Introduction to Databases (winter term 2004/2005)

Assignment 2

RWTH Aachen: hand in on November 8, 2004 during tutorial
B-IT: hand in on November 11, 2004 during tutorial

Task 2.1 (ER-Diagram) (2 Points)
A university wants to design a database with the following entities:

- Student with matriculation number, name, address and semester
- Subject (Computer Science, Electrical Engineering..) with subject number, name and degree (Diploma, Master..)
- Chair (‘Lehrstuhl’) with chair number, name, and address
- Employee with name and social security number(ssn), address and degree(s). An employee can be either professor or assistant.
- An assistant is employed on a certain date. His contract has a defined duration.
- Courses with course number, name, place, kind and dates

Furthermore, there are the following relationships: Students are enrolled in subjects, students visit courses. Chairs provide courses. Professors are on the head of a chair. Employees work at chairs. Employees support courses. Chairs belong to subjects. Professors supervise assistants. Assistants can supervise other assistants.

Design an ER model for the above university scenario (without cardinality constraints)!

Task 2.2 (Cardinality constraints) (2 Points)
Cardinality constraints allow the restriction of the number of participating entities in relationships. Remember that there are two possibilities to define cardinality constraints in ER diagrams:

a) 1:1, 1:m or m:n notation
b) (min,max) notation

Extend the ER model of exercise 2.1 by defining the cardinality restrictions using both possibilities (a+b) taking into account the following constraints:
Students are registered on at least one subject. On each subject at least 50 students are subscribed. Students can visit any number of courses. A course is visited by at least 10 students. A chair can provide any number of courses, a course belongs to exactly one chair. An employee supports at most two courses. A course is supported by at least one employee. An employee works on exactly one chair. On each chair work at least two employees. Each chair is headed by only one professor. A professor can be the head of only one chair. A chair belongs to exactly one subject. A subject has at least three chairs. An assistant is supervised by at most one assistant. An assistant can supervise any number of assistants. An assistant is supervised by exactly one professor. A professor can supervise any number of assistants.

Note: You will not be able to formalise all restrictions using notation a).
Task 2.3 (Expressivity of ER Diagrams)  
(3 Points)
Which of the following expressions can be represented with ER diagrams as introduced in the lecture? Model the expression as an ER diagram if you can do so, otherwise argue why it is not possible to represent the expression by an ER diagram.

a) Presidents drive limousines. Limousines are cars.

b) Presidents drive only two kinds of limousines: Audi and Mercedes. Other limousines, e.g. by Citroen, are not used by presidents.

c) Students have exactly one tutor, except the students that asked for a second tutor.

d) Legal persons are either ‘real’ persons or companies. Legal persons may own any number of buildings. A building may be owned by multiple legal persons. The percentage owned by a legal person is between 0 and 100.

e) as d), but in addition: The sum of all percentages is 100.

f) as d), but in addition: A building is either owned only by ‘real’ persons or only by companies. A building must not be owned by a ‘real’ person and a company at the same time.

Task 2.4 (ER-Modelling)  
(3 Points)
Each of the following ER diagrams contains (at least) one mistake. Identify what went wrong and correct the error.

a) The ER diagram below is intended to model the following scenario:
A course may or may not use a textbook. By definition, a text is a book that is used in some course. A course may not use more than five books. Instructors teach from two to four courses. A course is taught by exactly one instructor. Instructors base their lectures (adopt) on the content of all textbooks, that are used for their courses.

For simplicity we left out the entities’ attributes (do not consider this as an error!).

b) The diagram below is intended to model part of an international student and university database.

c) Note that in the following diagram $r$ denotes the same relationship with different cardinality constraints for different participants.

For simplicity we again left out the entities’ attributes (do not consider this as an error!).