

NAPIER UNIVERSITY
SCHOOL OF COMPUTING

RESIT DIET (SEMESTER TWO) EXAMINATION
SESSION 1999-2000

CS 22004: DATABASE SYSTEMS

DATE:

TIME ALLOWED: 2 HOURS

START TIME:

FINISH TIME:

EXAMINER:

**G. RUSSELL
J. MURRAY**

QUESTION PAPER DATA

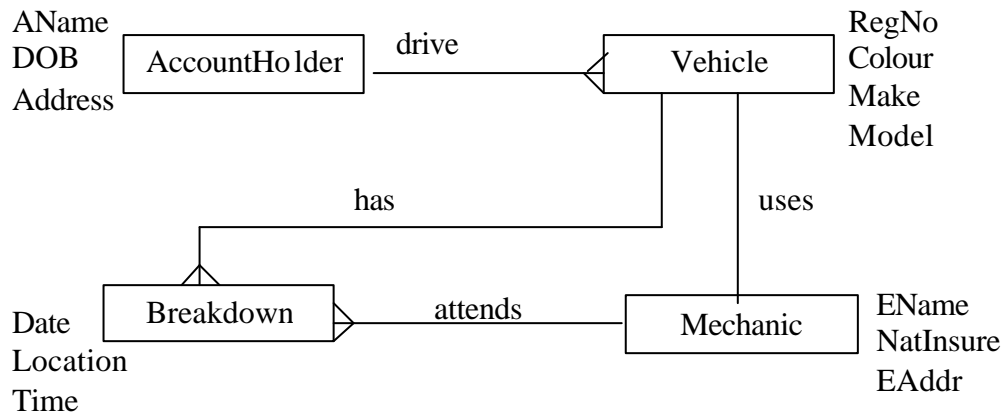
**Number of Pages - FIVE
Number of Questions - FIVE
Number of Sections - ONE**

INSTRUCTIONS TO CANDIDATES

Answer any THREE questions.

PLEASE READ FULL INSTRUCTIONS BEFORE COMMENCING WRITING

1. (a) Map the following ER model into a relational database schema, outlining the mapping process and clearly indicating any assumptions made.



(16)

- (b) Consider the following relations:

```

Person(NatInsure, Name, Address, City)
Player(NatInsure, teamno)
Team(teamno, teamName, teamAddress, teamCity)
Owner(NatInsure, teamno, percent)

```

Give SQL queries which will answer the following questions:

- (i) The names of owners who own more than 50 percent of their teams. (3)
- (ii) The names of players who live in the same city as their team city. (3)
- (iii) The names of owners who play for teams which they do not own. (3)

Hint: The following SQL gives the names of the players who play for Edinburgh based teams:

```

SELECT Name
FROM Person, Player, Team
WHERE
    Team.teamCity = 'Edinburgh'
AND Team.teamno = Player.teamno
AND Player.NatInsure = Person.NatInsure

```

Total marks [25]

2. Consider the following specification:

A theatre company wants to hold details of performances and actors in a database. Each performance occurs at a particular time and day, and is a performance of a particular play. A play may not always be played by the same actors. Each actor can appear in multiple plays. An actor may have particular skills, such as singing or tap-dancing, and this should be recorded. Finally, each play must have a captain, to make sure that the play is done professionally, and a captain must be an actor.

(a) Draw an ER diagram to represent an efficient implementation of the database specified above. (15)

(b) One problem which may result from the generation of an ER diagram is a chasm trap. Explain what is meant by a chasm trap, and how they can be removed from a diagram. (4)

(c) The theatre company specification is to be added to, such that each captain is to have their bodyweight recorded for insurance purposes.

(i) How could this best be implemented using standard ER diagramming techniques? (2)

(ii) Give a description and critical comparison with respect to standard ER of how this could be done using EER methods. (4)

Total marks [25]

3. (a) With respect to record storage, describe with the use of illustrations what is meant by:

(i) Sequential organisation (2)

(ii) The B+ tree index (4)

(b) Critically compare sequential and B+ tree organisation of records with respect to the algorithms for record insertion, record deletion, and searching. (10)

(c) Given a set of records each containing only a single attribute which is an integer and also the primary key, draw a diagram showing the resulting B+ tree. The set of records, in the order of insertion, is 10,20,4,9,23,18, and 11.

Assume that each node in the tree can hold two keys and appropriate address pointers. State any other assumptions which you make.

(9)

Total marks [25]

4. In a system without locking, the following transaction schedule was produced:

Time	Trans1	Trans2	Trans3
t1	Read(F)		
t2			Read(G)
t3		Write(G)	
t4			Read(F)
t5		Write(F)	
t6	Write(G)		
t7	Write(H)		
t8			Read(H)

(a) Draw a precedence graph for this transaction schedule, and state with reasons if this schedule is serializable.

(10)

(b) If the same system is changed so that it makes use of two-phase locking, describe in detail the effect that this will have on the transaction schedule shown above. If any transactions deadlock, simply write DEADLOCK at the point where the deadlock occurred.

(10)

(c) The introduction of locking may lead to deadlock. What is the procedure employed to resolve deadlocks?

(5)

Total marks [25]

5. (a) Consider the following relational schema and the associated functional dependencies:

Relation

X(A, B, C, D, E, F, G)

Dependencies

- 1) A → D
- 2) A, B → C, D, E, F, G
- 3) E → F
- 4) B, E → G
- 5) B, C, G → A, D, E, F
- 6) B, C, E → A, D, F, G

- (i) State, with reasons, the normal form of relation X. (3)
 - (ii) Convert the relations to BCNF, briefly justify each step in the process. (10)
- (b) Discuss the advantages and disadvantages of normalisation. (8)
- (c) Describe using an example why 3NF is needed. (4)

Total marks [25]

END OF PAPER