Database Systems Lab

SESSION 8

SQL Data Definition Language

SQL is a non-procedural relational database language. SQL mainly contains two main sub-components: Data Definition Language (DDL) and Data Manipulation Language (DML).

DDL is useful for implementing a relational schema in a given relational database. It is mainly comprise of:

- CREATE statements
- ALTER statements
- DROP statements

DML is useful working with the actual data. DML is comprised of the following:

- SELECT
- INSERT
- UPDATE
- DELETE

The focus for this lab session is DDL.

Tasks to be completed

A) Installation

1. RDBMS Installation: Install the DBMS software as per the instructions specified in the product document. For MySQL, you can find the instructions here: http://dev.mysql.com/downloads/mysql/. On Ubuntu, you can run the following command to install and assign the password for your installation:

```
sudo apt-get install mysql-server
```

2. Client Installation: All RDBMS can work with a variety of client tools. Some client tools provide a graphical user interface to the database. You must NOT use any GUI clients for your activities. For MySQL, everyone must be familiar and be comfortable using the command line tool called "mysql". So there must not be any need for any separate client installation on your machines:

   You can login using the following command and confirm the version:

```
mysql -u root –p

System must take you to the mysql prompt

mysql> select version();
mysql> quit
```

B) DDL Scripts

Implement the Company Database schema ("company_handout.pdf") using the database definition guidelines and database manipulation guidelines given in this document. As part of the implementation, you must create and upload the following SQL scripts that follow the given guidelines:

1. companydb_create.sql
2. companydb_alter.sql
3. companydb_drop.sql
4. companydb_data.sql

C) Database Definition Guidelines

1. First create an empty database using the procedure appropriate for the respective DBMS. For example, in MySQL, you can use the following commands to inspect the schema:

```
mysql> create database companydb;
mysql> use companydb;
mysql> show tables;
```

2. Have the relational schema design ready on paper. Having it in tabular form that we discussed will make it easier.
3. Full documentation on SQL DDL can be found here: http://dev.mysql.com/
4. The relation schema design must be implemented using a combination of three DDL script files as noted below:
    a. "CREATE" scripts: Create ONE large script file called **dbname_create.sql** (where dbname is replaced by the short name of the database; e.g., companydb_create.sql). This script file should contain:
        i. Basic CREATE TABLE statements for each table in the schema
        ii. PK Constraint against the appropriate attribute
        iii. NOT NULL constraints as applicable attributes
        iv. Do NOT include any FK constraints yet.

    Example for one table:

```
create table department(
    dname varchar(30) NOT NULL,
    dnumber smallint,
    mgr_ssn char(6),
    mgr_start_date date,
    constraint pk_department PRIMARY KEY (dnumber)
);
```

Useful mysql data types:

Character data types	CHAR(20) / *fixed length */
	VARCHAR(20) /* variable length */
Numeric data types	TINYINT (1 byte)
	SMALLINT (2 bytes)
	MEDIUMINT (3 bytes)
	INT (4 bytes)
	BIGINT (8 bytes)
	DECIMAL(p,s) FLOAT(p,s) p → Total number of digits s → Number of digits after the decimal point
Temporal Data Types	Date (default format YYYY-MM-DD)
	Datetime (default format YYYY-MM-DD HH:MI:SS)

b. "ALTER" scripts: Create ONE large script file called dbname_alter.sql (e.g., companydb_alter.sql). This script file should contain:

   i. ALTER TABLE statements to add foreign key constraints for each table as applicable.

   ii. ALTER TABLE statements to add any further semantic constraints as applicable.

Example for one table:

```
alter table employee
    add constraint fk_super_ssn FOREIGN KEY (super_ssn)
REFERENCES employee(ssn);
```

c. "DROP" scripts: Create ONE large script file called dbname_drop.sql (e.g., companydb_drop.sql). This script file should contain:

   i. ALTER TABLE statements to drop each of the FKs that were added.

Example for one table:

```
alter table employee
    drop FOREIGN KEY fk_super_ssn;
```

   ii. DROP TABLE statements to drop each of the tables.

Example for one table:

```
drop table employee;
```

D) Database Manipulation Guidelines

1. Insert rows into the database as per the data present in the handout. For attributes pertaining to the FK, assign NULL values. Example for one row given below:

```
insert into employee(fname, minit, lname, ssn, bdate, address,
sex, salary, super_ssn, dno)
VALUES('John','B','Smith','123456789','1965-01-09','731,
Fondren, Houston, TX','M',30000,NULL,NULL);
```

2. Update rows with appropriate foreign keys as per the handout. For example:

```
update employee
set super_ssn = '333445555', dno=5
where ssn='123456789';
```

3. You can check the entered data using the following simple SQL select statements:

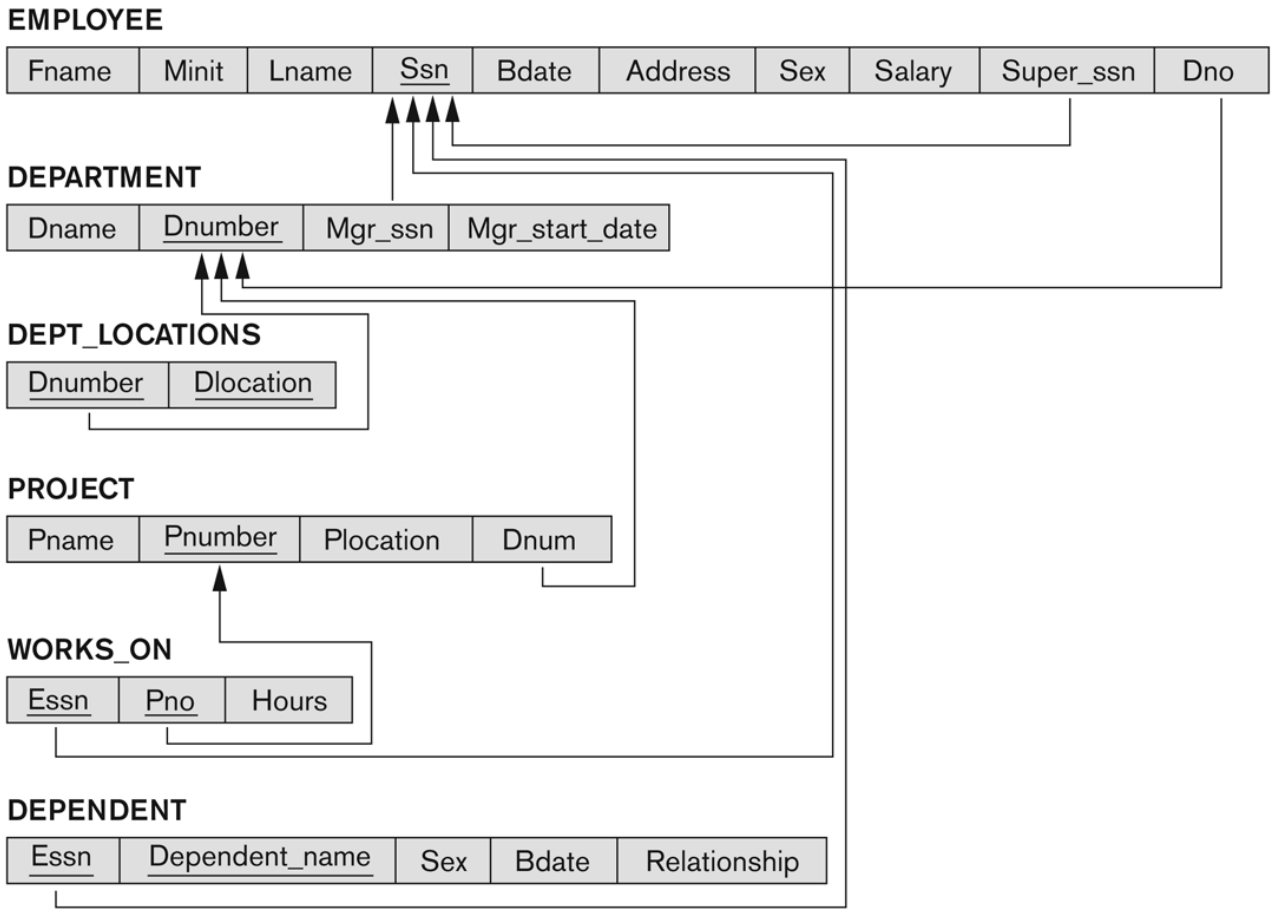
```
select * from employee;

select ssn, fname
from employee;

select ssn, fname
from employee
where ssn = '123456789';

select ssn "ID Number", fname "FirstName"
from employee
where ssn = '123456789';
```

What to upload

1. Zip file containing the following scripts:
    a. companydb_create.sql
    b. companydb_alter.sql
    c. companydb_drop.sql
    d. companydb_data.sql

Referential Integrity Constraints for COMPANY database

Figure 5.7
Referential integrity constraints displayed on the COMPANY relational database schema.



Populated database state for COMPANY

Figure 5.6
One possible database state for the COMPANY relational database schema.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	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	1968-01-19	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

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

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