Prof. Li-Yan Yuan

CMPUT 291: File and Database Management Systems

Midterm Examination

March 1, 2001

It is a close-book examination and the time for the test is 80 minutes. There are five(5) questions over two (2) pages. The value of each question is indicated and the total is 100. Good luck to all of you.

1. A university database contains information about professors (identified by sin) and courses (identified by course_id), and the teaches relationship between them. Each of the following situations concerns the teaches relationship. For each situation, draw an ER diagram that describes it.

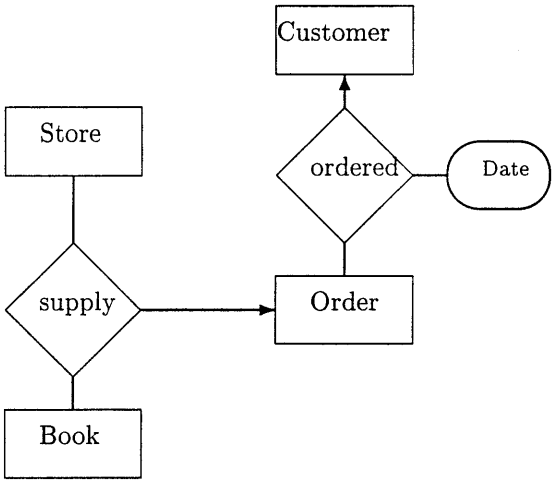
   Assume no further constraints hold. (You may use notations in the textbook, Assignments, or the lecture notes, and explain your notation if you wish. This applies to all subsequent questions.)

   (a) Professors can teach the same course in several semesters, and each offering must be recorded.

   (b) Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (This condition applies to the next question as well.)

   (c) Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor. [15]

2. The following ER diagram characterizes information about an on-line book store. Customer, Store, Book store information about customers, stores, and books respectively. Order represents each order placed by a customer. Relationship set `supply` indicates which store supplies which book to which order; and `ordered` indicates who placed the order.



   The attributes for all entity sets are Customer(c_id, c_name, c_address), Order(o_id, o_data), Store(s_id, s_address), Book(isbn, title, price), with `c_id, o_id, s_id, isbn` as respective keys.

   Find an appropriate relational database schema from the ER diagram. Note that the arrow indicates the one side of the corresponding relationship set. State any reasonable assumptions you may have. [14]

3. A company database needs to store information about employees (identified by social insurance number sin, with salary, and address as attributes); departments (identified by d_id, with d_name, and budget as attributes); and children of employees (with name and age as attributes). Employees work in departments; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.

   Draw an ER diagram that captures this information. [15]

4. Consider the following employee database.

```
employee(e_id, e_name, street, city)
work(e_id, c_id, salary)
company(c_id, c_name, city)
manager(e_id, m_id)
```

   The first two tables store information about the id, name, street address, city, the employer (c_id) and salary of each employee. The third table stores information about each company, including its id, name, and location; the last one indicates who is whose boss. Both e_id and m_id in the last table must be an e_id of the first table. Note that an employee may work for more than one company.

   Use SQL to express the following queries. (You results may contain duplicate tuples.)

   (a) Find the names of all employees who work for Telus.

   (b) Find the names of all managers of Sarah. Note that Sarah may work for more than one company and thus has more than one manager.

   (c) List the names of all employees who live in the same cities as the one of the companies for which they work for.

   (d) List the names of all employees in the database who do not work for West Edmonton Mall. (Please note that an employee may work for more than one company.)

   (e) Find the names of all employees in the database whose salary (from one company) is higher than that of every employee (including Bill Gate) working for Microsoft.

   (f) List the names and average salaries for all companies. [42]

5. Consider a relational database about a university with the following three relations

   teach(Prof, Course)
   take(Student, Course, Grade)
   advise (Prof, Student)

   The first relation indicates the courses a prof teaches; the second tells what courses each student takes and the corresponding grades; and the last indicates advisors of a student. Give relational algebra expressions to

   (a) retrieve all courses taught by advisors of "Peter Jennings";

   (b) all students who take only courses taught by their own advisors. Note that a student may take two courses, one taught by his/her own advisor and one by someone else. [14]