DBS: Database Systems
Carsten Schürmann
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Assignment 2

Due: see course homepage

You can submit your hand-written solutions to question 1 (formal query languages) in class. Your answers to questions 2 and 3 should be emailed to the TA (attached as a TXT file named Firstname Lastname AS2.txt; the first line should contain your name).

1. Recall the employee database we used in the previous assignment:

   ```
   employee(employee name, street, city)
   works(employee name, company name, salary)
   company(company name, city)
   manages(employee name, manager name)
   ```

   Give expressions in both tuple relational calculus and relational algebra for each of the following queries:

   (a) Find all employees who live in the same city as that in which the company they work for is located (2 x 2 points).

   (b) Find the names and the salaries of all employees who live in the same city and on the same street as their managers (2 x 2 points).

   (c) Find all employees who earn more than every employee of Small Bank Corporation (2 x 2 points).

2. Using the database from them previous question, define in SQL a view consisting of manager name and the average salary of all employees who work directly for that manager. Explain why the database system should not allow updates to be expressed in terms of this view (2 points).

3. The following schemas contain information about students, faculty, courses, and grades for a university:

   ```
   student(student id, name, class, major)
   course(course number, course name, department)
   course offering(course number, semester, year, instructor)
   faculty(name, office, salary)
   grade report(student id, course number, semester, year, grade)
   prerequisite(course number, prerequisite number)
   ```

   The following shows sample tuples from each relation:

student_id	name	class	major
999872543	Joe Smith	Senior	Computer Science
995389332	Jane Doe	Junior	Computer Science

course number	course name	department
DBS	Database Systems	Computer Science

course number	semester	year	instructor
DBS	Fall	2009	Carsten Schuermann

name	oce	salary
Carsten Schuermann	4C13	100000

student id	course number	semester	year	grade
999872543	DBS	Fall	2008	7
995389332	DBS	Fall	2008	12
999872543	OPI	Spring	2008	10
999872543	PW	Fall	2007	12

course number	prerequisite number
DBS	OPI
DBS	WP

(a) Give an SQL DDL definition of this database. Be sure to use appropriate data types or domains and to include any appropriate constraints (keys, referential integrity, checks etc.). List any assumptions you make about the data, and execute your commands in your mysql instance to make sure they work correctly (8 points).

(b) Try to insert a row into one of the tables in your database so that some constraints are violated. Write down the error message displayed. Correct the insert statement. Try it again. Your answer should include both SQL statements and the error message (2 points).

(c) Give a 10% rise to all faculty members who teach more than one course at the Computer Science department in the current semester (2 points).

(d) Delete all students who are not taking any course this year. What happened to their old grade reports? What can be done about that? (2 points)

(e) For each faculty member calculate the ratio of their salary to the number of students they teach this year. The results should be sorted by the ratio, starting from the lowest value (2 points).

Please do not use views. Each SQL statement should have no more than one subquery.