CSCC43: Introduction to Databases
Assignment 1

Out: June 1, 2005
Due: June 14, 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 sevarl 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.

$Researcher(\underline{r_number}, r_name, category, r_salary, r_area, ru_code)$

$Intern(\underline{i_number}, i_name, i_start_date, duration, salary, r_number)$

$Lab_staff(\underline{s_number}, l_name, l_start_date, salary, clearance, area)$

$Administrative_staff(\underline{s_number}, a_name, a_start_date, salary, description, experience)$

$Project(\underline{p_code}, start_date, budget, duration, r_number, ru_code)$

$Research_unit(\underline{ru_code}, security_level)$

$Intern_project(\underline{i_number, p_code})$

$Researcher_project(\underline{r_number, p_code})$

$Staff_project(\underline{s_number, p_code})$

$Staff_lab(\underline{s_number, ru_code})$

$Manages(\underline{r_number, ru_code})$

The following (inclusion dependencies) hold:

$\pi_{i_number}(Intern_project) \subset \pi_{i_number}(Intern)$

$\pi_{p_code}(Intern_project) \subset \pi_{p_code}(Project)$

$\pi_{r_number}(Researcher_project) \subset \pi_{r_number}(Researcher)$

$\pi_{p_code}(Researcher_project) \subset \pi_{p_code}(Project)$

$\pi_{s_number}(Staff_project) \subset \pi_{s_number}(Lab_staff)$

$\pi_{p_code}(Staff_project) \subset \pi_{p_code}(Project)$

$\pi_{r_number}(Manages) \subset \pi_{r_number}(Researcher)$

$\pi_{ru_code}(Manages) \subset \pi_{ru_code}(Research_unit)$

Part 1 - Relational algebra (50 marks)

1. (10 marks) Find the names of the researchers who are involved in exactly 3 projects.
2. (10 marks) List the researchers who work for all the projects that involve at least one of their interns.
3. (10 marks) List the researchers who coordinate projects for which at least 3 students whom they do not supervise work for.
4. (10 marks) Find the names of the researchers who coordinate only projects that are associated with their research unit.
5. (10 marks) List the codes of projects whose managers do not work on any other projects.

Part 2 - Relational Calculus (40 marks)

Note: Tuple Relational Calculus and Domain Relational Calculus are both acceptable.

1. (10 marks) Find the researchers who coordinate the projects with the biggest budget.
2. (10 marks) Find the researchers who have no supervised interns who work for projects they coordinate.
3. (10 marks) List the projects coordinated by researchers who have interns working for all the projects they are involved in.
4. (10 marks) Find the researchers with the second highest salary