UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN

DATABASE SYSTEMS LAB

LAB 3

To understand DDL and DML Command

MTECH-COMPUTER SCIENCE
ENGINEERING
CYBER SECURITY AND FORENSICS

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Title: To understand DDL and DML Command

Objective: To understand the concept of designing issue related to the database with creating, populating the tables. To understand the concept of data constraints that is enforced on data being stored in the table. Focus on Primary Key and the Foreign Key.

   a. **Create the tables for Company database as per ER diagram of Exp 2.**
   b. **Insert the following data into their respective tables of Company database.**

DDL (Data Definition Language) : defines structure of database objects

DDL Commands are blueprint commands. Used to create, change, or remove the structure of the database. Exp: CREATE, ALTER, DROP, TRUNCATE, RENAME.

```
 6 ● ⊕ CREATE TABLE Department (
14
15 ● ⊕ CREATE TABLE Employee (
30
31 ●    ALTER TABLE Department
32        ADD CONSTRAINT fk_mgr FOREIGN KEY (Mgr_ssn) REFERENCES Employee(Ssn);
33
34 ● ⊕ CREATE TABLE Dept_Locations (
40
41 ● ⊕ CREATE TABLE Project (
50
51 ● ⊕ CREATE TABLE Works_On (
59
60 ● ⊕ CREATE TABLE Dependent (
```

```
 6 ● ⊖ CREATE TABLE Department (
 7  │   Dname VARCHAR(15) NOT NULL,
 8  │   Dnumber INT NOT NULL,
 9  │   Mgr_ssn CHAR(9),
10  │   Mgr_start_date DATE,
11  │   PRIMARY KEY (Dnumber),
12  │   UNIQUE (Dname)
13  └   );
14
15 ● ⊖ CREATE TABLE Employee (
16  │    Fname VARCHAR(15) NOT NULL,
17  │    Minit CHAR,
18  │    Lname VARCHAR(15) NOT NULL,
19  │    Ssn CHAR(9) NOT NULL,
20  │    Bdate DATE,
21  │    Address VARCHAR(30),
22  │    Sex CHAR,
23  │    Salary DECIMAL(10,2),
24  │    Super_ssn CHAR(9),
25  │    Dno INT NOT NULL,
26  │    PRIMARY KEY (Ssn),
27  │    FOREIGN KEY (Super_ssn) REFERENCES Employee(Ssn),
28  │    FOREIGN KEY (Dno) REFERENCES Department(Dnumber)
29  └   );
```

```
31 ●    ALTER TABLE Department
32        ADD CONSTRAINT fk_mgr FOREIGN KEY (Mgr_ssn) REFERENCES Employee(Ssn);
33
34 ● ⊖ CREATE TABLE Dept_Locations (
35  │   Dnumber INT NOT NULL,
36  │   Dlocation VARCHAR(15) NOT NULL,
37  │   PRIMARY KEY (Dnumber, Dlocation),
38  │   FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber)
39  └   );
40
41 ● ⊖ CREATE TABLE Project (
42  │   Pname VARCHAR(15) NOT NULL,
43  │   Pnumber INT NOT NULL,
44  │   Plocation VARCHAR(15),
45  │   Dnum INT NOT NULL,
46  │   PRIMARY KEY (Pnumber),
47  │   UNIQUE (Pname),
48  │   FOREIGN KEY (Dnum) REFERENCES DEPARTMENT(Dnumber)
49  └   );
50
51 ● ⊖ CREATE TABLE Works_On (
52  │   Essn CHAR(9) NOT NULL,
53  │   Pno INT NOT NULL,
54  │   Hours DECIMAL(3,1) NOT NULL,
55  │   PRIMARY KEY (Essn, Pno),
56  │   FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn),
57  │   FOREIGN KEY (Pno) REFERENCES PROJECT(Pnumber)
58  └   );
60 ● ⊖ CREATE TABLE Dependent (
61  │   Essn CHAR(9) NOT NULL,
62  │   Dependent_name VARCHAR(15) NOT NULL,
63  │   Sex CHAR,
64  │   Bdate DATE,
65  │   Relationship VARCHAR(8),
66  │   PRIMARY KEY (Essn, Dependent_name),
67  │   FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn)
68  └   );
```

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DML (Data Manipulation Language) : manipulates the data inside the tables

DML are the everyday use commands. Used to add, change, delete, or read the actual data inside the database. Exp: INSERT, UPDATE, DELETE, SELECT.

```
70 ●  INSERT INTO Department (Dname, Dnumber, Mgr_ssn, Mgr_start_date)        102 ●    INSERT INTO Project (Pname, Pnumber, Plocation, Dnum)
71     VALUES                                                                 103      VALUES
72     ('Research', 5, NULL, '1988-05-22'),                                   104      ('ProductX', 1, 'Bellaire', 5),
73     ('Administration', 4, NULL, '1995-01-01'),                             105      ('ProductY', 2, 'Sugarland', 5),
74     ('Headquarters', 1, NULL, '1981-06-19');                               106      ('ProductZ', 3, 'Houston', 5),
75                                                                            107      ('Computerization', 10, 'Stafford', 4),
76 ●  INSERT INTO Employee (Fname, Minit, Lname, Ssn, Bdate, Address, Sex, Salary, Super_ssn, Dno)    108      ('Reorganization', 20, 'Houston', 1),
77     VALUES                                                                 109      ('Newbenefits', 30, 'Stafford', 4);
78     ('Franklin', 'T', 'Wong', '333445555', '1955-12-08', '638 Voss, Houston, TX', 'M', 40000, NULL, 5),    110
79     ('Jennifer', 'S', 'Wallace', '987654321', '1941-06-20', '291 Berry, Bellaire, TX', 'F', 43000, NULL, 4),    111 ●    INSERT INTO Works_On (Essn, Pno, Hours)
80     ('James', 'E', 'Borg', '888665555', '1937-11-10', '450 Stone, Houston, TX', 'M', 55000, NULL, 1);    112      VALUES
81                                                                            113      ('123456789', 1, 32.5),
82 ●  UPDATE Department SET Mgr_ssn = '333445555' WHERE Dnumber = 5;          114      ('123456789', 2, 7.5),
83 ●  UPDATE Department SET Mgr_ssn = '987654321' WHERE Dnumber = 4;          115      ('666884444', 3, 40.0),
84 ●  UPDATE Department SET Mgr_ssn = '888665555' WHERE Dnumber = 1;          116      ('453453453', 1, 20.0),
85                                                                            117      ('453453453', 2, 20.0),
86 ●  INSERT INTO Employee (Fname, Minit, Lname, Ssn, Bdate, Address, Sex, Salary, Super_ssn, Dno)    118      ('333445555', 2, 10.0),
87     VALUES                                                                 119      ('333445555', 3, 10.0),
88     ('John', 'B', 'Smith', '123456789', '1965-01-09', '731 Fondren, Houston, TX', 'M', 30000, '333445555', 5),    120      ('333445555', 10, 10.0),
89     ('Alicia', 'J', 'Zelaya', '999887777', '1968-01-19', '3321 Castle, Spring, TX', 'F', 25000, '987654321', 4),    121      ('333445555', 20, 10.0),
90     ('Ramesh', 'K', 'Narayan', '666884444', '1962-09-15', '975 Fire Oak, Humble, TX', 'M', 38000, '333445555', 5),    122      ('999887777', 30, 30.0),
91     ('Joyce', 'A', 'English', '453453453', '1972-07-31', '5631 Rice, Houston, TX', 'F', 25000, '333445555', 5),    123      ('999887777', 10, 10.0),
92     ('Ahmad', 'V', 'Jabbar', '987987987', '1969-03-29', '980 Dallas, Houston, TX', 'M', 25000, '987654321', 4);    124      ('987987987', 10, 35.0),
93                                                                            125      ('987987987', 30, 5.0),
94 ●  INSERT INTO Dept_Locations (Dnumber, Dlocation)                         126      ('987654321', 30, 20.0),
95     VALUES                                                                 127      ('888665555', 20, 0);
96     (1, 'Houston'),
97     (4, 'Stafford'),
98     (5, 'Bellaire'),
99     (5, 'Sugarland'),              129 ●    INSERT INTO Dependent (Essn, Dependent_name, Sex, Bdate, Relationship)
100    (5, 'Houston');                130      VALUES
---                                   131      ('333445555', 'Alice', 'F', '1976-04-05', 'Daughter'),
                                      132      ('333445555', 'Theodore', 'M', '1973-10-25', 'Son'),
                                      133      ('333445555', 'Joy', 'F', '1948-05-03', 'Spouse'),
                                      134      ('987654321', 'Abner', 'M', '1932-02-29', 'Spouse'),
                                      135      ('123456789', 'Michael', 'M', '1988-01-04', 'Son'),
                                      136      ('123456789', 'Alice', 'F', '1988-12-30', 'Daughter'),
                                      137      ('123456789', 'Elizabeth', 'F', '1967-05-05', 'Spouse');
                                      138
```

1. Created tables using *CREATE DATABASE;*
2. Insert data in the query using *INSERT INTO;*

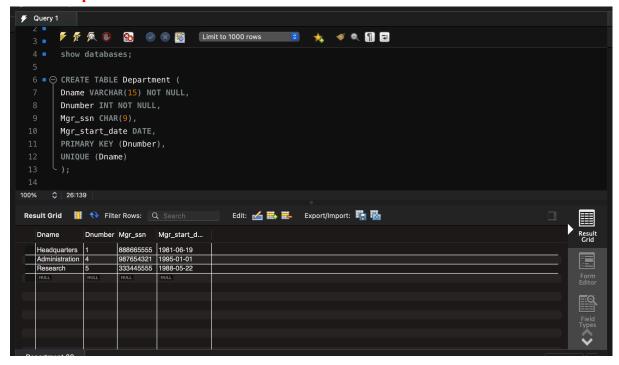   While creating tables I encountered various errors which are listed at the end of the document.

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Table1: Department


```
show databases;

CREATE TABLE Department (
Dname VARCHAR(15) NOT NULL,
Dnumber INT NOT NULL,
Mgr_ssn CHAR(9),
Mgr_start_date DATE,
PRIMARY KEY (Dnumber),
UNIQUE (Dname)
);
```

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

Table 2: Employee


```
CREATE TABLE Employee (
    Fname VARCHAR(15) NOT NULL,
    Minit CHAR,
    Lname VARCHAR(15) NOT NULL,
    Ssn CHAR(9) NOT NULL,
    Bdate DATE,
    Address VARCHAR(30),
    Sex CHAR,
    Salary DECIMAL(10,2),
    Super_ssn CHAR(9),
    Dno INT NOT NULL,
    PRIMARY KEY (Ssn),
    FOREIGN KEY (Super_ssn) REFERENCES Employee(Ssn),
    FOREIGN KEY (Dno) REFERENCES Department(Dnumber)
);
```

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000.00	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000.00	NULL	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000.00	333445555	5
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000.00	333445555	5
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000.00	NULL	1
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000.00	NULL	4
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000.00	987654321	4
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000.00	987654321	4
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

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Table 3: Dept_Locations


```
30
31
32        ADD CONSTRAINT fk_mgr FOREIGN KEY (Mgr_ssn) REFERENCES Employee(Ssn);
33
34  ⊖ CREATE TABLE Dept_Locations (
35    Dnumber INT NOT NULL,
36    Dlocation VARCHAR(15) NOT NULL,
37    PRIMARY KEY (Dnumber, Dlocation),
38    FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber)
39  );
40
41  ⊕ CREATE TABLE Project (
50
```

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

Table 4: Project


```
40
41  ⊖ CREATE TABLE Project (
42    Pname VARCHAR(15) NOT NULL,
43    Pnumber INT NOT NULL,
44    Plocation VARCHAR(15),
45    Dnum INT NOT NULL,
46    PRIMARY KEY (Pnumber),
47    UNIQUE (Pname),
48    FOREIGN KEY (Dnum) REFERENCES DEPARTMENT(Dnumber)
49  );
50
```

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
NULL	NULL	NULL	NULL

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Table 5: Works_On

Table 6: Dependent

ERRORS ENCOUNTERED / RESOLVED:

1. **CREATE TABLE Employee (Fname VARCHAR(15) NOT NULL,   Minit CHAR,   Lname VARCHAR(15) NOT NULL,   Ssn CHAR(9) NOT NULL,   Bdate DATE,   Address VARCHAR(30),   Sex CHAR,   Salary DECIMAL(10,2),   Super_ssn CHAR(9),   Dno INT NOT NULL,   PRIMARY KEY (Ssn),   FOREIGN KEY (Super_ssn) REFERENCES Employee(Ssn),   FOREIGN KEY (Dno) REFERENCES Department(Dnumber))**

   Error Code: 1824. Failed to open the referenced table 'Department'   0.0056 sec

2. **CREATE TABLE Department (Dname VARCHAR(15) NOT NULL, Dnumber INT NOT NULL, Mgr_ssn CHAR(9) NOT NULL, Mgr_start_date DATE, PRIMARY KEY (Dnumber), UNIQUE (Dname), FOREIGN KEY (Mgr_ssn) REFERENCES Employee(Ssn))**

   Error Code: 1824. Failed to open the referenced table 'Employee'   0.0017 sec

Employee was referenced to Department & Department was Referenced to Employee

Problem Query:

TABLE 1: EMPLOYEE
[Fname VARCHAR(15) NOT NULL,
Minit CHAR,
Lname VARCHAR(15) NOT NULL,
Ssn CHAR(9) NOT NULL,
Bdate DATE,
Address VARCHAR(30),
Sex CHAR,
Salary DECIMAL(10,2),
Super_ssn CHAR(9),
Dno INT NOT NULL,
PRIMARY KEY (Ssn),
FOREIGN KEY (Super_ssn) REFERENCES EMPLOYEE(Ssn),
FOREIGN KEY (Dno) REFERENCES DEPARTMENT(Dnumber)]

TABLE 2: DEPARTMENT
[Dname VARCHAR(15) NOT NULL,
Dnumber INT NOT NULL,
Mgr_ssn CHAR(9) NOT NULL,
Mgr_start_date DATE,
PRIMARY KEY (Dnumber),
UNIQUE (Dname),
FOREIGN KEY (Mgr_ssn) REFERENCES EMPLOYEE(Ssn));]

Resolved Query:

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```
 6  • ⊖ CREATE TABLE Department (
 7    │  Dname VARCHAR(15) NOT NULL,
 8    │  Dnumber INT NOT NULL,
 9    │  Mgr_ssn CHAR(9),
10    │  Mgr_start_date DATE,
11    │  PRIMARY KEY (Dnumber),
12    │  UNIQUE (Dname)
13    └  );
14
15  • ⊖ CREATE TABLE Employee (
16    │    Fname VARCHAR(15) NOT NULL,
17    │    Minit CHAR,
18    │    Lname VARCHAR(15) NOT NULL,
19    │    Ssn CHAR(9) NOT NULL,
20    │    Bdate DATE,
21    │    Address VARCHAR(30),
22    │    Sex CHAR,
23    │    Salary DECIMAL(10,2),
24    │    Super_ssn CHAR(9),
25    │    Dno INT NOT NULL,
26    │    PRIMARY KEY (Ssn),
27    │    FOREIGN KEY (Super_ssn) REFERENCES Employee(Ssn),
28    │    FOREIGN KEY (Dno) REFERENCES Department(Dnumber)
29    └  );
30
31  •    ALTER TABLE Department
32         ADD CONSTRAINT fk_mgr FOREIGN KEY (Mgr_ssn) REFERENCES Employee(Ssn);
```

3. **INSERT INTO Department (Dname, Dnumber, Mgr_ssn, Mgr_start_date) VALUES ('Research', 5, '000000000', '1988-05-22'), ('Administration', 4, '000000000', '1995-01-01'), ('Headquarters', 1, '000000000', '1981-06-19')**

   Error Code: 1452. Cannot add or update a child row: a foreign key constraint fails (`lab3db`.`department`, CONSTRAINT `fk_mgr` FOREIGN KEY (`Mgr_ssn`) REFERENCES `employee` (`Ssn`))   0.0017 sec

To resolve this we changed "Mgr_ssn" from NOT NULL to NULL accepted.

```
 3  ⊖ CREATE TABLE Department (
 4  │  Dname VARCHAR(15) NOT NULL,
 5  │  Dnumber INT NOT NULL,
 6  │  Mgr_ssn CHAR(9),
 7  │  Mgr_start_date DATE,
```

Due to encountering errors again I took another approach. First I inserted data to the Department table with Mgr_ssn = NULL. Secondly I inserted the provided data to the Employee table, after that I updated Mgr_ssn to the Department table.

```sql
60  CREATE TABLE Dependent (
69
70  INSERT INTO Department (Dname, Dnumber, Mgr_ssn, Mgr_start_date)
71  VALUES
72  ('Research', 5, NULL, '1988-05-22'),
73  ('Administration', 4, NULL, '1995-01-01'),
74  ('Headquarters', 1, NULL, '1981-06-19');
75
76  INSERT INTO Employee (Fname, Minit, Lname, Ssn, Bdate, Address, Sex, Salary, Super_ssn, Dno)
77  VALUES
78  ('Franklin', 'T', 'Wong', '333445555', '1955-12-08', '638 Voss, Houston, TX', 'M', 40000, NULL, 5),
79  ('Jennifer', 'S', 'Wallace', '987654321', '1941-06-20', '291 Berry, Bellaire, TX', 'F', 43000, NULL, 4),
80  ('James', 'E', 'Borg', '888665555', '1937-11-10', '450 Stone, Houston, TX', 'M', 55000, NULL, 1);
81
82  UPDATE Department SET Mgr_ssn = '333445555' WHERE Dnumber = 5;
83  UPDATE Department SET Mgr_ssn = '987654321' WHERE Dnumber = 4;
84  UPDATE Department SET Mgr_ssn = '888665555' WHERE Dnumber = 1;
```

4. **INSERT INTO Works_On (Essn, Pno, Hours) VALUES ('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), ('888665555', 20, NULL)**

Error Code: 1048. Column 'Hours' cannot be null   0.00086 sec

```sql
51  CREATE TABLE Works_On (
52      Essn CHAR(9) NOT NULL,
53      Pno INT NOT NULL,
54      Hours DECIMAL(3,1) NOT NULL,
55      PRIMARY KEY (Essn, Pno),
56      FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn),
57      FOREIGN KEY (Pno) REFERENCES PROJECT(Pnumber)
58  );
59
```

In the given data one attribute has NULL value for hours. To resolve this we changed the value from NULL to 0.

```sql
126      ('987654321', 30, 20.0),
127      ('888665555', 20, 0);
```

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