BASICS OF RDBMS
(CSEN 3206)

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) A relation can have only one
(a) Super key (b) Primary key
(c) Foreign key (d) Candidate key

(ii) If there are m tuples in relation R1 and n tuples in relation R2, then R1× R2 will have
(a) m+n tuples (b) m-n tuples
(c) m×n tuples (d) m÷n tuples

(iii) For a relation R = { A, B, C } with Functional Dependencies F ={AB –>C, C –>B}, the Candidate Key(s) are
(a) A and B (taken separately) (b) AB (taken together)
(c) Only A (d) AB and AC

(iv) In E-R diagram, weak entity is represented by
(a) Rectangle (b) Dashed rectangle
(c) Double rectangle (d) Double ellipse

(v) Given the functional dependencies: X→W, X→Y, Y→Z, Z→PQ. Which of the following does not hold true?
(a) X→Z (b) W→Z (c) X→WY (d) All of these

(vi) Collection of information stored in a database at a particular moment is:
(a) View (b) Schema (c) Tuple (d) Instance

(vii) The relations R1(A, B) currently has tuples {(1,2), (2,3), (3,3), (4,2)} and R2(B,C) currently has tuples {(2,5), (3,8), (4,7)}. Then the SQL query: SELECT * FROM R1 NATURAL JOIN R2 will produce _____ number of rows:
(a) 0 (b) 2 (c) 4 (d) 8

(viii) The property of transaction that states that either all operations of the transaction are reflected properly in the database or none are:
(a) Consistency (b) Isolation
(c) Atomicity (d) Durability

(ix) A clustering index is defined on the fields which are of type
(a) Key and ordered (b) Non-key and ordered
(c) Non key and not ordered (d) Key and not ordered

(x) In RDBMS, the constraint that no key attribute may be NULL is referred as
(a) Entity Integrity (b) Multivalued dependency
(c) Referential Integrity (d) Functional dependency.

Fill in the blanks with the correct word

(xi) The _____ operation of relational algebra allows us to find tuples that are present in one relation but not in the other.

(xii) _____ is a special type of stored procedure that is automatically invoked whenever the data of the table gets modified.

(xiii) The property of a transaction that persists all the system crashes is _____.

(xiv) In a relation, for each attribute, there is a set of permitted values, called the _____ of the attribute.

(xv) The state the transaction stays in while it is executing is called the _____state.

Group - B

2. (a) Mention some disadvantages of the file processing system. *[(CO1)(Remember/LOCQ)]*
(b) Mention the major functions of a Database Administrator. *[(CO1)(Remember/LOCQ)]*
(c) What is meant by Mapping Cardinality? Explain with example. *[(CO1)(Understand/LOCQ)]*

4 + 4 + 4 = 12

3. (a) Define the following terms with suitable examples:
(i) Candidate Key (ii) Derived Attribute (iii) One-to-Many mapping. *[(CO1)(Remember/LOCQ)]*
(b) What do you understand by a Weak entity? Explain with appropriate example. How is the primary key of a weak entity determined? *[(CO1)(Understand/LOCQ)]*

(2 × 3) + (3 + 3) = 12

Group - C

4. (a) What do you understand by Outer join? Differentiate between Left and Right outer join. Is there any demerit(s) of outer join? *[(CO2)(Understand/LOCQ)]*
(b) Consider a relational database as given below:

Product (p-no, p_name, price, supp-no)
Supplier(s-no, s_name, phn)
Order(o-no, p-no, s-no, date)

where the underlined attributes are the primary keys.

Write down the expressions using relational algebra for the following queries:
(i) List all the product names having price more than Rs.1200/-.
(ii) Find the product name(s) with the highest price.

(iii) Find the order number (o-no) and product name (p_name) of those products that have been supplied within the period of 10th June, 2023 and 5th January, 2024.

(iv) Find the supplier number and phone number (phn) of those who supplies products except product numbers P-10 and P-45. *[(CO2)(Design/HOCQ)]*

(1 + 2 + 1) + (4 × 2) = 12

5. (a) Describe the different anomalies that may arise if a database is not properly normalized. *[(CO4)(Understand/LOCQ)]*

(b) Consider the relation R = {A, B, C, D, E, F, G} and the set of functional dependencies F = {AB→ DEF, EF→ G, A→C}

(i) Find the candidate key(s) of R.

(ii) Based on the given set of FDs F, determine the partial and transitive dependencies (if any) and hence decide in which normal form the relation R is in?

(iii) Decompose R to the highest normal form (BCNF) by showing all the intermediate steps very clearly. *[(CO4)(Apply/HOCQ)]*

4 + (2 + 3 + 3) = 12

Group - D

6. Given a table Products= {PNo, PName, Price, Expiry_date} where PNo is the primary key.

Field Name	**Data Type**	**Constraints**
PNo	Number(5)	Unique product number for each product
PName	Varchar(20)	Must be in upper case
Price	Number(7,2)	
Expiry_date	Date	Must provide some value

Write the following queries using SQL:

(i) Create the "*Products*" table with appropriate integrity constraint as per given specifications.

(ii) List the product numbers (PNo) and names (PName) of those products whose price is more than the average price of all products.

(iii) List the Product numbers and expiry dates of those products those will expire within 15th November, 2023 and 25th April, 2024, both days inclusive.

(iv) Change the price of the product with PNo = 123 to Rs.1500/-. *[(CO3)(Design/HOCQ)]*

(4 × 3) = 12

7. (a) What do you understand by referential integrity constraint? What restrictions are imposed on the two relations if a referential integrity constraint is established between them? *[(CO3)(Analyse/IOCQ)]*

(b) What is a trigger? What is the importance of triggers in PL/SQL programming? *[(CO3)(Understand/LOCQ)]*

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

Group - E

8. (a) Let T1 and T2 be transactions that operate on the same data items A and B. Let r1(A) mean that T1 reads A, w1(A) mean that T1 writes A, and the same for T2. Consider the following schedule S1:
S1: r1(A); w1(A); r2(A); w2(A); r1(B); w1(B); r2(B); w2(B)
   (i) Using the precedence graph determine if this schedule is conflict serializable or not.
   (ii) If the schedule is serializable then write down the equivalent serial schedule. *[(CO5)(Analyse/IOCQ)]*

   (b) (i) Describe the Two Phase Locking protocol.
   (ii) What is the difference between strict two phase locking protocol and rigorous two phase locking protocol. *[(CO5)(Understand/LOCQ)]*

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

9. (a) Differentiate between dense and sparse index with suitable example(s). Is clustering indexing an example of sparse index or dense index? *[(CO6)(Compare/IOCQ)]*

   (b) What is the drawback of B-tree index? How is it overcome using B+ tree index? *[(CO6)(Understand/LOCQ)]*

(6 + 2) + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	48.96	21.87	29.17

Course Outcome (CO):

After the completion of the course students will be able to

CO1. 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. CO2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.

CO3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.

CO4. Apply normalization and various types of dependencies for evaluating a relational database design.

CO5. Apply and relate the concept of transaction, concurrency control and recovery in database.

CO6. 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.*