CBCS SCHEME

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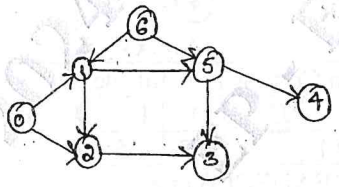
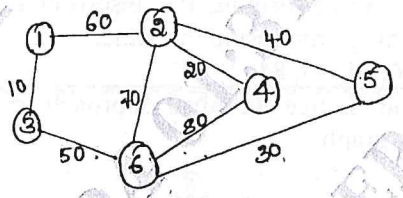
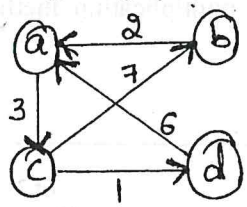
BCO402

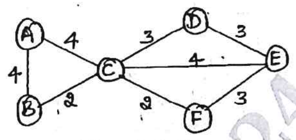
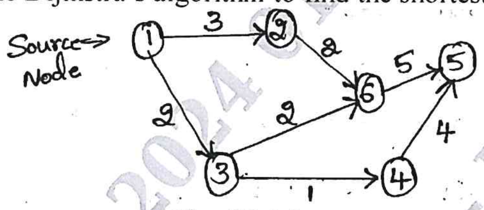
Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024
Analysis & Design of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Discuss different types of asymptotic notations that are used for analyzing the algorithm with an appropriate examples.	6	L2	CO1
	b.	Apply Backward substitution method to solve the following recurrence relations, (i) $T(n) = T\left(\frac{n}{2}\right) + T\left(\frac{n}{2}\right) + 2$ for $n > 2$ and $T(2) = 1$, $T(1) = 0$ (ii) $T(n) = T(n-1) + T(n-1) + 1$ for $n > 1$ and $T(1) = 1$	6	L3	CO1
	c.	Define a Brute force strategy. Solve the string matching problem using brute force approach and analyze its time complexity.	8	L3	CO1
		OR			
Q.2	a.	Discuss all the steps involved in mathematical analysis of Recursive algorithms. Design and analysis the time complexity for Tower of Hanoi problem.	6	L3	CO1
	b.	Devise an algorithm to check whether the given elements in an array are distinct or not. Analyse its time complexity.	6	L3	CO2
	c.	Design an algorithm for selection sort and find its time complexity. Trace it for n = 7 [19, 7, 23, 8, 56, 11, 2]	8	L3	CO2
		Module – 2			
Q.3	a.	Build an algorithm for performing the Insertion sort. Also sort the below elements in an ascending order using the same. n = 7 [18, 9, 26, 11, 43, 84, 7]	6	L3	CO2
	b.	Apply both DFS and Source Removal approach to perform the topological sorting for the below graph.  Fig. Q3 (b)	8	L3	CO2
	c.	Design an algorithm for Quicksort. Sort the below elements using the same. Also mention the best and worst time complexity of Quicksort algorithm. To sort : A L G O R I T H M S	6	L3	CO2
		OR			
Q.4	a.	Apply Strassen's matrix multiplication method to compute the product of following 2 metrices. $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$	6	L3	CO2

	b.	Build an algorithm for performing a merge sort. Analyze its time complexity and sort the below using the same. n = 9 [65, 70, 75, 24, 35, 12, 80, 20, 47]	8	L3	CO2
	c.	Apply Divide-and-Conquer approach for solving Binary Tree Traversal problem. Write a pseudocode / algorithm for the below : (i) To find the height of BT (ii) To count the number of nodes in a BT.	6	L2	CO2
		Module – 3			
Q.5	a.	Explain "Transform and Conquer" technique along with its three major variations of this idea.	5	L2	CO3
	b.	Define an AVL Trees? Explain 4 types of rotations used to construct AVL Tree. Construct the AVL Tree for the list of nodes below. [5, 6, 8, 3, 2, 4, 7]	10	L3	CO3
	c.	Briefly explain the concept of sorting by distribution counting technique.	5	L2	CO3
		OR			
Q.6	a.	Apply heapsort algorithm to sort the list below in an ascending order using Root deletion method. list = [19, 17, 12, 23, 9]	8	L3	CO3
	b.	Design and analyze the Horspool string matching algorithm for searching a given pattern in a main string.	6	L3	CO3
	c.	Sort the below elements using sorting by counting technique. S [17, 12, 15, 21, 10] C [0 0 0 0 0]	6	L3	CO3
		Module – 4			
Q.7	a.	Describe the Dynamic programming strategy. Design an algorithm to compute the maximum profit for the below knapsack instance using dynamic programming technique. n = 4 W = (2, 1, 3, 2) P = (12, 10, 20, 15) M = 5	7	L3	CO4
	b.	Design and Apply the Prim's algorithm to find the minimum spanning Tree for the given graph.  Fig. Q7 (b)	6	L3	CO4
	c.	Construct the Huffman Coding Tree for the below data: Character A B C D E Probability 0.05 0.1 0.15 0.2 0.5 Also Encode the text : EADECEB and Decode the text : 100010111001010	7	L3	CO4
		OR			
Q.8	a.	List all the differences between Dijikstra's and Floyd's algorithm. Compute all pair shortest path problem for the given graph.  Fig. Q8 (a)	7	L3	CO4

	b.	Define Minimum Spanning Tree. Compute the MST using Kruskal's algorithm with union ( ) – Find ( ) methods.  Fig. Q8 (b)	7	L3	CO4
	c.	Design and apply the Dijikstra's algorithm to find the shortest path.  Fig. Q8 (c)	6	L3	CO5
		Module – 5			
Q.9	a.	Distinguish between P, NP, NP complete problems, with an example for each.	6	L2	CO5
	b.	Apply back tracking algorithm to solve the following instance of the sum-of-subset problem. S = {2, 3, 4, 5} d = 11	8	L3	CO5
	c.	What are the Decision Trees? Demonstrate the uses of Decision trees with suitable example.	6	L3	CO6
		OR			
Q.10	a.	Write a short note on : (i) Backtracking technique. (ii) Branch and Bound technique.	6	L2	CO6
	b.	Apply backtracking approach to find the state-space tree for 4-Queen problem.	7	L2	CO6
	c.	Apply Branch and Bound technique to solve below knapsack instance. n = (1, 2, 3) W = (9, 5, 5) P = (27, 20, 10) M = 10	7	L3	CO6

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