Reg. No.																

Question Paper Code	14635

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Third Semester

Computer Science and Engineering (AIML)

(Common to Artificial Intelligence and Data Science)

24AMPC302 - FOUNDATIONS OF DATA STRCTURES AND ALGORITHM DESIGN

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (16 × 1 = 16 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which complexity represents constant time execution? a) O(n) b) O(log n) c) O(1) d) O(n^2)	1	K1	CO1
2.	Which asymptotic notation represents the upper bound of an algorithm? a) Omega (Ω) b) Theta (Θ) c) Alpha (α) d) Big O (O)	1	K1	CO1
3.	Why is time complexity important in algorithms? a) To increase memory usage b) To measure algorithm efficiency c) To reduce program size d) To avoid recursion	1	K2	CO1
4.	Which data structure is most suitable for recursion implementation? a) Queue b) Array c) Stack d) Linked list	1	K2	CO2
5.	Which linked list contains pointers to both previous and next nodes? a) Circular linked list b) Singly linked list c) Linear queue d) Doubly linked list	1	K1	CO2
6.	The time complexity for insertion at the beginning of a singly linked list is a) O(1) b) O(log n) c) O(n) d) O(n^2	1	K1	CO2
7.	Which traversal of a Binary Search Tree gives data in sorted order? a) Pre order b) Level order c) Post order d) In order	1	K1	CO3
8.	A node in an AVL tree becomes unbalanced after insertion into the left subtree of its left child. Which rotation is required to preserve the balance property? a) Left Rotation b) Left-Right Rotation c) Right Rotation d) Right-Left Rotation	1	K2	CO3
9.	A BST is formed with elements 15, 10, 20, 8, 12, 17, 25. Which node is the inorder successor of 15? a) 10 b) 12 c) 17 d) 20	1	K3	CO3
10.	A graph has 6 vertices and 9 edges. Using the adjacency matrix representation, how many matrix cells are required? a) 9 b) 18 c) 36 d) 81	1	K2	CO4

11.	A weighted graph contains edges with weights 4, 2, 7, 1, and 5. Which edge is selected first in Kruskal's Algorithm? a) 7 b) 5 c) 2 d) 1	*1*	*K2*	*CO4*
12.	A weighted graph contains edges with weights 4, 2, 7, 1, and 5. Which edge is selected first in Kruskal's Algorithm? a) 7 b) 5 c) 1 d) 2	*1*	*K3*	*CO4*
13.	An array is given as: 29, 10, 14, 37, 13. After the first pass of Bubble Sort, which element will be in the last position? a) 10 b) 13 c) 29 d) 37	*1*	*K3*	*CO5*
14.	An array contains the elements: 9, 7, 5, 3, 1.Which sorting algorithm will require the minimum number of swaps among the following? a) Bubble Sort b) Insertion Sort c) Selection Sort d) Merge Sort	*1*	*K3*	*CO5*
15.	A hash function is defined as h(k)=k mod 11. What is the hash value of key 35? a) 2 b) 4 c) 3 d) 5	*1*	*K3*	*CO6*
16.	In Linear Probing, a collision occurs at index 7. Which index is checked next? a) 6 b) 7 c) 14 d) 8	*1*	*K3*	*CO6*

PART – A (ii) (6 × 3 = 18 Marks)

Answer ALL Questions

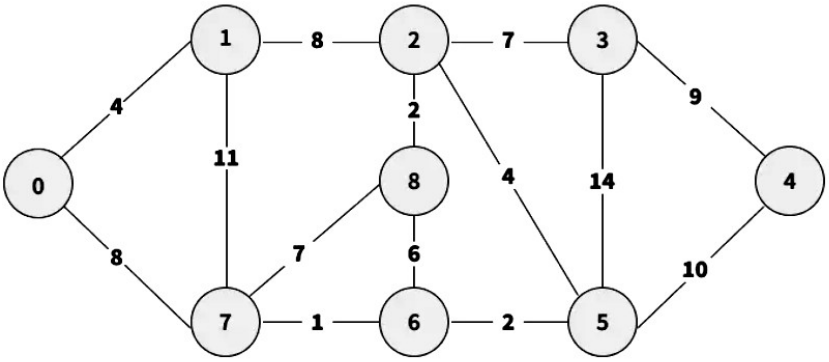
17.	Solve a recurrence relation using the substitution method for a simple recursive algorithm.	*3*	*K3*	*CO1*
18.	Apply the stack operations required to evaluate the arithmetic expression (12 + 6) × (5 − 2).	*3*	*K3*	*CO2*
19.	Analyze the tree traversal process for the following binary tree and determine the in order, preorder, and post order sequences**:** A binary tree is given with root node A, left child B, right child C; node B has children D and E; node Chas children F and G.	*3*	*K4*	*CO3*
20.	Given a weighted graph with vertices A, B, C, and D and edges AB=2, AC=3, BC=1, BD=4, CD=5, show the step-by-step execution of Prim's algorithm starting from vertex A to construct the Minimum Spanning Tree (MST).	*3*	*K3*	*CO4*
21.	Apply the behavior of insertion sort for the input sequence [7, 3, 5, 2] and determine the intermediate steps after each pass.	*3*	*K4*	*CO5*
22.	Given a hash table using extendible hashing with bucket size 2, show how the keys 10, 22, 37, 41, 52, 63 are inserted.	*3*	*K3*	*CO6*

PART - B (6 × 11 = 66 Marks)

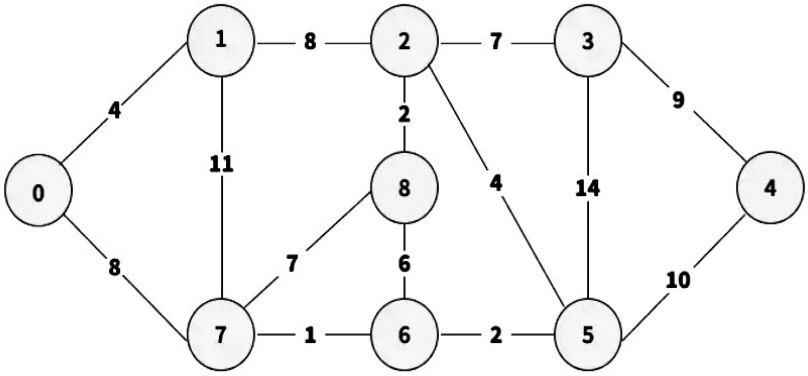
Answer ALL Questions

23.	a)	Illustrate master theorem for divide and conquer in recurrence relation with suitable example.	*11*	*K3*	*CO1*
		OR			
	b)	Apply the recursion tree method to solve a given recurrence relation and find its time complexity.	*11*	*K3*	*CO1*

24.	a)	Illustrate insertion in doubly linked list for begin, end, and position with suitable example.	*11*	*K3*	*CO2*
		OR			
	b)	Illustrate insertion in circular linked list for begin, end, and position with suitable example.	*11*	*K3*	*CO2*
25.	a)	Analyze a Binary Tree from following Traversal Results In–order Traversal: D B H E I A F J C G Post order Traversal: D H I E B J F G C A	*11*	*K4*	*CO3*
		OR			
	b)	Analyze AVL tree by inserting the following data 14,17,11,7,53,4,13,12,8,60,19,16,20 How many rotations are possible after insert 12? How many rotations are possible after insert 8? What is the balance factor value for 53 after insert 20 and how many rotations are possible for standard AVL format? Delete the following elements 8,7,11,14,17 using the previous AVL TREE.	*11*	*K4*	*CO3*
26.	a)	Apply Prim's algorithm for the following graph.	*11*	*K3*	*CO4*



		OR			
	b)	Apply KrusKal's algorithm for the following graph.	*11*	*K3*	*CO4*



27.	a)	Identify the working of Insertion Sort with suitable example. Analyze the Merge Sort algorithm and perform Merge Sort for the following elements: 45, 12, 33, 7, 29, 56, 18, 41.	*11*	*K3*	*CO5*
		OR			
	b)	Identify Merge Sort with necessary steps and suitable example. Sort the following list using Merge Sort 64, 27, 18, 9, 42, 55, 31, 14.	*11*	*K3*	*CO5*

28. a) Given the keys A = 11, 22, 33, 44, 55, 66, 77 and h1(k)=k mod 13, h2(k)=1+(kmod11) store the elements using Double Hashing technique. *11* *K4* *CO6*

OR

b) Analyze various Collision resolution techniques in detail with relevant examples. *11* *K4* *CO6*