SQL Data Definition and Data Manipulation Languages (DDL and DML)

Data Definition Language.

Creating a Relation

`CREATE TABLE` *Name* (
attribute-declarations
constraint-declarations
)

Attribute declarations:

AttName AttType [default *expression*] [*ColConstraints*]

Constraints

Column constraints:

`[constraint <ConstName>] [NOT] NULL :` Not null constraint.

`[constraint <ConstName>] PRIMARY KEY:` Primary key constraint (when the primary key consists of exactly one attribute, otherwise, use constraint declaration).

`[constraint <ConstName>] UNIQUE :` Key constraint (when the key consists of exactly one attribute, otherwise, use constraint declaration).

`[constraint <ConstName>] REFERENCES <Table>[(<AttName>)] [ON DELETE CASCADE]:` Foreign key constraint (when the foreign key consists of exactly one attribute, otherwise, use constraint declaration). `ON DELETE CASCADE` specifies that all rows containing a no longer existing value for must be deleted.

`[constraint <ConstName>] CHECK (<condition>):` any additional constraint on the value of the element in the table.

Constraint declarations:

`[constraint <ConstName>] PRIMARY KEY (<AttNames>):` Primary key constraint. Use when the primary key includes multiple attributes.

`[constraint <ConstName>] UNIQUE (<AttNames>):` Key constraint. Use when the key includes multiple attributes.

`[constraint <ConstName>] FOREIGN KEY (<AttNames>) REFERENCES <Table> [(<AttNames>)]:` Foreign key constraint. Use when the foreign key involve multiple attributes.

All column constraints except for not null constraint can only be used if the appropriate constraint (e.g., primary key) is associated with exactly one attribute. (i.e., if your primary key is two attributes, use the constraint declaration, rather than column constraint).

Types

Integer	`INTEGER` or `INT` `SHORTINT`
Real	`FLOAT` or `REAL` or `DOUBLE PRECISION`
Fixed Point	`DECIMAL`(n, d) n - number of digits d - number of decimals `NUMBER`(n, d) (Oracle)
Strings	`CHAR`(n) n - length of string, max=255 `VARCHAR`(n), `VARCHAR2(n)` (Oracle) n - length of string, max = 2000
Bit Strings	`BIT`(n) `BIT VARYING`(n)
Boolean	`BOOLEAN` values: `TRUE`, `FALSE`, `UNKNOWN`
Dates	`DATE` formatted as a string, converted to INT internally

Examples

```
CREATE TABLE Books (
    LibCode    INT,
    ISBN       CHAR(20),
    Title      CHAR(80),
    Authors    CHAR(60),
    Year       INT,
    Publisher  CHAR(20),
    PurchPrice REAL,
    TakeHome   BOOLEAN,
    PRIMARY KEY (LibCode),
    UNIQUE  (ISBN)
    );

CREATE TABLE Employees (
    SSN  INT PRIMARY KEY CHECK(SSN > 0),
    Name CHAR(30) NOT NULL,
    Department  INT REFERENCES Departments,
    Salary  FLOAT  NOT NULL CHECK(Salary >= 20000.00)
    Position CHAR(30) DEFAULT 'Not Specified',
    StartYear INT CHECK(StartYear > 1992)
     );

CREATE TABLE Departments (
    DeptID INT PRIMARY KEY,
    Name CHAR(30) UNIQUE,
    Head INT CHECK(Head > 0),
    FOREIGN KEY(Head) REFERENCES Employees
    );
```

Deleting a Table

`DROP TABLE` *Name* [CASCADE CONSTRAINTS]

Example:

```
DROP TABLE Books;

DROP TABLE Departments CASCADE CONSTRAINTS
```

In the latter case, all referential integrity constraints (foreign keys) are **dropped** from their respective tables, after `Departments` table is deleted.

Modifying a Table

- Adding an attribute

  `ALTER TABLE` *Name*
  `ADD` ([*AttName Type*]+)

  Example:

  ```
  ALTER TABLE  Books
         ADD (Genre CHAR(10),
              NumPages INT);
  ```

- Deleting an attribute

  `ALTER TABLE` *Name*
  `DROP` (*AttName*+)

  Example:

```
ALTER TABLE  Books
       DROP (Year);
```

- Modifying an attribute

  `ALTER TABLE` *Name*
  `MODIFY` ([*AttName Type*]+)

  Example:

```
ALTER TABLE  Books
       MODIFY (Genre VARCHAR2(30));
```

Data Manipulation Language

Inserting a Tuple

`INSERT INTO` *TableName(AttNames)*
`VALUES(`*values* `)`

`values` — comma-separated list of values. The number of values must match the number attribute names in *AttNames*, and the types must be compatible.

`INSERT INTO` *TableName*
`VALUES(`*values* `)`

Values for all attributes must be given and in the order in which attributes were defined in `CREATE TABLE` command.

Examples:

```
INSERT INTO Books(LibCode,Title,Year)
VALUES (12349, ‘‘Database Management Systems’’, 2000);

INSERT INTO Books
VALUES (15923, ‘‘1-56592-000-7’’,‘‘Lex \& Yacc’’,
        ‘‘J. Levine, T. Mason, D. Brown’’, 1990,
         ‘‘O’Reily’’, 29.95, True);
```

Deleting Tuples

`DELETE FROM` *TableName*
`WHERE` *Expression*

Expression identifies the properties of tuples to be removed from the table.

Examples:

```
DELETE FROM Books
WHERE Year < 1950
```

```
DELETE FROM Books
WHERE LibCode = 12349;

DELETE FROM Books
WHERE PurchPrice > 100.00 AND Year < 1950;
```

Updating Tuples

`UPDATE` *TableName*
`SET` *Assignments*
`WHERE` *Expression*

Expression identifies tuples to be updated. *Assignments* specifies modifications.

Examples:

```
UPDATE Books
SET Year = 2003
WHERE Year > 2003;

UPDATE Books
SET Year = Year - 1;
WHERE Year > 2000;

UPDATE Books
SET TakeHome = True;
```