CS 649 Database Management Systems Fall 2017

Instructor: Prof. Ping-Tsai Chung

Mini-Project

(**Total: 400 Points**) **Due: December 11, Monday, 2017**

Consider ***the Company Database*** given in the handout. This Database contains 6 relations, namely: **EMPLOYEE**, **DEPARTMENT**, **DEPT_LOCATION**, **WORKS_ON**, **PROJECT** and **DEPENDENT**. Each table is defined in the handout.

Please send your work in one file to my email account ptchung@ieee.org (i.e., pingtsaichung@gmail.com) and submit a hard copy in class, Thanks.

(I) (80 Points) Using any two available ER Tools to draw the ER Diagram for the Company Database. The Requirements were discussed in the class. Write two-page report to discuss your comparative results.

Note that ER Tools such as ERWin Software, http://erwin.com/products/data-modeler, ERDPlus, https://erdplus.com/, ER Assist Tool and Smartdraw, https://www.smartdraw.com/

(II) (50 Points) First using **Oracle SQL * Plus**, create the schema of this database. You need to check the database referential integrity to decide the order to create tables. Then follow the **Oracle syntax** to create tables, please see **Create-Tables-Notes-Company-DB** at the end of this notes for your reference, and

https://docs.oracle.com/cd/B28359_01/server.111/b28310/tables003.htm#ADMIN11004

https://www.techonthenet.com/oracle/tables/create_table.php

https://www.w3schools.com/sql/sql_create_table.asp

https://www.javatpoint.com/oracle-create-table

http://www.sqlinfo.net/oracle/oracle_Create_table.php

Continue by inserting the data records as presented in the handout. You should print out the result of final tables.

If you want to learn "**Insert Multiple Records",** please see an example at the end of this notes for your reference.

(III) (100 Points) Solve the following queries in SQL. For each query, you need to **specify the SQL** and **show the result of each query** if applied to the Company Database.

(a) Retrieve the names of employees in department 5 who work more than 10 hours per

week on the 'ProductX' project.

(b) List the names of employees who have a dependent with the same first name as themselves.

(c) Find the names of employees that are directly supervised by 'Franklin Wong'.

(d) For each project, list the project name and the total hours per week (by all employees) spent on that project.

(e) Retrieve the names of employees who work on every project.

(f) Retrieve the names of employees who do not work on any project.

(g) For each department, retrieve the department name, and the average salary of employees working in that department.

(h) Retrieve the average salary of all female employees.

(i) Find the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

(j) List the last names of department managers who have no dependents.

(IV) (30 Points) Solve the following queries in SQL. For each query, you need to **specify the SQL using the concept of nested queries** and **show the result of each query** if applied to the Company Database.

(k) Retrieve the names of all employees who work in the department that has the employee with the highest salary among all employees,

(l) Retrieve the names of all employees who supervisor's supervisor has '888665555' for ssn.

(m) Retrieve the names of employees who make at least $10,000 more than the employee who is paid the least in the company.

(V) (70 Points) S**pecify the following queries in (III) (a), (b), (c), (e), (f), (i), (j) on the Company relational database schema using the Relation Algebra Statements (i.e., the relational operators). Also, show the intermediate result of each query** if applied to the Company Database.

(VI) (70 Points) S**pecify the following queries in (III) (a), (b), (c), (e), (f), (i), (j) on the Company relational database schema in both tuple and domain relational calculus.**

Figure 3.6
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

```
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) );
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) );
CREATE TABLE DEPT_LOCATIONS
        ( Dnumber        INT                  NOT NULL,
          Dlocation      VARCHAR(15)          NOT NULL,
        PRIMARY KEY (Dnumber, Dlocation),
        FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber) );
CREATE TABLE PROJECT
        ( Pname          VARCHAR(15)          NOT NULL,
          Pnumber        INT                  NOT NULL,
          Plocation      VARCHAR(15),
          Dnum           INT                  NOT NULL,
        PRIMARY KEY (Pnumber),
        UNIQUE (Pname),
        FOREIGN KEY (Dnum) REFERENCES DEPARTMENT(Dnumber) );
CREATE TABLE WORKS_ON
        ( Essn           CHAR(9)              NOT NULL,
          Pno            INT                  NOT NULL,
          Hours          DECIMAL(3,1)         NOT NULL,
        PRIMARY KEY (Essn, Pno),
        FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn),
        FOREIGN KEY (Pno) REFERENCES PROJECT(Pnumber) );
CREATE TABLE DEPENDENT
        ( Essn           CHAR(9)              NOT NULL,
          Dependent_name VARCHAR(15)          NOT NULL,
          Sex            CHAR,
          Bdate          DATE,
          Relationship   VARCHAR(8),
        PRIMARY KEY (Essn, Dependent_name),
        FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn) );
```

Figure 4.1
SQL CREATE TABLE data definition statements for defining the COMPANY schema from Figure 3.7.

Subject: Syntax for Inserting Multiple Records in one Oracle Insertion Statement

You can use the following Oracle Insertion Statement Syntax to insert multiple records:

INSERT ALL
INTO table_name (column1, column2, column3) VALUES ('val1.1', 'val1.2', 'val1.3')
INTO table_name (column1, column2, column3) VALUES ('val2.1', 'val2.2', 'val2.3')
INTO table_name (column1, column2, column3) VALUES ('val3.1', 'val3.2', 'val3.3')
SELECT * FROM dual;

Example: (for Inserting Multiple Records in one Oracle Insertion Statement into DEPARTMENT table)

INSERT ALL
into Department(Dname, Dnumber, Mgr_ssn, Mgr_start_date) VALUES ('Research', 5, 333445555, '05,22,1988')
into Department(Dname, Dnumber, Mgr_ssn, Mgr_start_date) VALUES ('Administration', 4, 987654321, '01,01,1995')
into Department(Dname, Dnumber, Mgr_ssn, Mgr_start_date) VALUES ('Headquarters', 1, 888665555, '06,19,1981')
SELECT * FROM dual;

Database Notes - Using an ALTER TABLE statement Prof. P. T. Chung

Using an ALTER TABLE statement

The syntax for creating a foreign key in an ALTER TABLE statement is:

```
ALTER TABLE table_name
add CONSTRAINT constraint_name
  FOREIGN KEY (column1, column2, ... column_n)
  REFERENCES parent_table (column1, column2, ... column_n);
```

Example:

```
ALTER TABLE products
add CONSTRAINT fk_supplier
 FOREIGN KEY (supplier_id)
 REFERENCES supplier(supplier_id);
```