



VIT[®]
Vellore Institute of Technology
Approved by the University Grants Commission (UGC) as an Autonomous Institute

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

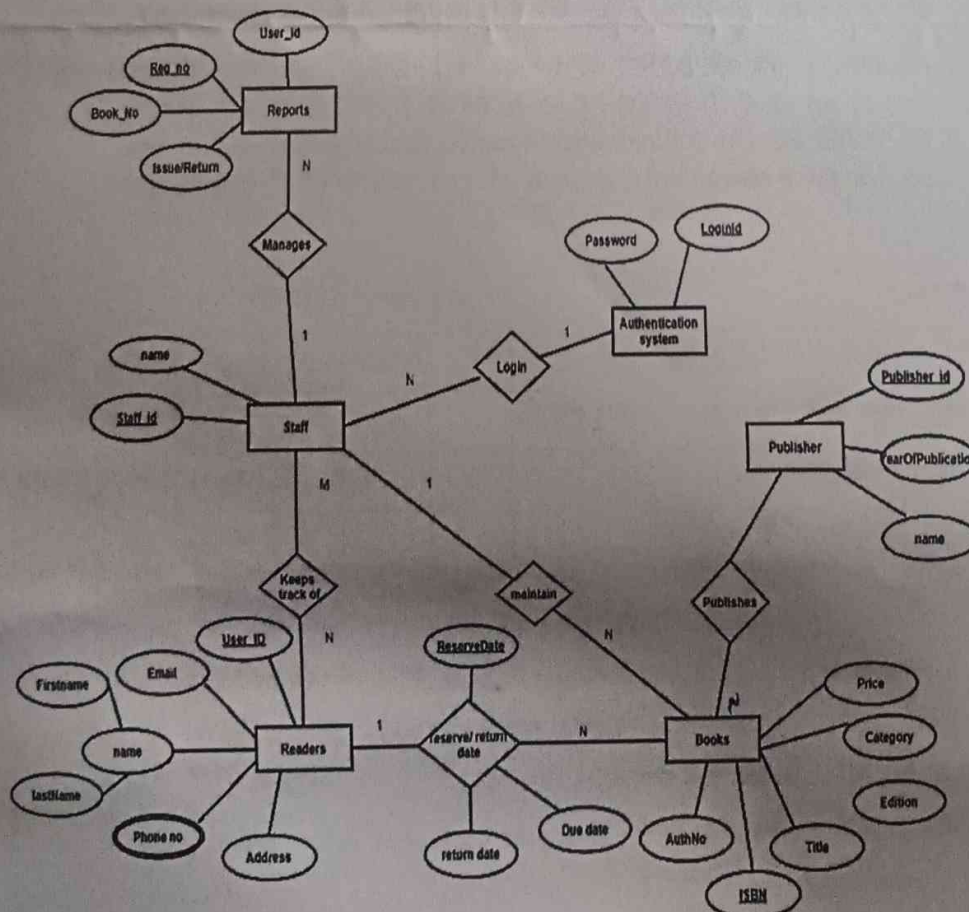
Max. Marks: 100

Time: Three Hours

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 $\longrightarrow$ Publisher, Book-type

Book – type $\longrightarrow$ list-price

Author – name $\longrightarrow$ Author – affil

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

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

4. a) Given a relation R (A,B,C,D,E,G) with the following eight functional dependencies F: $AB \rightarrow C$, $D \rightarrow EG$, $C \rightarrow A$, $BE \rightarrow C$, $BC \rightarrow D$, $CG \rightarrow BD$, $ACD \rightarrow B$, $CE \rightarrow AG$. 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 { $A \rightarrow BC$, $E \rightarrow C$, $AH \rightarrow D$, $CD \rightarrow E$, $D \rightarrow AEH$, $DH \rightarrow BC$ }

Compute AE^+ . Is $BCD \rightarrow H$ 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 [4]
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.

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

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 [5]
schedule is conflict serializable or not. If a schedule is conflict serializable,
write down the order in which the transaction can be executed.

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 [5]
multi-user transactions.

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.

