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.**

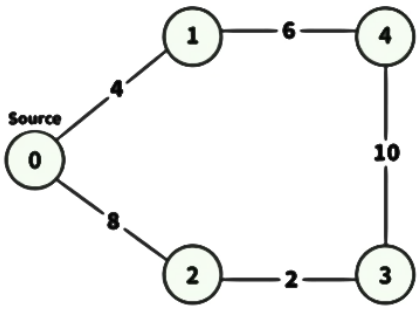
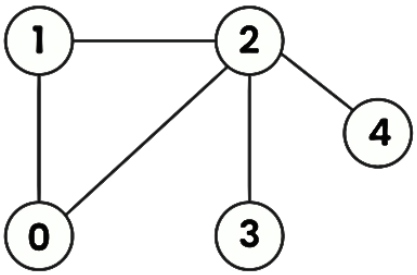
Course Code: 22AM4PCDAA **Max Marks: 100**

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)	List and explain the important characteristics that every algorithm must possess.	CO2	PO1	**06**
	b)	Explain the general steps involved in algorithmic problem solving with a suitable example	CO2	PO1	**06**
	c)	Explain the general plan for analyzing the efficiency of a non-recursive algorithm. suggest a non-recursive algorithm to find factorial of number and derive its efficiency.	CO2	PO1	**08**
		OR			
2	a)	Define algorithm. Explain asymptotic notations Big-Oh, Big-Omega and Big-Theta notations	CO2	PO1	**06**
	b)	Explain the general plan for analyzing the efficiency of a recursive algorithm. Provide a recursive algorithm to find factorial of number and derive its efficiency.	CO2	PO1	**08**
	c)	Write a recursive algorithm to find the factorial of a given number. Also compute the time complexity.	CO1	PO1	**06**
		UNIT - II			
3	a)	Explain the concept of divide and conquer. Design an algorithm for merge sort and derive its time complexity	CO1	PO3	**10**
	b)	Design a Bubble sort algorithm and obtain its time complexity. Also sort the elements 25,75,40,10,20,18 using Bubble sort.	CO2	PO3	**10**
		OR			
4	a)	Design an algorithm for quick sort, also sort the elements 25,75,40,10,20,05,15 using quick sort algorithm.	CO2	PO3	**10**
	b)	Given a weighted undirected graph, apply Dijkstra's algorithm for the given graph with source vertex 0 as shown in figure 4.	CO1	PO3	**10**

			 Figure 4			
			UNIT - III			
	5	a)	Design an algorithm to traverse a graph using Depth First Search (DFS). Apply DFS for the graph given below.  Figure 5	*CO2*	*PO3*	**10**
		b)	Given the text T = "abacaabadcabacabaabb" and the pattern P = "abacab", perform one iteration of the Horspool algorithm and show the shift table and matching process clearly.	*CO2*	*PO3*	**05**
		c)	What is Topological Sorting? State the conditions under which it can be applied. Explain the importance of topological sorting in real-world applications such as task scheduling and course prerequisite planning.	*CO1*	*PO1*	**05**
			OR			
	6	a)	Given a undirected graph represented by an adjacency list adj, where each adj[i] represents the list of vertices connected to vertex i. Perform a Breadth First Search (BFS) traversal starting from vertex 0, visiting vertices from left to right according to the adjacency list, and return a list containing the BFS traversal of the graph shown in figure 6.	*CO2*	*PO3*	**10**

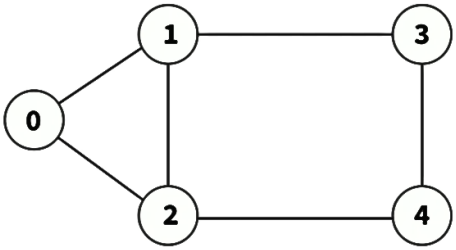


Figure 6

	b)	Given the keys: 42, 23, 34, 52, 46, 33, insert them into a hash table of size 7 using modulo division method and linear probing to resolve collisions. Show the final hash table.	*CO2*	*PO1*	**05**
	c)	List and explain at least two real-world applications each of Depth First Search (DFS) and Breadth First Search (BFS).	*CO2*	*PO3*	**05**
		UNIT - IV			
7	a)	Define heap. Explain the properties of heap along with its representation.	*CO1*	*PO3*	**05**
	b)	Define transitive closure of a graph. Apply Floyd's algorithm to compute transitive closure of a directed graph of figure 7	*CO2*	*PO3*	**10**

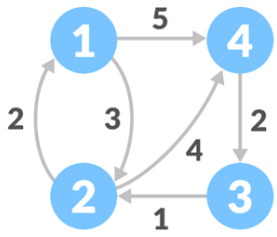
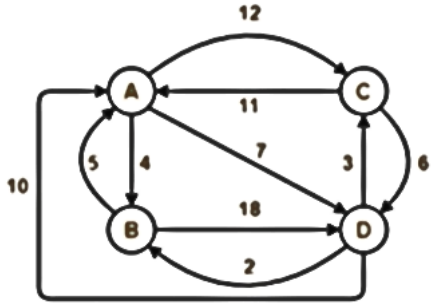


Figure 7

	c)	What is a 2-3 tree? Explain the properties of 2-3 trees.	*CO1*	*PO1*	**05**
		OR			
8	a)	Solve the given instance of 0/1 Knapsack problem using Branch and Bound technique. Given: Knapsack Capacity (m)=15.	*CO2*	*PO3*	**10**

Item	1	2	3	4	5	6	7
Profit	10	5	15	7	6	18	3
Weight	2	3	5	7	1	4	1

	b)	Explain Dynamic programming. Write an algorithm to compute binomial coefficient.	*CO1*	*PO1*	**05**
	c)	Provide an algorithm for presorting with an example.	*CO1*	*PO1*	**05**
		UNIT - V			
9	a)	Explain the following with an example: (i) P Class (ii) NP Class (iii) NP Complete Problem (iv) NP Hard Problem.	*CO1*	*PO1*	**10**

		b)	Apply the Branch and Bound algorithm to solve the travelling salesperson problem for the given graph shown in figure 9.  Figure 9	*CO2*	*PO3*	**10**
			OR			
	10	a)	Write an algorithm for N-Queen's and solve the 4 * 4 Problem using the Backtracking approach.	*CO2*	*PO3*	**10**
		b)	Apply Backtracking technique to solve the Sum of Subset Problem for the instance (sum of total weights) m = 30 and S = {5,10, 12, 13,15,18}.	*CO2*	*PO3*	**10**

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