Introduction to Databases (summer term 2007)

Assignment 3

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, ...).

Task 3.1 (ER-Diagram) (3 Points)
The Redhound coach company plans to design a database system for coach travel reservations. The database should contain information about connections.
Represent the following requirements in an extended ER diagram\(^1\) and use the min:max notation for cardinality restrictions.

a) Bus stations have names and are located in a country and related to a city.

b) A bus connection connects two bus stations.

c) We distinguish between direct connections and indirect connections with intermediate stops at other bus stations.

d) A coach travel is described by a departure and arrival time, coach type (including name and maximum number of passengers), and the relationship to a bus connection.

e) Each coach travel can be reserved by at most 25 passengers and each passenger can reserve any number of coach travels.

f) Time and date of the reservation and its current state (e.g. reserved, paid etc) as well as the name of the employee, who made the booking, have to be recorded.

g) For each passenger, his name, date and place of birth and his address composed of German postal code, street name and number and city have to be recorded. A passenger can be identified by his name, and the date and place of his birth.

h) The Redhound coach company wants to improve its customer relationship and therefore likes to keep track of a commutern\(^2\), who can be seen as a special group of passengers who frequently use one dedicated connection. This connection and the number of times it is used on average per week should be captured.

i) Another group of passengers that should be treated separately are employees of the Redhound coach company (who might get cheaper tickets). For them, the social security should be captured to allow for a link to the Redhound personnel database.

Task 3.2 (Mapping to Relational Database Model) (3 Points)
Map the ER diagram of exercise 3.1 to a relational data model and define the intra- and interrelational dependencies.
Remember, that the set of intra-relational dependencies can also include non-trivial intra-relational dependencies (i.e. functional dependencies, that are no keys of the relation).
Include all such functional dependencies that make sense in the presented scenario.

\(^1\)i.e. a ER diagram with specialisations/generalisations
\(^2\)German: Pendler
Task 3.3 (Mapping of Is-a-relations) (2 Points)
In the lecture you have learned about four ways to map is-a-relations to relational database schemata. Choose the most appropriate mapping method for each of the small ER models below (each method should be used only once), provide the resulting relational database schema in the formal notation (incl. interrelational dependencies) and give a short argument for your decision.

![ER Diagrams]

Task 3.4 (Ternary Relationships) (2 Points)
Consider the two scenarios depicted by the following ER diagrams:

![ER Diagrams]

Students work on seminar topics offered by chairs. Since we plan to store data from different semesters in one database, a chair can offer the same topic more than once. As usual, students can take more than one seminar (also at the same chair, if they want to). It is possible that different chairs offer the same topic, but a student is not allowed to work on the same topic twice.

A marriage between a man and a woman is stored together with the certificate that proves their marriage. We do not want to store any information about former wives resp. husbands. Therefore, we can assume that a man is married with only one woman (and vice versa).

Remember the different semantics of cardinality constraints in non-binary relationships as presented in the 0th tutorial session!

a) Annotate for both scenarios the relationship with appropriate cardinality constraints in both variants (1:n and (min,max) notation).

b) Decide which notation is more suitable for which scenario. Which constraint(s) is/are lost if the inappropriate variant is chosen?

---

3There is also a very brief summary available on our homepage.
4For simplicity we omitted the attributes.
5resulting in four diagrams!