



## **Semester 1 2017**

**Exam Code(s)** 3BCT1, SWB, EM  
**Exam(s)** Erasmus  
3<sup>rd</sup> B.Sc. Computer Science and Information Technology  
Science without Borders

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

Paper No.

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**Instructions:** Answer any 3 questions

**Duration** 2 hours  
**No. of Pages** 3 including this one  
**Department(s)** Information Technology

**Requirements** None

**PTO**

**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.

$$F = \{X \rightarrow YW, Y \rightarrow Z, X \rightarrow ZQ, Y \rightarrow Q\} \quad (11)$$

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

$$\begin{aligned} R &= \{A, B, C, D, E, F, G, H, I\} \\ F &= \{ \{A, B, C\} \rightarrow \{D, E, F\}, \{A, B\} \rightarrow \{G\}, \{A, C\} \rightarrow \{J\}, \\ &\quad \{C\} \rightarrow \{H\}, \{H\} \rightarrow \{I\}, \{J\} \rightarrow \{C\} \} \end{aligned} \quad (12)$$

- c) Define the term *non-additive join*. Show with a suitable example how you would check if a decomposition of a relation R into R1 and R2 has the *non-additive join property*. (10)

**Q. 2.**

- a) Linear hashing and dynamic hashing are two approaches to hashing values to a dynamically changing file. Briefly outline either approach and illustrate the approach using the following record key values. You may assume a blocking factor of two.

$$125, 124, 409, 412, 411, 415, 106, 110 \quad (13)$$

- b) Outline, with suitable examples, an approach to delete items from a dynamically hashed file. (7)
- c) Explain the structure of a B+ tree and an approach to inserting an item in a B+ tree. Discuss the advantages of a B+ tree index over a hash index. Your answer should refer to the following types of queries: range queries, point queries. (13)

**Q. 3.**

- a) Explain, with an example, the *incorrect summary problem*. (6)
- b) Explain the term *conflict-serializability*. Outline an approach to guarantee conflict serializability among a set of concurrently running transactions. Illustrate the approach on the example schedule you used in part a). (9)
- c) Prove the approach outlined in b) guarantees conflict serializability. (10)
- d) With respect to recovery, explain the notion of a commit point of a transaction and its role in recovery for a system operating under an immediate update protocol. (8)

**Q.4.**

- a) NOSQL database model have become popular as an alternative model to the relational database model. Discuss the main motivations behind these models and discuss how they differ from relational models. Your answer should include a discussion of the data models that are adopted and differences in terms of integrity enforcement. (11)
- b) Sorting is commonly performed procedure in SQL. Outline an efficient approach to implementing this operator on a relation. (11)
- c) Parallel architectures have been used to increase the efficiency of many standard operations used in database management systems. Outline an algorithm for parallel sorting a file. (11)