CS430/630 – Homework 1
Released Feb 03, Due Feb 16
50 points (5/100 of final grade)

Instructions: The homework is due BEFORE CLASS on Tue Feb 16. Please hand in paper copies (either typeset or hand-written copies are fine, as long as the hand writing is clear).

Question 1 (25 points)
Consider a database schema with three relations:

- Students (sid:integer, sname:string, age:integer)
- Enrolled (sid:integer, cid:integer, grade:integer)
- Courses(cid:integer, cname:string, credits:integer)

The keys are underlined in each relation. Students are identified uniquely by sid, and courses by cid. Students enroll to take courses, and for each course they obtain a grade which is an integer. sname is the student name (string), age represents the student age and is an integer. cname is the course name (string), and credits is the number of credits for a particular course (integer).

Write relational algebra expressions for the following queries:

(a) Find the names of students who got grade 10 in some course.
(b) Find the ages of students who take some course with 3 credits.
(c) Find the names of students who take a course named ‘Calculus’.
(d) Find the names of students who obtained grade at least 8 in some course that has less than 4 credits.
(e) Find the names of students who obtained only grades of 10 (implies that they took at least one course).
(f) Find the names of students who took a course with three credits or who obtained grade 10 in some course.
(g) Find the ages of students who attend ‘Calculus’ but never took any 4-credit course (assume there is a course ‘Calculus’ with 3 credits).
(h) Find the names of students who are enrolled in a single course.
(i) [630 only] Find the names of students who have the lowest age.
(j) [630 only] Find the grades of students who are enrolled in course(s) with the highest number of credits.
Question 2 (25 points)

Consider a database schema with three relations:

Employee (eid:integer, ename:string, age:integer, salary:real)
Works (eid:integer, did:integer, pct_time:integer)
Department (did:integer, dname:string, budget:real, managerid:integer)

The keys are underlined in each relation. Relation Employee stores employee information such as unique identifier eid, employee name ename, age and salary. Relation Department stores the department unique identifier did, department name dname, the department budget and managerid which is the eid of the employee who is managing the department. The managerid value can always be found in the eid field of a record of the Employee relation. The Works relation tracks which employee works in which department, and what percentage of the time s/he allocates to that department. Note that, an employee can work in several departments.

Write relational algebra expressions for the following queries:

(a) Find the ages of employees who earn at least $50,000 salary.
(b) Find the names of departments that have budget no higher than $100,000.
(c) Find the salaries of employees who work in a department named ‘Operations’.
(d) Find the salaries of employees that work at least 50% of their time in a department that has budget at least $500,000 (refers to 50% in same department, not cumulated across several departments that match the condition).
(e) Find the names of employees who work in the ‘Sales’ department or who spend more than half of their time in a single department.
(f) Find the names of employees who work for department ‘Catering’ but who do not work in any department that has budget higher than $500,000.
(g) Find the name of departments who employ only persons with salary $50,000 or higher.
(h) Find the ages of employees who work in exactly one department.
(i) [630 students only] Find the salaries of department managers.
(j) [630 students only] Find the age(s) of the manager(s) who earn the highest salary among all managers (note there may be several managers tied, find all their ages).