U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 22CS4PCADA **Max Marks: 100**
Course: Analysis and Design of Algorithms

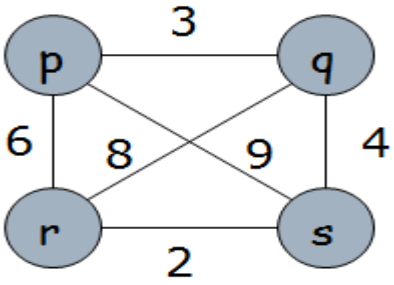
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		Demonstrate worst case best case and average case scenario complexity of an algorithm with an example.	CO1	PO 1	**8**
	b)		With the help of a flowchart, explain the various stages of algorithm design process.	CO1	PO1	**8**
	c)		Solve the following recurrence relation using backward substitution method. i. x(n)= x(n/2)+n for n>1, x(1)=1 ii. x(n)=x(n-1)+5 for n>1 and x(0)=0	CO1	PO1	**4**
			OR			

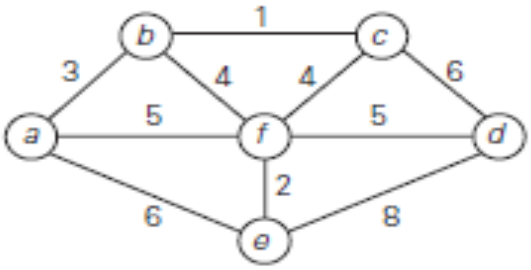
2	a)		By applying the steps in finding out the time complexity of non-recursive algorithm shown below.Find the time complexity for the following code.
			i. void main()
			{ int i, j, k = 0;
			for (i = n/2; i <= n; i++)
			{
			for (j = 2; j <= n; j = j * 2)
			{
			k = k + n / 2;
			}
			}
			}
				CO2	PO1	**4**

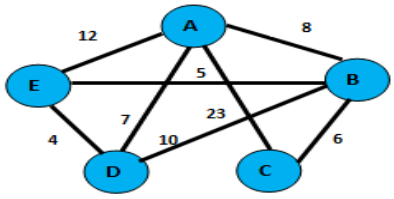
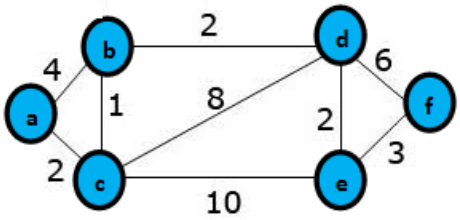
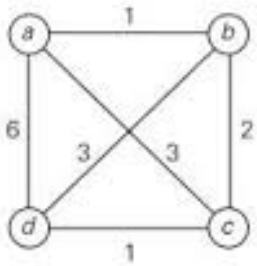
	b)		Write recursive algorithm for Towers of Hanoi problem for "n" disks. Draw the recursion tree for n=3 and showing the order of moves	CO2	PO1	**6**
	c)		Apply selection sort technique to sort the list {O, N, L, I, N, E, T, E, S, T} in alphabetical order showing the output of each pass during the sorting process. Write an algorithm for the same and find its time complexity	CO2	PO1	**10**

			UNIT - II			
	3	a)	Apply exhaustive search technique to list all tours starting from city 'p' and find the minimum cost route among them.  	*CO2*	*PO1*	**4**
		b)	Differentiate between different variations of Decrease and Conquer technique with an example	*CO2*	*PO2*	**6**
		c)	Determine the number of character comparisons made by the Brute-Force pattern matching algorithm in searching for the pattern "WOOD" in the text "TWO_ROADS_DIVERGED_IN_A_YELLOW_WOOD". Also write an algorithm for the same and derive the best-case and worst-case time complexities.	*CO1*	*PO2*	**10**
			OR			
	4	a)	Apply Decrease and Conquer technique to find Topological order for the following graph using DFS method and Source Removal method with the source vertex '1'.	*CO2*	*PO1*	**10**
		b)	Apply Johnson Trotter method to generate permutations for the following set. 1,2,3,4	*CO2*	*PO1*	**6**
		c)	Apply Exhaustive Search technique to solve the following instance of Knapsack problem: Number of objects N=4, weights of four objects= {7, 3, 4, 5) and profits= {42, 12, 40, 25} with the capacity of Knapsack W=10	*CO2*	*PO1*	**4**
			UNIT - III			
	5	a)	Given the numbers {10,34,22,11,54,66,33,24,25,56,77,21}. Construct MergeSort tree to sort these numbers in the ascending order. Also write an algorithm for Merge sort.	*CO2*	*PO2*	**8**
		b)	For the given array, write an algorithm to determine mode using the concept of presorting and analyze its time complexity	*CO1*	*PO1*	**6**
		c)	Briefly explain different variations of Transform and Conquer technique, explain each with an example.	*CO2*	*PO1*	**6**
			OR			
	6	a)	Is merge sort is better than quick sort in the worst case, justify your answer by deriving the time complexities for both in worst case.	*CO1*	*PO2*	**8**

	b)	Create a min heap tree for the following list of elements and sort an array. Also, write the algorithm for the same. {58, 25, 35, 38, 110, 48, 18}	*CO2*	*PO1*	**8**
	c)	Apply divide and conquer technique to multiply the following two long integers: 2547 and 1605	*CO2*	*PO1*	**4**
		UNIT - IV			
7	a)	Suppose the knapsack problem is solved by Dynamic programing technique and the solution table is given below. Explain step by step process of selecting objects to get optimal solution. Consider number of objects=4, Weight={1,5,3,4} for the items with the number (1,2,3,4), Capacity of Knapsack=8	*CO2*	*PO1*	**6**
	b)	Apply Krushkals's algorithm to find minimum spanning tree for the following graph. Also write an algorithm for the same	*CO2*	*PO1*	**8**
	c)	Suppose the string below is to be sent over a network. Construct a Huffman tree and find the code word for each character. Justify how Huffman tree reduces the string size through encoding compare to sending original string. BCAADDDCCACACAC	*CO2*	*PO1*	**6**
		OR			
8	a)	Design Dynamic programming based algorithm to find all pair shortest paths. Apply the same to the below graph	*CO2*	*PO1*	**10**

	0	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0	0
1	0	15	15	15	15	15	15	15	15
2	0	15	15	15	15	15	25	25	25
3	0	15	15	15	24	24	25	25	25
4	0	15	15	15	24	24	25	25	29



						
		b)	Design a Greedy algorithm for finding single source shortest paths. Apply the same on the below graph to find shortest paths from vertex 'A' to all other nodes. 	*CO2*	*PO1*	**10**
			UNIT - V			
	9	a)	Write the state space tree for finding sum of subset for the set X={5,8,13} with d=13 using Backtracking technique.	*CO2*	*PO1*	**6**
		b)	Distinguish between P, NP and NP completeness problem	*CO3*	*PO2*	**6**
		c)	Apply Branch and Bound approach to solve the Knapsack problem for the following data. Number objects n=4, Knapsack Capacity M=10 Item No. | Profit | Weight 1 | 40 | 4 2 | 42 | 7 3 | 25 | 5 4 | 12 | 3	*CO2*	*PO1*	**8**
			OR			
	10	a)	Apply backtracking approach to write state space tree to find sum of subsets for set S={5, 5, 10} and d=10.	*CO2*	*PO1*	**10**
		b)	Apply branch and bound technique for the travelling salesman problem to the below graph. 	*CO2*	*PO1*	**10**

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