CSC 3170 Assignment 1

This is an individual assignment and should be submitted by 5 pm, 18 February 2022 via Blackboard

1. Consider a university database, which stores the following information:

- students, including student-id, name, and program;
- instructors, including identification number, name, department, and title;
- courses, including number, title, credits, syllabus, and prerequisites;
- course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom.

The enrollment of students in courses, and grades awarded to students in each course they are enrolled for should be represented. Supposing that a class meets only at one particular place and time, and that any given room allows multiple class meetings (through partitioning the room).

(a) Design an E-R diagrams for this situation, indicating the data attributes and stating clearly any assumptions that you make.

(b) Construct relational schemas for the above E-R diagram.

(15 marks each)

2. 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. The kind of changes in (a) above can occur from time to time. Can you restructure the columns in the database schema to reduce the impact of the above change?

              (10 marks each)

3. Design a generalization–specialization hierarchy for a motor-vehicle sales company. The company sells motorcycles, passenger cars, vans, and buses. Assume that there are the two categories of vehicles: commercial and non-commercial. Note that each vehicle would attract a general sales tax, as well as an additional tax applicable to its category. You should determine the attributes of each entity type and indicate these attributes using appropriate notations. You should state any assumptions you make.

              (22 marks)

The following are related to Questions 4-10. 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, Pnumber, 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 the 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.

Use Relational Algebra to answer the following queries. You may use any of the Relational Algebra operations, including the natural join.

              (4 marks each for the following seven questions)

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

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

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?