PAPER CODE NO.
COMP302

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THE UNIVERSITY
of LIVERPOOL

MAY 2004 EXAMINATIONS

Bachelor of Science: Year 3
Bachelor of Science: Year 4

ADVANCED DATABASE MANAGEMENT

TIME ALLOWED: Two Hours

INSTRUCTIONS TO CANDIDATES

Attempt **ALL** questions from Section A.
Attempt **TWO** questions from Section B only
If you attempt to answer more questions than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).

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SECTION A

Attempt ALL questions from this section. Section A is worth 50 marks

1. Describe the five types of integrity constraint. (8 marks)

2. For each of the integrity constraints, illustrate with an example the SQL statements that can be used to enforce the constraint. (7 marks)

3. Consider the following schedule:

T1	T2	T3	T4
		write-lock(A)	
			read-lock(B)
		unlock(A)	
read-lock(A)			unlock(B)
		write-lock(B)	
	read-lock(A)		
		unlock(B)	
write-lock(B)	unlock(A)		
			write-lock(A)
unlock(A)			
	read-lock(B)		unlock(A)
	unlock(B)		

What is the precedence graph corresponding to this schedule? (6 marks).

4. Is this schedule conflict-serializable? Fully explain your answer. (4 marks)

5. Consider a database with the following relations:
`Researches-in(LecturerID, Research-Area)`
`Lecturer(LecturerID, LecturerName, OfficeNO)`
Create a trigger such that whenever we insert a new tuple in the `Lecturer` table, it checks whether the LecturerID also appears in the `Researches-in` table. If the LecturerID does not appear in the `Researches-in` table, then the trigger inserts it, with research area set to null. (7 marks)

6. Define a distributed database and five of its potential advantages. (8 marks)

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7. Assume A is the owner of the relation R. Consider the following course of events:

   (1) User A GRANTS insert on R to user B WITH GRANT OPTION
   (2) User B GRANTS insert on R to user C WITH GRANT OPTION
   (3) User E GRANTS insert on R to users C WITH GRANT OPTION
   (4) User C GRANTS insert on R to user D

   Assume also that the following action can occur:

   (5) User A REVOKES insert on R from user B CASCADE

   Assume no other actions involving grant and revoke of insert on R have occurred in the system.

   a) Name the users who have insert permission on R after step (5) (3 marks)
   b) Name the users who would have insert permission on R if step 3 did not occur. (3 marks)

8. Describe the methods `executeUpdate` and `executeQuery` (4 marks)

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SECTION B

Attempt TWO questions from this section. Each question carries 25 marks. Credit will be given for the best 2 answers only.

1. Consider the following transactions:

T1	T2
	begin_transaction
begin_transaction	read(bal_x)
read(bal_x)	$bal_x = bal_x * 2$
$bal_x = bal_x + 20$	write(bal_x)
write(bal_x)	commit
commit	

   (a) In database explain what are *locks*, and define the *two phase locking (2PL)*. (9 marks)

   (b) What is the *lost update problem*? Are the transactions above affected by the lost update problem? Fully explain your answer. (7 marks)

   (c) If the transactions are affected by a lost update problem, rewrite them using 2PL to overcome it. (9 marks)

2. (a) In a RDBMS what are transactions and why are they important in the operation of a RDBMS? (8 marks)

   (b) Describe each of the ACID properties and explain how they relate to concurrency control and recovery mechanisms. Illustrate your answers using examples (10 marks)

   (c) Describe how the lost update problem conflicts with the ACID properties. Illustrate your answer by means of an example. (7 marks)

3. (a) In database what is the notion of *view* in a database? Illustrate the answer by means of examples (8 marks)

   (b) Describe the two approaches for querying views and outline their disadvantages. Illustrate the answer by means of examples. (9 marks)

   (c) Consider a database described by the following relations:
   table BRANCH(BranchNo, Street, BCity, BPostcode, Manager)
   table STAFF(StaffNo, SFirstName, SLastName, Position, DOB, Salary, SBranchNo)
   table PROPERTY-FOR-RENT(PropertyNo, PStreet, PCity, PPostcode, Type, Rooms, Rent, OwnerNo, PStaffNo, PBranchNo)
   table CLIENT(ClientNo, CFirstName, CLastName, CTelNo,prefType, maxRent, comment)
   table VIEWING(VClientNo, VPropertyNo, viewDate, comment)
   Create a view of staff who manage properties for rent, which includes the branch number they work at, their staff number, and the number of properties they manage. (8 marks)