Lecture 7

SQL : Schema Definition, Constraints, and Queries and Views

SQL is an abbreviation of "Structured Query Language"

▶ The SQL has the Data definition language (DDL) and Data Manipulation Language (DML)

▶ DDL used to CREATE, DROP, and ALTER the descriptions of the tables (relations) of a database

▶ SQL provides four DML statements SELECT, UPDATE, DELETE, and INSERT.

Data Definition Language (DDL)

The available DDL statements of SQL are :

1. **CREATE TABLE   CREATE DOMAIN**
   CREATE VIEW   CREATE SCHEMA
2. **ALTER TABLE   ALTER DOMAIN**
3. **DROP TABLE   DROP DOMAIN**
   DROP   VIEW   DROP SCHEMA

Base tables are the relations, while the view tables are the views of the users to some relations.

Relational Database Schema

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Populated Database

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPT_LOCATIONS

DNUMBER	DLOCATION
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

WORKS_ON

ESSN	PNO	HOURS
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	null

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
333445555	Alice	F	1986-04-05	DAUGHTER
333445555	Theodore	M	1983-10-25	SON
333445555	Joy	F	1958-05-03	SPOUSE
987654321	Abner	M	1942-02-28	SPOUSE
123456789	Michael	M	1988-01-04	SON
123456789	Alice	F	1988-12-30	DAUGHTER
123456789	Elizabeth	F	1967-05-05	SPOUSE

CREATE TABLE

The general format for this statement is:

CREATE TABLE base-table-name

(column-definition [,column-definition]….

[, primary-key-definition]

[, foreign-key-definition[, foreign-key-definition]….);

Where a "column-definition" has the form:

Column-name data-type [NOT NULL]

Data Types: Numeric data

▶ **INTEGER**   Signed full word binary integer

▶ **SMALLINT** Signed half word binary integer

▶ **DECIMAL(p,q)** or **NUMBER(p,q)**

  Signed packed decimal number p digits and sign with assumed decimal point q digits

▶ **FLOAT**   Signed floating point number

String data

CHARACTER(n) or **CHAR(n)**

   Fixed length string of exactly n 8-bit characters.

VARCHAR(n)   Varying length string of up to n 8-bit characters.

GRAPHIC(n)   Fixed length string of exactly n 16-bit characters.

VARGRAPHIC(n)   Varying length string of up to n 16-bit characters.

Date and Time

- **DATE**   date (yyyy-mm-dd)

- **TIME**   time (hh:mm:ss)

- **TIMESTAMP**   combination of date and time

- **TIME(i):**

  - Made up of hour:minute:second plus i additional digits specifying fractions of a second

  - format is hh:mm:ss:ii...i

CREATE TABLE : Example

A constraint NOT NULL may be specified on an attribute

```
CREATE TABLE DEPARTMENT (
DNAME     VARCHAR(10)NOT NULL,
DNUMBER   INTEGER   NOT NULL,
MGRSSN    CHAR(9),
MGRSTARTDATE CHAR(9)   );
```

Candidate and Primary key

▶ For candidate key we use the following format and it may appear more than one :

UNIQUE (col_commalist)

▶ For PRIMARY key we use the following format and it is used only once in each table definition.

PRIMARY KEY (col_commalist)

CREATE TABLE : EXAMPLE

```
CREATE TABLE DEPT (
   DNAME VARCHAR(10) NOT NULL,
   DNUMBER INTEGER   NOT NULL,
   MGRSSN   CHAR(9),
   MGRSTARTDATE CHAR(9),
   PRIMARY KEY (DNUMBER),
   UNIQUE (DNAME),
   FOREIGN KEY (MGRSSN)
   REFERENCES EMP   );
```

CREATE TABLE : EXAMPLE

```
CREATE TABLE WORKS-ON (
  ESSN  INTEGER  NOT NULL,
  PNO   INTEGER  NOT NULL,
  HOURS FLOAT,
  PRIMARY KEY (ESSN,PNO),
  FOREIGN KEY (ESSN) REFERENCES EMP(SSN),
  FOREIGN KEY (PNO) REFERENCES PROJECT(PNUMBER)
         );
```

Foreign keys

FOREIGN KEY (col_commalist)

REFERENCE base_table [col-commalist]

    [ON DELETE option]

    [ON UPDATE option]

Option may be:

    CASCADE, SET NULL, SET DEFAULT or RESTRICT

REFERENTIAL INTEGRITY OPTIONS

```
CREATE TABLE DEPT (
    DNAME       VARCHAR(10) NOT NULL,
    DNUMBER   INTEGER       NOT NULL,
    MGRSSN    CHAR(9),
    MGRSTARTDATE    CHAR(9),
    PRIMARY KEY (DNUMBER),
    UNIQUE (DNAME),

FOREIGN KEY (MGRSSN) REFERENCES EMP
    ON DELETE RESTRICT

    ON UPDATE CASCADE);
```

REFERENTIAL INTEGRITY OPTIONS

```
CREATE TABLE EMP(
  ENAME    VARCHAR(30)  NOT NULL,
  ESSN     CHAR(9),
  BDATE    DATE,
  DNO      INTEGER  DEFAULT 1,
  SUPERSSN  CHAR(9),
  PRIMARY KEY (ESSN),
  FOREIGN KEY (DNO) REFERENCES DEPT
  ON DELETE    SET DEFAULT
   ON UPDATE   CASCADE,
  FOREIGN KEY(SUPERSSN) REFERENCES EMP
  ON DELETE SET NULL
   ON UPDATE CASCADE);
```

DROP TABLE

▶ Used to remove a relation (base table) and its definition

▶ The relation can no longer be used in queries, updates, or any other commands since its description no longer exists

▶   The general format is:

DROP TABLE base-table-name option;

Option: CASCADE or RESTRICT

ALTER TABLE

▶ Used to add or drop an attribute to one of the base relations

  ▪ When add new attribute, it will have NULLs in all the tuples of the relation right after the command is executed; hence, the NOT NULL constraint is not allowed for such an attribute

▶ The general format :

ALTER TABLE base-table-name   ADD column-name   data-type;

ALTER TABLE base-table-name   DROP column-name   option;

ALTER TABLE

▶ Example:

ALTER TABLE EMPLOYEE ADD JOB VARCHAR(12);

▶ The database users must still enter a value for the new attribute JOB for each EMPLOYEE tuple.

  ▪ This can be done using the UPDATE command.

ALTER TABLE

▶ To drop an attribute, we must use option (RESTRICT or CASCADE)

▶ EXAMPLE:

   ALTER TABLE EMPLOYEE DROP ADDRESS CASCADE;

That means all constraints and views that reference that attribute will be dropped too.

DROP TABLE

▶ Example:

DROP TABLE DEPENDENT CASCADE;

DEPENDENT table will be removed from the system with all views based on that table.

CREATE and DROP SCHEMA

▶ Specifies a new database schema by giving it a name

CREATE SCHEMA COMPANY **AUTHORIZATION** JOHN;

▶ DROP a schema with option

   DROP SCHEMA COMPANY RESTRICT;

That means drop schema if it has no elements in it