CSC 3170 Assignment 1

This is an individual assignment and should be submitted by 5 pm, 14 February 2010 via Blackboard

1. Consider the database schema:

STUDENT (Name, Student_number, Class, Major),

COURSE (Course_name, Course_number, Credit_hours, Department),

SECTION (Section_identifier, Course_number, Semester, Year, Instructor),

PREREQUISITE (Course_number, Prerequisite_number),

where example values of Department are: CS, MATH, MUSIC, and example values for Course_number are: CS3130, MATH1003, MUSIC2343 (i.e. each Course_number has the Department as prefix).

a. If the name of the 'CS' (Computer Science) Department changes to 'CSSE' (Computer Science and Software Engineering) Department and the corresponding prefix for the course number also changes, identify the columns in the database that would need to be changed.

b. Can you restructure the columns in COURSE, SECTION, and PREREQUISITE tables so that only one column will need to be changed?

2. In relational algebra, the DIVISION operation, denoted by ÷ is useful for certain kinds of queries that sometimes occur. Let $r(R)$ and $s(S)$ be two relations, and let $S \subseteq R$; i.e. every attribute of schema S is also in schema R. The relation $r(R) \div s(S)$ is a relation on schema $R-S$ (i.e. on the schema containing all attributes of schema R that are not in schema S). A tuple t is in $r \div s$ if and only if the following two conditions hold:

i. t is in $\prod_{R-S}(r)$

ii. For every tuple t_s in s, there is a tuple t_r in r, satisfying both of the following:

a. $t_r[S] = t_s[S]$

b. $t_r[R-S] = t$

where the notation $t_r[S]$ means the S attributes of tuple t_r.

An example of the division $r \div s$ is shown below.

r

A	B
a1	b1
a2	b1

s

A
a1
a2

a3	b1
a4	b1
a1	b2
a3	b2
a2	b3
a3	b3
a4	b3
a1	b4
a2	b4
a3	b4

a3

r ÷ *s*

B
b1
b4

Express the division operation in terms of other relational algebra operators.

The following are related to Questions 3-10. Consider the following database schema, where the primary keys are underlined.

EMPLOYEE (Fname, Minit, Lname, Ssn, Bdate, Address, Sex, Salary, Super_ssn, Dno)

DEPARTMENT (Dname, Dnumber, Mgr_ssn, Mgr_start_date),

DEPT_LOCATIONS (Dnumber, Dlocation),

WORKS_ON (Essn, Pno, Hours),

PROJECT (Pname, Pnumber, Plocation, Dnum)

DEPENDENT (Essn, Dependent_name, Sex, Bdate, Relationship)

where Fname signifies first name; Minit, middle initial; Lname, last name; Ssn, Essn are social security numbers; Super_ssn is the social security number of the supervisor; Dname, Dnum, Dno, Dlocation are department name, number and location (similarly for projects); while other attributes have an obvious interpretation.

In answering the following questions, you may use any of the relational Algebra operations, including the natural join and division. (The natural join is equality join with the redundant column removed and may be simply denoted by *)

3. Retrieve the name and address of all employees who work for the "Research" department.

4. For every project located in 'Stafford', list the project number, the controlling department manager's last name, address, and birth date.

5. Find the names of employees who work on all the projects controlled by department number 5.

6. Make a list of project numbers for projects that involve an employee whose last name is "Smith", either as a worker or as a manager of the department that controls the project.

7. Retrieve the names of employees who have no dependents.

8. List the names of managers who have at least one dependent.

9. Find all employees directly supervised by "James Borg".

10. Find all employees directly supervised by those directly supervised by "James Borg". Would it be possible to find all employees supervised by a given employee at all levels?