Assignment #4 – Relational Algebra/SQL
Due: Tuesday, 05/08/12, 11:59pm

Answer the following questions from your *Fundamentals of Database Systems* book:

1. (12 pts) Specify the following queries in Relational Algebra and SQL on the COMPANY relational database schema shown in Figure 3.5. Show the result of each query if it is applied to the COMPANY database in Figure 3.6.

   a. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductX project.

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

   c. Find the names of all employees who are directly supervised by 'Franklin Wong'.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

DEPT_LOCATIONS

Dnumber	Dlocation

PROJECT

Pname	Pnumber	Plocation	Dnum

WORKS_ON

Essn	Pno	Hours

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

Figure 3.5
Schema diagram for the COMPANY relational database schema.

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

2. (16 pts) Specify the following queries in Relational Algebra and SQL on the database schema of Figure 1.2 (see below).

   a. Retrieve the names of all senior students majoring in 'CS' (computer science).

   b. Retrieve the names of all courses taught by Professor King in 2007 and 2008.

   c. For each section taught by Professor King, retrieve the course number, semester, year, and number of students who took the section.

   d. Retrieve the name and transcript of each senior student (Class = 4) majoring in CS. A transcript includes course name, course number, credit hours, semester, year, and grade for each course completed by the student.

3. (12 pts) Write SQL update statements to do the following on the database schema shown in Figure 1.2 (see below).

   a. Insert a new student, <'Johnson', 25, 1,' Math'>, in the database.

   b. Change the class of student 'Smith' to 2.

   c. Insert a new course, <'Knowledge Engineering', 'CS4390', 3, 'CS'>.

   d. Delete the record for the student whose name is 'Smith' and whose student number is 17.

4. (60 pts) **Project Development**
   (30pts) Write the SQL scripts to create and populate corresponding entities and relations (with at least 4 records in each) to the ER diagram you have created for you real-world application from Assignment #3. Make sure you include the primary and foreign keys, as well as what to do on updates and deletions. If your translation cannot capture some constraints in the ER diagram, explain why.

   (30pts) Review the list of requirements for the operation/functionality of your database that you wrote in Assignment #3. This list will influence the user-driven questions/queries for your database. Develop this list of questions/queries in English, and then use relational algebra and MySQL statements to answer the questions that you have pointed out as important questions for your real-world application.

   These questions are user-driven rather than system-driven. For example, a system-driven question can be "select all the rows from the employees table". In contrast, a user-driven question can be "identify all the transactions committed yesterday with an amount bigger than $100". Write a list of user-driven questions for your application, along with the relational algebra and SQL statements that implement these user-driven questions.

STUDENT

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

COURSE

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

SECTION

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	07	King
92	CS1310	Fall	07	Anderson
102	CS3320	Spring	08	Knuth
112	MATH2410	Fall	08	Chang
119	CS1310	Fall	08	Anderson
135	CS3380	Fall	08	Stone

GRADE_REPORT

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

PREREQUISITE

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

Figure 1.2
A database that stores student and course information.