



### **Autumn Examinations 2014/2105**

<b>Exam Code(s)</b>	3BCT, SWB
<b>Exam(s)</b>	3rd year Information Technology and Computer Science Science without Borders
<b>Module Code(s)</b>	CT332
<b>Module(s)</b>	Database Systems II
<b>Discipline(s)</b>	Information Technology
<b>Internal Examiner(s)</b>	Dr. Michael Madden Dr. Colm O'Riordan*
<b>External Examiner(s)</b>	Dr. John Power
<b>No. of Pages</b>	3 (including cover sheet)
<b>Duration</b>	2 hours
<b><u>Instructions:</u></b>	Answer any three questions

**PTO**

**Q.1.**

- i) Discuss the properties of a well designed relational schema. (8)
- ii) 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)
- iii) Given an ER model, explain with the use of examples, how mapping to an object-oriented database would proceed. (12)

**Q.2.**

- 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. (13)
- ii) Explain what is meant by a *grid-file*. Explain briefly the efficiency of searching for matches on two attributes indexed using a grid-file. (9)
- 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. (11)

**Q.3.**

- i) The join operator is a commonly used operator in the relational algebra. Outline an efficient algorithm to implement a join between two relations *R* and *S*. Discuss the efficiency of the algorithm. (11)
- ii) Assuming a parallel architecture with *N* nodes each with equal computation power, describe how you could implement a join algorithm using the capabilities of the parallel architecture. Comment on the efficiency of your algorithm. (12)
- iii) In the context of distributed databases, outline an approach to efficiently join two relations that are stored at two different sites. (10)

- Q.4.** i) Given the following schedule, outline if, and how, problems might arise. Illustrate how a graph representing the conflicts can be used to show the existence of potential problems.

Ta	Tb	Tc
read_item(x)		
	read_item(y) write_item(y)	
write_item(x)		read_item(x)
		read_item(z) write_item(z)
	read_item(z) write_item(z)	
		write_item(x)
read_item(y) write_item(y)		

(7)

- ii) Timestamping and two-phase locking are two approaches to ensuring conflict-serializable schedules. For either approach, show how the above schedule in part (i) would continue. Show that the approach you have adopted (timestamping or two-phase locking) will guarantee conflict-serializable schedules. (17)
- iii) The two-phase commit is often used in distributed databases to ensure atomicity of transactions. With respect to the different types of failure that could occur, explain how the two phase commit operates to ensure atomic transactions. (9)