Final Assessment Test – July 2023

Course: **BCSE302L - Database Systems**

Class NBR(s): **0683/0685/0687/0688/0699/0704/0707/ 0721/0727/0736/0738/0740/0742/0744/0750/0753/ 0756/0760/0764/0768/0771/0776/0944/0957/1259/ 1371**

Slot: **A2+TA2**

Time: **Three Hours**

Max. Marks: **100**

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN "OFF" POSITION IS TREATED AS EXAM MALPRACTICE

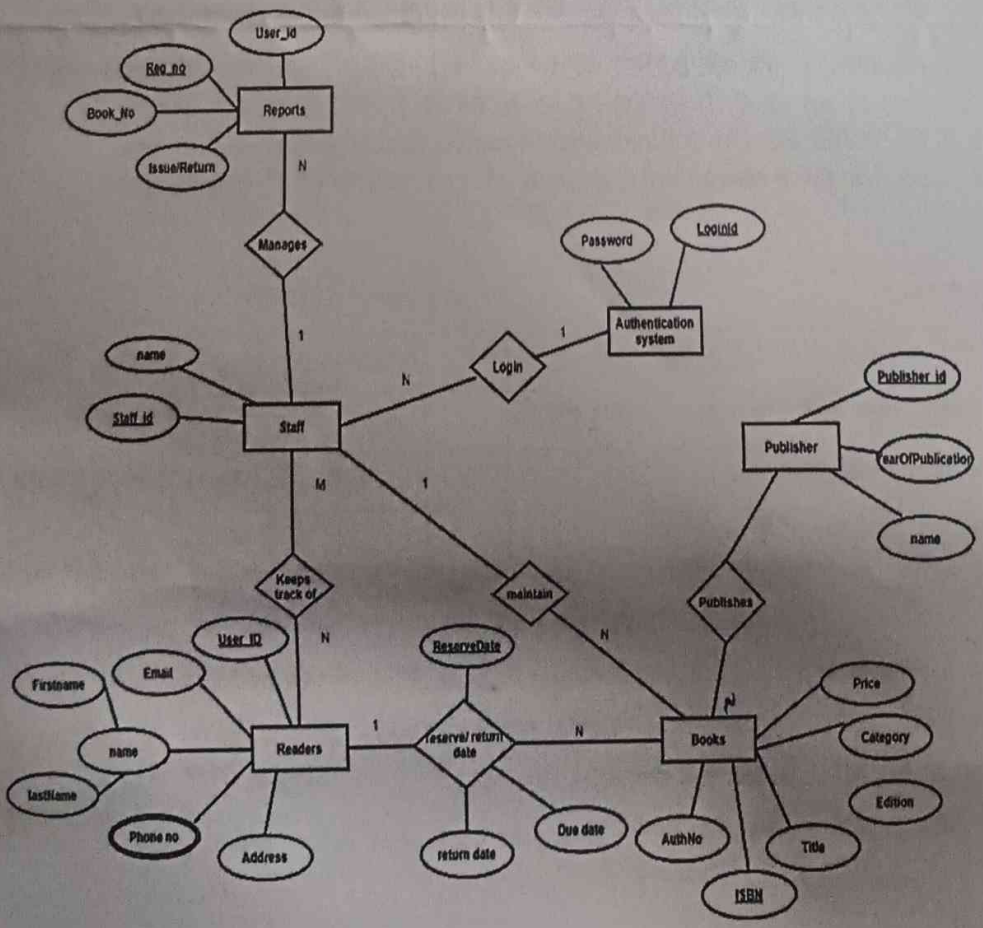
Answer ALL Questions

(10 X 10 = 100 Marks)

1. a) Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system? **[5]**

   b) Explain the difference between external, internal, and conceptual schemas. How are these different schema layers related to the concepts of logical and physical data independence? **[5]**

2. a) Map the following ER diagram to a relational model. Identify the relationship and map the cardinality. Represent primary key and foreign key in the schema. **[5]**



b) Construct an EER diagram for the following requirement specification. [5]

A university maintains records of its students and the programmes in which they have enrolled. It stores student id, name, address and phone number of a student and programme code, programme name and duration of a programme. A student is either a full-time student or a part-time student (only one of the types). A student can register for many programmes and a programme can have many students.

3. Consider the following relation for published books.

Book (Book – title, Author – name, Book – type, List price, Author – affil, Publisher).

Author - affil refers to the affiliation of author. Suppose the following dependencies exist:

Book – title ⟶ Publisher, Book-type

Book – type ⟶ list-price

Author – name ⟶ Author – affil

a) What normal form is the relation in? Explain your answer. [5]

b) Apply normalization until you cannot decompose the relation further. State the reasons behind each decomposition. [5]

4. a) Given a relation R (A,B,C,D,E,G) with the following eight functional dependencies F: AB → C, D → EG , C → A, BE → C, BC → D, CG → BD, ACD → B, CE → AG. For the following statements, decide whether they are true or false. For false statements, explain why do you think that they are wrong. [8]

Id	Statement	True	False	Explanation
1.	The closure of BC is {A, D, E, G}			
2.	All attributes of R are in the closure of BC			
3.	The closure of AC is {A,C}			
4.	ABC is super key of R			

b) Consider a relational schema R (A, B, C, D, E, F, G, H) and set of functional dependencies: [2]

F { A →BC, E →C, AH→ D, CD →E, D→ AEH, DH→ BC}

Compute AE^+. Is BCD →H valid or not?

5. Considering the following Library Relational schema. Write the queries in relational algebra format.

Book(Book_id, title, publisher)
Book_Authors(Book_id, author_name)
Book_loans(Book_id, Card_no, Date_out, Due_date)
Borrower(Card_no, Name, address)

a. Find the books written by 'Ramakrishnan' or published by 'Tata Mcgraw hill'.
b. Find the library members dwelling in 'katpadi' who have not taken any books.
c. Find the books published by 'pearson education' which are taken by a person named 'John'.
d. Find the members who have taken more than three books.
e. Find the card numbers for which the members have taken all the books of 'Wiley' Publications.

6. a) An ordered file of 1,00,000 records is stored in a disk with block size 2048 bytes. File records are fixed and are un-spanned with record length 256 bytes. Suppose the index file has key field of 10 bytes and pointer of 6 bytes, Compare the performance of accessing data file directly and by primary index. [4]

b) Draw the initial query tree for the following query and show the steps to optimize the query. [6]

SELECT P.PNO, P.DUM, E.LNAME, E.ADDRESS, E.DOB FROM PROJECT P, DEPARTMENT D, EMPLOYEE E WHERE P.DUM=D.DNO AND D.MGRSSN=E.SSN AND P.LOCATION='CHENNAI'.

7. a) Draw the Serializable graphs for the schedule S1 and state whether each schedule is conflict serializable or not. If a schedule is conflict serializable, write down the order in which the transaction can be executed. [5]
S1:r1(X);r2(Z);r1(Z);r3(X);r3(Y);w1(X);w3(Y);r2(Y);w2(Z);w2(Y)

b) Elaborate on recovery techniques (deferred and immediate) for single and multi-user transactions. [5]

8. a) What are some variations of the two-phase locking protocol? Why is strict or rigorous two-phase locking often preferred? [5]

b) Compare binary locks to exclusive/share locks. Why is the latter type of locks preferable? [5]

9. a) Discuss the problems of deadlock and starvation, and the different approaches to dealing with these problems. [5]

b) How does the granularity of data items affect the performance of concurrency control? What factors affect the selection of granularity size for data items? [5]

10. Give a Comparative Study of NoSQL and Relational Database.

⇔⇔⇔