Course A7B36DBS: Database Systems

Practice 01:

#### **Conceptual Modeling in ER and UML**

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# **Conceptual Modeling**

- Database modeling layers
  - Conceptual, logical and physical

#### • 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

#### Assignments

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

- Extend the previous diagram...
  - Each person may have several login names that can be used for accessing the information system
  - Together with each login name we also store hashed value of a corresponding password

- Modify the previous diagram...
  - 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 this moment

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

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

- Extend the previous diagram...
  - Two courses may have a mutual dependency
    - We also would like to distinguish between the two following types of such dependencies: co-requisites and pre-requisites

- Extend the previous diagram...
  - 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

- Modify the previous diagram...
  - Can the previous relationship type for assignment / leadership of theses be modeled using a binary relationship type (instead of ternary)?

- Extend the previous diagram...
  - 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
  - You can limit yourself on one active semester only

- Modify the previous diagram...
  - Model timetable events using an entity type

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

- Modify the previous diagram...
  - Thesis name as such is no longer sufficient to identify particular theses
  - However, a pair of a thesis type and name is sufficient for this purpose
  - Finally, an artificially assigned thesis number in a repository may be used for the identification as well

- Extend the previous diagram...
  - 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 its abbreviated name within a particular department it belongs to

- Extend and modify the previous diagram...
  - 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)

- 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