Courses B0B36DBS, A7B36DBS: **Database Systems**

Practical Class 03:

Relational Model

Martin Svoboda

7. 3. 2017

Faculty of Electrical Engineering, Czech Technical University in Prague

Exercise 1

- Create an ER conceptual schema for a simple **cinema information system**:
  - Each cinema is identified by its name and has its residency at right one address which consists of a street and city only. Employees have unique birth numbers as well as employee numbers, have structured names comprising of a first name, last name and degrees. They also have contact addresses (street, city, and zip code in particular.) Each employee may work in at most one cinema, at several positions at a time. Finally, each employee has its boss (except the CEO).
  - Cinemas have several auditoriums, each with a locally unique number and a given maximal capacity. All the screening sessions of movies happen in these auditoria (on which they are identification dependent). Movies as such are always identified by their title together with a year of production. Screening sessions are scheduled to a particular date and time of beginning. They also have a recommended price for the only movie that is being screened.
  - Tickets to sessions are always sold to a particular row and seat number. We also need to store a price a given ticket has been sold for and a unique and artificially generated ticket number. For practical reasons we distinguish between two types of tickets. Ordinary ones are sold by cinema employees, whereas electronic have a verification code and are bought online by registered users.
  - Users are described by their first name and last name, they can have multiple phone numbers. Their unique e-mail address together with a hashed value of their password is used for authentication. Users can also make ratings of movies, always in a connection with a particular cinema.

Relational Model

- **Relational model**
  - Relation schema and relation
    - Atomicity, uniqueness, ordering, completeness
    - Keys, superkeys
    - Referential integrity
  - Relations vs. tables
  - Relational database schema and relational database

Referential Integrity

- **Sample relational schema**

  Course(Code, Name, …)

  Schedule(Id, Event, Day, Time, …), Event ⊆ Course.Code

- **… and data**

Id	Event	Day	Time	…
1	A7B36DBS	THU	11:00	
2	A7B36DBS	THU	12:45	
3	A7B36DBS	THU	14:30	
4	A7B36XML	FRI	09:15	

Code	Name	…
A7B36DBS	Database systems	
A7B36XML	XML technologies	
A7B36PSI	Computer networks	

Logical Schema

- **Transformation of ER / UML to relational model**
  - What we have
    - ER: entity types, attributes, identifiers, relationship types, ISA hierarchies
    - UML: classes, attributes, associations
  - What we need
    - Relation schemas with attributes and keys and foreign keys
  - How to do it
    - **Classes with attributes** → relation schemas
    - **Associations** → separate relation schemas or together with classes (depending on cardinalities…)

Exercise 2

- Transform the following parts of the ER schema to the relational model:
  - **Cinema** entity type with all its attributes

Exercise 3

- Transform the following parts of the ER schema to the relational model:
  - **Address** entity type and its relationship to cinemas
  - Correctly determine keys and foreign keys (if relevant)

Exercise 4

- Transform the following parts of the ER schema to the relational model:
  - **Employee** entity type with all its attributes, including those with nontrivial multiplicities
  - **Boss** relationship type

Exercise 5

- Transform the following parts of the ER schema to the relational model:
  - **Workplace** relationship type including its attributes

Exercise 6

- Transform the following parts of the ER schema to the relational model:
  - **Auditorium** entity type including its dependency on cinemas

Exercise 7

- Transform the following parts of the ER schema to the relational model:
  - Screening **session** entity type including its dependency on auditoria of cinemas
  - **Movie** entity type
  - Relationship type between sessions and movies

Exercise 8

- Transform the following parts of the ER schema to the relational model:
  - Complete hierarchy of **tickets**

Exercise 9

- Transform the following parts of the ER schema to the relational model:
  - **User** entity type
  - **Sale** relationship types for both electronic and ordinary tickets

Exercise 10

- Transform the following parts of the ER schema to the relational model:
  - **Rating** relationship type

Modeling Tools

- Conceptual modeling: **ER**
  - **Creately Online**
    - https://creately.com/
    - Free registration
    - Diagrams shared with community
    - New document: **Entity Relationship Diagrams**

Modeling Tools

- Conceptual modeling: **UML**
  - **Visual Paradigm Community Edition**
    - https://www.visual-paradigm.com/download/community.jsp
    - Free for non-commercial use
    - New diagram: **Class Diagram**
  - **Enterprise Architect**
    - http://www.sparxsystems.com/

Modeling Tools

- Logical modeling: **Relational model**
  - **DBDesignerFork**
    - https://sourceforge.net/projects/dbdesigner-fork/
    - Display: Notation: **EER [1,n]**