DBMS
(CBS3101)

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) Which type of entity in an ER model has a primary key that is composed of attributes from another entity?
(a) Strong Entity (b) Weak Entity
(c) Generalized Entity (d) Specialized Entity

(ii) What does the "Projection" operator in relational algebra do?
(a) Combines two relations based on a common attribute
(b) Removes duplicate tuples from a relation
(c) Selects specific columns from a relation
(d) Selects specific rows based on a condition

(iii) What is the main difference between the "Natural Join" and the "Equi Join" operations?
(a) Natural Join eliminates duplicate columns, while Equi Join does not
(b) Equi Join performs set difference, while Natural Join performs Cartesian product
(c) Natural Join is a subset of Equi Join
(d) Equi Join is a subset of Natural Join

(iv) 4 NF differs from BCNF in only the use of MVD instead of
(a) Super key (b) Candidate key
(c) Functional dependency (d) Non trivial

(v) What does a Trivial Functional Dependency refer to?
(a) A dependency where the right-hand side is a subset of the left-hand side
(b) A dependency where the left-hand side is a subset of the right-hand side
(c) A dependency that cannot be derived from other dependencies
(d) A dependency that involves multiple attributes on both sides

(vi) Which SQL command is used to remove a table from a database?
(a) DELETE (b) DROP (c) TRUNCATE (d) REMOVE

(vii) What is the purpose of a VIEW in SQL?
(a) To create a new table in the database
(b) To present a subset of data from one or more tables
(c) To enforce data constraints
(d) To optimize query performance

(viii) What is the purpose of a LOCK in a database system?
(a) To ensure data is consistent by preventing concurrent access
(b) To optimize query execution
(c) To improve the performance of data retrieval
(d) To create indexes on tables

(ix) What are the four ACID properties of a transaction?
(a) Atomicity, Consistency, Isolation, Durability
(b) Atomicity, Concurrency, Integrity, Durability
(c) Atomicity, Consistency, Isolation, Deletion
(d) Atomicity, Consistency, Isolation, Dependency

(x) What is the purpose of serializability in transaction management?
(a) To ensure that transactions are processed in parallel
(b) To ensure transactions are executed in a way that the end result is the same as if transactions were executed serially
(c) To ensure transactions are executed as quickly as possible
(d) To avoid deadlocks between transactions

Fill in the blanks with the correct word

(xi) BCNF is _____ than 3NF.

(xii) _____ is a deadlock prevention technique in DBMS.

(xiii) A _____ entity depends on another entity for its existence.

(xiv) In a _____ functional dependency, the left side of the dependency is a subset of the right side.

(xv) Equi-join is a special case of _____.

Group - B

2. (a) Differentiate between database instances and schemas. How do these concepts contribute to the overall functioning of a DBMS? *[(CO1)(Understand/LOCQ)]*
(b) What is aggregation in ER modelling? Provide an example to illustrate how aggregation can simplify complex ER diagrams. *[(CO2)(Understand/LOCQ)]*
(c) What is the importance of discriminators in ER modelling? *[(CO2)(Analyse/IOCQ)]*

4 + 5 + 3 = 12

3. (a) Given the following schema: Student (Roll, Name, Address, DOB, Marks)
Write a relational algebraic query to find the maximum marks attained by a student. *[(CO2)(Analyse/IOCQ)]*
(b) Explain Referential Integrity with example. *[(CO3)(Understand/IOCQ)]*

(c) Design an ER diagram for an Online Retail company. Customers need to register and then could place order. Retail company need to order the products to the different companies and need to maintain the Inventory. If the stock is available then they could deliver the products to the customers through Courier Company. Specify your assumptions. *[(CO2)(CO5)(Analyse/IOCQ)]*

3 + 3 + 6 = 12

Group - C

4. (a) Deduce the following relation to 2NF then convert it to 3NF:
R(T, F, D1, D2, D3, A1, A2, A3)
Following functional dependencies hold in this relation:
T→F; F→D1; D1→D2,D3; A1→A2; A1→A3. *[(CO3)(Analyse/IOCQ)]*

(b) R = (A, B, C, D, E). We decompose it into R1 = (A, B, C), R2 = (C, D, E). The set of functional dependencies is: A → BC, CD → E, B → D, E → A. Check whether the decomposition is a lossless or lossy decomposition. *[(CO3)(Apply/IOCQ)]*

(c) Explain DKNF with example. *[(CO3)(Understand/LOCQ)]*

4 + 5 + 3 = 12

5. (a) Describe briefly the database anomalies with example. *[(CO3)(Remember/LOCQ)]*

(b) What is the information rule among the Codd's rules? *[(CO2)(Remember/LOCQ)]*

(c) Briefly explain the Armstrong's Axioms. *[(CO3)(Understand/LOCQ)]*

6 + 2 + 4 = 12

Group - D

6. (a) Compare and contrast Super Key and Candidate Key. *[(CO2)(Understand/LOCQ)]*

(b) Consider the following relational database tables, and write the SQL queries for (i)-(v):
salesman (salesman_id,name,city,commission)
customer(customer_id,customer_name,city,grade,salesman_id)
orders(order_no,purch_amt,order_date,customer_id,salesman_id)

(i) Display all the orders that had amounts that were greater than at least one of the orders from September 5th 2023.
(ii) Display all those orders by the customers not located in the same cities where their salesmen live.
(iii) Find the name and ids of all salesmen who had more than one customer.
(iv) Find all orders attributed to salesmen in Kolkata.
(v) Display all the orders issued by the salesman 'Ram Kumar Das' from the orders table? *[(CO4)(Apply/IOCQ)]*

2 + (5 × 2) = 12

7. (a) What are the conditions of performing union operation? *[(CO3)(Apply/IOCQ)]*

(b) Consider the following relational schema
Supplier(Sno, SName, Location)
Parts(Pno, Pname, Price)
SP(Sno, Pno)

Write the relational algebra (using only basic operations) & SQL statements for the following queries:
(i) Give the name of the Supplier who supplied maximum number of parts.
(ii) Give the name of the Suppliers who have supplied Parts named "Tyre".
[(CO4)(Apply/IOCQ)]

(c) Why is Armstorng's axiom said to be complete and sound? *[(CO4)(Understand/LOCQ)]*

2 + (4 + 4) + 2 = 12

Group - E

8. (a) Consider the following schedule written in log:
$< T_0$, Start>
$< T_0$, X, 102>
$< T_0$, Y, 80>
$< T_0$, Commit>
$< T_1$, Start>
$< T_1$, X, 68>
$< T_1$, Y, 800>
What actions will be taken for recovery if i) Deferred Database Modification & ii) Immediate Database Modification applied? *[(CO6)(Evaluate/HOCQ)]*

(b) Briefly explain active set. *[(CO5)(Remember/LOCQ)]*

(c) Explain why secondary index is useful? *[(CO5)(Understand/LOCQ)]*

6 + 2 + 4 = 12

9. (a) Explain the ACID properties of transaction with example. *[(CO5)(Remember/LOCQ)]*

(b) Explain the ECA model in the light of database triggers. *[(CO4)(Remember/LOCQ)]*

(c) Write a cursor to calculate the grade of the students depending on their marks. *[(CO4)(Apply/IOCQ)]*

4 + 3 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	42.71	51.04	6.25