Semester 1, 2015

Exam Code(s)	3BCT, SWB, EM
Exam(s)	3rd year Information Technology and Computer Science Science Without Borders Erasmus
Module Code(s)	CT3532
Module(s)	Database Systems 2
Discipline(s)	Information Technology
Internal Examiner(s)	Dr. Michael Madden Dr. Colm O'Riordan*
External Examiner(s)	Dr. John Power
No. of Pages	3 (including cover sheet)
Duration	2 hours
Instructions:	Answer any three questions

PTO

Q.1.

i) Let R(A, B, C, D, E) be a relational schema with five attributes. Let F be the set of functional dependencies as follows: F = {A → B, {E, D} → A, {B, C} → E} List all candidate keys for R. (6)

ii) Explain, with an example, how a relation may not satisfy Boyce-Codd normal form. Show how you decompose the relation such that the resulting relations satisfy Boyce Codd normal form.
(8)

iii) Explain the process of database design by synthesis. Your answer should include an explanation of functional dependencies, closure and cover sets. Illustrate your answer with an example. Outline any disadvantages associated with this approach.
(13)

iv) Describe briefly the properties of the schema resulting from the design by synthesis approach
(6).

Q.2.

i) Explain the term *conflict-serializability* and explain its importance in concurrency control. (6)

ii) Outline the time-stamping approach to guaranteeing conflict-serializability in database systems and explain how it guarantees conflict serializibility. (10)

iii) With respect to recovery in database systems explain the role of both *commit points* and *checkpoints.* (8)

iv) For a system operating under the immediate update protocol, describe the main entries that are stored in the system log. Explain how the recovery process might proceed under the immediate update protocol. (9)

Q.3.

i) Describe the structure of a B+ tree. Outline an algorithm for inserting values into a B+ tree; illustrate the operation of your algorithm with suitable examples. Discuss briefly how deletion from a B+ tree might proceed. (12)

ii) Discuss the advantages of B+ trees over B trees as means to index data. (8)

iii) Explain what is meant by *linear hashing*. Outline a suitable algorithm to illustrate the operation of inserting values into a dynamic file via linear hashing. Illustrate your algorithm with the following values. You may assume each block has capacity for two records:

24, 29, 11, 13, 10, 15, 26 (13)

Q.4.

i) The join operator is a commonly used operator. Outline an efficient algorithm to implement a join between two relations *R* and *S*. Discuss the efficiency of the algorithm. (11)

ii) With respect to object-oriented databases, discuss the main differences between the classical relational model and the object-oriented model. Your answer should include a discussion of the comparative advantages of the two models. (11)

iii) NOSQL databases have been proposed as an alternative to relational models. 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)