CSCC43: Introduction to Databases
Assignment 2

Out: June 14, 2005
Due: July 5, at the beginning of the lecture

This assignment must by typed. Handwritten assignments will **not be remarked**. Pages must be numbered. Make sure there are no pages missing.

Exercise 1

Consider the following schema for a database recording information about a research lab. The research lab, composed of several research units, employs researchers, interns, lab and administrative staff who work on various projects. A researcher may supervise students and be involved in several research projects. Every intern is supervised by a researcher and may work on several research projects. All research units and projects are managed by a researcher.

$Researcher(\underline{r\_number}, r\_name, category, r\_salary, r\_area, ru\_code)$

$Intern(\underline{i\_number}, i\_name, i\_start\_date, duration, salary, r\_number)$

$Lab\_staff(\underline{s\_number}, l\_name, l\_start\_date, salary, clearance, area)$

$Administrative\_staff(\underline{s\_number}, a\_name, a\_start\_date, salary, description, experience, ru\_code)$

$Project(\underline{p\_code}, start\_date, budget, duration, r\_number, ru\_code)$

$Research\_unit(\underline{ru\_code}, security\_level)$

$Intern\_project(\underline{i\_number, p\_code})$

$Researcher\_project(\underline{r\_number, p\_code})$

$Staff\_project(\underline{s\_number, p\_code})$

$Staff\_lab(\underline{s\_number, ru\_code})$

$Manages(\underline{r\_number, ru\_code})$

The following (inclusion dependencies) hold:

$\pi_{i\_number}(Intern\_project) \subset \pi_{i\_number}(Intern)$

$\pi_{p\_code}(Intern\_project) \subset \pi_{p\_code}(Project)$

$\pi_{r\_number}(Researcher\_project) \subset \pi_{r\_number}(Researcher)$

$\pi_{p\_code}(Researcher\_project) \subset \pi_{p\_code}(Project)$

$\pi_{s\_number}(Staff\_project) \subset \pi_{s\_number}(Lab\_staff)$

$\pi_{p\_code}(Staff\_project) \subset \pi_{p\_code}(Project)$

$\pi_{r\_number}(Manages) \subset \pi_{r\_number}(Researcher)$

$\pi_{ru\_code}(Manages) \subset \pi_{ru\_code}(Research\_unit)$

$\pi_{p\_code,r_number}(Project) \subset \pi_{p\_code,r\_number}(Researcher\_project)$

Part 1 - SQL (100 marks)

1. (10 marks) List for each researcher her/his r_number and the average budget of the projects s/he manages. For researchers who did not manage any project list 0 as the average.
2. (10 marks) List the research units that have the highest ratio of administrative staff to researchers.

3. (10 marks) List the researchers who manage the projects which involve the lowest number of people(researchers, interns and staff).
4. (10 marks) Find the names of the researchers who coordinate only projects that are not associated with their research unit.
5. (10 marks) List the codes of projects whose lab staff members do not work on any other projects.
6. (10 marks) Find the interns who have worked on all the projects they have been involved in for the entire duration of the project. For projects not finished yet, an intern listed as working on a project is assumed to be working on that project until the end of the project or the end of the intership, whichever comes first.
7. (10 marks) Find the researchers who only hired interns they supervise to work for projects they coordinate.
8. (10 marks) List the projects coordinated by researchers who have interns working for all the projects they are involved in.
9. (10 marks) List the projects that involve only people from the research unit the project belongs to.
10. (10 marks) Find the interns who are/where involved in most projects.

Part 2 - SQL (50 marks)

1. (10 marks) Write an assertion that checks if an intern works on more than 5 projects.
2. (10 marks) Write an assertion that checks whether there are projects whose budget is less than the salaries of the people(researchers, interns and staff) who work only on that project.
3. (10 marks) Write a "BEFORE UPDATE" trigger that raises with 5% the salary of the lab staff who becomes involved in at least 3 projects.
4. (10 marks) Write an "AFTER DELETE" trigger that decreases by 5% the salaries of the interns supervised by researchers who no longer manage at least 2 projects.
5. (10 marks) Write an "AFTER INSERT" trigger that checks if the salary of a new intern is lower or greater by 5% than the average intern salary in her/his research unit(an intern's research unit is considered to be that of her/his supervisor) and sets it to the average if the condition is not met.