NUI Galway
OÉ Gaillimh

Autumn Examinations 2014

Exam Code(s)	3BCT
Exam(s)	3rd B.Sc. (Information Technology and Computer Science)
Module Code(s)	CT332
Module(s)	Database Systems II
Paper No.	
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Internal Examiner(s)	Prof. G. Lyons Dr. M. Madden Dr. C. O'Riordan
Instructions:	Answer any 3 questions
Duration	2 hours
No. of Pages	3 (including cover page)
Discipline(s)	Information Technology
Requirements	None

PTO

Q.1.

i) In database design by synthesis, a minimal cover set is generated from which the relations can be derived. Explain with an example the term *minimal cover* set. Discuss the advantages and disadvantages of this approach to relational database design. (11)

ii) In relational databases, it is sometimes advantageous to relax some of the constraints of normalisation and to de-normalise the schema. Explain, with examples when this is used. Explain briefly how some of the normalization constraints are relaxed in other non-relational or extended relational database models. (11)

iii) Describe how a specialization in an EER model can be mapped to
(a) a relational database schema
(b) an object-oriented database schema. (11)

Q.2. i) Given the following company database schema (keys underlined):

EMPLOYEE:	RSI, Fname, Lname, Salary, Address, Age, Dno
DEPARTMENT:	Dno, Dname, Description
DEPT_LOCN:	Dno, DLocation
PROJECT:	Pno, Pname, Budget, Proj_Desc, Plocation
WORKS_ON:	RSI, Pno, Hours

provide an SQL query for the following:

List all employees (Fname, Lname) who work for a department based in "Dublin" *or* who have worked more than 10 hours on a project located in "Dublin".

Outline the process of heuristic optimisation. Develop an operator tree that represents an efficient evaluation strategy for the above query. (15)

ii) Discuss the structure of a B tree and describe, with an example, the algorithm for the insertion of values into a B tree. (9)

iii) Compare, in terms of data retrieval in databases, the efficiency of the B Tree and B+Tree data structures. (9)

PTO

Q.3.

i) Timestamping and two-phase locking are two approaches to ensuring concurrency control. Outline *either* approach and present pseudo-code for the primitives used. Show how the following schedule would proceed under *either* protocol.

Ta	**Tb**	**Tc**
		read_item(X)
		read_item(Y)
	read_item(Y)	
	read_item(Z)	
read_item(X)		
read_item(Y)		
	read_item(X)	
	read_item(W)	
	write_item(W)	
		write_item(X)
write_item(Y)		

(20)

iii) Explain, with respect to recovery, the importance of a *commit point* of a transaction. Given the following fragment of a log, describe how recovery might proceed under an immediate update protocol.

[start_transaction, T1]
[read, A, T1]
[write, A, 10, 12, T1]
[start_transaction, T2]
[read, A, T2]
[write, A, 12, 13, T2]
[commit, T1]
[read, B, T2]
[write, B, 50, 60, T2]
[checkpoint]
[start_transaction, T3]
[read, C, T3]
[write, C, 45, 60, T3]
[read, D, T3]
[read, C, T2]
[read, D, T2]
[write, C, 60, 61, T2]
[write, D, 100, 0, T2]
[commit, T2]
<crash>

(13)

PTO

Q.4.

i) With respect to parallel databases, explain with examples, the following terms:
   a) Interquery parallelism
   b) Intraquery parallelism
   c) Interoperation parallelism
   d) Intraoperation parallelism (12)

ii) In the context of parallel databases, suggest approaches one could adopt to partitioning data across multiple disks. Discuss the suitability of the approaches with respect to the efficiency of point and range queries. (12)

iii) In deductive databases, explain with the use of appropriate examples, what is meant by *rule safety*. (9)