NUI Galway
OÉ Gaillimh

# ***Autumn Examinations 2018-2019***

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| **Course Instance Code(s)** | 3BCT1, 1EM1 |
| **Exam(s)** | 3Rd B.Sc Computer Science and Information Technology<br>Erasmus |
| **Module Code(s)** | CT3532 |
| **Module(s)** | Database Systems 2 |
| Paper No. | 1 |
| External Examiner(s) | Dr Jacob Howe |
| Internal Examiner(s) | Professor Michael Madden<br>*Dr. Colm O'Riordan |

**Instructions:** Candidates should answer any **THREE** questions.
All questions will be marked equally.

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| **Duration** | 2 hours |
| **No. of Pages** | 3 |
| **Discipline(s)** | Information Technology |
| **Course Co-ordinator(s)** | Dr D Chambers |

**Requirements**:

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|---|---|---|---|---|
| Release in Exam Venue | Yes | ☐ | No | ☐ |
| MCQ Answersheet | Yes | ☐ | No | ☐ |
| Handout | None | | | |
| Statistical/ Log Tables | None | | | |
| Cambridge Tables | None | | | |
| Graph Paper | None | | | |
| Log Graph Paper | None | | | |
| Other Materials | None | | | |
| Graphic material in colour | Yes | ☐ | No | ☐ |

**PTO**

**Q.1.**

(a) Explain the term conflict-serializability. Describe in detail an approach to guarantee conflict serializability among a set of concurrently running transactions. (10)

(b) For the approach chosen in part a), explain, with examples, any of the undesired side-effects of the approach. (7)

(c) 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.2.**

(a) Describe the structure of a B+tree. Provide pseudo code to outline how insertion into a B+tree occurs.
Illustrate the operation of your algorithm by showing how the following values would be inserted into a B+tree. You may assume a tree of order 3.

*21, 12, 16, 18, 22, 23, 24* (12)

(b) Explain briefly what is meant by the term *dynamic hashing*. Outline the advantages of this approach. (6)

(c) Explain with a suitable example an approaches to building a multi-attribute index (7)

**Q.3.**

(a) Explain, with suitable examples, the process of normalisation in relational database design (10)

(b) Outline an algorithm to generate a minimal cover set. Illustrate, with a suitable example, how your algorithm operates. (9)

(c) Explain the role *Armstrong's axioms* play in the role of database design.

(6)

**Q.4.**

(a) With respect to parallel database, outline different approaches to partitioning a large relation across N disks and discuss their suitability for handling both point and range queries. (9)

(b) The join operator is a very common operator in relational database queries. Outline an efficient algorithm for sorting large quantities of data where the size of the data is too large to store in memory. (8)

(c) Outline an approach to performing a parallel join where the data is distributed across several separate machines. (8)