HOCHSCHULE FÜR TECHNIK STUTTGART
UNIVERSITY OF APPLIED SCIENCES

MASTER'S COURSE   **S**OFTWARE **T**ECHNOLOGY

EXAMINATION in **WINTER SEMESTER 07/08**

MODULE: **Databases**   NAME:

DATE: **15 January 2008**   SEMESTER:

TIME: **8.30 - 10.30 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
ANNEXES: None

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	8	12	8	8	10	12	8	8	10	10	12	106
Achieved points												
Grade												

Problem 1. (8 points)

Briefly explain the trade-off between storing a derived attribute in the database and computing it at the time the information is asked for.

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

a) Briefly describe a scenario in which it is better to use a file system than a DBMS. Briefly explain why.

b) Briefly describe a scenario in which it is better to use a DBMS than a file system. Briefly explain why.

Problem 3. (2 times 4 points = 8 points)

Briefly explain the trade-off (pros and cons) when implementing triggers in a database.

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

a) Which data sources are necessary to recover from a media failure (for instance, when the disk with the database has crashed). Why are they needed?

b) Name the rough steps of the recovery in this situation.

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

Consider a situation in which you join a company where you are given the task of administrator of a database for some technical application.

Briefly explain two things you could do to decide whether the database will profit from design changes or not. (By design we mean here not just the conceptual model, but also the general layout of the system: everything the DBA or application developers can influence).
In both cases, name the type of design change and your procedure for arriving at the decision.

Problem 6. (12 points)

A database stores information about the organisational structure in a large institution.
A department can contain other departments which can, in turn, contain other depart-
ments, and so on. Inside the departments on the bottom level, the employees work in
teams.
We assume one manager can run several departments.

The system has the following schema:

Department (dNr, name, address, superDept, mgrNr)
(Description of the departments. superDept is a foreign key referencing dNr in Depart-
ment; it denotes the next higher department. mgrNr denotes the manager of the depart-
ment and is a foreign key referencing pNr in Person).

Person (pNr, firstName, LastName, job)
(Description of the employees).

Team (tNr, tName, budget, dNr)
(Description of the teams inside the departments. dNr is a foreign key referencing the
department this team belongs to).

Membership (pNr, tNr, startDate, endDate)
(Description of who belongs to which teams. pNr is a foreign key referencing pNr in Per-
son, and tNr is a foreign key referencing tNr in Team. Since persons can enter and
leave teams, startDate and endDate describe the period of their membership in a spe-
cific team).

Your task:
Design a suitable entity relationship model that would result in the above relational
schema after applying the algorithm described in class for transforming an ERM to a
relational schema.

Problem 7. (8 points)

This problem uses the relational database schema in the previous problem.
Express the following query in SQL:

For the department with dNr =5 list all sub departments whose manager's last name is
Koch. With each department, give the dNr, the name, and the address.

Problem 8. (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 pro-
blem.

Problem 9. (2 times 5 points = 10 points)

SQL queries can be embedded into software applications. Depending on the techno-logy that is used, it is possible to do this in a static way or in a dynamic way (i.e. new queries can be generated and passed to the database at runtime).

Briefly explain one advantage and one disadvantage of doing it in the dynamic way. (You can refer to JDBC as an example, but the question applies to other database programming possibilities equally).

Problem 10. (2 time 5 points = 10 points)

a) Consider the following scenario with a log file where <u>sharp</u> checkpointing is used:
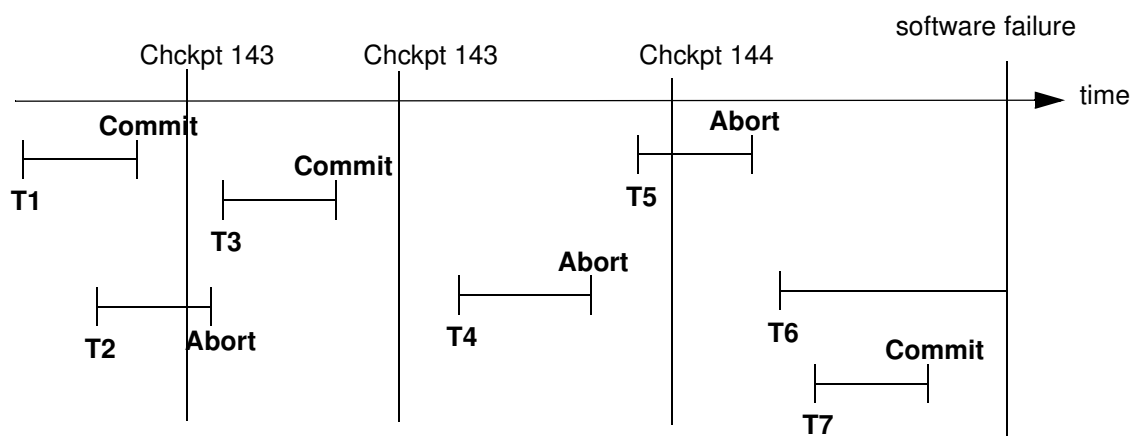
List which transactions the recovery manager must undo and which ones it must redo. Also list those for which no recovery is necessary.
Briefly explain your choice.

b) Briefly explain the main reason why one cannot assume that a data block with changes made by a transaction is safely on disk at the commit point of the transaction.

Problem 11. (2 times 6 points = 12 points)

Briefly explain two different things that have an impact on the response time of a data-base query. In particular explain how the effect on the response time happens.