NAPIER UNIVERSITY

SCHOOL OF COMPUTING

RESIT DIET EXAMINATION

SESSION 2000-2001

MODULE: CO22001

DATABASE SYSTEMS

DATE: **DURATION: 2 HOURS**

START TIME:

EXAMINERS:

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QUESTION PAPER DATA

Number of pages - SIX
Number of questions - FIVE
Number of sections - ONE

INSTRUCTION TO CANDIDATES

Answer ANY THREE questions.

PLEASE READ THE FULL INSTRUCTIONS BEFORE COMMENCING WRITING

1. Consider the following database specification:

A customer wants a database designed to handle mail-order train ticket allocation. The same database is also used to allocate drivers to individual trains. Each customer who writes in can ask to buy any number of tickets. Any particular ticket will allow a customer to travel on a particular "run". A run is a particular train travelling on a particular route with a particular driver on a certain day between certain times. A route is made up of a collection of stations. A train can be used on more than one run, and each driver can drive more than one train (but not at the same time). Each run has only a single route, although a station may appear in more than one route.

(a) Design a database to match the above specification. State all assumptions made. Use an ER diagram to describe the resulting design. List likely attributes for each entity type. The resulting design should be as constrained as possible while still matching the specification.

(15)

(b) Given that a driver entity type contains the driver's name and address, and that a customer also contains name and address, and in addition a driver can also be a customer, redraw the ER diagram to show how this redundant information could be normalised out.

(5)

(c) EER diagrams offer another way of drawing the driver and customer entity types using classes and sub-classes. Using the process of specialisation redraw driver and customer using sub-classes.

(5)

Total Mark [25]

2. Consider the following transaction schedule:

Time	Transaction A	Transaction B	Transaction C
t1	bal:=READ(X)		
t2	bal:=bal+100		
t3		bbal:=READ(X)	
t4		intr:=bbal*1.05	
t5			a1bal:=READ(X)
t6			a2bal:=READ(Y)
t7			a1bal=a1bal-10
t8			a2bal=a2bal+10
t9			WRITE(X[a1bal])
t10			WRITE(Y[a2bal])
t11			COMMIT
t12		WRITE(X[intr])	
t13		COMMIT	
t14	WRITE(X[bal])		
t15	COMMIT		

The schedule shown is for a transaction management system which DOES NOT use locking. Transaction A is designed to add 100 pounds to account X. Transaction B is designed to add 5% interest to account X. Transaction C is designed to transfer 10 pounds from account X to account Y.

(a) (i) Is the interaction between Transaction A and Transaction B (ignoring transaction C) serialisable? Explain your answer.

(5)

(ii) Is the interaction between Transaction A and Transaction C (ignoring transaction B) serialisable? Explain your answer.

(5)

(b) Draw a precedence graph of the interaction between transactions A, B, and C. Explain the result.

(8)

(c) If locking was introduced into the scenario, redraw the schedule showing all lock state changes on X and Y and all WAIT states.

(7)

Total Mark [25]

3. A database system has been implemented using Oracle. The list below shows the relations used in this system.

```
customer(cno,forenames,surname,address)
order(cno,stockno,amount)
lightbulb(stockno,typeno,wattage,noinbox,unitcost)
lighttype(typeno,typename)
```

The system allows the customer to create an order list of lightbulbs. The same lightbulb may appear in the **lightbulb** relation, provided it has a unique stockno. The same lightbulb may be available in different sizes of box (i.e. 1 bulb per box, 5 bulbs per box, etc.)

(a) Write an SQL query which gives the total order cost for all orders made by customer number 10.

(6)

(b) Write SQL statements which would select the cheapest way to order 100 of "Spot Lights ES" at 60 watts. You should assume in answering this question that bulbs are only available in boxes of 1 bulb and 5 bulbs.

(14)

(c) Explain in words how you could find the cheapest way to order 100 of "Spot Lights ES" at 60 watts where boxes can contain any number of bulbs between 1 and 100. You do not need to write SQL in answering this question, and your solution does not need to be efficient.

(5)

Total Mark [25]

4.

time	Transaction A	Transaction B
t1	READ(J)	
t2		WRITE(K)
t3	READ(K)	
t4	????????????????	READ(K)
t5	????????????????	WRITE(J)
t6	????????????????	????????????????

(a) (i) Consider the transaction schedule shown above. In a system which supports attribute-based locking, explain what happens to transactions A and B in the regions marked with question marks and why this happens.

(6)

(ii) If the DBMS did not have locking, what effect would this have on the transaction schedule and the data contained in the database?

(3)

(b) Describe how the problem depicted by transactions A and B can be detected and resolved to allow at least one of the transactions to complete.

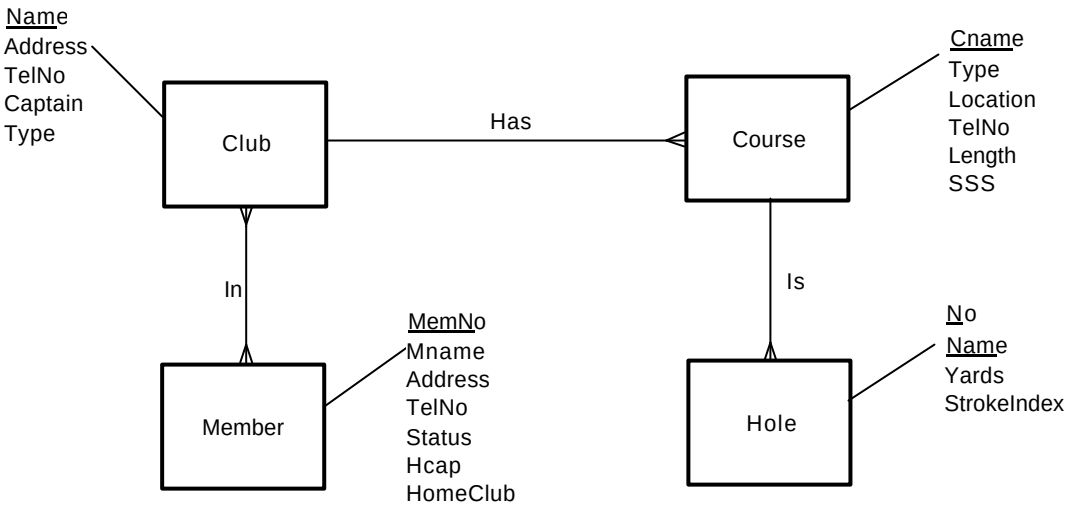
(6)

(c) Aborting a transaction cancels all that transaction's modifications to the database. Using diagrams explain how transaction B shown above could be aborted in a system which uses Deferred Update and another system which uses Immediate Update. Focus particularly on how attributes on the disk changes before and during this process. As part of your answer critically contrast how the two update techniques handle the abort.

(10)

Total Mark [25]

5. (a) The Scottish Golf Union has designed the following E-R diagram to describe its organisation. Map the E-R diagram to a relational schema, clearly identifying the primary and foreign keys.



(12)

(b) Given the relational schema: R (A, B, C, D, E) with functional dependencies B -> C and E -> A and the following instance:

A	B	C	D	E
1	1	1	1	5
2	1	1	1	6
3	2	2	2	7
4	3	2	3	8
5	4	3	3	9
6	4	3	4	0

(i) Explain whether the above relation R is a valid instance, given the stated functional dependencies.

(3)

(ii) Normalise the above relation R to BCNF, showing all working.

(4)

(c) If a database implementation is based on a set of relations which have not been fully normalised, briefly discuss the disadvantages and the advantages in the resulting implementation.

(6)

Total Mark [25]

END OF PAPER