

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) In airline reservation system, the entities are date, flight number, place of departure, destination, type of plane and seats available. The primary key is
 - (a) flight number
 - (b) flight number + place of departure
 - (c) flight number + date
 - (d) flight number + destination.
- (ii) Student and courses enrolled, is an example of
 - (a) one-to-one relationship
 - (b) one-to-many relationship
 - (c) many-to-one relationship
 - (d) many-to-many relationship.
- (iii) A relation is in **Boyce-Codd Normal Form (BCNF)** if
 - (a) It is in 1NF and all attributes are functionally dependent on the primary key
 - (b) Every determinant is a candidate key
 - (c) It is in 3NF and has no transitive dependencies
 - (d) It contains no multi-valued dependencies
- (iv) For a relation $R = \{ J, K, L \}$ with functional dependencies $F = \{ JK \rightarrow L ; L \rightarrow K \}$ the candidate keys are
 - (a) Both J and K
 - (b) only K
 - (c) only J
 - (d) JK and JL
- (v) Which of the following SQL clauses is used to eliminate duplicates in a query result?
 - (a) DISTINCT
 - (b) GROUP BY
 - (c) HAVING
 - (d) ORDER BY
- (vi) Referential integrity ensures that
 - (a) Data in a table is unique
 - (b) Foreign keys in one table must match primary keys in another table
 - (c) A table is always in 3rd normal form
 - (d) Data in a column is not NULL
- (vii) In a lock-based concurrency control scheme, what is the purpose of a "lock"?
 - (a) To prevent multiple users from accessing the same data
 - (b) To guarantee that all transactions will execute in serial order
 - (c) To prevent database crashes
 - (d) To increase the speed of transaction processing

- (viii) What is the main advantage of a B+ tree over a B-tree?
- B+ trees store both data and index values in the leaf nodes
 - B+ trees are faster for searching than B-trees because of their linked leaf nodes
 - B+ trees use a simpler structure than B-trees
 - B+ trees do not support dynamic changes.
- (ix) Which of the following is the correct basic structure of an SQL query?
- SELECT columns FROM table WHERE condition;
 - SELECT table FROM columns WHERE condition;
 - INSERT INTO table VALUES columns;
 - UPDATE table SET column WHERE condition;
- (x) Which of the following describes a **functional dependency** in a relational database?
- One attribute depends on another attribute in the same relation
 - A table depends on another table
 - One relation depends on another relation
 - Attributes in a relation are independent of each other.

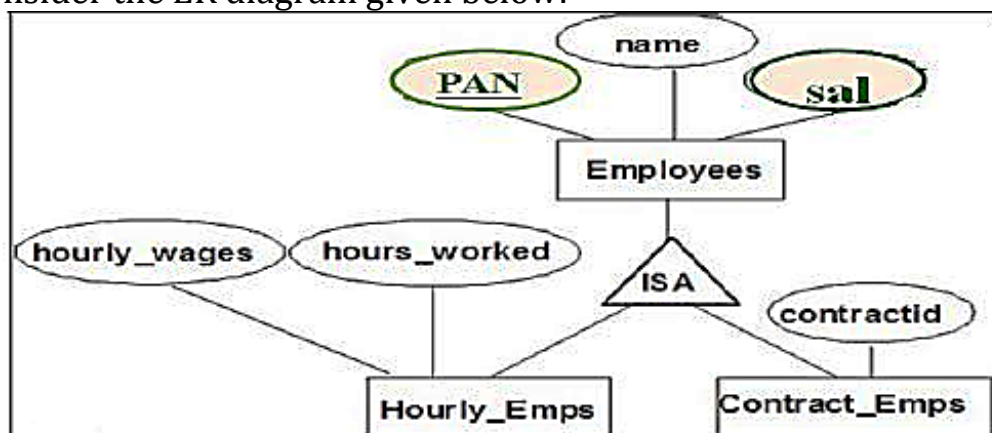
Fill in the blanks with the correct word

- (xi) The operation in relational algebra used to retrieve a subset of columns from a relation is called _____.
- (xii) The attribute (s) used for unique identification of tuple in weak entity set is called _____.
- (xiii) The _____ join operator preserves unmatched rows of both of the relations that are being joined in a query.
- (xiv) In SQL, _____ queries are those in which one query is embedded within another query.
- (xv) In normalization, a relation is in _____ when it has no atomic attribute with non-atomic data value.

Group - B

2. (a) Define the following terms with suitable examples:
- Derived attribute
 - Many to many mapping
- (b) Consider the ER diagram given below:

[[C01](Remember/LOCQ)]



Clearly mention the relations (tables) you need corresponding to the above ER diagram. Mention the attributes and keys for each relation. [[CO1](Apply/HOCQ)]

- (c) Mention the major functions of a Database Administrator. [[CO1](Remember/LOCQ)]
(2 + 2) + 5 + 3 = 12

3. (a) Clearly differentiate the following. Give suitable examples in each case.
(i) Single valued attribute and multi-valued attribute
(ii) Primary Key and unique constraint
(iii) Candidate key and Super key
(iv) Partial Key [[CO1](Remember/LOCQ)]
- (b) What is a weak entity set? Explain with proper example. How do we determine the primary key of a weak entity set? [[CO1](Apply/IOCQ)]
(4 × 2) + (2 + 2) = 12

Group - C

4. Consider the relational database as given below:
Project (PId, PName, Project_Amount, Project_Location)
Department (DId, DName, DLocation)
Proj_Dept (PId, DId, Start_date, End_date)
The underlined attributes are the primary keys. Write down the relational algebra expressions for the following queries:
(i) Show the project details having project_amount more than Rs. 250000
(ii) Show the project_location wise maximum project_amount
(iii) Find the PId, PName, DId, and DNamedetails where the project has started on or after 01-04-2023 and ended on or before 31-03-2024
(iv) Find the DId, DName of the departments which have worked on the projects having ids P11 or P25. [[CO2](Analyse/HOCQ)]
(4 × 3) = 12

5. (a) (i) Consider the attribute set R = ABCDEF and the functional dependency set: F = {AD → B, A → E, C → E, DEF → A, F → D}.
Find a candidate key of R. [[CO4](Apply/IOCQ)]
(ii) Given the attribute set R = ABCDEFGH and the functional dependency set: F = {BC → GH, AD → E, A → H, E → BCF, G → H}.
Decompose R into BCNF by decomposing in the order of the given functional dependencies. [[CO4](Apply/IOCQ)]
- (b) Distinguish between partial dependency and transitive dependency. [[CO4](Remember/LOCQ)]
(5 + 5) + 2 = 12

Group - D

6. (a) What is trigger in SQL? Why we use it? [[CO3](Remember/LOCQ)]
(b) Suppose we want to check whenever an employee's salary is greater than the salary of his or her direct supervisor in the Employee table. The action will be to

call an external stored procedure SALARY_VIOLATION, which will notify the supervisor. Consider the table

Employee (Name, SSN, DOB, Salary, Super_SSN, Dno).

Suggest the query to do this job.

[[CO3](Apply/IOCQ)]

(c) What is view? What is the purpose of use, describe.

[[CO3](Remember/LOCQ)]

(d) Create a view, "which gives the total loan amount at each branch" from the Loan = (loan-number, branch-name, amount)

[[CO3](Apply/IOCQ)]

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

7. Consider the following relational database:

Suppliers(supplier_id, supplier_name, city)

Parts(part_id, part_name, color)

Catalog(supplier_id, part_id, cost)

For each of the following queries, give an expression in SQL.

(i) Find the names of suppliers who supply some red part

(ii) Find the supplier_ids of suppliers who supply every part

(iii) Find the part_ids of the most expensive parts supplied by the supplier named "Pipe Supplier".

(iv) Find the names of all suppliers who live in Kolkata.

[[CO4](Apply/IOCQ)]

(4 × 3) = 12

Group - E

8. (a) What are the differences between sequential and indexed file organization?

[[CO6](Remember/LOCQ)]

(b) Write the difference between commit and rollback.

[[CO5](Remember/LOCQ)]

(c) Construct a B+ tree for the key values 1, 3, 5, 7, 9, 2, 4, 6. Order of each node is 4. Show each step.

[[CO6](Apply/IOCQ)]

3 + 3 + 6 = 12

9. (a) Consider the three transactions : T1, T2 and T3 and the schedule S1 given below. Draw the precedence graph and determine whether the schedule is serializable or not. If serializable, give the equivalent serial schedule.

T1: r1(X); r1(Z); w1(X);

T2 : r2(Z); r2(Y); w2(Z); w2(Y);

T3 : r3(X); r3(Y); w3(Y);

S1 : r1(X); r2(Z); r1(Z); r3(X); r3(Y); w1(X); w3(Y); r2(Y); w2(Z); w2(Y);

[[CO6](Analyse/HOCQ)]

(b) Describe 2-phase locking protocol in details. How does it guarantee conflict serializability?

[[CO5](Remember/LOCQ)]

4 + (6 + 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	38.5	39.6	21.9