

Tentamen 2005-12-21

DATABASE TECHNOLOGY - 1MB025

Date Wednesday 21 December, 2005
Time 08:00-13:00
Teacher on duty Kjell Orsborn, phone 471 11 54 or 070 425 06 91
Exam aids calculator

Instructions:

- Read through the complete exam and note any unclear directives before you start solving the questions. The following guide lines hold:
 - Write clear and neat answers! Answers that cannot be read can obviously not result in any points and unclear formulations can be misunderstood.
 - Assumptions outside of what is stated in the question must be explained. Any assumptions made should not alter the given question.
 - Write your answer on only one side of the paper and use a new paper for each new question to simplify the correction process and to avoid possible misunderstandings.
- A passing grade requires about 50% of the maximum number of points.

1. **Database terminology:** 4 pts

Explain the following database concepts:

- (a) meta data
- (b) primary index
- (c) referential integrity (sv. referensintegritet)
- (d) full functional dependency (sv. fullt-funktionellt beroende)

2. **Data models - three schema architecture:** 4 pts

Explain and give examples on what is meant by the concepts *physical* and *logical data independence*.

3. **Physical database design - indexing:** 4 pts

- (a) Describe the structure of B+ trees
- (b) Describe the principle for retrieval of data records by using a B+ tree index.

4. **SQL and relational algebra:** 4 pts

Assume that we have a literature database where there are two relations (tables) with the following schemas:

BOOK(BID, BNAME)
CHAPTER(CID, CNAME, LENGTH, BOID)

, where xID's represents keys.

- (a) Formulate a query in relational algebra that retrieves book id, book name, chapter id, chapter name and the length of the chapters for the book "Guide Uppsala". (2p)
- (b) Formulate an SQL query that retrieves the book id, book name, and the number of chapters for each book, i.e. how many chapters each book consists of. (2p)

5. **Concurrency control (sv. samtidighetskontroll):** 4 pts

- (a) Describe the principles for lock management (sv. låshantering) for transactions controlled by a *two-phase locking protocol* (sv. två-fas låsningsprotokoll).
- (b) What important properties can be stated by transaction schedules controlled by two-phase locking protocols?

6. Object-oriented and object-relational databases:

4 pts

- (a) What is the purposes of the three main kinds of user-definable database extensibility mechanisms available in an *object-relational* database system (sv. 'objektrelationella databaser')?
- (b) Which of the above extensibility mechanisms are lacking or weak in a first generation object-oriented database system, i.e. in *object stores* (sv. 'objektlager')?

7. Query optimization:

4 pts

- (a) What is *selectivity* (sv. 'selektivitet') and how is it used in cost-based query optimization?
- (b) What is the worst case complexity of cost-based query optimization and how does one avoid this cost?
- (c) Why does cost-based query optimization pay off despite its complexity?
- (d) How are operators in execution plans different from relational algebra operators? Give examples.

8. ODBC:

4 pts

- (a) What is ODBC?
- (b) What is the difference between JDBC and ODBC?
- (c) What is an ODBC driver (sv. 'drivrutin')?
- (d) What is the purpose of the ODBC driver manager?

Good luck and a Merry, Merry Christmas!

/ Kjell och Tore