Exam IIS/Databases - 16 April 2010,   09-12 AM

Remarks:
- Write readably and clear, using a black or blue pen
- You may offer your answers in Dutch or in English
- Write at the top of the first page all relevant data, such
  as your name, studentnumber, affiliation (TM, TBK, or CS), and the
  total number of pages. Number all of your pages!
- The exam is "closed book"
- Always motivate your answers!

Question1 (ORM modelling, R-Map; 60 points)

Our Universe of Discourse (UoD) pertains to an information system (IS) used by a company to maintain details about its employees. In the IS, we keep track of employee identity (its reference mode), the department the employee works in, and phone numbers at which an employee can be reached. Each employee has at most one phone number at which he can be reached at work. We have exactly two departments: Sales and Production, and each employee works in some department (and possibly works in two departments).
For each combination of employee and department, we keep track of the salary (in euro's) that the employee earns in that department. In the IS, we make a distinction between Sales-employees (working in the Sales department) and Production-employees (working in the Production department). Each Sales-employee and each Production-employee is also referred to by a separate local number, identifying that employee. In the IS, we keep track of the functions that are assigned to a Production-employee. Each function refers to a job, and each Production-employee can have at most two functions. Sales-employees have at most one phone number at which they can be reached at home, but if they have a home phone number listed in the IS, then they also must have a work phone number listed in the IS. Phone numbers at home and phone numbers at work can never be the same.
Sales-employees manage zero or more orders, and each order is managed by exactly one Sales-employee. An order has exactly one customer. An order consists of one or more order-lines. Each order-line has a number, and the combination of order and order-line number uniquely identifies an order-line. In an order-line, we keep track of the product being ordered, and the quantity of the ordered product. A product has a unit price, and in an order-line, we keep track of the total price of the ordered products of that order-line. Finally, we keep track of the total price of each order.

i) Construct an ORM model of the UoD as described above. Make systematic use of the CSDP method for constructing the model. Be precise in your choice of reference modes for each entity involved. Make sure that you

capture all relevant constraints, and describe them accurately in the model.

ii) Map the ORM model to a relational schema, using the RMap-procedure.

Question 2 (Relational model, SQL; 40 points)

Consider the following relational database schema:

```
Department (Id:String, Name:String)
Student (Id:Integer, Name:String, Address:String)
Lecturer (Id:Integer, Name:String, DepId:String, Age:Integer)
Course (CourseId:Integer, DepId:String, CourseName:String)
Exam (StudId:Integer, CourseId:Integer, Semester:String, Grade: Integer)
Lecture (LectId:Integer, CourseId:Integer, Semester:String)
```

Where CourseId, DepId, and StudId are references to their respective foreign keys in the table schemas Course, Department, and Student.

Give SQL-solutions for the following queries and/or transactions:

a) Give, for each lecturer, the StudId and Grade of all students who passed a course given by that lecturer in semester "2009-2.2".

b) Give for each department, that is responsible for more than 10 courses, the total number of lecturers that give courses in that department.

c) Give the names of lecturers and their courses for those lecturers who let all students pass for their course.

d) Increase the grade of course "DB1" with 1 point for all students who did exam in
course "DB1" in semester "2009-2.2" and who failed that exam.