**Exam IIS/Databases**
**February 3rd, 2011**
**9-12 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, student number, affiliation (TM, TBK, or INF), and the total number of pages.
-Number all of your pages!
-The exam is "closed book".

**Question1 (ORM modelling, R-Map; 70 pts)**

Our Universe of Discourse (UoD) pertains to an information system (IS) used by a medical clinic to maintain details about its patients, their treatment plans, their medication, and costs. Patients are identified by a number, and we keep track of patient name, date of birth, and their insurance company. Most patients (but not all) are sent to the clinic by their GP (general practitioner), in order to follow a treatment for some illness. A GP is identified by a name. Patients are also to be identified by the combination of their name, date of birth, and their GP. For each patient submission, we register the submission date, and the associated diagnosis. Each patient submission is offered a number of patient treatments, where each patient treatment is headed by exactly one nurse, and the treatment has exactly one supervising medical specialist. Specialist and nurse are both employees. An employee has a separate identifier, and belongs to a department and has a name. Specialists and nurses can never be the same employee. Each nurse has at least one, and at most two internal phone numbers by which the nurse can be reached. For each patient treatment, we keep track of the treatment date, and we record a separate invoice, recording the cost of the treatment session; for each invoice we also register whether the invoice has been paid. Each patient treatment prescribes exactly one recipe, and each recipe has a number and a date. A recipe consists of a number of recipe items, and each recipe item is written on a separate line. A recipe item is identified by the combination of recipe and line number. For each recipe item we register an item (typically some medical product), and the issued quantity of that item. Each item has a certain unit price, and each recipe item records a subtotal of costs for the issued items.

For each recipe we also record the total price of all items prescribed.

(i) Construct an ORM model of the UoD as described above. Make systematic use of the CSDP method for constructing the model. Make sure that you capture all relevant constraints, and describe them accurately in the model.

(ii) Map the ORM model to a relational schema by using the R-Map procedure.

## Question 2 (SQL; 30 pts)

Consider the following relational schema

Product (maker, model)

PC (model, price)
price)

Laptop (model, framesize, price)
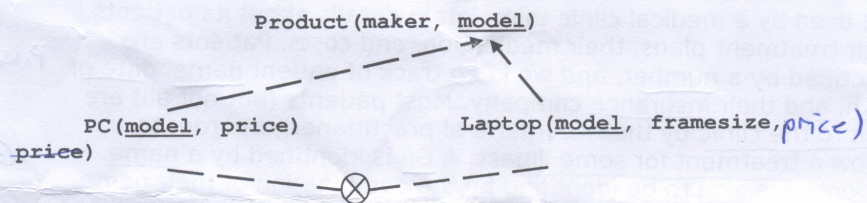
Keys are underlined, and the dashed arrows indicate foreign key constraints. We also have the constraint that PC model values must always be different from Laptop model values. Prices are in euro's, and frame size is in inches.

Specify in SQL the following query statements

    a. "List all makers that make both PC's and Laptops"
    b. "List all makers of products (PC or Laptop) that sell their product at the lowest current price"
    c. "For each maker of PC's, that also makes Laptops with a frame size larger than 15 inches, give the average price of their PC's"

2