the referenced package
- SYSADM or DBADM authority.

To revoke the CONTROL privilege, SYSADM or DBADM authority are required.

Syntax



Notes:

1 RUN can be used as a synonym for EXECUTE.

2 PROGRAM can be used as a synonym for PACKAGE.

Description

BIND
Revokes the privilege to execute BIND or REBIND on the referenced package.

The BIND privileges cannot be revoked from an *authorization-name* that holds CONTROL privilege on the package without also revoking the CONTROL privilege.

CONTROL
Revokes the privilege to drop the package and to extend package privileges to other users.

Revoking CONTROL does not revoke the other package privileges.

EXECUTE
Revokes the privilege to execute the package.

The EXECUTE privilege cannot be revoked from an *authorization-name* that holds CONTROL privilege on the package without also revoking the CONTROL privilege.

ON PACKAGE *package-name*
Specifies the package on which privileges are revoked.

FROM
Indicates from whom the privileges are revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists one or more authorization IDs.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the privileges from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  - If all rows for the grantee in the SYSCAT.PACKAGEAUTH catalog view have a GRANTEETYPE of U, then USER will be assumed.
  - If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  - If some rows have U and some rows have G, then an error (SQLSTATE 56092) is raised.
  - If DCE authentication is used, then an error is raised (SQLSTATE 56092).

Notes

- Revoking a specific privilege does not necessarily revoke the ability to perform the action. A user may proceed with their task if other privileges are held by PUBLIC or a group, or if they have privileges such as ALTERIN on the schema of a package.

Examples

Example 1: Revoke the EXECUTE privilege on package CORPDATA.PKGA from PUBLIC.

```
REVOKE EXECUTE
  ON PACKAGE CORPDATA.PKGA
  FROM PUBLIC
```

Example 2: Revoke CONTROL authority on the RRSP_PKG package for the user FRANK and for PUBLIC.

```
REVOKE CONTROL
  ON PACKAGE RRSP_PKG
  FROM USER FRANK, PUBLIC
```

REVOKE (Schema Privileges)

This form of the REVOKE statement revokes the privileges on a schema.

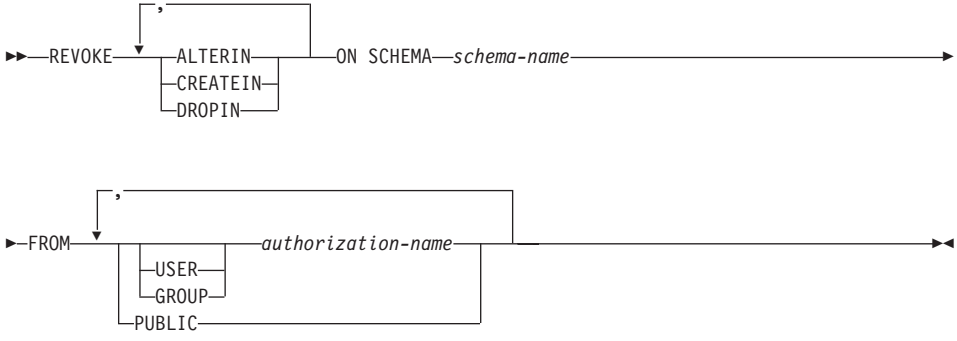
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement must hold either SYSADM or DBADM authority (SQLSTATE 42501).

Syntax



Description

ALTERIN
Revokes the privilege to alter or comment on objects in the schema.

CREATEIN
Revokes the privilege to create objects in the schema.

DROPIN
Revokes the privilege to drop objects in the schema.

ON SCHEMA *schema-name*
Specifies the name of the schema on which privileges are to be revoked.

FROM
Indicates from whom the privileges are revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists one or more authorization IDs.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the privileges from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  - If all rows for the grantee in the SYSCAT.SCHEMAAUTH catalog view have a GRANTEETYPE of U, then USER will be assumed.
  - If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  - If some rows have U and some rows have G, then an error (SQLSTATE 56092) is raised.
  - If DCE authentication is used, then an error is raised (SQLSTATE 56092).

Notes

- Revoking a specific privilege does not necessarily revoke the ability to perform the action. A user may proceed with their task if other privileges are held by PUBLIC or a group, or if they have a higher level authority such as DBADM.

Examples

Example 1: Given that USER4 is only a user and not a group, revoke the privilege to create objects in schema DEPTIDX from the user USER4.

```
REVOKE CREATEIN ON SCHEMA DEPTIDX FROM USER4
```

Example 2: Revoke the privilege to drop objects in schema LUNCH from the user CHEF and the group WAITERS.

```
REVOKE DROPIN ON SCHEMA LUNCH
   FROM USER CHEF, GROUP WAITERS
```

REVOKE (Server Privileges)

This form of the REVOKE statement revokes the privilege to access and use a specified data source in pass-through mode.

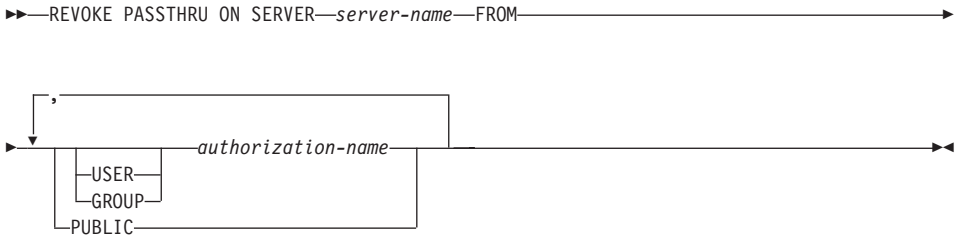
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement must have SYSADM or DBADM authority.

Syntax



Description

SERVER *server-name*
Names the data source for which the privilege to use in pass-through mode is being revoked. *server-name* must identify a data source that is described in the catalog.

FROM
Specifies from whom the privilege is revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists the authorization IDs of one or more users or groups.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes from all users the privilege to pass through to *server-name.*

Examples

Example 1: Revoke USER6's privilege to pass through to data source MOUNTAIN.

```
REVOKE PASSTHRU ON SERVER MOUNTAIN FROM USER USER6
```

Example 2: Revoke group D024's privilege to pass through to data source EASTWING.

```
REVOKE PASSTHRU ON SERVER EASTWING FROM GROUP D024
```

The members of group D024 will no longer be able to use their group ID to pass through to EASTWING. But if any members have the privilege to pass through to EASTWING under their own user IDs, they will retain this privilege.

REVOKE (Table, View, or Nickname Privileges)

This form of the REVOKE statement revokes privileges on a table, view, or nickname.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

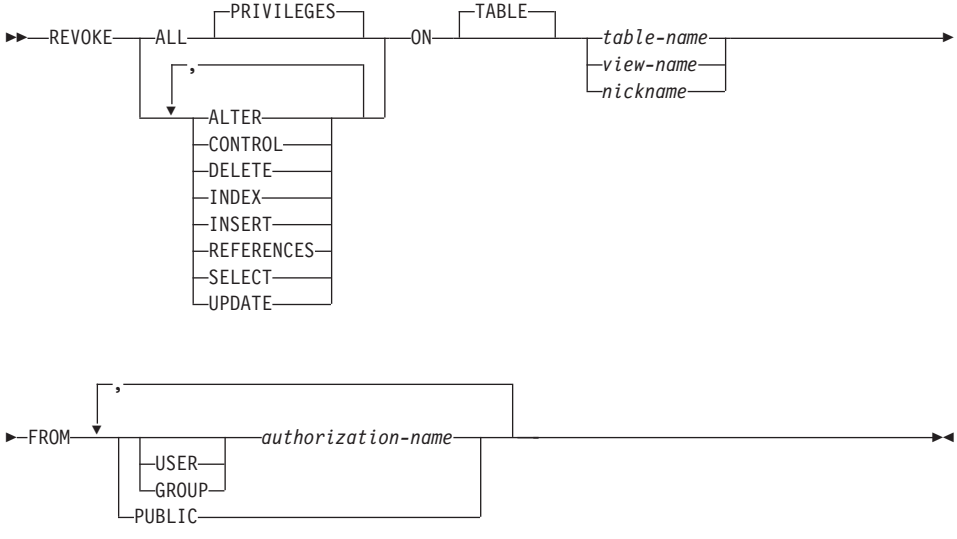
The privileges held by the authorization ID of the statement must include at least one of the following:

- SYSADM or DBADM authority
- CONTROL privilege on the referenced table, view, or nickname.

To revoke the CONTROL privilege, either SYSADM or DBADM authority is required.

To revoke the privileges on catalog tables and views, either SYSADM or DBADM authority is required.

Syntax



Description

ALL or **ALL PRIVILEGES**
Revokes all privileges held by an authorization-name for the specified tables, views, or nicknames.

If ALL is not used, one or more of the keywords listed below must be used. Each keyword revokes the privilege described, but only as it applies to the tables, views, or nicknames named in the ON clause. The same keyword must not be specified more than once.

ALTER
Revokes the privilege to add columns to the base table definition; create or drop a primary key or unique constraint on the table; create or drop a foreign key on the table; add/change a comment on the table, view, or nickname; create or drop a check constraint; create a trigger; add, reset, or drop a column option for a nickname; or, change nickname column names or data types.

CONTROL
Revokes the ability to drop the table, view, or nickname, and the ability to execute the RUNSTATS utility on the table and indexes.

Revoking CONTROL privilege from an *authorization-name* does not revoke other privileges granted to the user on that object.

DELETE
Revokes the privilege to delete rows from the table or updatable view.

INDEX
Revokes the privilege to create an index on the table or an index specification on the nickname. The creator of an index or index specification automatically has the CONTROL privilege over the index or index specification (authorizing the creator to drop the index or index specification). In addition, the creator retains this privilege even if the INDEX privilege is revoked.

INSERT
Revokes the privileges to insert rows into the table or updatable view, and to run the IMPORT utility.

REFERENCES
Revokes the privilege to create or drop a foreign key referencing the table as the parent. Any column level REFERENCES privileges are also revoked.

SELECT
Revokes the privilege to retrieve rows from the table or view, to create a view on a table, and to run the EXPORT utility against the table or view.

Revoking SELECT privilege may cause some views to be marked inoperative. For information on inoperative views, see "Notes" on page 832.

UPDATE
Revokes the privilege to update rows in the table or updatable view. Any column level UPDATE privileges are also revoked.

ON TABLE *table-name* or *view-name* or *nickname*
Specifies the table, view, or nickname on which privileges are to be revoked. The *table-name* cannot be a declared temporary table (SQLSTATE 42995).

FROM
Indicates from whom the privileges are revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name,...
Lists one or more authorization IDs.

The ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the privileges from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  - If all rows for the grantee in the SYSCAT.TABAUTH and SYSCAT.COLAUTH catalog views have a GRANTEETYPE of U, then USER will be assumed.
  - If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  - If some rows have U and some rows have G, then an error (SQLSTATE 56092) is raised.
  - If DCE authentication is used, then an error is raised (SQLSTATE 56092).

Notes

- If a privilege is revoked from the *authorization-name* used to create a view (this is called the view's DEFINER in SYSCAT.VIEWS), that privilege is also revoked from any dependent views.
- If the DEFINER of the view loses a SELECT privilege on some object on which the view definition depends (or an object upon which the view

definition depends is dropped (or made inoperative in the case of another view)), then the view will be made inoperative (see the "Notes" section in "CREATE VIEW" on page 823 for information on inoperative views).

However, if a DBADM or SYSADM explicitly revokes all privileges on the view from the DEFINER, then the record of the DEFINER will not appear in SYSCAT.TABAUTH but nothing will happen to the view - it remains operative.

- Privileges on inoperative views cannot be revoked.
- All packages dependent upon an object for which a privilege is revoked are marked invalid. A package remains invalid until a bind or rebind operation on the application is successfully executed, or the application is executed and the database manager successfully rebinds the application (using information stored in the catalogs). Packages marked invalid due to a revoke may be successfully rebound without any additional grants.

  For example, if a package owned by USER1 contains a SELECT from table T1 and the SELECT privilege for table T1 is revoked from USER1, then the package will be marked invalid. If SELECT authority is re-granted, or if the user holds DBADM authority, the package is successfully rebound when executed.
- Packages, triggers or views that include the use of OUTER(*Z*) in the FROM clause, are dependent on having SELECT privilege on every subtable or subview of *Z*. Similarly, packages, triggers, or views that include the use of DEREF(*Y*) where *Y* is a reference type with a target table or view *Z*, are dependent on having SELECT privilege on every subtable or subview of *Z*. If one of these SELECT privileges is revoked, such packages are invalidated and such triggers or views are made inoperative.
- Table, view, or nickname privileges cannot be revoked from an *authorization-name* with CONTROL on the object without also revoking the CONTROL privilege (SQLSTATE 42504).
- Revoking a specific privilege does not necessarily revoke the ability to perform the action. A user may proceed with their task if other privileges are held by PUBLIC or a group, or if they have privileges such as ALTERIN on the schema of a table or a view.
- If the DEFINER of the summary table loses a SELECT privilege on a table on which the summary table definition depends, (or a table upon which the summary table definition depends is dropped), then the summary table will be made inoperative (see the "Notes" on page 753 for information on inoperative summary tables).

  However, if a DBADM or SYSADM explicitly revokes all privileges on the summary table from the DEFINER, then the record in SYSTABAUTH for the DEFINER will be deleted, but nothing will happen to the summary table - it remains operative.

- Revoking nickname privileges has no affect on data source object (table or view) privileges.
- Revoking the SELECT privilege for a table or view that is *directly* or *indirectly* referenced in an SQL function may fail if the SQL function cannot be dropped because some other object is dependent on the function (SQLSTATE 42893).

Note: "Rules" on page 884 lists the dependencies that objects such as tables and views can have on one another.

Examples

Example 1: Revoke SELECT privilege on table EMPLOYEE from user ENGLES. There is one row in the SYSCAT.TABAUTH catalog view for this table and grantee and the GRANTEETYPE value is U.

```
REVOKE SELECT
  ON TABLE EMPLOYEE
  FROM ENGLES
```

Example 2: Revoke update privileges on table EMPLOYEE previously granted to all local users. Note that grants to specific users are not affected.

```
REVOKE UPDATE
  ON EMPLOYEE
  FROM PUBLIC
```

Example 3: Revoke all privileges on table EMPLOYEE from users PELLOW and MLI and from group PLANNERS.

```
REVOKE ALL
  ON EMPLOYEE
  FROM USER PELLOW, USER MLI, GROUP PLANNERS
```

Example 4: Revoke SELECT privilege on table CORPDATA.EMPLOYEE from a user named JOHN. There is one row in the SYSCAT.TABAUTH catalog view for this table and grantee and the GRANTEETYPE value is U.

```
REVOKE SELECT
  ON CORPDATA.EMPLOYEE FROM JOHN
```

or

```
REVOKE SELECT
  ON CORPDATA.EMPLOYEE FROM USER JOHN
```

Note that an attempt to revoke the privilege from GROUP JOHN would result in an error, since the privilege was not previously granted to GROUP JOHN.

Example 5: Revoke SELECT privilege on table CORPDATA.EMPLOYEE from a group named JOHN. There is one row in the SYSCAT.TABAUTH catalog view for this table and grantee and the GRANTEETYPE value is G.

```
REVOKE SELECT
  ON CORPDATA.EMPLOYEE FROM JOHN
```

or

```
REVOKE SELECT
 ON CORPDATA.EMPLOYEE FROM GROUP JOHN
```

Example 6: Revoke user SHAWN's privilege to create an index specification on nickname ORAREM1.

```
REVOKE INDEX
  ON ORAREM1 FROM USER SHAWN
```

REVOKE (Table Space Privileges)

This form of the REVOKE statement revokes the USE privilege on a table space.

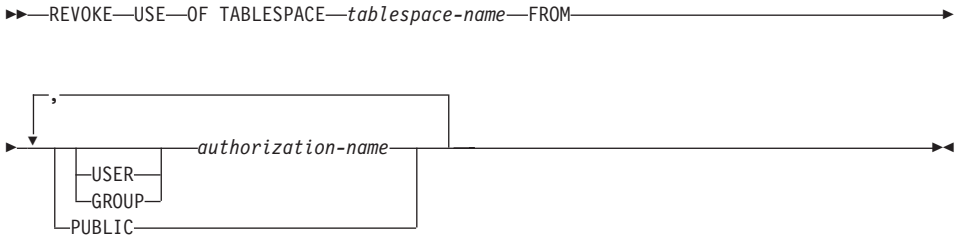
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement must hold either SYSADM, SYSCTRL or DBADM authority (SQLSTATE 42501).

Syntax



Description

USE
Revokes the privilege to specify or default to the table space when creating a table.

OF TABLESPACE *tablespace-name*
Specifies the table space on which the USE privilege is to be revoked. The table space cannot be SYSCATSPACE (SQLSTATE 42838) or a SYSTEM TEMPORARY table space (SQLSTATE 42809).

FROM
Indicates from whom the USE privilege is revoked.

USER
Specifies that the *authorization-name* identifies a user.

GROUP
Specifies that the *authorization-name* identifies a group name.

authorization-name
Lists one or more authorization IDs.

The authorization ID of the REVOKE statement itself cannot be used (SQLSTATE 42502). It is not possible to revoke the privileges from an *authorization-name* that is the same as the authorization ID of the REVOKE statement.

PUBLIC
Revokes the USE privilege from PUBLIC.

Rules

- If neither USER nor GROUP is specified, then:
  - If all rows for the grantee in the SYSCAT.TBSPACEAUTH catalog view have a GRANTEETYPE of U, then USER will be assumed.
  - If all rows have a GRANTEETYPE of G, then GROUP will be assumed.
  - If some rows have U and some rows have G, then an error results (SQLSTATE 56092).
  - If DCE authentication is used, then an error results (SQLSTATE 56092).

Notes

- Revoking the USE privilege does not necessarily revoke the ability to create tables in that table space. A user may still be able to create tables in that table space if the USE privilege is held by PUBLIC or a group, or if the user has a higher level authority, such as DBADM.

Examples

Example 1: Revoke the privilege to create tables in table space PLANS from the user BOBBY.

```
REVOKE USE OF TABLESPACE PLANS FROM USER BOBBY
```

ROLLBACK

The ROLLBACK statement is used to back out of the database changes that were made within a unit of work or a savepoint.

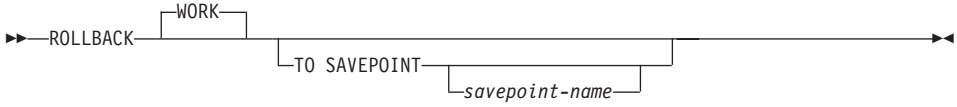
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax



Description

The unit of work in which the ROLLBACK statement is executed is terminated and a new unit of work is initiated. All changes made to the database during the unit of work are backed out.

The following statements, however, are not under transaction control and changes made by them are independent of issuing the ROLLBACK statement:

- SET CONNECTION,
- SET CURRENT DEGREE,
- SET CURRENT DEFAULT TRANSFORM GROUP,
- SET CURRENT EXPLAIN MODE,
- SET CURRENT EXPLAIN SNAPSHOT,
- SET CURRENT PACKAGESET,
- SET CURRENT QUERY OPTIMIZATION,
- SET CURRENT REFRESH AGE,
- SET EVENT MONITOR STATE,
- SET PASSTHRU,
- SET PATH,
- SET SCHEMA,
- SET SERVER OPTION.

TO SAVEPOINT
Indicates that a partial rollback (ROLLBACK TO SAVEPOINT) is to be performed. If no savepoint is active, an SQL error is returned (SQLSTATE

3B502). After a successful ROLLBACK, the savepoint continues to exist. If a *savepoint-name* is not provided, rollback is to the most recently set savepoint.

If this clause is omitted, the ROLLBACK WORK statement rolls back the entire transaction. Furthermore, savepoints within the transaction are released.

savepoint-name
Indicate the savepoint to which to rollback. After a successful ROLLBACK, the savepoint defined by *savepoint-name* continues to exist. If the savepoint name does not exist, an error is returned (SQLSTATE 3B001). Data and schema changes made since the savepoint was set are undone.

Notes

- All locks held are released on a ROLLBACK of the unit of work. All open cursors are closed. All LOB locators are freed.
- Executing a ROLLBACK statement does not affect either the SET statements that change special register values or the RELEASE statement.
- If the program terminates abnormally, the unit of work is implicitly rolled back.
- Statement caching is affected by the rollback operation. See the "Notes" on page 896 for information.
- Savepoints are not allowed in atomic execution contexts such as atomic compound statements and triggers.
- The impact on cursors resulting from a ROLLBACK TO SAVEPOINT depends on the statements within the savepoint
  - If the savepoint contains DDL on which a cursor is dependent, the cursor is marked invalid. Attempts to use such a cursor results in an error (SQLSTATE 57007).
  - Otherwise:
    - If the cursor is referenced in the savepoint, the cursor remains open and is positioned before the next logical row of the result table.[104]
    - Otherwise, the cursor is not affected by the ROLLBACK TO SAVEPOINT (it remains open and positioned).
- Dynamically prepared statement names are still valid, although the statement may be implicitly prepared again, as a result of DDL operations that are rolled back within the savepoint.
- A ROLLBACK TO SAVEPOINT operation will drop any declared temporary tables named within the savepoint. If a declared temporary table is modified within the savepoint, then all rows in the table are deleted.

104. A FETCH must be performed before a positioned UPDATE or DELETE statement is issued.

- All locks are retained after a ROLLBACK TO SAVEPOINT statement.
- All LOB locators are preserved following a ROLLBACK TO SAVEPOINT operation.

Example

Delete the alterations made since the last commit point or rollback.

```
ROLLBACK WORK
```

SAVEPOINT

Use the SAVEPOINT statement to set a savepoint within a transaction.

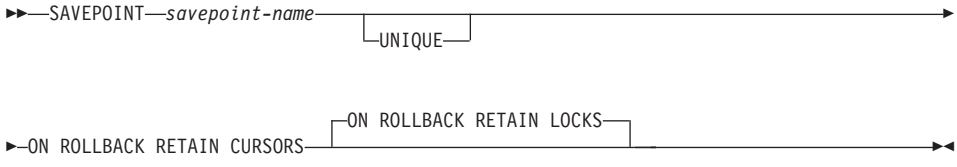
Invocation

This statement can be imbedded in an application program (including a stored procedure) or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

None required.

Syntax



Description

savepoint-name
Name of the *savepoint*.

UNIQUE
Specifying a UNIQUE savepoint indicates that the application does not intend to reuse this savepoint name while the savepoint is active.

ON ROLLBACK RETAIN CURSORS
Specifies system behavior upon rollback to this savepoint with respect to open cursor statements processed after the SAVEPOINT statement. The RETAIN CURSORS clause indicates that, whenever possible, the cursors are unchanged by a rollback to savepoint. For situations where the cursors are affected by the rollback to savepoint, see "ROLLBACK" on page 992.

ON ROLLBACK RETAIN LOCKS
Specifies system behavior upon rollback to this savepoint with respect to locks acquired after the setting of the savepoint. Locks acquired since the savepoint are not tracked and are not rolled back (released) on rollback to the savepoint.

Rules

- Savepoints cannot be nested. If a savepoint statement is issued, and there is already an established savepoint present, then an error occurs (SQLSTATE 3B002).

Notes

- The UNIQUE keyword is supported for compatibility with DB2 Universal Database for OS/390. The following describes the behavior on DB2 Universal Database for OS/390.

  If a savepoint named *savepoint-name* already exists within the transaction, an error is returned (SQLSTATE 3B501). By omitting the UNIQUE clause, the applications assert that this savepoint name may be reused within the transaction. If *savepoint-name* already exists within the transaction, it will be destroyed and a new savepoint named *savepoint-name* will be created.

  Destruction of a savepoint by reusing its name for another savepoint is not the same as releasing the old savepoint with the RELEASE SAVEPOINT statement. Destruction of a savepoint by reusing its name destroys just that savepoint. Releasing a savepoint by means of the RELEASE SAVEPOINT statement releases the named savepoint and all savepoints established after the named savepoint.
- Within a savepoint, if a utility, SQL statement, or DB2 command performs intermittent COMMIT statements during processing, then the savepoint will be implicitly released.
- The SQL statement SET INTEGRITY has the same effects as a DDL statement within a savepoint.
- In an application, inserts may be buffered (that is, the application was precompiled with INSERT BUF option). The buffer will be flushed when SAVEPOINT, ROLLBACK, or RELEASE TO SAVEPOINT statements are issued.

SELECT

The SELECT statement is a form of query. It can be embedded in an application program or issued interactively. For detailed information, see “select-statement” on page 439 and “subselect” on page 394.

SELECT INTO

The SELECT INTO statement produces a result table consisting of at most one row, and assigns the values in that row to host variables. If the table is empty, the statement assigns +100 to SQLCODE and '02000' to SQLSTATE and does not assign values to the host variables. If more than one row satisfies the search condition, statement processing is terminated, and an error occurs (SQLSTATE 21000).

Invocation

This statement can be embedded only in an application program. It is an executable statement that cannot be dynamically prepared.

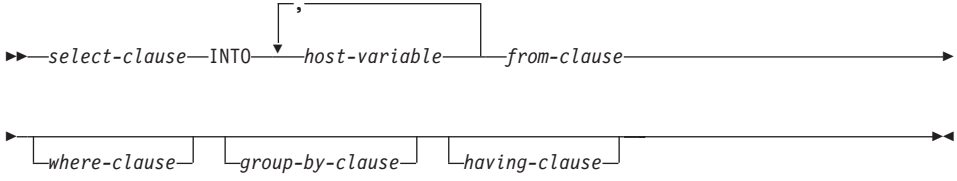
Authorization

The privileges held by the authorization ID of the statement must include, for each table or view referenced in the SELECT INTO statement, at least one of the following:

- SELECT privilege
- CONTROL privilege
- SYSADM or DBADM authority.

GROUP privileges are not checked for static SELECT INTO statements.

Syntax



Description

See "Chapter 5. Queries" on page 393 for a description of the *select-clause*, *from-clause*, *where-clause*, *group-by-clause*, and *having-clause*.

INTO

Introduces a list of host variables.

host-variable

Identifies a variable that is described in the program under the rules for declaring host 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. If the number of host variables is less than the number of column values, the value

'W' is assigned to the SQLWARN3 field of the SQLCA. (See "Appendix B. SQL Communications (SQLCA)" on page 1107.)

Each assignment to a variable is made according to the rules described in "Assignments and Comparisons" on page 94. Assignments are made in sequence through the list.

If an error occurs, no value is assigned to any host variable.

Examples

Example 1: This C example puts the maximum salary in EMP into the host variable MAXSALARY.

```
EXEC SQL SELECT MAX(SALARY)
  INTO :MAXSALARY
  FROM EMP;
```

Example 2: This C example puts the row for employee 528671, from EMP, into host variables.

```
EXEC SQL SELECT * INTO :h1, :h2, :h3, :h4
  FROM EMP
  WHERE EMPNO = '528671';
```

SET CONNECTION

The SET CONNECTION statement changes the state of a connection from dormant to current, making the specified location the current server. It is not under transaction control.

Invocation

Although an interactive SQL facility might provide an interface that gives the appearance of interactive execution, this statement can only be embedded within an application program. It is an executable statement that cannot be dynamically prepared.

Authorization

None Required.

Syntax

Description

server-name or *host-variable*

Identifies the application server by the specified *server-name* or a *host-variable* which contains the *server-name*.

If a *host-variable* is specified, it must be a character string variable with a length attribute that is not greater than 8, and it must not include an indicator variable. The *server-name* that is contained within the *host-variable* must be left-justified and must not be delimited by quotation marks.

Note that the *server-name* is a database alias identifying the application server. It must be listed in the application requester's local directory.

The *server-name* or the *host-variable* must identify an existing connection of the application process. If they do not identify an existing connection, an error (SQLSTATE 08003) is raised.

If SET CONNECTION is to the current connection, the states of all connections of the application process are unchanged.

Successful Connection

If the SET CONNECTION statement executes successfully:

- No connection is made. The CURRENT SERVER special register is updated with the specified *server-name*.
- The previously current connection, if any, is placed into the dormant state (assuming a different *server-name* is specified).

- The CURRENT SERVER special register and the SQLCA are updated in the same way as documented under Type 1 CONNECT; details 552.

Unsuccessful Connection

If the SET CONNECTION statement fails:

- No matter what the reason for failure, the connection state of the application process and the states of its connections are unchanged.
- As with an unsuccessful Type 1 CONNECT, the SQLERRP field of the SQLCA is set to the name of the module that detected the error.

Notes

- The use of type 1 CONNECT statements does not preclude the use of SET CONNECTION, but the statement will always fail (SQLSTATE 08003), unless the SET CONNECTION statement specifies the current connection, because dormant connections cannot exist.
- The SQLRULES(DB2) connection option (see "Options that Govern Distributed Unit of Work Semantics" on page 39) does not preclude the use of SET CONNECTION, but the statement is unnecessary because type 2 CONNECT statements can be used instead.
- When a connection is used, made dormant, and then restored to the current state in the same unit of work, that connection reflects its last use by the application process with regard to the status of locks, cursors, and prepared statements.

Examples

Execute SQL statements at IBMSTHDB, execute SQL statements at IBMTOKDB, and then execute more SQL statements at IBMSTHDB.

```
EXEC SQL CONNECT TO IBMSTHDB;
/* Execute statements referencing objects at IBMSTHDB */
EXEC SQL CONNECT TO IBMTOKDB;
/* Execute statements referencing objects at IBMTOKDB */
EXEC SQL SET CONNECTION IBMSTHDB;
/* Execute statements referencing objects at IBMSTHDB */
```

Note that the first CONNECT statement creates the IBMSTHDB connection, the second CONNECT statement places it in the dormant state, and the SET CONNECTION statement returns it to the current state.

SET CURRENT DEFAULT TRANSFORM GROUP

The SET CURRENT DEFAULT TRANSFORM GROUP statement changes the value of the CURRENT DEFAULT TRANSFORM GROUP special register. This statement is not under transaction control.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax

Description

group-name
Specifies a one-part name that identifies a transform group defined for all structured types. This name can be referenced in subsequent statements (or until the special register value is changed again using another SET CURRENT DEFAULT TRANSFORM GROUP statement).

The name must be an SQL identifier, up to 18 characters in length (SQLSTATE 42815). No validation that the *group-name* is defined for any structured type is made when the special register is set. Only when a structured type is specifically referenced is the definition of the named transform group checked for validity.

Rules

- If the value specified does not conform to the rules for a *group-name*, an error is raised (SQLSTATE 42815)
- The TO SQL and FROM SQL functions defined in the *group-name* transform group are used for exchanging user-defined structured type data with a host program.

Notes

- The initial value of the CURRENT DEFAULT TRANSFORM GROUP special register is the empty string.
- See "CURRENT DEFAULT TRANSFORM GROUP" on page 118 for additional rules regarding the use of the special register.

Examples

Example 1: Set the default transform group to MYSTRUCT1. The TO SQL and FROM SQL functions defined in the MYSTRUCT1 transform group will be used for exchanging user-defined structured type variables with the current host program.

```
SET CURRENT DEFAULT TRANSFORM GROUP = MYSTRUCT1
```

SET CURRENT DEGREE

The SET CURRENT DEGREE statement assigns a value to the CURRENT DEGREE special register. This statement is not under transaction control.

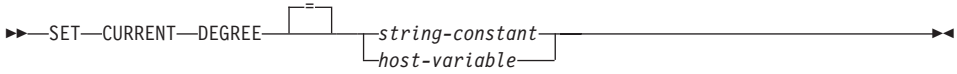
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax



Description

The value of CURRENT DEGREE is replaced by the value of the string constant or host variable. The value must be a character string that is not longer than 5 bytes. The value must be the character string representation of an integer between 1 and 32 767 inclusive or 'ANY'.

If the value of CURRENT DEGREE represented as an integer is 1 when an SQL statement is dynamically prepared, the execution of that statement will not use intra-partition parallelism.

If the value of CURRENT DEGREE is a number when an SQL statement is dynamically prepared, the execution of that statement can involve intra-partition parallelism with the specified degree.

If the value of CURRENT DEGREE is 'ANY' when an SQL statement is dynamically prepared, the execution of that statement can involve intra-partition parallelism using a degree determined by the database manager.

host-variable

The *host-variable* must be of data type CHAR or VARCHAR and the length must not exceed 5. If a longer field is provided, an error will be returned (SQLSTATE 42815). If the actual value provided is larger than the replacement value specified, the input must be padded on the right with blanks. Leading blanks are not allowed (SQLSTATE 42815). All input values are treated as being case-insensitive. If a *host-variable* has an associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815).

string-constant
The *string-constant* length must not exceed 5.

Notes

The degree of intra-partition parallelism for static SQL statements can be controlled using the DEGREE option of the PREP or BIND command. Refer to the *Command Reference* for details on these commands.

The actual runtime degree of intra-partition parallelism will be the lower of:

- Maximum query degree (max_querydegree) configuration parameter
- Application runtime degree
- SQL statement compilation degree

The intra_parallel database manager configuration must be on to use intra-partition parallelism. If it is set to off, the value of this register will be ignored and the statement will not use intra-partition parallelism for the purpose of optimization (SQLSTATE 01623).

Some SQL statements cannot use intra-partition parallelism. See the *Administration Guide* for a description of degree of intra-partition parallelism and a list of restrictions.

Example

Example 1: The following statement sets the CURRENT DEGREE to inhibit intra-partition parallelism.

```
SET CURRENT DEGREE = '1'
```

Example 2: The following statement sets the CURRENT DEGREE to allow intra-partition parallelism.

```
SET CURRENT DEGREE = 'ANY'
```

SET CURRENT EXPLAIN MODE

The SET CURRENT EXPLAIN MODE statement changes the value of the CURRENT EXPLAIN MODE special register. It is not under transaction control.

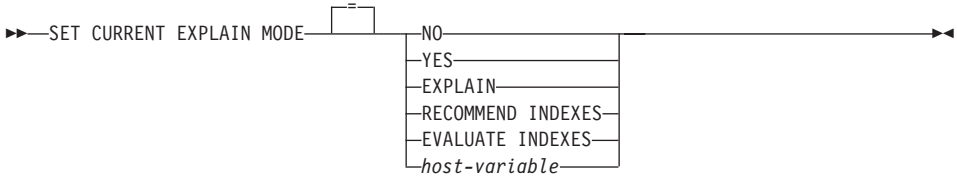
Invocation

This statement can be embedded in an application program or issued interactively. It is an executable statement that can be dynamically prepared.

Authorization

No special authorization is required to execute this statement.

Syntax



Description

NO
Disables the Explain facility. No Explain information is captured. NO is the initial value of the special register.

YES
Enables the Explain facility and causes Explain information to be inserted into the Explain tables for eligible dynamic SQL statements. All dynamic SQL statements are compiled and executed normally.

EXPLAIN
Enables the Explain facility and causes Explain information to be captured for any eligible dynamic SQL statement that is prepared. However, dynamic statements are not executed.

RECOMMEND INDEXES
Enables the SQL compiler to recommend indexes. All queries that are executed in this explain mode will populate the ADVISE_INDEX table with recommended indexes. In addition, Explain information will be captured in the Explain tables to reveal how the recommended indexes are used, but the statements are neither compiled nor executed.

EVALUATE INDEXES
Enables the SQL compiler to evaluate indexes. The indexes to be evaluated are read from the ADVISE_INDEX table, and must be marked with EVALUATE = Y. The optimizer generates virtual indexes based on the values from the catalogs. All queries that are executed in this explain

mode will be compiled and optimized using estimated statistics based on the virtual indexes. The statements are not executed.

host-variable
The *host-variable* must be of data type CHAR or VARCHAR and the length must not exceed 254. If a longer field is provided, an error will be returned (SQLSTATE 42815). The value specified must be NO, YES, EXPLAIN, RECOMMEND INDEXES, or EVALUATE INDEXES. If the actual value provided is larger than the replacement value specified, the input must be padded on the right with blanks. Leading blanks are not allowed (SQLSTATE 42815). All input values are treated as being case-insensitive. If a *host-variable* has an associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815).

Notes

Explain information for static SQL statements can be captured by using the EXPLAIN option of the PREP or BIND command. If the ALL value of the EXPLAIN option is specified, and the CURRENT EXPLAIN MODE register value is NO, explain information will be captured for dynamic SQL statements at runtime. If the value of the CURRENT EXPLAIN MODE register is not NO, then the value of the EXPLAIN bind option is ignored. For more information on the interaction between the EXPLAIN option and the CURRENT EXPLAIN MODE special register, see Table 143 on page 1326.

RECOMMEND INDEXES and EVALUATE INDEXES are special modes which can only be set with the SET CURRENT EXPLAIN MODE command. These modes cannot be set using PREP or BIND options, and they do not work with the SET CURRENT SNAPSHOT command.

If the Explain facility is activated, the current authorization ID must have INSERT privilege for the Explain tables or an error (SQLSTATE 42501) is raised.

For further information, see the *Administration Guide*.

Example

Example 1: The following statement sets the CURRENT EXPLAIN MODE special register, so that Explain information will be captured for any subsequent eligible dynamic SQL statements and the statement will not be executed.

```
SET CURRENT EXPLAIN MODE = EXPLAIN
```

SET CURRENT EXPLAIN SNAPSHOT

The SET CURRENT EXPLAIN SNAPSHOT statement changes the value of the CURRENT EXPLAIN SNAPSHOT special register. It is not under transaction control.

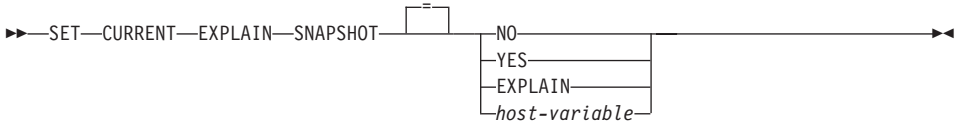
Invocation

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

NO
Disables the Explain snapshot facility. No snapshot is taken. NO is the initial value of the special register.

YES
Enables the Explain snapshot facility, creating a snapshot of the internal representation for each eligible dynamic SQL statement. This information is inserted in the SNAPSHOT column of the EXPLAIN_STATEMENT table (see "Appendix K. Explain Tables and Definitions" on page 1291).

The EXPLAIN SNAPSHOT facility is intended for use with Visual Explain.

EXPLAIN
Enables the Explain snapshot facility, creating a snapshot of the internal representation for each eligible dynamic SQL statement that is prepared. However, dynamic statements are not executed.

host-variable
The *host-variable* must be of data type CHAR or VARCHAR and the length of its contents must not exceed 8. If a longer field is provided, an error will be returned (SQLSTATE 42815). The value contained in this register must be either NO, YES, or EXPLAIN. If the actual value provided is larger than the replacement value specified, the input must be padded on the right with blanks. Leading blanks are not allowed (SQLSTATE 42815). All input values are treated as being case-insensitive. If *host-variable* has an

associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815).

Notes

Explain snapshots for static SQL statements can be captured by using the EXPLSNAP option of the PREP or BIND command. If the ALL value of the EXPLSNAP option is specified, and the CURRENT EXPLAIN SNAPSHOT register value is NO, Explain snapshots will be captured for dynamic SQL statements at runtime. If the value of the CURRENT EXPLAIN SNAPSHOT register is not NO, then the EXPLSNAP option is ignored. For more information on the interaction between the EXPLSNAP option and the CURRENT EXPLAIN SNAPSHOT special register, see Table 144 on page 1327.

If the Explain snapshot facility is activated, the current authorization ID must have INSERT privilege for the Explain tables or an error (SQLSTATE 42501) is raised.

For further information, see the *Administration Guide*.

Example

Example 1: The following statement sets the CURRENT EXPLAIN SNAPSHOT special register, so that an Explain snapshot will be taken for any subsequent eligible dynamic SQL statements and the statement will be executed.

```
SET CURRENT EXPLAIN SNAPSHOT = YES
```

Example 2: The following example retrieves the current value of the CURRENT EXPLAIN SNAPSHOT special register into the host variable called SNAP.

```
EXEC SQL VALUES (CURRENT EXPLAIN SNAPSHOT) INTO :SNAP;
```

SET CURRENT PACKAGESET

The SET CURRENT PACKAGESET statement sets the schema name (collection identifier) that will be used to select the package to use for subsequent SQL statements. This statement is not under transaction control.

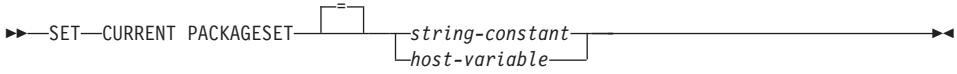
Invocation

This statement can be embedded only in an application program. It is an executable statement that cannot be dynamically prepared. This statement is not supported in REXX.

Authorization

None required.

Syntax



Description

string-constant
A character string constant with a maximum length of 30. If more than the maximum, it will be truncated at runtime.

host-variable
A variable of type CHAR or VARCHAR with a maximum length of 30. It cannot be set to null. If more than the maximum, it will be truncated at runtime.

Notes

- This statement allows an application to specify the schema name used when selecting a package for an executable SQL statement. The statement is processed at the client and does not flow to the application server.
- The COLLECTION bind option can be used to create a package with a specified schema name. See the *Command Reference* for details.
- Unlike DB2 for MVS/ESA, the SET CURRENT PACKAGESET statement is implemented without support for a special register called CURRENT PACKAGESET.

Example

Assume an application called TRYIT is precompiled by userid PRODUSA, making 'PRODUSA' the default schema name in the bind file. The application is then bound twice with different bind options. The following command line processor commands were used:

```
DB2 CONNECT TO SAMPLE USER PRODUSA
DB2 BIND TRYIT.BND DATETIME USA
DB2 CONNECT TO SAMPLE USER PRODEUR
DB2 BIND TRYIT.BND DATETIME EUR COLLECTION 'PRODEUR'
```

This creates two packages called TRYIT. The first bind command created the package in the schema named 'PRODUSA'. The second bind command created the package in the schema named 'PRODEUR' based on the COLLECTION option.

Assume the application TRYIT contains the following statements:

```
EXEC SQL CONNECT TO SAMPLE;
 .
 .
EXEC SQL SELECT HIREDATE INTO :HD FROM EMPLOYEE WHERE EMPNO='000010'; 1
 .
 .
EXEC SQL SET CURRENT PACKAGESET 'PRODEUR';                            2
 .
 .
EXEC SQL SELECT HIREDATE INTO :HD FROM EMPLOYEE WHERE EMPNO='000010'; 3
```

1 This statement will run using the PRODUSA.TRYIT package because it is the default package for the application. The date is therefore returned in USA format.

2 This statement sets the schema name to 'PRODEUR' for package selection.

3 This statement will run using the PRODEUR.TRYIT package as a result of the SET CURRENT PACKAGESET statement. The date is therefore returned in EUR format.

SET CURRENT QUERY OPTIMIZATION

The SET CURRENT QUERY OPTIMIZATION statement assigns a value to the CURRENT QUERY OPTIMIZATION special register. The value specifies the current class of optimization techniques enabled when preparing dynamic SQL statements. It is not under transaction control.

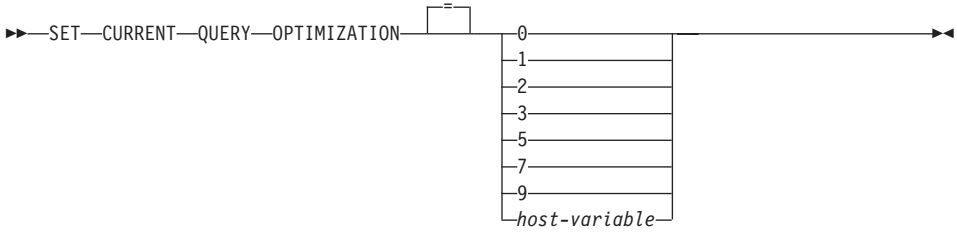
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared.

Authorization

No authorization is required to execute this statement.

Syntax



Description

optimization-class

optimization-class can be specified either as an integer constant or as the name of a host variable that will contain the appropriate value at run time. An overview of the classes follows (for details refer to the *Administration Guide*).

0 Specifies that a minimal amount of optimization is performed to generate an access plan. This class is most suitable for simple dynamic SQL access to well-indexed tables.

1 Specifies that optimization roughly comparable to DB2 Version 1 is performed to generate an access plan.

2 Specifies a level of optimization higher than that of DB2 Version 1, but at significantly less optimization cost than levels 3 and above, especially for very complex queries.

3 Specifies that a moderate amount of optimization is performed to generate an access plan.

5 Specifies a significant amount of optimization is performed to generate an access plan. For complex

dynamic SQL queries, heuristic rules are used to limit the amount of time spent selecting an access plan. Where possible, queries will use summary tables instead of the underlying base tables.

7 Specifies a significant amount of optimization is performed to generate an access plan. Similar to 5 but without the heuristic rules.

9 Specifies a maximal amount of optimization is performed to generate an access plan. This can greatly expand the number of possible access plans that are evaluated. This class should be used to determine if a better access plan can be generated for very complex and very long-running queries using large tables. Explain and performance measurements can be used to verify that a better plan has been generated.

host-variable The data type is INTEGER. The value must be in the range 0 to 9 (SQLSTATE 42815) but should be 0, 1, 2, 3, 5, 7, or 9 (SQLSTATE 01608). If *host-variable* has an associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815).

Notes

- When the CURRENT QUERY OPTIMIZATION register is set to a particular value, a set of query rewrite rules are enabled, and certain optimization variables take on particular values. This class of optimization techniques is then used during preparation of dynamic SQL statements.
- In general, changing the optimization class impacts the execution time of the application, the compilation time, and resources required. Most statements will be adequately optimized using the default query optimization class. Lower query optimization classes, especially classes 1 and 2, may be appropriate for dynamic SQL statements for which the resources consumed by the dynamic *PREPARE* are a significant portion of those required to execute the query. Higher optimization classes should be chosen only after considering the additional resources that may be consumed and verifying that a better access plan has been generated. For additional detail on the behavior associated with each query optimization class see *Administration Guide*.
- Query optimization classes must be in the range 0 to 9. Classes outside this range will return an error (SQLSTATE 42815). Unsupported classes within this range will return a warning (SQLSTATE 01608) and will be replaced with the next lowest query optimization class. For example, a query optimization class of 6 will be replaced by 5.
- Dynamically prepared statements use the class of optimization that was set by the most recently executed SET CURRENT QUERY OPTIMIZATION

statement. In cases where a SET CURRENT QUERY OPTIMIZATION statement has not yet been executed, the query optimization class is determined by the value of the database configuration parameter, dft_queryopt.

- Statically bound statements do not use the CURRENT QUERY OPTIMIZATION special register; therefore this statement has no effect on them. The QUERYOPT option is used during preprocessing or binding to specify the desired class of optimization for statically bound statements. If QUERYOPT is not specified then, the default value specified by the database configuration parameter, dft_queryopt, is used. Refer to the BIND command in the *Command Reference* for details.
- The results of executing the SET CURRENT QUERY OPTIMIZATION statement are not rolled back if the unit of work in which it is executed is rolled back.

Examples

Example 1: This example shows how the highest degree of optimization can be selected.

```
SET CURRENT QUERY OPTIMIZATION 9
```

Example 2: The following example shows how the CURRENT QUERY OPTIMIZATION special register can be used within a query.

Using the SYSCAT.PACKAGES catalog view, find all plans that were bound with the same setting as the current value of the CURRENT QUERY OPTIMIZATION special register.

```
EXEC SQL DECLARE C1 CURSOR FOR
  SELECT PKGNAME, PKGSCHEMA FROM SYSCAT.PACKAGES
  WHERE QUERYOPT = CURRENT QUERY OPTIMIZATION
```

SET CURRENT REFRESH AGE

The SET CURRENT REFRESH AGE statement changes the value of the CURRENT REFRESH AGE special register. It is not under transaction control.

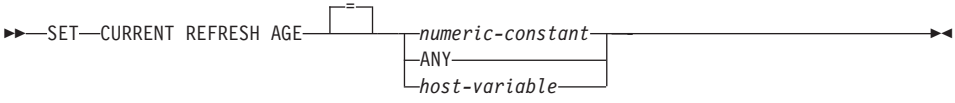
Invocation

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

numeric-constant
A DECIMAL(20,6) value representing a timestamp duration. The value must be 0 or 99 999 999 999 999 (the microseconds portion of the value is ignored and can therefore be any value).

0	Indicates that only summary tables defined with REFRESH IMMEDIATE may be used to optimize the processing of a query.
99999999999999	Indicates that any summary tables defined with REFRESH DEFERRED or REFRESH IMMEDIATE may be used to optimize the processing of a query. This value represents 9 999 years, 99 months, 99 days, 99 hours, 99 minutes, and 99 seconds.

ANY
This is a shorthand for 99999999999999.

host-variable
A variable of type DECIMAL(20,6) or other type that is assignable to DECIMAL(20,6). It cannot be set to null. If *host-variable* has an associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815). The value of the host-variable must be 0 or 99 999 999 999 999.000000.

Notes

- The initial value of the CURRENT REFRESH AGE special register is zero.

- Setting the CURRENT REFRESH AGE special register to a value other than zero should be done with caution. By allowing a summary table that may not represent the values of the underlying base table to be used to optimize the processing of the query, the result of the query may NOT accurately represent the data in the underlying table. This may be reasonable when you know the underlying data has not changed or you are willing to accept the degree of error in the results based on your knowledge of the data.
- The CURRENT REFRESH AGE value of 99 999 999 999 999 cannot be used in timestamp arithmetic operations since the result would be outside the valid range of dates (SQLSTATE 22008).

Examples

Example 1: The following statement sets the CURRENT REFRESH AGE special register.

```
SET CURRENT REFRESH AGE ANY
```

Example 2:

The following example retrieves the current value of the CURRENT REFRESH AGE special register into the host variable called CURMAXAGE.

```
EXEC SQL VALUES (CURRENT REFRESH AGE) INTO  :CURMAXAGE;
```

The value would be 99999999999999.000000, set by the previous example.

SET EVENT MONITOR STATE

The SET EVENT MONITOR STATE statement activates or deactivates an event monitor. The current state of an event monitor (active or inactive) is determined by using the EVENT_MON_STATE built-in function. The SET EVENT MONITOR STATE statement is not under transaction control.

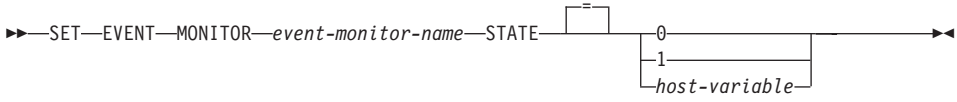
Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The authorization ID of the statement most hold either SYSADM or DBADM authority (SQLSTATE 42815).

Syntax



Description

event-monitor-name
Identifies the event monitor to activate or deactivate. The name must identify an event monitor that exists in the catalog (SQLSTATE 42704).

new-state
new-state can be specified either as an integer constant or as the name of a host variable that will contain the appropriate value at run time. The following may be specified:

0 Indicates that the specified event monitor should be deactivated.

1 Indicates that the specified event monitor should be activated. The event monitor should not already be active; otherwise a warning (SQLSTATE 01598) is issued.

host-variable The data type is INTEGER. The value specified must be 0 or 1 (SQLSTATE 42815). If *host-variable* has an associated indicator variable, the value of that indicator variable must not indicate a null value (SQLSTATE 42815).

Rules

- Although an unlimited number of event monitors may be defined, there is a limit of 32 event monitors that can be simultaneously active (SQLSTATE 54030).
- In order to activate an event monitor, the transaction in which the event monitor was created must have been committed (SQLSTATE 55033). This rule prevents (in one unit of work) creating an event monitor, activating the monitor, then rolling back the transaction.
- If the number or size of the event monitor files exceeds the values specified for MAXFILES or MAXFILESIZE on the CREATE EVENT MONITOR statement, an error (SQLSTATE 54031) is raised.
- If the target path of the event monitor (that was specified on the CREATE EVENT MONITOR statement) is already in use by another event monitor, an error (SQLSTATE 51026) is raised.

Notes

- Activating an event monitor performs a reset of any counters associated with it.

Example

The following example activates an event monitor called SMITHPAY.

```
SET EVENT MONITOR SMITHPAY STATE = 1
```

SET INTEGRITY

The SET INTEGRITY[105] statement is used to do one of the following:

- Turn off integrity checking for one or more tables. This includes check constraint and referential constraint checking, datalink integrity checking, and generation of values for generated columns. If the table is a summary table with REFRESH IMMEDIATE, the immediate refreshing of the data is turned off. Note that this places the table(s) into a *check pending state* where only limited access by a restricted set of statements and commands is allowed. Primary key and unique constraints continue to be checked.
- Both turn the integrity checking back on for one or more tables and to carry out all the deferred checking. If the table is a summary table, the data is refreshed as necessary and, when defined with the REFRESH IMMEDIATE attribute, immediate refreshing of the data is turned on.
- Turn on integrity checking for one or more tables without first carrying out any deferred integrity checking. If the table is a summary table defined with the REFRESH IMMEDIATE attribute, immediate refreshing of the data is turned on.
- Place the table into check pending state if the table is already in DataLink Reconcile Pending (DRP) or DataLink Reconcile Not Possible (DRNP) state. If a table is not in either of those states, then unconditionally set the table to DRP state and check pending state.

When the statement is used to check integrity for a table after it has been loaded, the system will by default incrementally process the table by checking only the append portion for constraint violations. However, there are some situations in which the system will decide that full processing (by checking the entire table for constraints violations) is necessary to ensure data integrity. There is also a situation in which user needs to explicitly request incremental processing by specifying the INCREMENTAL option. See “Notes” on page 1024 for details.

The SET INTEGRITY statement is under transaction control.

Invocation

This statement can be embedded in an application program or issued through the use of dynamic SQL statements. It is an executable statement that can be dynamically prepared. However, if the bind option DYNAMICRULES BIND applies, the statement cannot be dynamically prepared (SQLSTATE 42509).

Authorization

The privileges required to execute SET INTEGRITY depend on the use of the statement, as outlined below:

105. The SET INTEGRITY statement, rather than the SET CONSTRAINTS statement, is the preferred method for working with integrity checking in DB2.

1. Turn off integrity checking.

   The privileges of the authorization ID of the statement must include at least one of the following:

   - CONTROL privilege on the tables and all their dependents and descendants in referential integrity constraints
   - SYSADM or DBADM authority
   - LOAD authority

2. Both turn on integrity checking and carry out checking.

   The privileges of the authorization ID of the statement must include at least one of the following:

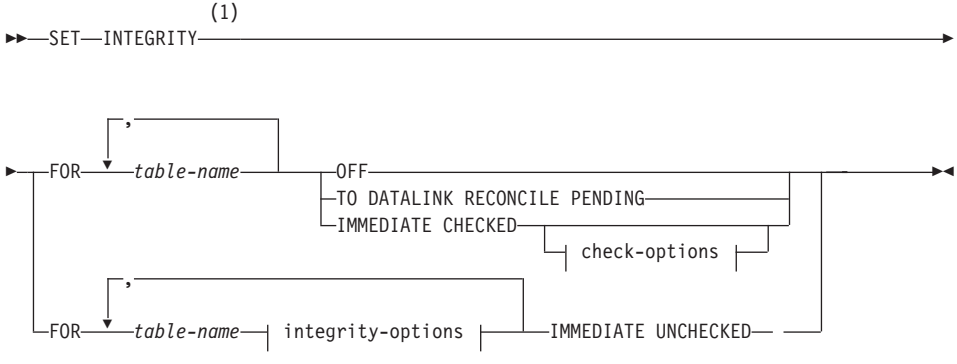
   - SYSADM or DBADM authority
   - CONTROL privilege on the tables that are being checked **and** if exceptions are being posted to one or more tables, INSERT privilege on the exception tables
   - LOAD authority and, if exceptions are being posted to one or more tables:
     - SELECT and DELETE privilege on each table being checked; and
     - INSERT privilege on the exception tables.

3. Turn on integrity checking without first carrying out checking.

   The authorization ID of the statement must have at least one of the following:

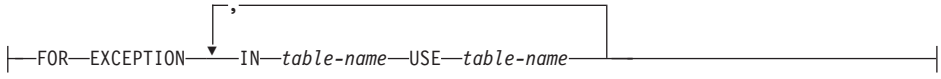
   - SYSADM or DBADM authority
   - CONTROL privilege on the tables that are being checked
   - LOAD authority

Syntax

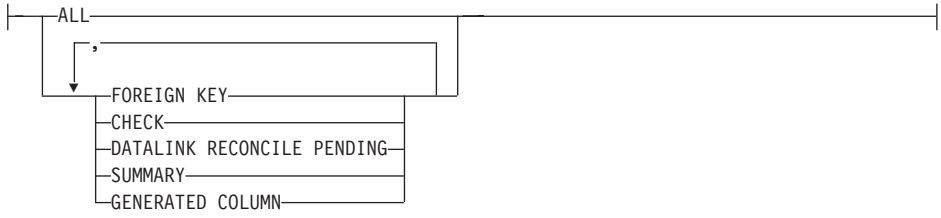


check-options:

exception-clause:



integrity-options:



Notes:

1 For compatibility with previous versions, the keyword CONSTRAINTS will continue to be supported.

Description

table-name
Identifies a table for integrity processing. It must be a table described in the catalog and must not be a view, catalog table, or typed table.

OFF
Specifies that the tables are to have their foreign key constraints, check constraints, and column generation turned off and are, therefore to be placed into the check pending state. If it is a summary table, then immediate refreshing is turned off (if applicable) and the summary table is placed into check pending state.

Note that it is possible that a table may already be in the check pending state with only one type of integrity checking turned off; in such a situation the other type of integrity checking will also be turned off.

If any table in the list is a parent table, the check pending state for foreign key constraints is extended to all dependent and descendent tables.

If any table in the list is an underlying table of a summary table, the check pending state is extended to such summary tables.

Only very limited activity is allowed on a table that is in the check pending state. "Notes" on page 1024 lists the restrictions.

TO DATALINK RECONCILE PENDING
Specifies that the tables are to have DATALINK integrity constraint checking turned off and the tables placed in check pending state. If the table is already in DataLink Reconcile Not Possible (DRNP) state, it remains in this state with check pending. Otherwise, the table is set to DataLink Reconcile Pending (DRP) state.

Dependent and descendent table are not affected when this option is specified.

IMMEDIATE CHECKED
Specifies that the table is to have its integrity checking turned on and that the integrity checking that was deferred is to be carried out. This is done in accordance with the information set in the STATUS and CONST_CHECKED columns of the SYSCAT.TABLES catalog. That is:

- The value in STATUS must be C (the table is in the check pending state) or an error (SQLSTATE 51027) is returned.
- The value in CONST_CHECKED indicates which integrity options are to be checked.

If it is a summary table, then the data is checked against the query and refreshed as necessary.

DATALINK values are not checked, even when the table is in DRP or DRNP state. The RECONCILE command or API should be used to perform the reconciliation of DATALINK values. The table will be taken out of check pending state but continue to have the DRP or DRNP flag set. This makes the table usable while the reconciliation of DATALINK values can be deferred to another time.

check-options

FORCE GENERATED
If the table includes generated columns, the values are computed based on the expression and stored in the column. If this clause is not specified, the current values are compared to the computed value of the expression as if an equality check constraint existed.

INCREMENTAL
Specifies the application of deferred integrity checks on the appended portion (if any) of the table. If such a request cannot be satisfied (i.e. the system detects that the whole table needs to be checked for data integrity), an error (SQLSTATE 55019) will be returned. If the attribute

is not specified, the system will determine if incremental processing is possible; if not, the whole table will be checked. See Notes for situations in which system will favor full processing (checking whole table for integrity) over incremental processing. Also, see Notes for situations in which the INCREMENTAL option is necessary and situations in which it cannot be specified.

If the table is not in the check pending state, an error (SQLSTATE 55019) is returned.

exception-clause

FOR EXCEPTION
Indicates that any row that is in violation of a foreign key constraint or a check constraint will be copied to an exception table and deleted from the original table. See "Appendix N. Exception Tables" on page 1335 for more information on these user-defined tables. Even if errors are detected the constraints are turned back on again and the table is taken out of the check pending state. A warning (SQLSTATE 01603) is issued to indicate that one or more rows have been moved to the exception tables.

If the FOR EXCEPTION clause is not specified and any constraints are violated, then only the first violation detected is returned to the user (SQLSTATE 23514). In the case of a violation in any table, all the tables are left in the check pending state, as they were before the execution of the statement. This clause cannot be specified if the *table-name* is a summary table (SQLSTATE 42997).

IN *table-name*
Specifies the table from which rows that violate constraints are to be copied. There must be one exception table specified for each table being checked.

USE *table-name*
Specifies the exception table into which error rows are to be copied.

integrity-options
Used to define the integrity options that are set to IMMEDIATE UNCHECKED.

ALL
This indicates that all integrity-options are to be turned on.

FOREIGN KEY
This indicates that foreign key constraints are to be turned on.

CHECK
This indicates that check constraints are to be turned on.

DATALINK RECONCILE PENDING
This indicates that DATALINK integrity constraints are to be turned on.

SUMMARY
This indicates that immediate refreshing should be turned on for a summary table with the REFRESH IMMEDIATE attribute.

GENERATED COLUMN
This indicates that generated columns are to be turned on.

IMMEDIATE UNCHECKED
Specifies one of the following:

- The table is to have its integrity checking turned on (and, thus, are to be taken out of the check pending state) without having the table checked for integrity violations or the summary table is to have immediate refreshing turned on and be taken out of check pending state.

  This is specified for a given table either by specifying ALL, or by specifying CHECK when only check constraints are off for that table, or by specifying FOREIGN KEY when only foreign key constraints are off for that table, or by specifying DATALINK RECONCILE PENDING when only DATALINK integrity constraints are off for that table or by specifying SUMMARY when only summary table query checking is off for that summary table, or by specifying GENERATED COLUMN when only column generation is off for that table.
- The table is to have one type of integrity checking turned on, but is to be left in the check pending state.

  This is specified for a given table by specifying only CHECK, FOREIGN KEY, SUMMARY, GENERATED COLUMN, or DATALINK RECONCILE PENDING when any of those types of constraints are off for that table.

The state change is not extended to any tables not explicitly included in the list.

If the parent of a dependent table is in the check pending state, the foreign key constraints of a dependent table cannot be marked to bypass checking (the check constraints checking can be bypassed).

The implications with respect to data integrity should be considered before using this option. See "Notes".

Notes

- Effects on tables in the check pending state:
  - Use of SELECT, INSERT, UPDATE, or DELETE is disallowed on a table that is either:

- in the check pending state itself
- or requires access to another table that is in the check pending state.

For example, a DELETE of a row in a parent table that cascades to a dependent table that is in the check pending state is not allowed.

– New constraints added to a table are normally enforced immediately. However, if the table is in check pending state the checking of any new constraints is deferred until the table is taken out of the check pending state.
– The CREATE INDEX statement cannot reference any tables that are in the check pending state. Similarly, ALTER TABLE to add a primary key or unique constraint cannot reference any tables that are in the check pending state.
– The utilities EXPORT, IMPORT, REORG, and REORGCHK are not allowed to operate on a table in the check pending state. Note that the IMPORT utility differs from the LOAD utility in that it always checks the constraints immediately.
– The utilities LOAD, BACKUP, RESTORE, ROLLFORWARD, UPDATE STATISTICS, RUNSTATS, LIST HISTORY, and ROLLFORWARD are allowed on a table in the check pending state.
– The statements ALTER TABLE, COMMENT ON, DROP TABLE, CREATE ALIAS, CREATE TRIGGER, CREATE VIEW, GRANT, REVOKE, and SET INTEGRITY can reference a table that is in the check pending state.
– Packages, views and any other objects that depend on a table that is in the check pending state will return an error when the table is accessed at run time.

The removal of violating rows by the SET INTEGRITY statement is not a delete event. Therefore, triggers are never activated by a SET INTEGRITY statement. Similarly, updating generated columns using the FORCE GENERATED option does not activate triggers.

• Because incremental processing is the default behavior, the INCREMENTAL option is not needed in most cases. It is needed, however, in two cases:
  – To force incremental processing on a table that was previously taken out of the check pending state with the IMMEDIATE UNCHECKED option. By default, the system chooses full processing to verify integrity of ALL data. This default behavior can be overridden by specifying the INCREMENTAL option to check only the newly appended portion. (Refer to the bullet "Warning about the use of IMMEDIATE UNCHECKED clause" for further details.)
  – To ensure that integrity checks are indeed processed incrementally. By specifying the INCREMENTAL option, the system returns an error (SQLSTATE 55019) when the system detects that full processing is needed to ensure data integrity.

- Warning about the use of the IMMEDIATE UNCHECKED clause:
  - This clause is intended to be used by utility programs and its use by application programs is not recommended.

    The fact that integrity checking was turned on without doing deferred checking will be recorded in the catalog (the value in the CONST_CHECKED column in the SYSCAT.TABLES view will be set to 'U'). This indicates that the user has assumed responsibility for data integrity with respect to the specific constraints. This value remains until either:

    - The table is put back into the check pending state (by referencing the table in a SET INTEGRITY statement with the OFF clause), at which time the 'U' values in the CONST_CHECKED column will be changed to the 'W' values, indicating that the user had previously assumed responsibility for data integrity and the system needs to verify the data.
    - All unchecked constraints for the table are dropped.
    - A REFRESH TABLE statement is issued for a summary table.

    The 'W' state differs from the 'N' state in that it records the fact that the integrity was previously checked by the user and not yet by the system, and if given a choice, the systems rechecks the whole table for data integrity and then changes it to the 'Y' state. If no choice is given (e.g. when IMMEDIATE UNCHECKED or INCREMENTAL is specified) it is changed back to the 'U' state to record that some data is still not verified by the system. In the latter (INCREMENTAL) case, a warning (SQLSTATE 01636) is returned.
- After appending data using Load Insert, the SET INTEGRITY ... IMMEDIATE CHECKED statement checks the table for constraint violation and then brings the table out of the check pending state. The system determines if incrementally processing on the table is possible. If so, only the appended portion is checked for integrity violations. If not, the system will check the whole table for integrity violations (see below for situations when the system favors full processing).
- Situations where the system checks the whole table for integrity when the user did not specify the INCREMENTAL option for the statement SET INTEGRITY for T IMMEDIATE CHECKED are:
  1. when the table T has one or more 'W' values in its CONST_CHECKED column in the SYSCAT.TABLES catalog.
- Situations in which the system must check the whole table for integrity (INCREMENTAL option cannot be specified) for the statement SET INTEGRITY for T IMMEDIATE CHECKED are:
  1. when new constraints have been added to T itself, or to any of its parents which are in check pending state

2. when a Load Replace has taken place into T, or the NOT LOGGED INITIALLY WITH EMPTY TABLE option has been activated after the last integrity check on T
3. (cascading effect of full processing) when any parent of T has been Load Replaced or checked for integrity non-incrementally
4. if the table was in check pending state before migration, full processing is required the first time the table is checked for integrity after migration
5. if the table space containing the table or its parent has been rolled forward to a point in time.

- A table that is in DataLink Reconcile Not Possible (DRNP) state requires corrective action to be taken (possibly outside of the database). Once corrective action is completed, the table is taken out of DRNP state using the IMMEDIATE UNCHECKED option. The RECONCILE command or API should then be used to check the DATALINK integrity constraints. For more details refer on removing a table from DataLink Reconcile Not Possible state refer to *Administration Guide*.
- While integrity is being checked an exclusive lock is held on each table specified in the SET INTEGRITY invocation.
- A shared lock is acquired on each table that is not listed in the SET INTEGRITY invocation but is a parent table of one of the dependent tables being checked.
- If an error occurs during integrity checking, all the effects of the checking including deleting from the original and inserting into the exception tables will be rolled back.
- If a SET INTEGRITY statement issued with a FORCE GENERATED clause fails because of a lack of log space, and log space cannot be sufficiently increased, the **db2gncol** command can be used to generate the values by using intermittent commits. SET INTEGRITY can then be rerun, without the FORCE GENERATED clause.

Example

Example 1: The following is an example of a query that gives us information about the check pending state of tables. SUBSTR is used to extract the first 2 bytes of the CONST_CHECKED column of SYSCAT.TABLES. The first byte represents foreign key constraints, and the second byte represents check constraints.

```
SELECT TABNAME,
  SUBSTR( CONST_CHECKED, 1, 1 ) AS FK_CHECKED,
  SUBSTR( CONST_CHECKED, 2, 1 ) AS CC_CHECKED
  FROM SYSCAT.TABLES
  WHERE STATUS = 'C'
```

Example 2: Set tables T1 and T2 in the check pending state:

```
SET INTEGRITY FOR T1, T2 OFF
```

Example 3: Check the integrity for T1 and get the first violation only:

```
SET INTEGRITY FOR T1 IMMEDIATE CHECKED
```

Example 4: Check the integrity for T1 and T2 and put the violating rows into exception tables E1 and E2:

```
SET INTEGRITY FOR T1, T2 IMMEDIATE CHECKED
   FOR EXCEPTION IN T1 USE E1,
                 IN T2 USE E2
```

Example 5: Enable FOREIGN KEY constraint checking in T1 and CHECK constraint checking in T2 to be bypassed with the IMMEDIATE CHECKED option:

```
SET INTEGRITY FOR T1 FOREIGN KEY,
                  T2 CHECK IMMEDIATE UNCHECKED
```

Example 6: Add a check constraint and a foreign key to the EMP_ACT table, using two ALTER TABLE statements. To perform constraint checking in a single pass of the table, integrity checking is turned off before the ALTER statements and checked after execution.

```
SET INTEGRITY FOR EMP_ACT OFF;
ALTER TABLE EMP_ACT ADD CHECK (EMSTDATE <= EMENDATE);
ALTER TABLE EMP_ACT ADD FOREIGN KEY (EMPNO) REFERENCES EMPLOYEE;
SET INTEGRITY FOR EMP_ACT IMMEDIATE CHECKED
```

Example 7: Set integrity for generated columns.

```
SET INTEGRITY FOR T1 IMMEDIATE CHECKED
   FORCE GENERATED
```