

DATA STRUCTURE & RDBMS
(CSEN 3106)

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) Last in first out (LIFO) is true for a/an
(a) array (b) linked list (c) stack (d) queue
- (ii) Which of the following algorithms is not feasible to implement in a linked list?
(a) Linear search (b) Binary search
(c) All of the above (d) None of the above.
- (iii) In which type of linked lists traversals can be performed in both directions?
(a) Doubly linked list (b) Singly linked list
(c) Circular linked list (d) All of the above.
- (iv) The number of nodes in a complete binary tree of depth d (depth of root is 0) is
(a) $2^{d-1} + 1$ (b) $2^{d+1} - 1$ (c) $2^{d-1} - 1$ (d) $2^{d+1} + 1$.
- (v) Random access of elements is not possible in
(a) One dimensional array (b) Two dimensional array
(c) Linked list (d) String.
- (vi) A table can have only one
(a) Super key (b) Primary key
(c) Foreign key (d) Candidate key.
- (vii) An attribute of one table matching the primary key of another table is called
(a) Composite Key (b) Super Key
(c) Foreign Key (d) Secondary key
- (viii) Which of the following is not a constraint in SQL?
(a) UNIQUE (b) CURSOR (c) CHECK (d) NOT NULL
- (ix) Which of the following is not a proper state of a transaction?
(a) Partially aborted (b) Failed
(c) Partially committed (d) Committed.

- (x) Second normal form (2NF) is based on the concept of _____
 (a) Closure Dependency (b) Transitive Dependency
 (c) Full Dependency (d) Partial Dependency.

Fill in the blanks with the correct word

- (xi) Postfix expression of A^B^C (A to the power B to the power C) is _____.
 (xii) Maximum number of nodes in a binary tree of height h is _____.
 (xiii) The rows of a relation are known as _____.
 (xiv) In ER diagram, double rectangle is used to denote _____.
 (xv) A relation in 3NF must not have any _____ dependency.

Group - B

2. (a) Convert the given infix expression to its corresponding postfix expression using stack. Show all intermediate steps.
 $(200 + 43) * (49 - 22) / (75 + 16)$ *[(CO2)(Understand/LOCQ)]*
 (b) Write an algorithm / pseudo-code to traverse a singly-linked list. *[(CO2)(Remember/LOCQ)]*
 (c) An array or a linked list, which one is better to implement a stack? Justify. *[(CO6)(Apply/HOCQ)]*
5 + 4 + 3 = 12
3. (a) Write an algorithm to insert a node after a given node in a singly-linked list. *[(CO4)(Remember/LOCQ)]*
 (b) Write an algorithm to delete a node after a given node in a singly-linked list. *[(CO4)(Remember/LOCQ)]*
6 + 6 = 12

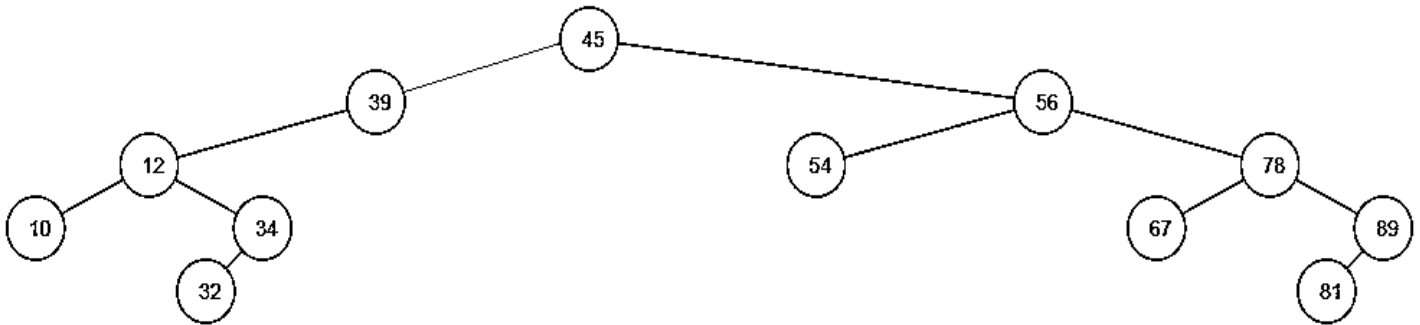
Group - C

4. (a) Write down the differences between recursion and iteration. *[(CO4)(Remember/LOCQ)]*
 (b) Convert the following recursive function into an equivalent iterative function:

```
int fun (int n)
{
    if (n > 0)
        return n * fun(n - 2);
    else
        return 1;
}
```

 Assume that n is a positive integer. *[(CO6)(Apply/HOCQ)]*
 (c) Arrange the following list of elements in ascending order using quicksort.
 77, 66, 55, 44, 33, 11, -2, -10
 Show each step of the algorithm. *[(CO4)(Understand/LOCQ)]*
2 + 4 + 6 = 12

5. (a) Given:
 Inorder : D B H E A I F J C G
 Preorder: A B D E H C F I J G
 Construct the binary search tree. Show all intermediate steps. *[[CO4](Analyse/HOCQ)]*
- (b) Is it possible to represent a binary tree using an array? If, yes, represent the following tree using array:



[[CO4](Remember/LOCQ)]
 $6 + (1 + 5) = 12$

Group - D

6. (a) Explain the difference between physical data independence and logical data independence based on the three-tier architecture of DBMS. *[[CO1](Understand/LOCQ)]*
- (b) What is a DBA? What major roles does the DBA play in a database management? *[[CO1](Remember/LOCQ)]*
- (c) Name the four categories of database users. *[[CO1](Remember/LOCQ)]*
- $4 + (2 + 4) + 2 = 12$

7. Consider a relational database as given below:

Customer (cust-id, cust-name, cust-city)

Product (p-id, p-name, p-rate)

Sale_Details (cust-id, p-id, p-rate, p-count, sale-date)

where the underlined attributes are the primary keys.

Write the following queries using SQL:

- (i) List all product names in ascending order.
- (ii) Find customer name, product name and sale date for all customers.
- (iii) Find customer names of those who have purchased the product 'Soap' on or before 4th July, 2024.
- (iv) Find the number of 'Soap' (p-name) purchased by customer 'ABC'.
- (v) Find the customer ids of those who have ordered products of rate more than Rs. 500.
- (vi) Find the customer ids of those who have ordered products that were not ordered by customer 'PQR'.

[[CO5](Design/HOCQ)]
 $(1 + 2 + 2 + 2 + 2 + 3) = 12$

Group - E

8. (a) What are the ACID properties of a transaction? Describe the properties in details. *[[CO6](Understand/LOCQ)]*

(b) What is a recoverable schedule? Explain with proper example.

[[CO6](Understand/LOCQ)]

8 + 4 = 12

9. (a) Let T1 and T2 be two transactions that operate on the same data items A and B. R1(A) means that T1 reads A, W1(A) means that T1 writes A. The same is applicable for T2 also. Consider the following schedule:

$S = R1(A), R1(B), W1(A), R2(A), W2(A), W1(B), R2(C), W2(C).$

Using a precedence graph, find out if schedule S is conflict-serializable or not? If it is conflict serializable, then what is the equivalent serial schedule?

[[CO6](Analyse/HOCQ)]

(b) Describe the Two-phase Locking protocol. What are the drawbacks of this protocol?

[[CO6](Remember/LOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	67.71	0	32.29