

PAPER CODE NO.  
COMP302

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THE UNIVERSITY  
of LIVERPOOL

## MAY 2005 EXAMINATIONS

Bachelor of Science : Year 3

Bachelor of Science : Year 4

### Advanced Database Management

TIME ALLOWED : 2.5 hours

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#### INSTRUCTIONS TO CANDIDATES

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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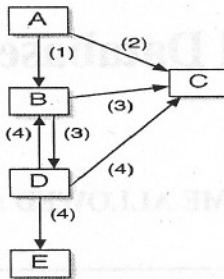
SECTION A

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

1. Define the notion of *Referential integrity*, and provide the SQL statement used to enforce this type of constraint. Explain what happens when a referential integrity constraint is violated. (10 marks)
2. Assume that A is the owner of the relation **Table**, while B, C, D, E are other users. Consider the following sequence of actions:

- (1) User A issues the following command:  
GRANT INSERT ON **Table** TO B WITH GRANT OPTIONS;
- (2) User A then grants the insert privilege to C: GRANT INSERT ON **Table** TO C;
- (3) User B, then issues the SQL command GRANT INSERT ON **Table** TO C, D WITH GRANT OPTIONS;
- (4) User D, finally, issues the following statement: GRANT INSERT ON **Table** TO B, C, E WITH GRANT OPTIONS;

This leads to the following privilege diagram:



Assume that the following two actions occur:

- (5) User B revokes the insert privilege from D: REVOKE INSERT ON **Table** FROM D CASCADE;
- (6) User A, then, revokes the insert privilege from C: REVOKE INSERT ON **Table** FROM C CASCADE;

Show the privilege diagram after both step (5) and (6) have occurred. Assume that no other actions involving grant (10 marks)



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3. Describe what strategy might be used to manage geographically distributed databases. (10 marks)
4. Define the notion of a *view* in a relational database, and provide the SQL syntax to define a view. Describe the use of views as a security mechanism. Illustrate your answer with examples and/or diagrams if needed. (10 marks)
5. In database explain what are *locks*, and define the *two phase locking (2PL)* protocol. (10 marks)



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SECTION B

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

1. (a) Describe what is meant by concurrent execution of database transactions in a multi-user system. Discuss why concurrency control is needed, and give informal examples justifying the need for concurrency control. (15 marks)
- (b) Consider the diagram below and determine whether the schedule is serialisable. Illustrate your answer, with diagrams if needed. (10 marks)

Time	Transaction 1	Transaction 2
t <sub>1</sub>	begin_transaction	
t <sub>2</sub>	read(bal <sub>x</sub> )	
t <sub>3</sub>	bal <sub>x</sub> = bal <sub>x</sub> + 100	
t <sub>4</sub>	write(bal <sub>x</sub> )	begin_transaction
t <sub>5</sub>		read(bal <sub>x</sub> )
t <sub>6</sub>		bal <sub>x</sub> = bal <sub>x</sub> * 1.1
t <sub>7</sub>		write(bal <sub>x</sub> )
t <sub>8</sub>		read(bal <sub>y</sub> )
t <sub>9</sub>		bal <sub>y</sub> = bal <sub>y</sub> * 1.1
t <sub>10</sub>		write(bal <sub>y</sub> )
t <sub>11</sub>	read(bal <sub>y</sub> )	commit
t <sub>12</sub>	bal <sub>y</sub> = bal <sub>y</sub> - 100	
t <sub>13</sub>	write(bal <sub>y</sub> )	
t <sub>14</sub>	commit	

2. (a) Define *triggers* and describe what they are used for by the Oracle DBMS. Illustrate the syntax by means of an example (15 marks)

- (b) Given the following relations:

Teaches(lecturer-ID, module-code)

Lecturer(lecturer-ID, name, room)

Write an Oracle trigger to carry out the following actions: After insert on table Lecturer, check if the lecturer-ID is present in table Teaches and insert it if it is null (with a null module code).

(10 marks)

3. (a) Describe the three principles that must be followed during *fragmentation*. (10 marks)

- (b) Let us consider the following relation:

Property-for-Rent(property-id, type, address, rent, owner-id)

If we assume that there are only two possible property types, Flat and House, determine the horizontal fragmentation of the relation. Check the correctness of the fragmentation schema against the three principles listed above. (15 marks)