



THE UNIVERSITY
of LIVERPOOL

SUMMER 2002 EXAMINATIONS

Bachelor of Arts : Year 3
Bachelor of Science : Year 3
Master of Science : Year 1

ADVANCED DATABASE MANAGEMENT

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Attempt *all* questions in Section A
Attempt *two* questions from Section B

If you attempt to answer more than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).



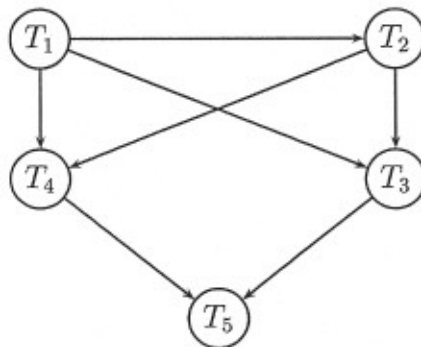
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Section A.

Attempt ALL questions from this section

A1. describe the four (so-called ACID) properties of transactions. (6 marks)

A2. Consider the following precedence graph



Is the corresponding schedule conflict-serializable? Explain your answer.

If it is conflict-serializable give a corresponding serial schedule. (4 marks)

A3. What is timestamping? (4 marks)

A4. Consider the two following schedules:

Schedule 1

T_1	T_2	T_3
read(B)		
read(A)		
write(B)		
	read(B)	
	read(C)	
	write(C)	
		read(C)
		read(A)
		write(A)

Schedule 2

T_1	T_2	T_3	T_4
read(A)			
	read(A)		
	read(B)		
		read(A)	
			read(A)
write(A)			
	write(B)		

For each of these schedules:

- draw the precedence graph for the schedule;
- determine whether the schedule is conflict-serializable. If it is conflict-serializable, list all the equivalent serial schedules.

(6 marks)



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A5. Consider a banking system where A and B are two accounts accessed by transactions T_1 and T_2 . Transaction T_1 transfers £50 from account B to account A. Transaction T_2 displays the total amount of money in accounts A and B. In order to control the interaction among the concurrent execution of T_1 and T_2 lock requests have been added to T_1 and T_2 as follows:

T_1 :	write_lock(B)	T_2 :	read_lock(A)
	read(B)		read(A)
	B:= B - 50		unlock(A)
	write(B)		read_lock(B)
	unlock(B)		read(B)
	write_lock(A)		unlock(B)
	read(A)		display(A+B)
	A:=A+50		
	write(A)		
	unlock(A)		

Suppose that the values of accounts A and B are £100 and £200, respectively. If these transactions are executed serially, either in the order T_1, T_2 or in the order T_2, T_1 , then transaction T_2 will display the value £300.

If these transactions are executed concurrently, are the locking operations enough to ensure that transaction T_2 always displays the correct value £300? Justify your answer.

If locking operations are not correct modify T_1 and T_2 to ensure serializability. (6 marks)

A6. What is a distributed database ? (4 marks)

A7. Consider a distributed database with the following relation:

EmployeeInfo(employeeID, name, designation, salary).

where the primary key is underlined.

For privacy and security reasons, this relation is fragmented into two fragments:

$F_1 = \Pi_{\text{employeeID}, \text{salary}}(\text{EmployeeInfo})$

$F_2 = \Pi_{\text{name}, \text{designation}}(\text{EmployeeInfo})$

which are stored at different sites of the distributed database.

Is the fragmentation operation correct? Justify your answer. If the fragmentation operation is not correct, define an alternative fragmentation of the relation EmployeeInfo which satisfies the initial requirement of storing data about salary, and data about name and designation in different sites. (6 marks)

A8. Object-relational capabilities in SQL are centralized around the UDT, or user defined type. Describe the two main contexts in which UDTs can be used. Give an example of UDT usage in each of the two contexts. (4 marks)



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Section B.

Attempt TWO questions from this section. Each question carries 20 marks. Credit will be given for the best two answers only.

- B1. a. Describe what is generally known as “the lost update” problem. Give an example of two concurrent transactions that generate a lost update. (10 marks)
- b. Describe how to prevent the lost update problem in the example that you have shown above using the two-phase locking (2PL) protocol. (10 marks)
- B2. a. How does the concept of an object in the object-oriented database model differ from the concept of an entity in the entity-relationship model? (10 marks)
- b. Describe the use of views as a security mechanism. Illustrate your answer with examples and/or diagrams if needed. (5 marks)
- c. Consider a database with the following relation:
Manages (employee-name, manager-name)
Assume that we wish to allow a user manager the insert privilege on the table Manages, and allow manager to grant this privilege to others. Write an SQL statement that performs this task. (5 marks)
- B3. a. Referential integrity is a form of integrity constraint that ensures that all non-null values that appear in a certain column A of a table R must also appear in the column B of a table S. Table S is called the parent table, and table R is called the child table.
When a user attempts to update a row in the parent table, and there are matching rows in the child tables, SQL supports four possible outcomes. Describe the four possible outcomes. (8 marks)
- b. Triggers can be used in Oracle to enforce enterprise constraints. They are often called *event-condition-action* rules.
Describe what the event, the condition and the action are. (5 marks)
- c. Consider a database with the following relations:
Manages (employee-name, manager-name)
Employee (employee-name, street, city)
Write an Oracle trigger to carry out the following action: after insert on the table Employee, check if the employee name is present in the table Manages and insert it if not (with a null manager name). (7 marks)