

**FUNDAMENTALS OF RDBMS  
(CSEN 3221)**

**Time Allotted : 2½ hrs**

**Full Marks : 60**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 4 (four) from Group B to E, taking one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A**

1. Answer any twelve:

**12 × 1 = 12**

*Choose the correct alternative for the following*

- (i) All aggregate functions ignore null values in their input collection. The exception is for which function?  
(a) Count(attribute)      (b) Count(\*)      (c) Avg      (d) Sum.
- (ii) We indicate roles in E-R diagrams by labeling the lines  
(a) from diamond to diamond      (b) from Rectangle to diamond  
(c) from Rectangle to rectangle      (d) from Diamond to rectangle
- (iii) In relational algebra, \_\_\_\_\_ is an unary operator.  
(a) Project      (b) Join      (c) Rename      (d) Outer join
- (iv) The number of attributes in relation is called as its  
(a) Cardinality      (b) Degree      (c) Tuples      (d) Entity.
- (v) In ACID property, the letter “C” stands demotes  
(a) Commitment      (b) Consistency      (c) Concurrency      (d) Collective
- (vi) Preservation of functional dependency is ensured by which of the correctness rule of the fragmentation?  
(a) Disjointness      (b) Reconstruction      (c) Completeness      (d) All of these.
- (vii) Which forms have a relation that contains information about a single entity?  
(a) 4NF      (b) 2NF      (c) 5NF      (d) 3NF.
- (viii) Which of the following operations is used if we are interested in only certain columns of table?  
(a) SELECTION      (b) PROJECTION      (c) Join      (d) UNION.
- (ix) Which of the following is not a feature of DBMS?  
(a) Minimum Duplication and Redundancy of Data  
(b) High Level of Security  
(c) Single-user Access only  
(d) Support ACID Property

- (x) Consider R1 and R2 are two different relations, which operation will produce a relation that has all attributes of R1 and R2 and guaranteed to have all tuples  
 (a) Union (b) Intersection (c) Cartesian Product (d) Join.

*Fill in the blanks with the correct word*

- (xi) \_\_\_\_ operator is used for appending two strings.  
 (xii) A \_\_\_\_\_ is an organized collection of data.  
 (xiii) Composite Key is a combination of \_\_\_\_\_ columns.  
 (xiv) The term attribute refers to a \_\_\_\_\_ of a table..  
 (xv) DBMS is a general program designed to manage a \_\_\_\_\_.

### Group - B

2. (a) Distinguish between total and partial participation in an E-R diagram. [[CO3](Understand/LOCQ)]  
 (b) What is cardinality ratio? [[CO2](Remember/LOCQ)]  
 (c) Draw an E-R diagram for the following: "A publishing company produces books on various subjects. The books are written by Authors who specialize in one particular subject. The company employs editors who not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book requires some items for publication. These items supplied by suppliers. One Supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books, but one book can be bought by one shop owner only. Books are uniquely identified by book-id." [[CO4](Analyse/IOCQ)]  
**3 + 2 + 7 = 12**
3. (a) What is logical data independence and why is it important? [[CO1](Remember/LOCQ)]  
 (b) Explain the following terms with example:  
 (i) many-to-many relationship (ii) weak entity set [[CO1](Remember/LOCQ)]  
 (c) State two disadvantages of Database systems. [[CO1](Describe/LOCQ)]  
**(2 + 2) + (3 + 3) + 2 = 12**

### Group - C

4. (a) Consider the following relations containing airline flight information:  
**Flights**(flno:integer, from: string, to:string, distance: integer, departs: time, arrives:time)  
**Aircraft**(aid: integer, aname: string, cruisingrange: integer)  
**Certified**(eid:integer, aid: integer)  
**Employees**(eid: integer, ename: string, salary: integer)  
 Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly.  
 Write the following queries in **relational algebra**:  
 (i) Find the names of pilots certified for some Boeing aircraft.

- (ii) Identify the flights that can be piloted by every pilot whose salary is more than \$100,000.
- (iii) Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft. *[[CO2)(Analyse/HOCQ)]*
- (b) Describe the set difference and intersection operations with respect to Relational Algebra. *[[CO2)(Remember/LOCQ)]*  
**(3 + 3 + 3) + 3 = 12**
5. (a) Consider a relation R with attributes ABCDE. Let the following FDs be given:  
 A → BC, BC → E, and E → DA.  
 Is R in 3NF? Explain. *[[CO4)(Analyse/HOCQ)]*
- (b) What is Multi-valued dependency? Explain with example. *[[CO4)(Remember/LOCQ)]*
- (c) What is Lossless Decomposition? Consider a relation R = (A, B, C) and dependencies F = {A → B, B → C}. R is decomposed into R1 = (A, B) and R2 = (B, C). Verify the decomposition is lossless or not. *[[CO4)(Understand/LOCQ)]*  
**4 + 3 + (2 + 3) = 12**

### Group - D

6. Consider the bank database as  
 branch(branch\_name, branch\_city, assets)  
 customer (ID, customer\_name, customer\_street, customer\_city)  
 loan (loan\_number, branch\_name, amount)  
 borrower (ID, loan\_number)  
 account (account\_number, branch\_name, balance )  
 depositor (ID, account\_number)
- Construct the following SQL queries for bank Database.
- (i) Find the ID of each customer of the bank who has an account but not a loan.
- (ii) Find the ID of each customer who lives on the same street and in the same city as customer with ID "12345".
- (iii) Find the name of each branch that has at least one customer who has an loan account."
- (iv) Find the name of each branch that has at least one customer who has an account in the bank and who lives in "Kolkata". *[[CO3)(Apply/IOCQ)]*  
**(3 × 4) = 12**
7. (a) What is a UNIQUE constraint? Explain its utility with example. *[[CO1)(Remember/LOCQ)]*
- (b) Consider the Employee database:  
 employee (ID, person\_name, street\_city)  
 works (ID, Company\_name, salary)  
 company (Company\_name, city)  
 Identify the data type and constraints in the above database. Then create the above tables in SQL. *[[CO3)(Apply/IOCQ)]*  
**(1 + 2) + [3 + (3 × 2)] = 12**

### Group - E

8. (a) Distinguish between Locking and Time\_Stamping? *[[CO4)(Remember/LOCQ)]*

(b) Consider the following two transactions:

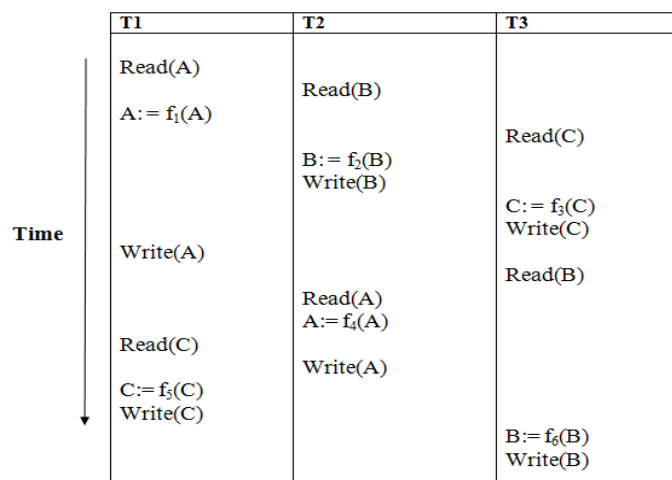
<p>T1: read_lock(Y);          read_item(Y);          unlock(Y);          write_lock(X);          read_item(X);          X=X+Y;          write_item(X);          unlock(X);</p>	<p>T2: read_lock(X);          read_item(X);          unlock(X);          write_lock(Y);          read_item(Y);          Y=X+Y;          write_Item(Y);          unlock(Y);</p>
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Considering initial values X=20 and Y=30 what will be the result of serial schedule T1 followed by T2. [[CO4](Analyse/IOCQ)]

(c) Explain the fundamental concepts of two-phase locking (2PL). [[CO3](Understand/LOCQ)]

**3 + 5 + 4 = 12**

9. (a) Explain Multi-level Indexing. Give example. What is the utility of it?



Schedule S1

**Fig. 1**

[[CO6](Remember/LOCQ)]

(b) Consider the schedule in Fig. 1. Test whether it is serializable or not. [[CO5](Analyse/HOCQ)]

(c) Define Durability. [[CO5](Remember/LOCQ)]

**(3 + 1 + 2) + 4 + 2 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	42.71	39.58	17.71

**Course Outcome (CO):**

After the completion of the course students will be able to

- CSEN3221.1. Identify the basic concepts and various data model used in database design. Be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
- CSEN3221.2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.
- CSEN3221.3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.
- CSEN3221.4. Apply normalization and various types of dependencies for evaluating a relational database design.
- CSEN3221.5. Apply and relate the concept of transaction, concurrency control and recovery in database.
- CSEN3221.6. Understand with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.