SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

BACHELOR OF SCIENCE HONOURS DEGREE

LEVEL 4 SEMESTER 1

EXAMINATION QUESTION PAPER

MODULE CODE	**HCS408**
MODULE NARRATION	**ADVANCED DATABASES**
DATE	
DURATION	**3 HOURS**

INSTRUCTIONS TO CANDIDATES:

1. **Section A carries 40 marks**
2. **Questions in Section B carries 20 marks each.**
3. **Answer all questions in section A and any three (3) in section B.**

SECTION A

QUESTION 1

a) Giving practical examples explain the ACID properties **[10 marks]**

b) With an example illustrate the difference between a Transaction Rollback & Restart recovery **[10 marks]**

c) Explain how concurrency control and recovery is performed in distributed database **[10 marks]**

d) For the given schedule below, explain how the 2PL can be used to prevent the concurrent problem presented. **10 marks]**

Time	T_1	T_2	bal_x
t_1		begin_transaction	100
t_2	begin_transaction	read (bal_x)	100
t_3	read (bal_x)	$bal_x = bal_x + 100$	100
t_4	$bal_x = bal_x - 10$	write (bal_x)	200
t_5	write (bal_x)	commit	90
t_6	commit		90

SECTION B

QUESTION 2

a) Given a relational database below

Company

CName	StockPrice	Country
Gizmo Works	25	USA
Canon	65	Japan
Hitachi	15	Japan

Table 1

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	Gizmo Works
Powergizmo	$29.99	Gadgets	Gizmo Works
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Table 2

a) Compute SQL statements for the following:

i. Find all products under $200 manufactured in Japan; return their names and prices. **[3marks]**

ii. Find all countries that manufacture some product in the 'Gadgets'category **[3marks]**

iii. Find products that are more expensive than all those produced By "Gizmo-Works" **[3marks]**

b) Explain the main objective and principles behind the two phase locking (2PL) protocol. **[8 marks]**

c) Describe a possible security control for each of the following threats to database security:

i. Loss of confidentiality; **[1 mark]**

ii. Loss of integrity; **[1mark]**

iii. Loss of availability **[1 mark]**

QUESTION 3

a) Using appropriate examples and diagrams, explain in your own words what the following database concepts mean:

i. Horizontal Fragmentation. **[5 marks]**
ii. Vertical Fragmentation. **[5 marks]**
iii. Replication. **[5 marks]**

b) Describe a range of techniques that can be used to counter or minimise the impact of deadlocks in a highly concurrent system. Comment on the effectiveness of each technique. **[5 marks]**

QUESTION 4

a) Giving an example of your choice, explain the concepts of serial, non-serial, and serializable schedules. Stating the rules for equivalence of schedules. **[10 marks]**

b) Define redundancy **[2 marks]**

c) Explain different problems encountered by redundancy in databases. **[8 marks]**

QUESTION 5

Ensuring data integrity and consistency is of vital importance to a DBMS during the application of transactions to the database, particularly concurrent transactions. Using your own suitable examples and diagrams, explain and discuss the following transaction-related concepts.

i. Query optimization **[5 marks]**
ii. COMMIT & TWO-PHASE COMMIT **[5 marks]**
iii. ROLLBACK & CASCADED ROLLBACK **[5 marks]**
iv. Checkpoints & Savepoints **[5 marks]**

END OF PAPER