Question Paper Code	14053

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Third Semester
Computer and Communication Engineering
24COPC302-ALGORITHMS AND DATA STRUCTURES
Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K–Level	CO

1. _____ method repeatedly makes substitutions for each occurrence of the function T on the right-hand side until all such occurrences disappear. — 1, K1, CO1
   a) Substitution method
   b) The recursion-tree method
   c) The master method
   d) None of the mentioned

2. Which collision-resolution technique for hash tables involves using linked lists to store multiple elements in the same hash table slot? — 1, K1, CO1
   a) Linear probing
   b) Quadratic probing
   c) Separate chaining
   d) Double hashing

3. The postfix form of the expression (A+ B) (C D- E) F / G is? — 1, K2, CO2
   a) AB+ CDE - FG /   b) AB + CD E - F G /
   c) AB + CD E - F G/   d) AB + CDE F G /

4. If the MAX_SIZE is the size of the array used in the implementation of circular queue, array index starts with 0, front point to the first element in the queue, and rear point to the last element in the queue. Which of the following condition specify that circular queue is FULL? — 1, K2, CO2
   a) Front = rear = -1   b) Front = (rear+1)%max_size
   c) Rear = front+1   d) Rear = (front+1)%max_size

5. Which of the following is a property of a Binary Search Tree (BST)? — 1, K1, CO3
   a) All nodes have two children.
   b) The left subtree of a node contains nodes with keys less than the node's key, and the right subtree contains nodes with keys greater than the node's key.
   c) Every subtree is a complete binary tree.
   d) It is a full binary tree.

6. Which one of the following property is correct for a red-black tree? — 1, K1, CO3
   a) Every simple path from a node to a descendant leaf contains the same number of black nodes
   b) If a node is red, then one children is red and another is black
   c) If a node is red, then both its children are red
   d) Every leaf node (sentinel node) is red

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14053**

7. You are designing a social networking platform, and you need to efficiently represent the network of friends among users. Users can have varying numbers of friends, and you want to minimize memory usage. Would you choose an adjacency list or an adjacency matrix for this task? Why?   *1*   *K2*   *CO4*
   a) Adjacency List, because it uses less memory for sparse connections.
   b) Adjacency Matrix, because it provides efficient edge lookups.
   c) Both, depend on the number of users.
   d) Neither, as social networks do not require graph representations.

8. Find the minimum distance from the source vertex A to vertex I in the given graph using Dijkstra's algorithm.   *1*   *K2*   *CO4*
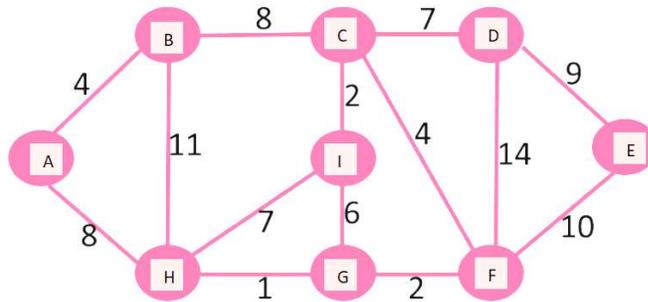
   a) 14
   b) 8
   c) 11
   d) 21

9. You are implementing an algorithm that needs to recursively break down a problem into smaller subproblems. If the problem has overlapping subproblems, which technique would be most efficient to use?   *1*   *K1*   *CO5*
   a) Dynamic Programming
   b) Greedy Approach
   c) Backtracking
   d) Divide and Conquer

10. Recognize the necessary condition for a problem to be NP-Complete.   *1*   *K1*   *CO6*
    a) It can be solved in constant time
    b) It must be solvable by greedy algorithms
    c) It must be in NP and every problem in NP reduces to it in polynomial time
    d) It must have an exponential time complexity

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Compare best and worst time complexity of Quick Sort.	2	K2	CO1
12. Discuss the concepts of asymptotic notations and its properties.	2	K2	CO1
13. What is the advantage of linked list over arrays?	2	K1	CO2
14. Point out the rules followed during the infix to postfix conversions.	2	K1	CO2
15. Construct a Binary tree for(a+b)*(c-d).	2	K2	CO3
16. Define a heap. How can it be used to represent a priority queue?	2	K1	CO3
17. Name the different ways of representing a graph? Give examples.	2	K1	CO4
18. Prove that the maximum number of edges that a graph with n Vertices is n*(n-1)/2.	2	K2	CO4
19. Why a travelling salesman problem cannot be solved by Backtracking Algorithm?	2	K1	CO5
20. Write the difference between the Greedy method and Dynamic programming.	2	K2	CO5
21. Define the terms NP-Completeness and NP-Hard with appropriate examples.	2	K2	CO6
22. When is a problem said to be NP Hard?	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Examine the following recurrence relation: 11   K2   CO1
   (i) T (n) = T (n-1) + n 4
   (ii) T (n) = T (n/4) + T (n/2) + n 2

OR

   b) Explain Merge sort technique. Give the time complexity of merge sort.   11   K2   CO1

24. a) Explain Stack ADT and its operations.   11   K2   CO2

OR

   b) Explain how to add two polynomials using linked list.   11   K2   CO2

25. a) Construct the AVL tree with the following keys: 11   K3   CO3
   {35,36,80,85,67,89,25,16,10,14,50}.Give suitable procedures.

OR

   b) Create a binary search tree for the following numbers start from an empty binary   11   K3   CO3
   search tree. 45,26,10,60,70,30,40 Delete keys 10,60 and 45 one after the other and
   show the trees at each stage.

26. a) Explain the following Depth First search and Breadth First search graph traversal.   11   K2   CO4

OR

   b) Describe in detail about the Adjacency Matrix and Adjacency List representations   11   K2   CO4
   of a graph.

27. a) Explain 0/1 knapsack problem dynamic programming.   11   K2   CO5

OR

   b) Explain the Travelling salesmen problem using Branch and Bound technique.   11   K2   CO5

28. a) Discuss about class P, NP problems with diagrams and algorithms.   11   K2   CO6

OR

   b) How will you prove that the max-clique problem is NP-Complete? If not, why?   11   K2   CO6
   Discuss with suitable points.