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22CMU207N

PSG COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025

(Second Semester)

Branch – **COMPUTER SCIENCE**

DATA STRUCTURES AND ALGORITHMS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which of the following sorting algorithms has the best average time complexity? a) Bubble Sort b) Insertion Sort c) Merge Sort d) Quick Sort	K1	CO1
	2	What is the primary advantage of using sparse matrices? a) They consume less memory b) They are faster to compute c) They are easier to implement d) They contain more non-zero elements	K2	CO1
2	3	Which of the following operations does a linked list provide that an array does not? a) Accessing elements by index in constant time b) Dynamic memory allocation c) Storing elements of different types d) Fixed size storage	K1	CO2
	4	What is the time complexity of searching for an element in an unsorted linked list? a) O(1) b) O(log n) c) O(n) d) $O(n^2)$	K2	CO2
3	5	Which of the following is true about a Binary Search Tree (BST)? a) The left child node is greater than the root node. b) The right child node is smaller than the root node. c) All nodes in the left subtree of a node contain smaller values than the node, and all nodes in the right subtree contain larger values. d) Both left and right children can have nodes of any value.	K1	CO3
	6	Which of the following is the primary disadvantage of using a Linked Queue compared to an Array-based Queue? a) Linked Queue requires extra space for pointers. b) Array-based queues are more flexible. c) Linked Queue has a slower enqueue and dequeue time. d) Linked Queue cannot be resized.	K2	CO3
4	7	Which of the following algorithms is primarily used to find the shortest path between all pairs of vertices in a weighted graph? a) Depth First Search b) Floyd-Warshall Algorithm c) Dijkstra's Algorithm d) Bellman-Ford Algorithm	K1	CO4
	8	Which of the following best describes the time complexity of solving the Travelling Salesman Problem (TSP) using brute force? a) O(n) b) $O(n^2)$ c) O(n!) d) $O(2^n)$	K2	CO4
5	9	Which of the following algorithms is used to find the Minimum Spanning Tree (MST) of a graph? a) Dijkstra's Algorithm b) Kruskal's Algorithm c) Huffman Coding d) Bellman-Ford Algorithm	K1	CO5
	10	What is the primary advantage of using Huffman Coding for data compression? a) It ensures the code is unique for each input. b) It minimizes the total number of bits required for encoding. c) It uses a constant-length code for all characters. d) It provides a lossless compression that can recover original data.	K2	CO5

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SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the difference between a pointer and a reference in C++. Provide examples to demonstrate how pointers work with arrays.	K3	CO1
		(OR)		
	11.b.	Discuss the working of the Merge Sort algorithm. Explain the divide-and-conquer approach and analyze its time complexity.		
2	12.a.	Explain the concept of a stack data structure. Discuss its operations and provide examples of real-world applications of stacks.	K3	CO2
		(OR)		
	12.b.	Describe the working of Binary Search and Sequential Search. Compare their time complexities and discuss in what scenarios each algorithm is efficient.		
3	13.a.	Explain the working of an AVL Tree. Discuss the different types of rotations required for balancing the tree during insertions and deletions.	K4	CO3
		(OR)		
	13.b.	Discuss the different tree traversal methods (in-order, pre-order, post-order). Write the algorithm for each method and explain their applications.		
4	14.a.	Explain the concept of dynamic programming. Illustrate how the Warshall's Algorithm works with an example to find the transitive closure of a graph.	K5	CO4
		(OR)		
	14.b.	Describe the difference between Depth First Search (DFS) and Breadth First Search (BFS). Provide algorithms and examples where each of these searches would be more efficient to use.		
5	15.a.	Explain Prim's algorithm for finding the Minimum Spanning Tree (MST) of a graph. Illustrate the algorithm with an example.	K4	CO5
		(OR)		
	15.b.	Describe the N-Queens problem and explain the backtracking approach to solving it. Provide a sample solution for N = 4.		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Discuss the quick and radix sorting algorithms. Explain their working, time complexity, and space complexity. Compare their advantages and disadvantages in different scenarios.	K5	CO1
2	17	Discuss the structure, operations, and applications of linked lists. Compare singly linked lists with doubly linked lists. Provide detailed implementations of insertion, deletion, searching, and traversing in a singly linked list.	K6	CO2
3	18	Explain the concepts of a Queue, Linked Queue, Circular Queue, and Priority Queue. Discuss their operations and applications. Compare the performance of these queues in terms of time complexity.	K5	CO3
4	19	Discuss the 0/1 Knapsack Problem in detail. Explain how exhaustive search can be used to solve it and then describe how dynamic programming optimizes the solution. Provide a comparison of time complexities for both approaches.	K4	CO4
5	20	Discuss the backtracking approach to solving the Hamiltonian Circuit problem. Explain the algorithm and its time complexity. Illustrate the approach with an example where the graph has 4 vertices.	K5	CO5

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