



THE UNIVERSITY OF THE WEST INDIES

EXAMINATION OF DECEMBER 19 98

Code and Name of Course: CS35A - DATABASE MANAGEMENT SYSTEMS Paper:
Date and Time: MONDAY 14TH DECEMBER 1998: 9.00 - 11.00 A.M. Duration: 2 HRS
INSTRUCTIONS TO CANDIDATES: This paper has 3 page(s) and 4 questions

Answer question 1 and two others.

Question 1.

- a. The West Indies Cricket Board has approached you to build a program to help them streamline their operations. Cricket in the various islands is the responsibility of national cricket boards (e.g., Jamaica Cricket Board, Antigua Cricket Board) each of which has a president and a contact person. Each officer has a name, an address and a telephone number.

- b. Each cricket club has to register with the national cricket board. A club has a name. It also has three officers, namely a president, a treasurer and a secretary. Each officer has a name, an address and a telephone number. A club may field up to three teams.

Each player is registered with a club and has a name, an address and a telephone number. For each player one also has to record whether he is a bowler, a batsman or an all-rounder. If he is a bowler, we want to record his strike rate and his best bowling figures. If he is a batsman, we want to record his average and his highest score. For all-rounders, we record both.

Finally, the national board has the responsibility for the various grounds. Each ground has a name, an address and a groundsman, with a name, an address and a telephone number. Each ground also has a capacity. Clubs each have one ground assigned to them as their home ground.

- i. Develop an E-R diagram for the above application. [9 marks]
- ii. Turn the E-R diagram into a set of tables normalized up to third normal form. [6 marks]

b. A new development is the use of data warehousing by large organizations. A data warehouse is a repository of the historical data relevant to that organization. For example, a retailer may keep a record of all the sales that they made for a particular period. The data in data warehouses is typically not normalized. We know that typically not normalizing data may lead to difficulties. Why then is it not a problem not to normalize tables in a data warehouse?

[5 marks]

c. In a distributed database, what is meant by fragmentation?

[5 marks]

d. A supplier of auto parts with many branches on the island has approached you to advise them on whether to set up a distributed database. Each branch has to keep records of the auto parts that they have in stock. However, if a customer comes in with a request for an auto part that is not in stock at that particular branch, it should be possible to check if any of the other branches has the part in stock. There are communication lines between the various branches but they are not reliable. Would you recommend that the supplier have a centralized database, or that they opt for a distributed database? If they opt for a distributed database, what type of fragmentation and replication would you recommend? Justify your answer.

[5 marks]

e. Consider the following tables used in a database for an organization which rents out records to borrowers:

```
record(recId, Artist, Title, Producer, Company)
borrower(bId, Name, Address, Tel#)
loan(bID, recId, date)
```

Translate the following into relational algebra and SQL:

i) What are the titles of records made by Bob Marley?

[2 marks]

ii) What are the telephone number(s) of the person who borrowed a record on September 30?

[2 marks]

iii) What are the name(s) of the person(s) who borrowed records produced by "Xtra Large"?

[2 marks]

iv) What are the names of the persons who borrowed records on September and what are the titles of the records that they borrowed?

[4 marks]

Question 2

a. What is a serializable execution of a set of transactions?

[5 marks]

b. What are locks and how can they help in avoiding bad interleaving of the execution of transactions?

[5 marks]

Question 3

- a. Formulate Armstrong's axioms. [5 marks]
- b. How can Armstrong's axioms be used in the design of a database? [5 marks]

Question 4

- a. What is checkpointing and how does it help speed up database recovery? [5 marks]
- b. What recovery mechanism would you use when there is a system-wide failure with damage to the database? [5 marks]