UNIVERSITY OF PORTSMOUTH

BACHELOR OF SCIENCE (HONS) IN COMPUTING

APRIL 2004 EXAMINATION

20 APRIL 2004

IT354
DATABASE DESIGN & MANAGEMENT

TIME: 2 HOURS + 10 MINUTES READING

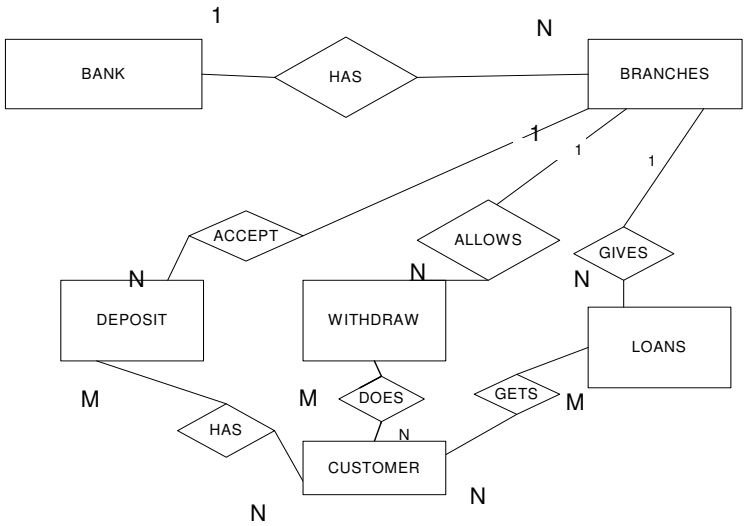
☞ **INSTRUCTIONS:**

- This is a **CLOSED BOOK** examination.
- Choose any **THREE (3)** out of **FIVE (5)** questions.
- Do not answer more than **THREE (3)** questions in total.
- Please start every question on a new page.
- Answers will not be marked if they are illegible.
- Write the question numbers (in the order you have attempted them) in the boxes provided in the answer script.
- Write your **INDEX NUMBER** and **MODULE NUMBER** on the cover page of every answer booklet.

QUESTION 1

An ER diagram of a BANK database is shown in the following diagram.
The attributes of the entities are as given below.

BANK(Bank_code, Bank_Name, address)
BRANCHES(Branch_no, Location)
CUSTOMER(Cust_id, cust_address, tel_no)
DEPOSIT(Deposit_no, account_no, amount, type)
LOAN(Loan_no, amount, type)
WITHDRAW(Withdraw_no, account_no, amount, date)



a) One of the entities shown is in fact a weak entity. Identify which one this is and give the ***full*** primary key of this weak entity.

(3 Marks)

b) Identify any two entities which have total participation in the relationship that joins them.

(4 Marks)

c) If every customer must make at least one deposit and can have at most three loans, indicate the (min, max) constraints on the relationship between "Customer" and "Deposit" and on the relationship between "Customer" and "Loans".

(4 Marks)

d) Translate the ER diagram into a set of relations.

(9 Marks)

[TOTAL MARKS FOR QUESTION 1: 20 MARKS]

QUESTION 2

A database schema consists of the following relations:

Film (moviename, category, date_of_production)

Actors (starname, gender , age)

Studio (studioname, location)

Produces (studioname, moviename)

Acting_stars (starname, moviename)

Write relational algebra expressions for the following queries

a) List the films acted in by Arnold that were produced during the years 1995 to 2000.

(5 Marks)

b) List all the films produced by Venus Studios located in Hollywood.

(5 Marks)

c) Calculate the average age of all the actors who have acted in the film "Gone with the Wind ".

(5 Marks)

d) List the number of films produced by each studio.

(5 Marks)

[TOTAL MARKS FOR QUESTION 2: 20 MARKS]

QUESTION 3

Super Construction is a construction company that manages several building projects. Each project has its own project number, name, employees assigned to the project and so on. Each employee has an employee number, name, and a job classification such as engineer, computer technician and so on. The company charges its clients by billing the hours spent on each contract. The hourly billing rate is dependent on the employee's position.

The firm maintains all its information in a single table as shown below.

P_NO	P_NAME	E_NO	E_NAME	JOB_CLASS	CHG/HOUR	HRS
001	Computer center_1	101	John	Elec. Engg.	65	13
		102	Wong Hwee	Comp. Tech.	60	16
		104	Anne	Comp. Tech.	60	19
002	Electical_1	101	John	Elec. Engg.	65	15
		103	June Arbough	Biol. Engg.	55	17
003	Computer_center_2	104	Anne	Comp. Tech.	60	18
		102	Wong Hwee	Comp. Tech.	60	14
		105	Carl Adams	Elec. Engg	65	26

a) Discuss the data redundancy and possible data anomalies in the given single table.

(8 Marks)

b) Super Construction feels that as the table grows bigger it might become difficult to manage. The firm has hired you to advise it on how to design its database for efficient retrieval of data. You have studied the table and decided to "normalize" the database.

Identify the Functional dependencies available in the above single relations and hence normalise to BCNF. Designate the primary keys for each table.

(12 Marks)

[TOTAL MARKS FOR QUESTION 3: 20 MARKS]

QUESTION 4

A schedule of two transactions is given below.

Time	Transaction A	Transaction B
1	Read X	
2	X = X+100	
3	Write X	
4		Read X
5		X = X*1.1
6		Write X
7		Read Y
8		Y = Y*1.1
9		Write Y
10		Commit
11	Read y	
12	Y= Y-10	
13	Write Y	
14	Commit	

a) Find the result of the schedule for the following conditions, With initial values X = 50 and Y = 100:
   i) Transaction A executes before Transaction B.
   ii) Transaction B executes before Transaction A.
   iii) Transactions A and B are executed with interleaved operations as given in the above schedule.

(6 Marks)

b) By drawing a precedence graph or otherwise, identify whether the above schedule is serialisable.

(6 Marks)

c) Rewrite the schedule, introducing write locks and unlocking operations as appropriate, so that the resulting new schedule follows the two phase locking protocol.

(8 Marks)

[TOTAL MARKS FOR QUESTION 4: 20 MARKS]

QUESTION 5

a) Discuss the following:

i) Any two methods of implementing the relational algebra operator "Join".

ii) Any two methods of searching used in the relational algebra operator "Select".

(12 Marks)

b) Consider the following relational schema and SQL query:

Student(student_id,Exam_code,student_name, gender, Age)

Examination(Exam_code, course, Marks)

SQL query:

```
SELECT  *
FROM    Student , Examination
WHERE  Student.Exam_code = Examination.Exam_code
AND       Student.Age > 30
AND       Examination.Result > 70;
```

This SQL query can be implemented by either of the following two relational algebra expressions:

Expression 1

$$\pi_{Age>30}(Student) \rightarrow F1$$
$$\pi_{Marks>70}(Exa\min ation) \rightarrow F2$$
$$F1 * F2 \rightarrow \mathrm{Re}\,sult$$

Expression 2 :

$$Student * Exa\min ation \rightarrow F1$$
$$\pi_{Age>30\&Marks>70}(F1) \rightarrow \mathrm{Re}\,sult$$

Compare the two relational algebra expressions and determine which one of them is a more efficient implementation of the original SQL query.

(8 Marks)

[TOTAL MARKS FOR QUESTION 5: 20 MARKS]

- End of Paper -