THE UNIVERSITY
of LIVERPOOL

MAY 2003 EXAMINATIONS

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

Advanced Database Management

TIME ALLOWED : Two Hours and a Half

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**

A1. 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.

(3 marks)

A2. Assume A is the owner of the relation P. Consider the following sequence of actions:

(1) User A GRANT insert on P to user B WITH GRANT OPTION

(2) User A GRANT insert on P to user C

(3) User B GRANT insert on P to users C and D WITH GRANT OPTION

(4) User D GRANT insert on P to users B, C, E WITH GRANT OPTION

This leads to the following grant diagram:
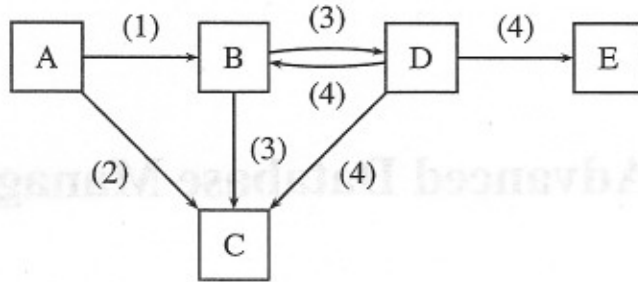
Assume that the following two actions occur

(5) User B REVOKE insert on P from user D CASCADE

(6) User A REVOKE insert on P from user C CASCADE

Show the grant diagrams after steps (6).

Assume no other actions involving grant and revoke of insert on P have occurred in the system. Name the users who have the permission of inserting on P after step (6) (5 marks)

A3. Describe the methods `executeQuery` and `executeUpdate`. (4 marks)

A4. Suppose that there is a database system that never fails. Is a recovery manager required for the system? (5 marks)

A5. Consider the following two schedules:

Schedule 1

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

Schedule 2

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

(4 marks)

A6. What is a timestamp? How do timestamp based protocols for concurrency control differ from locking based protocols? (5 marks)

A7. Describe 5 potential advantages of distributed databases. (9 marks)

A8. Consider a distributed database with the following relation:

`EmployeeInfo(employeeID, name, address, designation, salary)`.

where the primary key is underlined. For privacy and security reasons, we decide to store data about the employee salary into one, database and the personal data of the employee, that is name, address and designation, into another database.

Illustrate how we can achieve this and explain in what sense the proposed solution is correct. (5 marks)

A9. Briefly describe how the concept of an object in the object-oriented database model differs from the concept of an entity in the entity-relationship model. (5 marks)

A10. Object-relational capabilities in Oracle are centralized around user defined types (UDTs). Describe the two main contexts in which UDTs can be used. Give an example of UDT usage in each of the two contexts. (5 marks)

Section B.

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

B1. a. Describe what is meant by the 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. (8 marks)

b. This question is based on the following relation

Emp(eid, ename, age, salary)

and the following update command

```
UPDATE Emp
SET salary = salary * 1.1
WHERE ename = 'Chiara'
```

Give an example of a transaction that would conflict with this command (in a concurrency control sense) if both were run at the same time. Explain what could go wrong, and how you could solve the problem. (9 marks)

c. This question is based on the following relational schema

Movie(title, year, length, inColor, studioName)

Studio(name, address)

Write a trigger enforcing the following enterprise constraint: at all times, any studio name appearing in Movie also appears in Studio. (8 marks)

B2. a. What are locking methods? Are they enough to ensure serializability? If not how can we modify locking to obtain serializability? (8 marks)

b. Discuss the main differences between view resolution and view materialization. (7 marks)

c. One problem area with distributed databases is that of distributed database design. Discuss the issues that have to be addressed with distributed database design. (10 marks)

B3. a. Illustrate the potential problems of the 2PL protocol and how they can be solved. (8 marks)

b. How do optimistic concurrency control techniques differ from other concurrency control techniques? Discuss the typical phases of an optimistic concurrency control method. (8 marks)

c. Briefly discuss the nested relational data model and compare it with the relational data model. Give informal examples illustrating your answer. (9 marks)