CS 405G: Introduction to database systems Assignment 3

Assigned:	Feb. 7 th , 2010
Due:	Feb. 18 th , 2010

Submission instructions: Please try to prepare the assignment in word document (hand-written homework is also acceptable). Print and bring them to class on the due date. Put the course number and your name at the top left corner of the first page of your homework. Please follow the rules in the course syllabus regarding late homework and plagiarism.

Topics: Relation Algebra

employee (person-name, street, city) works (person-name, company-name, salary) company (company-name, city) manages (person-name, manager-name)

Figure 1: Relation schema for Problem 1

Problem 1 (50 points):

Consider the relational database of Figure 1, where the primary keys are underlined. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who work for First Bank Corporation.

b. Find the names and cities of residence of all employees who work for First Bank Corporation.

c. Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000 per annum.

d. Find the names of all employees in this database who live in the same city as the company for which they work.

e. Assume the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.

f. Give all employees of First Bank Corporation a 10 percent salary raise.

g. Give allmanagers in this database a 10 percent salary raise, unless the salary would be greater than \$100,000. In such cases, give only a 3 percent raise.

h. Delete all tuples in the *works* relation for employees of Small Bank Corporation.

I. find the employees who work for more than two companies in the following ways:

- **1**). Using an aggregate function.
- 2). Without using any aggregate functions.

Problem 2 (30 points)

Specify the following relational queries on the COMPANY relational database schema shown in Figure 2. Also show the result of each query as it would apply to the database state of Figure 3.

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

d. Retrieve the names of employees who do not work on any project.

e. 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.

f. List the last names of department managers who have no dependents.



Figure 2. Company Database Relation Schema (for problems 2 & 3)

Problem 3 (20 points).

Suppose each of the following update operations is applied directly to the database of Figure 3. Discuss all integrity constraints violated by each operation, if any, and the different ways of enforcing these constraints:

(a) Insert < 'Robert', 'F', 'Scott', '943775543', '21-JUN-42', '2365 Newcastle Rd, Bellaire, TX', M, 58000, '888665555', 1 > into EMPLOYEE.
(b) Insert < 'ProductA', 4, 'Bellaire', 2 > into PROJECT.
(c) Insert < 'Production', 4, '943775543', '01-OCT-88' > into DEPARTMENT.
(d) Insert < '677678989', null, '40.0' > into WORKS_ON.
(e) Insert < '453453453', 'John', M, '12-DEC-60', 'SPOUSE' > into DEPENDENT.

Figure 3. A populated database with schema defined in Figure 2. (for problems 2 & 3)

EMPLOYEE Table

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	В	Smith	123456789	09-JAN-55	731 Fondren, Houston, TX N		30000	333445555	5
Franklin	Т	Wong	333444555	08-DEC-45	638 Voss, Houston, TX	М	40000	888665555	5
Alicia	J	Zelaya	999887777	19-JUL-58	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	20-JUN-31	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	Κ	Narayan	666884444	15-SEP-52	975 Fire Oak, Humble, TX	М	38000	333445555	5
Joyce	А	English	453453453	31-JUL-62	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	29-MAR-59	980 Dallas, Houston, TX	М	25000	987654321	4
James	Е	Borg	888665555	10-NOV-27	450 Stone, Houston, TX	М	55000	Null	1

DEPARTMENT Table

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research	5	333445555	22-MAY-78
Administration	4	987654321	01-JAN-85
Headquarters	1	888665555	19-JUN-71

DEPT LOCATION Table

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

PROJECT Table						
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			

WORKS_ON Table

ESSN	<u>PNO</u>	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

DEPENDENT Table

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
333445555	Alice	F	05-APR-76	DAUGHTER
333445555	Theodore	М	25-OCT-73	SON
333445555	Joy	F	03-MAY-48	SPOUSE
987654321	Abner	М	29-FEB-32	SPOUSE
123456789	Michael	М	01-JAN-78	SON
123456789	Alice	F	31-DEC-78	DAUGHTER
123456789	Elizabeth	F	05-MAY-57	SPOUSE