HOCHSCHULE FÜR TECHNIK STUTTGART
UNIVERSITY OF APPLIED SCIENCES

MASTER'S COURSE **S**oftware **T**echnology
STUDIENGANG **M**aster **M**athematik

EXAMINATION in **SUMMER SEMESTER 2011**

MODULE: **Databases II** NAME:

DATE: **14 July 2011** SEMESTER:

TIME: **13.30 - 15.30 Uhr**

EXAMINER: **Prof. D. Koch**

ALLOWED AIDS: All materials that were distributed in class and in the Blackboard, all your own notes, two text books of your choice, plus an English dictionary.
NOT ALLOWED: Mobile Phones, laptop, and other communication devices
APPENDIX:

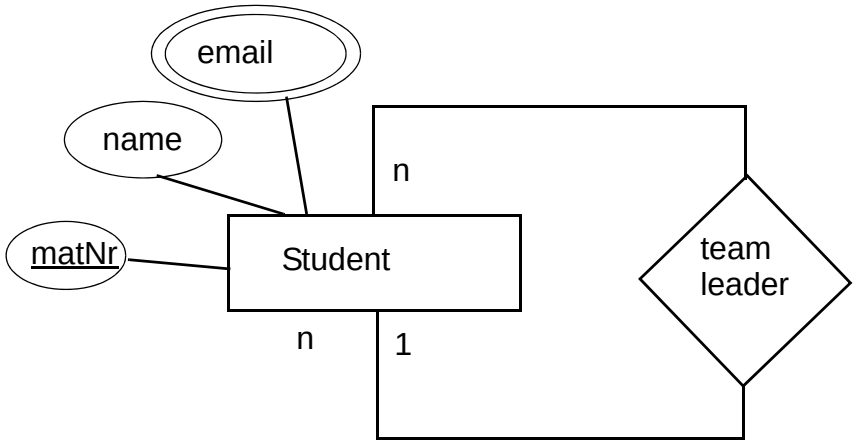
Please write your name on each sheet that you turn in.

Turn in the problem sheets as well!

Problem	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	Σ
Maximum points	12	8	12	10	10	8	8	12	10	8	8	106
Achieved points												
Grade												

Problem 1. (12 points)

Consider the following ER model that describes project team structures in a semester group.



You can assume that an email address is used exclusively by one person.
Based on this model, someone designs the following relational tables (primary keys are underlined):

Students (matNr, name, email)
TeamLeaders (memberMatNr, leaderMatNr) where memberMatNr and leaderMatNr are foreign keys referencing matNr in Students.

Your task:
Evaluate this relational design. Explain whether it is good or whether something could be improved, and in which way. If something needs improvement, also explain what its disadvantage in the given schema is.

Problem 2. (8 points)

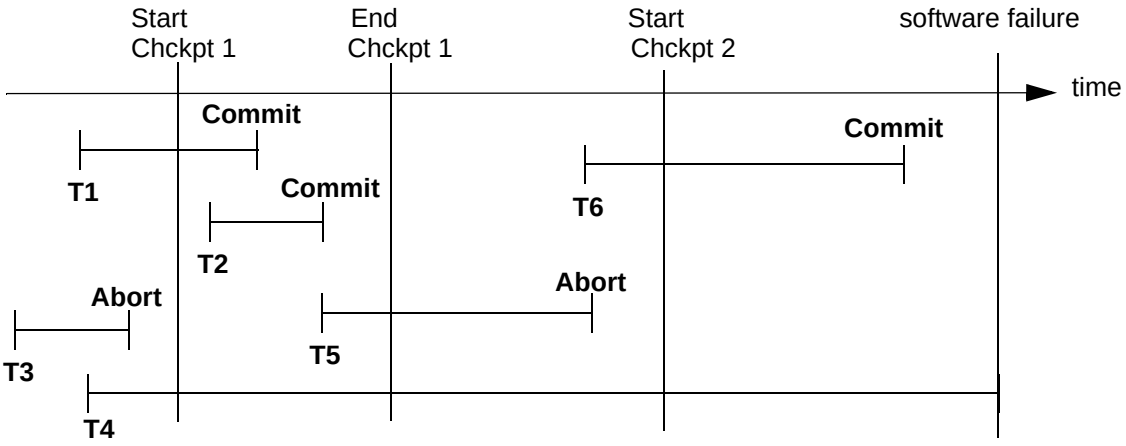
Briefly explain why it is important to be able to query meta data in a Java application that accesses a database using JDBC.

Problem 3. (12 points)

Consider the relation ProdStruct (partNr, partName, weight, containedIn) which describes product data of a computer vendor.
ContainedIn is a foreign key referencing partNr and describes for a given part the information in which larger part this part is contained. Example: a CPU is contained in a laptop.
Write the following query in a single SQL statement:
List the names of all parts which are lighter than 1g and which are used somewhere within parts named "Intel Pentium".
Note that a part called "Intel Pentium" is complex and contains parts that contain other parts, which in turn contain even other parts, etc.. This question asks for all parts in the entire "Intel Pentium" part hierarchy that fulfill the condition.

Problem 4. (2 times 5 points = 10 points)

Consider the following transaction scenario with a log file where fuzzy checkpointing is used and the execution is unexpectedly ended by a software failure:



a) (5 points)
List which transactions the recovery manager must undo and which ones it must redo. Briefly explain your choice.

b) (5 points)
Now assume that Checkpoint 2 had successfully finished just before the software failure occurred, after the Commit of T6. What is the answer of problem a) now? Briefly explain.

Problem 5. (2 + 2 + 6 points = 10 points)

Consider the following schedule of two transactions A and B:
$A_{read\ (x)}\ A_{read\ (y)}\ A_{write\ (x)}\ B_{read\ (x)}\ B_{write\ (x)}\ A_{write\ (y)}\ B_{read\ (y)}\ B_{write\ (y)}$

a) (2 points)
Is the schedule serial?
b) (2 points)
Is the schedule serializable?

c) (6 points)
If the schedule is serializable, explain why that is so.
If the schedule is not serializable, rearrange the operations to form a serializable, but not serial schedule.

Problem 6. (8 points)

Assume that in a DBMS the Force at Commit Rule for the log file is not applied.
Describe and explain an execution scenario that shows how this can lead to a problem.

Problem 7. (2 times 4 points = 8 points)

Imagine the following situation: You glimpse over the shoulder of a fellow student who is working with MySQL in the lab. You see the following code displayed in a MySQL session:

```
mysql> select * from ta;
+-------+----------+-------+----------+
| matNr | classNr  | hours | taSalary |
+-------+----------+-------+----------+
|  1000 | LIA-WS92 |    40 |     1011 |
|  1234 | LIA-WS92 |    35 |     1011 |
|  2345 | DTB-SS93 |    80 |     2011 |
|  1000 | STP-WS92 |    40 |     1011 |
+-------+----------+-------+----------+
4 rows in set (0.05 sec)
mysql>
```

a) (4 points) Could this code be a transaction or part of a transaction?
b) (4 points) What would you need to see in addition in order to decide whether this is a transaction or part of a transaction?

Problem 8. (2 times 6 points = 12 points)

Standard SQL provides 4 different isolation levels for locking. The safest level is "serializable" and prevents all errors.
a) (6 points) Why is the isolation level serializable not always used?
b) (6 points) Briefly describe a real life situation in which isolation level "repeatable read" is sufficient and explain which acceptable errors might happen.

Problem 9. (10 points)
In comparison to the "immediate update strategy" and the "deferred update strategy" the "steal/no force strategy" suffers from the severe disadvantage that it is much more complex and requires a lot more implemented functionality for recovery. Name and explain the main reason why it is still the strategy that is most frequently used.

Problem 10. (8 points)

Consider a database to which all users are granted only read access. (A realistic example for this is a data warehouse).
Briefly explain what the consequence of the read-only access is for the selection of the concurrency control strategy in this system.

Problem 11. (8 points)

Briefly explain the purpose of having two phases in the two phase commit protocol for nested transactions.