Courses B0B36DBS, A7B36DBS: **Database Systems**

Practical Classes 01 and 02:

Conceptual Modeling in ER and UML

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Conceptual Modeling

- Conceptual, logical, and physical layers
- **ER**
  - Entity type (strong, weak)
  - Relationship type (binary, n-ary, recursive, cardinalities)
  - Attribute (ordinary, composite, multivalued)
  - Identifier (full, partial)
  - ISA hierarchy (covering, overlap constraints)
- **UML**
  - Class, association, attribute, generalization

Exercise 1

- Create an ER conceptual schema for a simple student information system…
  - Each person has a name, personal id number, address, and e-mail address
  - Values of personal ids are unique among persons

Exercise 2

- Extend the previous schema…
  - Each person may have several login names
  - Together with each login name we also store hashed value of a corresponding password

Exercise 3

- Modify the previous schema…
  - We would like to split the unstructured address attribute of a person to separate values of a street, city, and post code
  - Each person may have at least one e-mail address from now on

Exercise 4

- Extend the previous schema…
  - Two types of persons are now distinguished:
    - Student has at least one phone number
    - Teacher may have a website and is also identifiable using an employee number

Exercise 5

- Extend the previous schema…
  - Course is identified by its code, it has a unique name, and also a number of credits
  - Each course is guaranteed by exactly one teacher

Exercise 6

- Extend the previous schema…
  - Two courses may have a mutual dependency
    - Two types of such dependencies are distinguished: co-requisites and pre-requisites

Exercise 7

- Extend the previous schema…
  - Students work on theses which are lead by teachers
  - Each thesis has its type (bachelor, master, doctoral), unique name, and year of assignment
  - Use an entity type for theses
  - Determine all the relationship cardinalities correctly

Exercise 8

- Modify the previous schema…
  - Can the relationship types of thesis assignment / leadership be modeled using two binary relationship types (instead of one ternary)?

Exercise 9

- Extend the previous schema…
  - Model a timetable using a relationship type
  - I.e. describe timetable events of teaching courses by teachers, always in a given day of a week, at a given time, and on a given place
  - Limit yourself to one active semester only

Exercise 10

- Extend the previous schema…
  - Each thesis may also be associated with several teachers acting as consultants

Exercise 11

- Extend the previous schema…
  - Departments consist of research groups
  - Each department has its name and code, both allowing to be used as independent identifiers
  - Research group can only be identified locally using an abbreviated name within a particular department which it belongs to

Exercise 12

- Extend and modify the previous schema…
  - Timetable events must support different semesters
  - Students can enroll in courses (even repeatedly)
  - For each such enrollment we need to record the final achieved grade (if any)

Exercise 13

- Modify the previous schema…
  - Model timetable events using an entity type

Exercise 14

- Create a UML schema diagram for the entire student information system as described
  - I.e. model all the following classes and associations:
    - Person, student, teacher, login, course, thesis, timetable event, time slot, room, semester, department, group