Name, first name: Enrollment number: Study program:

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# Mock exam
# Database System Concepts for Non-Computer Scientists
# Winter 2017/18, February 7th, 2018

**Important notes for the exam:**

- Processing time 40 minutes; you can gain maximal 40 points; to pass you have to gain at least 50% of the points (20 points)
- Your answers may be in English and /or German
- Papers
    - Please do only use the delivered papers.
    - Inscribe the first paper with your name, enrollment number, study program; every further paper with your name.
    - Please do check the completeness of your papers. The exam comprises
        - 6 pages (including this front page)
        - 4 assignments
- If you realize that your papers are not complete, please tell us immediately!

Assignments

- Please do not use pencils, and no red or green pens.
- This is a closed book exam.

- Please provide us with an ID card and a student card.
- Please sign this cover sheet.

Good luck!

Signature student: _____

Name, first name:

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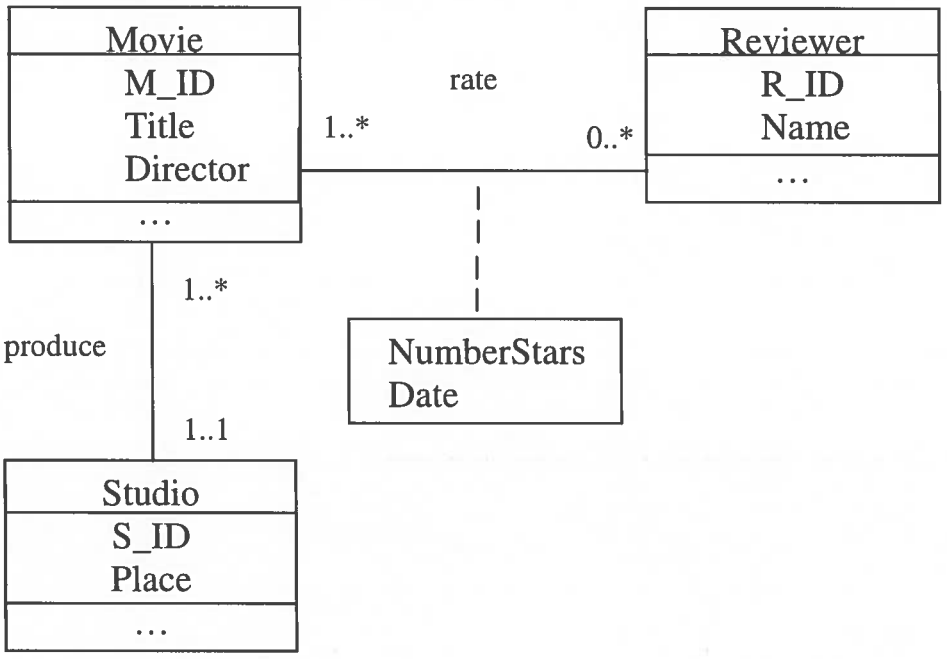
**Assignment 1 (UML-Modeling, Relational Schema) 8 Points**

Given the following excerpt of a UML model (in the notation of our lecture) for movies. A reviewer can rate the same movie on different days.




a) Transform the UML schema into a relational schema **with refinement** in giving the table structures (see below). Mark the primary keys by underlining, indicate which attributes must not be NULL, and describe the foreign key constraints – everything that can be derived from the schema above. If possible no constraints from the schema should be lost.
**Example form** of the table structures and constraints:
T1(A, B, C), T2(A, B), T1.A, T1.B, T2.A, T2.B NOT NULL, T1.C references T2.A

Movie(M_ID, Title, Director, S_ID)
Studio(S_ID, Place)
Reviewer(R_ID, Name)
rate(M_ID, R_ID, NumberStars, Date)
NOT NULL: Movie.M_ID, Studio.S_ID, Reviewer.R_ID, rate.M_ID, rate.R_ID, rate.Date, Movie.S_ID
Movie.S_ID references Studio.S_ID, rate.M_ID references Movie.M_ID,
rate.R_ID references Reviewer.R_ID

b) Which information from the schema above cannot be described in the DDL?

Every studio produces at least one movie
Every reviewer rates at least one movie

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**Assignment 2 (SQL-Queries) 12 Points**

Formulate SQL queries for the university schema, see supplementary sheet:

a) Average weekly hours of the lectures of Professor Russel

```
select avg (Weekly Hours)
from professors p, lectures l
where p.PersNr = l.Given_by and
p.Name = 'Russel'
```

b) Which output is given with the query below on that data of the university schema which is given on the supplementary sheet? Please give attribute names and values in form of a table.

```
SELECT name, s.studnr, COUNT(a.studnr) AS Quantity
FROM students s LEFT OUTER JOIN attend a
ON s.studnr = a.studnr
WHERE s.studnr = 24002 OR s.studnr = 28106
GROUP BY name, s.studnr
```

| Name | StudNr | Quantity |
|---|---|---|
| Carnap | 28106 | 4 |
| Xenokrates | 24002 | 0 |

c) Names of all professors who give at least 2 lectures

```
select Name
from lectures l, professors p
where p.PersNr = l.Given_by
group by Name having count(*) > 1
```

d) Which assistants share the same boss? Give the pairs of those assistants. Take care that an assistant with him-/herself as a pair is not in the output.

```
select a1.Name, a2.Name
from assistants a1, assistants a2
where a1.Boss = a2.Boss and
a1.Name <> a2.Name
```

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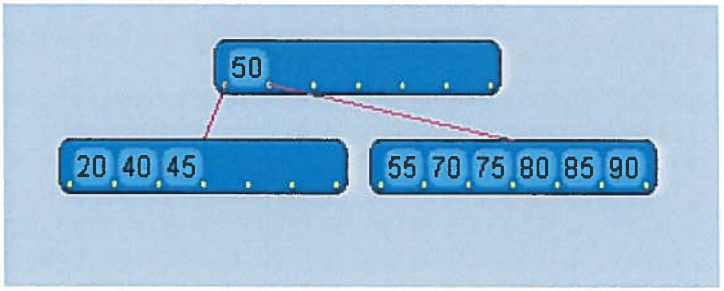
**Assignment 3 (B-Trees) 8 Points**

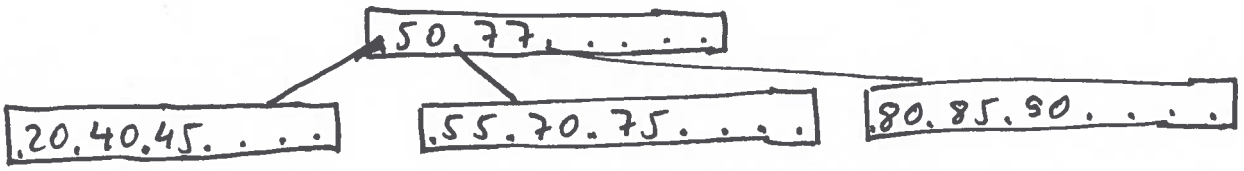
Given the following B-Tree:




a) What is the degree of this B-Tree?

3

b) Insert 77 into the B-Tree above. Depict the resulting B-Tree completely.
**Use the algorithm discussed in the lecture.**




c) Name one advantage and two disadvantages of hashing as an index structure for disk access.

+ point access O(1), easy to implement

- no range queries, not dynamic (collision handling), preallocation of memory

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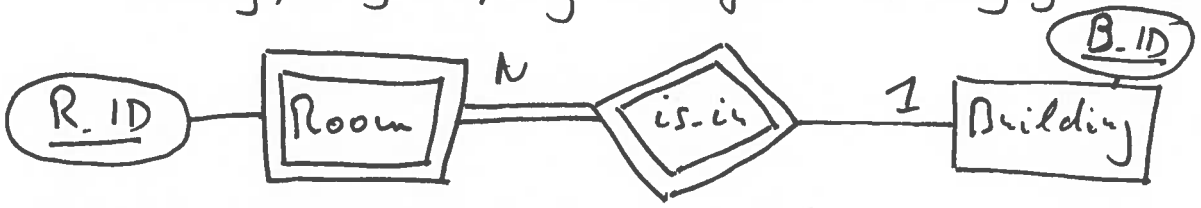
**Assignment 4 (Miscellaneous) 12 Points**

a) What is a weak entity in E/R-modeling? Depict a **typical** example.

weak entity cannot exist on its own, is dependent on another entity, only uniquely identified with key of the other entity




b) What does the ‚A' in the acronym ACID for transaction properties stand for?

Atomicity

Give a **short** explanation.

All or nothing

c) **Shortly** describe the anomaly *Dirty Read*.

Transactions read values which are never set valid (by abort or failure)

d) Give one example each for logical and physical optimization in query execution.

Logical: push selections down; determine join order

Physical: Implement join operator by hash join; use indexes for reading data

e) Can an index be defined over several attributes?

yes ☒ no ☐

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f) What does the acronyms below stand for?

OLTP: Online Transaction Processing

OLAP: Online Analytical Processing

For which classes of applications (OLTP or OLAP) storing relations in column stores is advantageous?

OLAP (read mostly, wide columns)

g) What means ‚on delete cascade' with foreign key constraints?

If the parent element is deleted, also all referenced child elements are deleted