Sub Code: R2331053 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
III B. Tech I Semester Regular Examinations November -2025
DESIGN AND ANALYSIS OF ALGORITHMS
(CSE)

Time: 3 hours **Max. Marks: 70**

The Question paper consists of Part A & Part B.
Part A is compulsory, Answer all questions.
Part B Answers any one question from each unit.
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1		PART-A	(20Marks)
	a)	Define amortized analysis and give one example where it is useful.	[2]
	b)	Differentiate between time complexity and space complexity with examples.	[2]
	c)	Write the recurrence relation for Merge Sort and solve its time complexity.	[2]
	d)	What is the main idea behind Decrease-and-Conquer strategy? Give an example.	[2]
	e)	State the Greedy-choice property with reference to Minimum Spanning Trees.	[2]
	f)	Why is Strassen's Matrix Multiplication considered better than the conventional method?	[2]
	g)	Construct the recurrence relation for the Fibonacci sequence using dynamic programming.	[2]
	h)	Define Hamiltonian Cycle problem. Why is it suitable for backtracking?	[2]
	i)	What is a bounding function in Branch and Bound? Illustrate briefly.	[2]
	j)	Differentiate between FIFO Branch-and-Bound and LC Branch-and-Bound.	[2]
		PART-B	(50Marks)
		Question from **Unit – I**	
2	a)	Explain asymptotic notations with suitable examples.	[5]
	b)	Write and analyze a recursive algorithm for factorial.	[5]
		(OR)	
3	a)	Define Amortized Analysis and apply it to incrementing a binary counter.	[5]
	b)	Explain performance measurement techniques of algorithms with an example.	[5]
		Question from **Unit – II**	
4	a)	Apply Divide and Conquer to find the maximum element in an array and derive its time complexity.	[5]
	b)	Demonstrate Strassen's Matrix Multiplication for two 2×2 matrices.	[5]
		(OR)	
5	a)	Trace the steps of Quick Sort for the input array [25, 10, 30, 15, 20].	[5]
	b)	Explain Transform and Conquer with an example of Heap construction.	[5]

		Question from **Unit – III**	
6	a)	Solve the Job Sequencing with Deadlines problem for: Jobs: {J1, J2, J3, J4}, Profits: {100, 19, 27, 25}, Deadlines: {2, 1, 2, 1}.	[5]
	b)	Apply Prim's Algorithm step by step to find the Minimum Spanning Tree (MST) for the graph with vertices V = {1,2,3,4,5,6,7,8} and weighted edges E = {(1,2,w=4), (1,3,w=3), (2,4,w=5), (2,5,w=2), (3,6,w=7), (3,7,w=3), (4,8,w=6), (5,6,w=4), (6,8,w=2), (7,8,w=5)}.	[5]
		(OR)	
7	a)	Apply Kruskal's Algorithm step by step to find the Minimum Spanning Tree (MST) for the graph with vertices V = {1,2,3,4,5,6,7,8} and weighted edges E = {(1,2,w=3), (1,4,w=6), (2,3,w=5), (2,5,w=4), (3,6,w=2), (4,7,w=3), (5,6,w=6), (5,8,w=7), (6,7,w=4), (7,8,w=5)}.	[5]
	b)	Illustrate the Greedy Method with an example of the Knapsack Problem (fractional case).	[5]
		Question from **Unit – IV**	
8	a)	Construct an Optimal Binary Search Tree (OBST) for the set of keys {A, B, C} with corresponding access probabilities {0.2, 0.5, 0.3}.	[5]
	b)	Solve the All-Pairs Shortest Paths problem using the Floyd–Warshall Algorithm for the weighted directed graph with vertices V = {1, 2, 3, 4}. The directed edges (with weights) are: (1→2, 3), (1→4, 10), (2→3, 5), (3→4, 2), (4→2, -1). First, construct the initial adjacency matrix W(0) yourself (use $+\infty$ where there is no direct edge, and 0 on the diagonal). Then apply Floyd–Warshall to compute W(1), W(2), W(3), and W(4). Finally, report the all-pairs shortest-path distance matrix and the predecessor (path) matrix, and state whether a negative cycle exists.	[5]
		(OR)	
9	a)	Apply Dynamic Programming to solve Matrix Chain Multiplication for dimensions [10×20, 20×30, 30×40].	[5]
	b)	Explain the Multistage Graph problem. Illustrate your answer with a simple example showing how the shortest path is obtained.	[5]
		Question from **Unit – V**	
10	a)	Apply Backtracking to solve the Graph Coloring problem for a graph with 4 vertices using 3 colors.	[5]
	b)	Explain the **Subset Sum** problem. Solve it using backtracking for the set {3, 5, 6, 7} with target sum = 12.	[5]
		(OR)	
11	a)	Solve the 8-Queens problem using backtracking and show a valid placement of queens.	[5]
	b)	Explain how the **15-Puzzle** problem can be solved using LC Branch-and-Bound. Show how nodes are selected and pruned based on cost.	[5]

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