

Assignment 1

Total scores: 60

Summer 1998

Due Thursday, May 28

Instructor: Osmar R. Zaiane

1. (12 points) Construct an E-R diagram for the simplified university registrar's office discussed in class.

Also, define the *tables (schemes)* corresponding to your E-R diagram, and indicate the *primary keys* of each table.

- Make sure your design includes at least the following: Students, Courses, Instructors, Assignments, Departments, Textbooks, classrooms.
- TA's are instructors.
- For each student-assignment pair a grade is recorded.
- For each student-course pair a grade is recorded.
- Each Course is assigned only one classroom.

There could be many "correct" answers for this question, depending on the assumptions made. State your assumptions clearly. *For full points, your design and assumptions should match and the E-R diagram should be clear.*

2. (24 points) Consider the following relational database:

person(pname, street, city)
works-for(pname, cname, salary)
company(cname, city)
manages(pname, mname)

Answer each of the following queries in:

- the *relational algebra*
- the *tuple relational calculus*
- the *domain relational calculus*

- a. Find the street and city of all employees who work for the SuperStore, live in Coquitlam, and earn more than \$35,000.
 - b. Find the names and the companies they work for, for all people who have a higher salary than their manager.
 - c. Assume that companies may be located in several cities. Find all companies located in *every* city in which the SuperStore is located.
 - d. Find the names of managers who manage more than 5 employees living in Richmond.
3. (12 points) Let $R = (A, B, C)$ and $S = (D, E, F)$. Express each following expression in two other equivalent forms (relational algebra, tuple relational calculus, or domain relational calculus).
 - a. $\{t | \exists u \in r, v \in s (u[C] = v[D] \wedge v[E] = e \wedge t[B] = u[B])\}$, where $r(R)$ and $s(S)$.
 - b. $\Pi_{A,B}(r_1) \bowtie \Pi_{B,C}(r_2)$, where $r_1(R)$ and $r_2(R)$.
 $\{ \langle a, b, d \rangle \mid \langle a, b, c \rangle \in r \wedge \langle a, d, f \rangle \in s \}$, where $r(R)$ and $s(S)$.

c. $\{ \langle a, b, d \rangle \mid \langle a, b, c \rangle \in r \wedge \langle a, d, f \rangle \in s \}$, where $r(R)$ and $s(S)$.

4. (12 points) Consider the relational database defined by the schema in your solution of question 1. Give a relational-algebra expression for each of the following queries:
- Find the course with the most students.
 - Find the smallest classroom (least number of seats).
 - Find the average grade for CMPT-354
 - Find the instructor teaching the course with the highest average grade