Introduction to Databases (summer term 2007)

Assignment 9

hand in on June 25, 2007 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, ...).

Task 9.1 (Normalisation) (4 Points)
Consider a (German) address database with the attributes street, city, state\(^1\) and zipCode.
For this task we assume (a bit simplifying) the following functional dependencies:

\[ \{ \text{street, city, state} \} \rightarrow \text{zipCode} \quad \text{and} \quad \text{zipCode} \rightarrow \{ \text{state, city} \}. \]

a) Find all keys and prove your claim.

b) In which normal form is the above relation?

c) Apply the decomposition algorithm to reach relations in BCNF.

d) What is the advantage of this BCNF-relation over the universal relation\(^2\)?
   What is the disadvantage?

Task 9.2 (Distributed Databases) (2 Points)
Explain briefly the differences between the following levels of ‘distribution transparency’:

- Fragmentation transparency
- Location transparency
- Local mapping transparency
- No transparency

Task 9.3 (Inheritance vs. Subtyping) (2 Points)
Inheritance and subtyping are commonly associated with one another. However, this mix of the two (slightly) different concepts may lead to problems. As an example, consider modelling of cubes and cuboids\(^3\). Assume that a cube is modelled by one attribute length and a cuboid by three attributes length, width, and height.

a) Consider that type Cuboid is represented as a subtype of Cube, which inherits the one attribute length and augments the structural representation by two further attributes width and height. Illustrate the problems arising from this type structure on program fragments.

b) Consider alternatively that Cube is represented as a subtype of Cuboid. Sketch the problems that occur now.

\(^1\)German: Bundesland
\(^2\)universal relation: relation containing all attributes
\(^3\)German: Quader
The class of the hotel is between 1 and 5 stars, the capacity is measured by the number of beds, the category of a room can be 'single' or 'double'. The occupation of the maid can be 'full-time' or 'part-time'. To realize enumeration types, use the type constructor enum \{value_1, value_2, \ldots\}, e.g.: attribute enum \{male, female\} gender.

a) Map the above ER schema to ODL classes including definitions of extents as entry points for the queries below. For one of the classes of your choice, include two appropriate methods declarations describing meaningful operations on the object data.

b) Specify in OQL the following queries on the basis of your object model:

- List the SSN, the name of and the email address of managers who work for a hotel with 3 stars.
- List the SSN and salary of all maids together with the average price of rooms they are responsible for.