Code No: 23CS3301, 23AM3301, 23DS3301

PVP SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS
(Common to CSE, IT, CSE (AI&ML), CSE (Data Science))

Duration: 3 Hours   **Max. Marks: 70**

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Bloom's Level   CO – Course Outcome
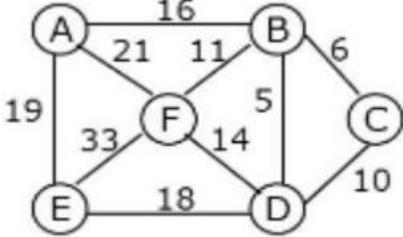
PART-A   10 x 2 = 20 Marks

		BL	CO
1 a)	Define time and space complexity.	L2	CO1
1 b)	List the rotation in the AVL Tree.	L1	CO1
1 c)	Illustrate some applications of binary heaps.	L2	CO1
1 d)	Compare DFS and BFS	L2	CO1
1 e)	Solve the recurrence relation using the substitution method $T(1) = 1$ n=1 $T(n) = 2T(n-1)+1$ n >1	L2	CO1
1 f)	Can a greedy algorithm guarantee the optimal solution?	L1	CO1
1 g)	Define the principle of optimality.	L2	CO1
1 h)	What is the time complexity of All pairs Shortest paths problem?	L2	CO1
1 i)	Compare FIFO branch bound and LC branch bound.	L2	CO1
1 j)	Define NP-complete. Mention any two NP-complete problems.	L2	CO1

PART –B

                                                                  5 x10 = 50 Marks

			BL	CO	Max. Marks
UNIT-I					
2	(a)	Explain about the asymptotic notations with suitable examples.	L2	CO1	5 M
	(b)	Develop an algorithm for matrix multiplication and find its time complexity.	L3	CO2	5 M
OR					
3	(a)	Construct an AVL tree with the following elements 34,56,23 12,25,18,55,79,65.	L2	CO2	5 M

	(b)	Discuss B-tress with insert and delete operations.	L3	CO2	5 M
		UNIT-II			
4	(a)	Define Graph? Explain how graph are represented.	L2	CO3	5 M
	(b)	Write an for Breadth first Search with an example.	L4	CO3	5 M
		OR			
5	(a)	Discuss about Heaps and heaps as priority queues.	L3	CO3	5 M
	(b)	Apply heap sort for the following list of elements 10,20,34,12,45,56,17,43.	L4	CO4	5 M
		UNIT-III			
6	(a)	Write an algorithm for the quick sort and show that the worst-case time complexity of the merge sort is better than the quick sort.	L4	CO4	5 M
	(b)	Apply brute-force algorithm is used to find the minimum and maximum in the given list of elements with 2*(n-1) comparisons. Write the algorithm for finding minimum and maximum using divide and conquer and show that your algorithm takes less number of comparisons than 2*(n-1).	L4	CO3	5 M
		OR			
7	(a)	Develop an algorithm for single source shortest paths with an example.	L3	CO3	5 M
	(b)	Apply the Prims algorithm to find out the minimum cost spanning for the below Graph. 	L3	CO3	5 M
		UNIT-IV			
8	(a)	Apply all pairs shortest path solutions for the graph represented by below adjacency matrix below: $$\begin{bmatrix} \infty & 6 & 5 & 4 \\ 3 & \infty & 2 & 6 \\ 18 & 6 & \infty & 7 \\ 8 & 12 & 10 & \infty \end{bmatrix}$$	L3	CO3	5 M
	(b)	What is the principle of optimality? How it is used in dynamic programming to solve optimization problems.	L3	CO2	5 M

		OR			
9	(a)	Find an optimal solution to the 0/1 Knapsack instance n=3, (w1, w2, w3)=(2,3,4), (p1,p2,p3)=(1,2,5) and m=6.	L3	CO4	5 M
	(b)	Compare and contrast dynamic programming with the greedy approach.	L4	CO4	5 M
		UNIT-V			
10	(a)	Apply the least cost branch and bound method to solve the TSP for the following cost matrix. Draw a state space tree and find the optimum cost of the tour. $$\begin{bmatrix} \infty & 11 & 10 & 9 & 6 \\ 8 & \infty & 7 & 3 & 4 \\ 8 & 4 & \infty & 4 & 8 \\ 11 & 10 & 5 & \infty & 5 \\ 6 & 9 & 5 & 5 & \infty \end{bmatrix}$$	L3	CO2	6M
	(b)	Explain the Graph–Coloring problem and draw the state space tree for m= 3 colors and n=4 vertices graph.	L2	CO2	4 M
		OR			
11	(a)	Define N queen's problem. Draw the tree organization of the 4-queens solution space. Find out the possible solutions for the 4-queens problem by using the back-tracking approach.	L3	CO4	5 M
	(b)	Explain P, NP and NP-complete problems.	L2	CO1	5 M