Introduction to Databases (winter term 2005/2006)

Assignment 1

hand in on November 7, 2005 during the tutorial

Please hand in your solutions in groups of up to 3 students.
Do not forget to write down your name and matriculation number on the solutions you hand in. Please also add your study course (e.g. Dipl.-Inf., Master SSE, ...).
Remember that there will be no lecture on November 1, 2005 (Allerheiligen).
On November 7 (when you have to hand in your solution of this assignment) there will be a tutorial session covering additional aspects of ER modelling.

Task 1.1 (Terminology) (1 Point)
Give a short definition for each of the following terms in your own words:

- information system
- database
- database system
- database management system
- data model
- integrity constraint

Task 1.2 (ER-Diagram) (4 Points)
Freddy T. V. Junkie wants to develop a database that can help him planning his beloved hobby: watching TV. After a short brainstorming he considers the following entity and relationship types as relevant:

- A broadcasting station has a unique short name and an address (street, zip code and city) of its headquarter.
- There are (only) two different kinds of broadcasting stations: so called public broadcasting stations\textsuperscript{1} and private broadcasting stations\textsuperscript{2}.
- For a public broadcasting station Freddy wants to store the name of the country that it is located in, for private broadcasting station he is interested in the name of the owner company and the annual turnover.
- Public as well as private broadcasting stations can (but do not have to) organize themselves in broadcasting groups. They can belong to at most one group. Such groups can consist of arbitrarily many stations, but all members have to be of the same type (public or private).
- Freddy has a number of TV devices (and he wants to keep this number flexible). Each such device is characterized by the place in his apartment where it is located. For potential warranty claims he also wants to store the name of the manufacturer and the exact type number.
- For each TV device, broadcasting stations can be placed on different channel numbers (or may cannot be watched at all on this device). But Freddy wants to make sure that there is some broadcasting station information available about all channels he can watch.
- The most important entity type for Freddy is the broadcast\textsuperscript{3}. A broadcast can be (among others) either a documentary or a movie. A broadcast is uniquely identified by its ID. It has a title and a start and end time. It is broadcasted by exactly one station.

\textsuperscript{1}German: Öffentlich-Rechtliche Fernsehanstalten
\textsuperscript{2}German: Privatsender
\textsuperscript{3}German: Sendung
- As Freddy sometimes forgets to switch on his device at the right time, he wants to implement an alarm function that reminds him of the broadcasts he like. Therefore he wants to be able to mark certain broadcasts. Additionally, he wants to store all repetitions of a broadcast.

- For movies, Freddy is also interested in the hyperlink to the IMDb entry. Furthermore, he wants to store the main actors and the director of the movie.

- Actors and Directors are considered to be persons who have a unique ID and a name. For actors the number of Oscar nominations is interesting, for directors the number of films made so far should be stored.

- Freddy assumes that there can be many actors in a movie but only one director. He knows that there are persons who work as actors and directors.

Design an ER model that depicts the conceptualization of the personal TV program information system Freddy has in mind.

a) Use the 1:1, 1:m or m:n notation for cardinality constraints.

b) Use the (min,max) notation for cardinality constraints.

**Task 1.3 (Inconsistent ER Diagrams)** (2 Points)
An ER diagram is said to be inconsistent if there is no way to satisfy all mentioned constraints. Give the appropriate cardinality constraints ((min,max)-notation) for the two relationship types in the following ER diagram such that the diagram becomes inconsistent and explain why there is no way to satisfy all your constraints.

![ER Diagram](image)

**Task 1.4 (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 has at least one owner and 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 for one building 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.

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4http://www.imdb.com
5More formal: An ER diagram is inconsistent iff all entity and relationship sets that satisfy all constraints are empty.
6Hint: Keep in mind that the number of entities of one entity type is always assumed to be finite!
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