



Semester 1 Examination 2018/2019

Exam Code(s) 3BCT1. 1EM1
Exam(s) 3rd B.Sc. (Computer Science and Information Technology)
Erasmus

Module Code(s) CT3532
Module(s) Database Systems 2

Paper No. 1
Repeat Paper

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Instructions: Candidates should answer any **Three** questions
All questions carry equal marks.

Duration: 2 hours

No. of Pages 3

Discipline(s) Information Technology

Requirements:
MCQ Release to Library: No
Handout
Statistical/ Log Tables
Cambridge Tables
Graph Paper
Log Graph Paper
Other Materials

Q. 1.

- a) Explain the term *minimal cover set*. Given a set of functional dependencies F , outline an algorithm to generate a minimal set of functional dependencies. Illustrate your answer with the following set F .

$$F = \{A \rightarrow BDE, B \rightarrow C, A \rightarrow C, AD \rightarrow G\} \quad (8)$$

- b) Given the following relation, R , and functional dependencies, F , decompose the relation such that the resulting relations satisfy BCNF.

$$\begin{aligned} R &= \{A, B, C, D, E, F, G, H, I\} \\ F &= \{ \{A, B, C\} \rightarrow \{D, E, F\}, \{A, B\} \rightarrow \{G\}, \{A, C\} \rightarrow \{J\}, \\ &\quad \{C\} \rightarrow \{H\}, \{H\} \rightarrow \{I\}, \{J\} \rightarrow \{C\} \} \end{aligned} \quad (10)$$

- c) Explain, with the use of a suitable example, when denormalisation may be appropriate.

(7)

Q. 2.

- a) Explain the structure of a B+ tree and outline an algorithm for insertion of items into a B+ tree. Illustrate your algorithm by showing how a B+ tree would develop given the following values to insert. You may assume each node in the tree can hold two search values.

$$32, 23, 15, 29, 12, 18, 9, 21, 22 \quad (10)$$

- b) Outline briefly, with examples, an algorithm for deletion from a B+ tree.

(5)

- c) Linear hashing and dynamic hashing are two approaches to hash values to a dynamically changing file. Briefly outline either approach and illustrate the approach using the following record key values. You may assume each block can hold two records.

$$32, 23, 15, 29, 12, 18, 9, 21 \quad (10)$$

Q.3.

- a) Explain the concept of two phase locking and show with an example how it ensures correct concurrent access in databases. (10)
- b) Outline the increased difficulties in guaranteeing correct concurrent access in a distributed database. (5)
- c) Outline an approach to database recovery using a *system log*. Your answer should explain the following concepts
 - i) system log
 - ii) commit point
 - iii) checkpoint
 - iv) an algorithm for recovery(10)

Q.4.

- a) Outline an efficient approach to implementing the join operator. (8)
- b) Parallel architectures have been used to increase the efficiency of many standard operations used in database management systems. Outline approaches to distributing a relation and discuss the suitability for different types of queries (point and range). (9)
- c) Explain, with an example, how to perform a join between two relations when the relations are partitioned across multiple partitions in a parallel database. (8)