

2056
B.E. (Information Technology)
Sixth Semester
PCIT-603: Design and Analysis of Algorithms

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

x-x-x

Qn 1	a. What do you understand by growth of functions? Discuss its significance in analyzing asymptotic time complexity of algorithms. b. Compare the worst case time complexity of merge sort and quick sort. c. What is the purpose of a spanning tree in graph algorithms. d. Explain the term <i>optimal substructures</i> with an example. e. Write an algorithm to add two matrices. Give the frequency count of all the program step and determine the time complexity.	(10)															
	PART-A																
Qn 2	a. What is asymptotic analysis? Analyse the complexity of the following program <pre>int a = 0; for (i = 0; i < N; i++) { for (j = N; j > i; j--) { a = a + i + j; } }</pre> b. What are recurrence relations and what is its significance in the study of algorithm analysis? Solve the following recurrences using Master method $T(n) = 3T(n/2) + n$	(5,5)															
Qn 3	a. Explain the Greedy choice property. Discuss the advantages and limitations of Greedy algorithm design strategy. Use it to solve the following Knapsack problem to find the feasible and optimal solution. Capacity of knapsack $K = 20\text{kg}$. <table border="1"><thead><tr><th>ITEMS</th><th>Item1</th><th>Item2</th><th>Item3</th><th>Item4</th></tr></thead><tbody><tr><td>WEIGHT</td><td>8</td><td>10</td><td>7</td><td>4</td></tr><tr><td>VALUE</td><td>40</td><td>45</td><td>65</td><td>30</td></tr></tbody></table> b. Explain the Divide and Conquer strategy with the help of Binary Search algorithm. Formulate the recurrence relation and solve it to obtain the time complexity.	ITEMS	Item1	Item2	Item3	Item4	WEIGHT	8	10	7	4	VALUE	40	45	65	30	(5,5)
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WEIGHT	8	10	7	4													
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Qn 4	a. Explain the method of computing space complexity of an algorithm. Differentiate between fixed and variable space components with suitable examples. Also discuss the impact of recursive functions on the overall space complexity of an algorithm? b. Explain Kruskal's algorithm for Minimum Spanning Tree with suitable example. What data structure is most appropriate for the implementation of the algorithm.	(5,5)															

	PART-B	
Qn 5	a. Discuss the features of Backtracking approach. Formulate the criterion function with respect to N-Queens problem and explain how it can be used to test if a queen can be placed in a specific position or not. b. What is the Multistage graph problem? Solve the problem using dynamic programming approach and use it to explain the optimal substructures and overlapping substructures properties.	(5,5)
Qn 6.	a. What is Dynamic Programming strategy? Given the graph in figure below, where nodes represent cities and edges represent distance between them. Solve the TSP, given salesman starts from City 0. Use it to illustrate in detail the characteristic features of dynamic programming approach. <pre>graph TD; 0((0)) --- 20 1((1)); 0 --- 10 2((2)); 0 --- 12 3((3)); 1 --- 11 3; 2 --- 17 3; 2 --- 15 1;</pre> b. Draw the state space tree and find possible solutions of the following sum of subset problem. Provide the time complexity analysis. c. $n=4$, $(w_1, w_2, w_3, w_4) = (11, 13, 24, 7)$, $m=31$	(5,5)
Qn 7.	a. Discuss in detail about the class P, NP, NP-hard and NP-complete problems. Give examples for each class b. Discuss the key characteristics, limitations and application of: Floyd Warshall Algorithm, Dijkstra algorithm.	(5,5)