

PAPER CODE NO.  
**COMP502**

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THE UNIVERSITY  
*of* LIVERPOOL

MAY 2004 EXAMINATIONS

Master of Science: Year 1

**ADVANCED DATABASE MANAGEMENT**

TIME ALLOWED: Two Hours

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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.

1. Describe the five types of integrity constraints. (8 marks)
2. For each of the integrity constraints described above, 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)	
		unlock(A)	read-lock(B)
read-lock(A)		write-lock(B)	unlock(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 such schedule? (6 marks).
4. Is this schedule conflict-serializable? Motivate the 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 table in `Lecturer` makes sure that the `Lecturer` also appears in the `Researches-in` table. If the `Lecturer` does not appear in the `Researches-in` table, then it inserts it, with null research area. (7 marks)
  6. Define a distributed database and five of their potential advantages. (8 marks)
  7. Assume A is the owner of the relation R. Consider the following course of actions:
    - (1) User A GRANT insert on R to user B WITH GRANT OPTION
    - (2) User B GRANT insert on R to user C WITH GRANT OPTION
    - (3) User E GRANT insert on R to users C WITH GRANT OPTION
    - (4) User C GRANT insert on R to user D

Assume also that the following action occur:

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

Assume no other actions involving grant and revoke of insert on R have occurred in the system. Name the users who have the permission of insert on R after step (5) (3 marks)

Name the users who would have the permission of insert 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:

Time	T1	T2
t1		begin_transaction
t2	begin_transaction	read(bal <sub>x</sub> )
t3	read(bal <sub>x</sub> )	bal <sub>x</sub> = bal <sub>x</sub> * 2
t4	bal <sub>x</sub> = bal <sub>x</sub> + 20	write(bal <sub>x</sub> )
t5	write(bal <sub>x</sub> )	commit
t6	commit	

- Describe what are locks and define the two phase locking (2PL). (9 marks)
  - What is the lost update problem? Are the transactions above affected by the lost update problem? Motivate the answer. (7 marks)
  - If the transactions are affected by the lost update problem, rewrite them preventing the problem by using 2PL. (9 marks)
- 2.
- Explain what are transactions in a RDBMS and why they are important in the operation of a RDBMS (8 marks)
  - Describe each of the ACID properties and how they relate to the concurrency control and recovery mechanisms. Illustrate your answers by means of examples (10 marks)
  - Describe how the lost update problem conflicts with the ACID properties. Illustrate the answer by means of an example. (7 marks)



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3. (a) Define 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 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. (7 marks)