

**NAPIER UNIVERSITY**  
**SCHOOL OF COMPUTING**

**RESIT DIET - SESSION 1998-99**

**DATABASE SYSTEMS 2**

**MODULE NO: CS22004**

**DATE: TUESDAY 24<sup>th</sup> AUGUST 1999**

**EXAM TIME: 1½ HOURS**

**START TIME: 0930 HOURS**

**FINISH TIME: 1100 HOURS**

**EXAMINERS:**

**J. MURRAY**

**G. RUSSELL**

**QUESTION PAPER DATA**

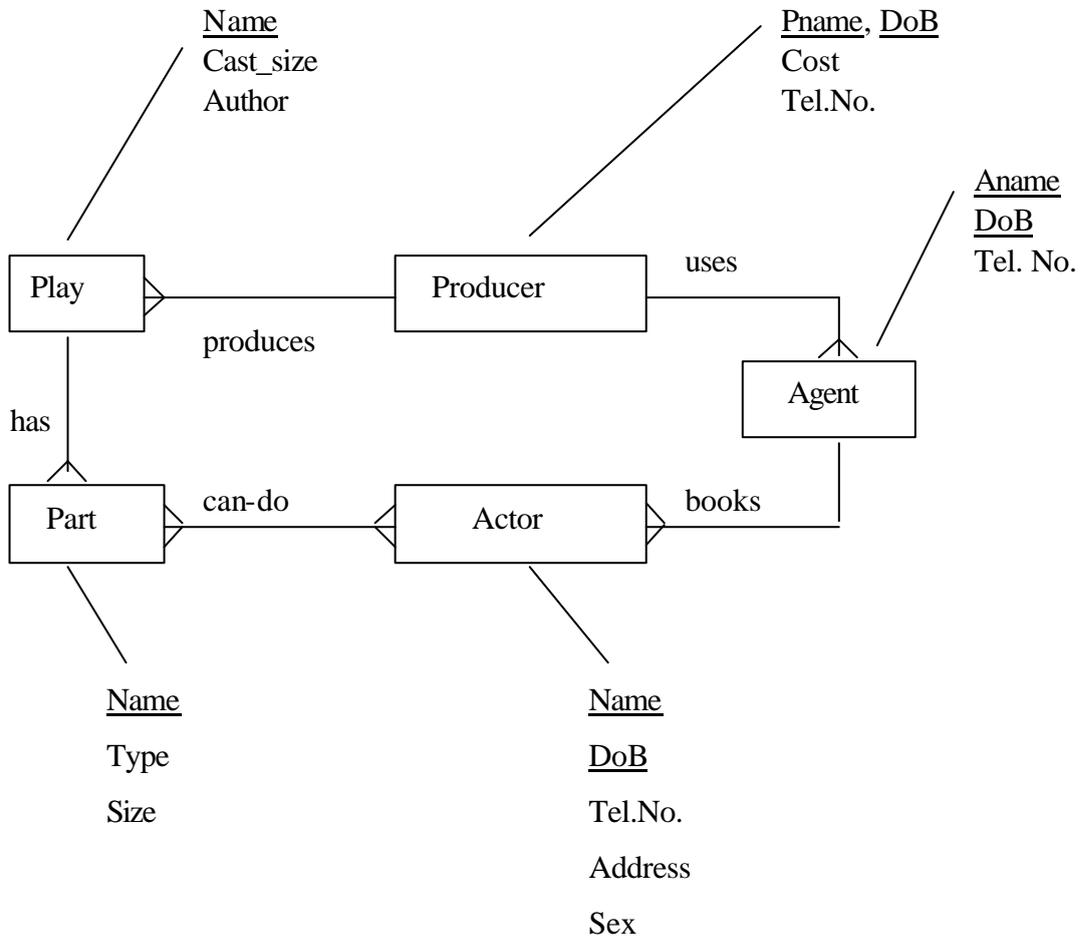
**Number of pages – FIVE**

**Number of questions – FIVE**

**INSTRUCTIONS TO CANDIDATES**

**Answer any THREE questions.**

1. (a) Map the following E-R model to a relational database scheme, outlining the mapping process.



(16)

- (b) Employee (EmpNo, name, salary)  
 Emp-Proj (EmpNo, ProjNo, Hrs\_worked)  
 Project (ProjNo, name, budget)

Given the above relational schema, construct SQL queries to answer the following:

- (i) List the names of employees earning more than the average salary. (3)
- (ii) List the names of employees working on project number 2. (3)
- (iii) List the names of employees working on projects with a budget more than 25,000. (3)

Total marks [25]

2.           A(a1, a2 a3, a4)  
              B(b1, (b2, b3))  
              C(c1, c2, c3, c4)

Dependencies:

a2 → a4

c3 → c4

- (a) In what normal form are the above relational schemes, given the associated dependencies? Transform these relations to third normal form, showing the steps involved.

(12)

- (b) Discuss briefly the purpose of normalisation, detailing also its disadvantages.

(7)

- (c) Define entity, integrity and referential integrity. What is the significance of these concepts for data retrieval?

(6)

Total marks [25]

3. (a) Discuss the use of transactions in database systems.

(8)

(b) The following table shows the schedule for three transactions updating values A, B, C.

Time	Transactions		
	T1	T2	T3
t0		read_item (A)	
t1		read_item (B)	
t2		read_item (B)	
t3			read_item (B)
t4			read_item (A)
t5	read_item (C)		
t6	write_item (C)		
t7			write_item (B)
t8			write_item (A)
t9		read_item (C)	
t10	read_item (B)		
t11	write_item (B)		
t12	abort	write_item (C)	
t13		commit	commit

(i) Explain why the above schedule could result in update errors in a database without concurrency control.

(2)

(ii) Locking could be used to allow concurrent execution of the three transactions t1, t2 and t3. Explain how locking works, and how it interacts with the transaction mechanism. Demonstrate the effect of locking on the schedule shown above.

(7)

(iii) What is deadlock and how can it be controlled?

(4)

(c) Describe a method of concurrency control other than locking.

(4)

Total marks [25]

4. (a) With the aid of suitable examples, discuss the need for 2-phase locking in concurrent access to a DBMS. (7)
- (b) Discuss the problems associated with choosing the granularity of locking in a 2-phase locking system. (4)
- (c) Compare and contrast the following 2 methods of achieving transactions, recovery and secure concurrent access in a DBMS.
- (i) Shadow-paging.
- (ii) Log files. (14)

Total marks [25]

5. (a) Describe the characteristics of the ANSI / SPARC database architecture model. (10)
- (b) Discuss the use of indexes in a relational database, indicating how these might be specified and the situations in which their use might affect the efficiency of processing. (15)

Total marks [25]

END OF PAPER