Summer 2005 CSC343 INTRODUCTION TO DATABASES

Assignment 1

STUDENT 1

Last name:_____ First name:_____

Student Number:_____

STUDENT 2

Last name:_____ First name:_____

Student Number:_____

Section (please circle only one): Afternoon Evening

Problem 1	_____	(out of 50)
Problem 2	_____	(out of 50)
TOTAL	_____	(out of 100)

Summer 2004 CSC343 INTRODUCTION TO DATABASES

Assignment 1

by Ramona C. Truta

Assigned May 30, due June 13, at 5pm

This assignment must be **typed**. Handwritten assignments will **not** be marked.

If you wish, you can work in groups of two people, but submit only *one* assignment per group. Your assignment must be submitted electronically. The electronic submission must contain the following (text) files (with these exact names):

- group.txt — text file with names and student numbers of all members of the group.
- a1.pdf – your solution to this assignment.

To submit, use the command:
`submit -c csc343h -a Assignment1 group.txt a1.pdf`

For more information on `submit`, use `man submit`.

Pages must be numbered, and it is your responsibility to ensure that no pages are missing. For late assignment policies, please consult the syllabus. Late assignments should be emailed to `your instructor`, as a PDF attachment. No other formats will be accepted.

For this assignment we use the schema of the Project Managament database. It includes the following relations. Keys are underlined.

- `Company(`cID`, cName, city, country, assets)`. That is, the ID of a company, its name, the city and the country were the company is located, and its assets.

- `Department(`deptID`, cID, deptName, mngID, emplNo)`. That is, the ID of a department, the ID of the company to which this department belongs to, the name of the department, the ID of the manager of this department, and the number of employees this department has.

- `Employee(`eID, deptID`, eName, city, salary, age)`. That is, the ID of an employee, the ID of the department where he/she works in that company, his/hers name, the city where he/she leaves, his/hers salary and age.

- `Project(`prID`, deptID, prMngID, cost)`. That is, the ID of a project, the ID of the department where it is developed, the ID of his project manager, and its (estimated) cost.

- `WorksOn(`eID, prID`)`. That is, the ID of an employee and the ID of the project he/she works on.

The following inclusion dependencies hold:

- Department[cID] $\subseteq$ Company[cID]
- Department[mngID] $\subseteq$ Employee[eID]
- Employee[deptID] $\subseteq$ Department[deptID]
- Project[deptID] $\subseteq$ Department[deptID]
- Project[prMngID] $\subseteq$ Employee[eID]
- WorksOn[eID] $\subseteq$ Employee[eID]
- WorksOn[prID] $\subseteq$ Project[prID]

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When you are asked to find companies, your query must return their IDs and their location. When you are asked to find projects, your query must return all the attributes in the `Project` relation. When you are asked to find departments, your query must return all the attributes in the `Department` relation. When you are asked to find employees, your query must return their IDs and names.

Problem 1 (50 points)

Write the following queries in Relational Algebra. Each one is worth 10 points.

You are **not** allowed to use the renaming of *relations* used in the text, and the extended relational algebra. You may use renaming of attributes, as well as numerical comparisons (e.g., $R.A > 5$).

1. Find projects where only one employee works on, the project manager.
2. Find companies where at least 3 of their employees commute(they live in a city other than that where the company is located), and they work only for this company.
3. Find employees who were the project manager of all the expensive projects they worked on. An expensive project is one that costs more than $1,000,000.
4. Among the youngest employees of "Intel", find those who have the highest salary. (**Note**: "Intel" is the name of the company).
5. Find all "salary anomalies": that is, pairs (e_1, e_2) of employees (their IDs), both working for the same company, one is a department manager, the other is a project manager, and the second employee has a salary higher than that of the first employee. (**Note**: your output should contain only one of the pairs $(e_1, e_2), (e_2, e_1)$).

Problem 2 (50 points)

Write the following queries in Relational Calculus. Each one is worth 10 points.

1. Find employees who work for at least 3 companies, all located in the same city, and the departments in which they work in these companies have all the same name. For this question only, you can safely assume that each such employee works for one department only in each of these companies.
2. Find employees who work on all the projects their department develops. For this question only, you can safely assume that each such employee works for only one department in one single company.
3. Find the department with the highest number of employees in the company with the smallest assets.
4. Check if the following anomaly happens: there is a department where there are employees working on the projects developed in that department, and who are not employed in that department. (*hint*: this is a boolean query)
5. Find the salary of the manager of the "IBM" Canada department where the most expensive project (of this company) is developed. (**Note**: "IBM" is the name of the company, and Canada is the country where it is located).