U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

Course Code: 24AM4PCDAA **Max Marks: 100**

Course: Design and Analysis of Algorithms

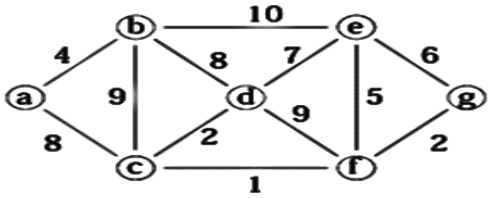
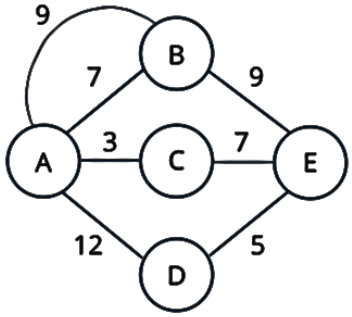
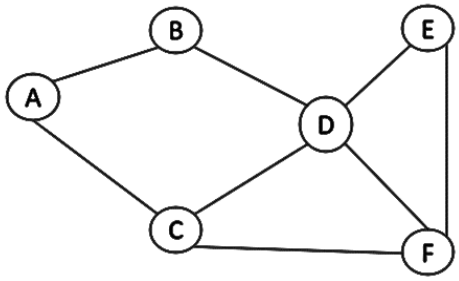
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

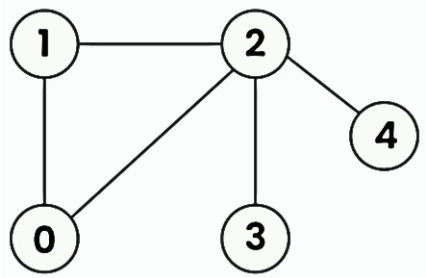
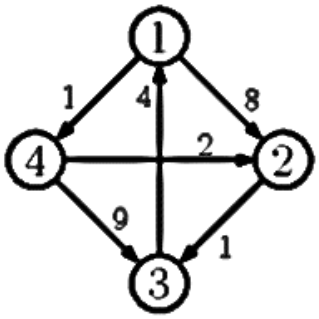
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

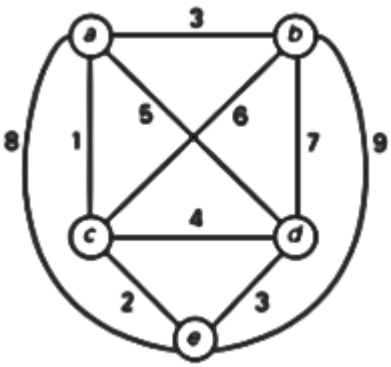
		UNIT - I	CO	PO	Marks
1	a)	Define an algorithm. Illustrate the process of an algorithm design and analysis with a neat flowchart.	CO1	PO1	**8**
	b)	Construct an algorithm to find the maximum element among n elements and analyze its time complexity using mathematical methods	CO2	PO2	**7**

	c)	Determine the frequency count of operations for the following algorithm:
		Algorithm Sum (A, n) {
		S=0;
		for (i=0; i<n; i++){
		S = S+A[i];
		}
		return S;
		}
			CO2	PO2	**5**

		OR			
2	a)	Outline the general approach for analyzing the time efficiency of recursive algorithms. Apply this approach to the Tower of Hanoi algorithm and determine its time complexity.	CO2	PO2	**10**
	b)	Graphically illustrate the different types of asymptotic notations with suitable examples.	CO2	PO1	**6**
	c)	Describe the key characteristics of an algorithm.	CO1	PO1	**4**
		UNIT - II			
3	a)	Formulate the Selection Sort algorithm to sort the array [45, 12, 89, 33, 22, 78, 56] in an ascending order, and analyze its time complexity using mathematical analysis.	CO2	PO2	**8**

		b)	Determine the optimal set of edges to connect all nodes in the graph shown in the Figure 3b. Specify Minimum Spanning Tree (MST) using Kruskal's algorithm.  Figure 3b	*CO1*	*PO2*	**6**
		c)	Apply the Merge Sort algorithm to sort the following array in ascending order: [38, 12, 27, 43, 3, 9, 82]. Show the steps involved and analyze the time complexity of an algorithm.	*CO1*	*PO2*	**6**
			OR			
	4	a)	Write an algorithm for string matching using the Brute Force technique and use it to find a specified pattern within a given text. Text: Banana is a Plant Pattern: Plant	*CO1*	*PO1*	**7**
		b)	Use Prim's algorithm on the given graph shown in Figure 4b to find the minimum spanning tree.  Figure 4b	*CO1*	*PO2*	**7**
		c)	Sort the following array elements in ascending order [29, 10, 14, 37, 13] using Quick Sort algorithm.	*CO1*	*PO1*	**6**
			UNIT - III			
	5	a)	Apply the Breadth-First Search (BFS) traversal on the graph shown in Figure 5a, starting from vertex A.  Figure 5a	*CO1*	*PO2*	**7**
		b)	Analyze the algorithm for generating combinational objects and print all permutations for the given string ABCD.	*CO1*	*PO1*	**7**

		c)	Given a list of keys: [18, 41, 22, 44, 59, 32, 31, 73], insert them into a hash table of size 7 using the division method (k mod n). Resolve any collisions using linear probing.	*CO1*	*PO1*	**6**
			OR			
	6	a)	Perform Depth-First Search (DFS) traversal on the graph shown in Figure 6a beginning from vertex 0.  Figure 6a	*CO1*	*PO2*	**7**
		b)	Apply the Horspool string matching algorithm to find the occurrences of a given pattern in the provided text. Illustrate the steps involved in the matching process. Text: "HERE IS A SIMPLE EXAMPLE" Pattern: "SIMPLE"	*CO1*	*PO2*	**8**
		c)	Given a set of Keys: 123456, 987654, 456789, 321654, apply the folding method to generate hash values and insert them into a hash table of size: 1000.	*CO1*	*PO1*	**5**
			UNIT - IV			
	7	a)	Describe the process of insertion in 2- 3 tree and construct a 2-3 tree for the string COMPUTER.	*CO1*	*PO1*	**8**
		b)	Compute Floyd's algorithm to determine the shortest paths in a weighted graph shown in Figure 7b:  Figure 7b	*CO1*	*PO2*	**8**
		c)	Explain how the presorting technique can be applied to simplify any problem?	*CO1*	*PO1*	**4**
			OR			
	8	a)	Apply Heapsort for the given set of node elements 2, 7, 6, 5, 10, 8, 3 using Bottom-Up approach.	*CO1*	*PO2*	**7**
		b)	Elaborate the concept of Binomial Coefficient algorithm with suitable example.	*CO1*	*PO1*	**5**
		c)	Apply the Bottom-Up dynamic programming algorithm in the following instance of the Knapsack problem, Knapsack capacity M =10.	*CO1*	*PO2*	**8**

				Item	**Weight**	**Value**			
				1	7	42			
				2	3	12			
				3	4	40			
				4	5	25			
			UNIT - V						
	9	a)	Utilize the Branch and Bound algorithm to solve the Travelling Salesman Problem (TSP) for the provided graph shown in Figure 9a.  Figure 9a	*CO1*	*PO2*	**10**
		b)	Construct a Decision Tree to establish lower bounds on the efficiency for the tree-element selection sort using the elements 1,2,3.	*CO1*	*PO2*	**5**
		c)	Differentiate between Backtracking and Branch and Bound Technique.	*CO1*	*PO1*	**5**
			OR						
	10	a)	Compute the following Assignment problem using Branch and Bound technique provided in Table 10a. to obtain the optimal allocation. Job 1 Job 2 Job 3 Job 4 A 9 2 7 8 B 6 4 3 7 C 5 8 1 8 D 7 6 9 4 Table 10a	*CO1*	*PO2*	**10**
		b)	Explain the following computational complexity classes: i. P Class ii. NP Class iii. NP-Hard Class iv. NP-Complete Class	*CO1*	*PO2*	**6**
		c)	Solve the N Queen's problem for 4*4 Chessboard using Backtracking.	*CO1*	*PO1*	**4**

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