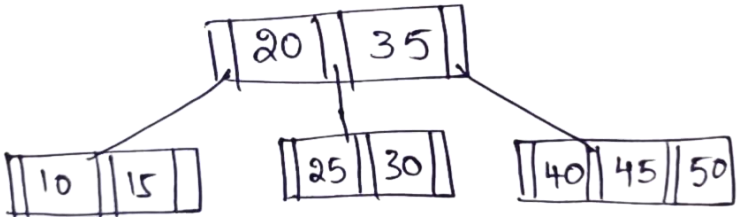
Advanced Data Structures and Algorithm Analysis (ADSAA) - II CSE

UNIT-I

ESSAY QUESTIONS

		MARKS	CO	LEVEL
1	(a) What is an Algorithm? Explain the criterion that an algorithm must satisfy.	5 M	CO1	L1
	(b) Explain the process of finding time complexity of an algorithm through step count method and derive the time complexity of matrix addition algorithm.	5 M	CO1	L3
2	Discuss about space complexity calculation of iterative and recursive algorithms with examples.	10M	CO1	L2
3	(a) What is an Algorithm? Explain the criterion that an algorithm must satisfy.	5 M	CO1	L1
	(b) Explain the process of finding time complexity of an algorithm using tabulation method and derive the time complexity of a recursive algorithm for finding the sum of array elements.	5 M	CO1	L3
4	Why is Asymptotic Notation Needed in Algorithm Analysis? Discuss the Different Types of Notations Used.	10 M	CO1	L2
5	(a) What is an AVL Tree? Discuss its Key Features and Properties.	3 M	CO1	L1
	(b) Construct an AVL tree by inserting the numbers in the specified order – 25, 46, 13, 55, 15, 30, 58, 4, 6, 50, 10, 40 and then delete 25, 13, and 30.	7 M	CO1	L2
6	(a) What is an AVL Tree? Discuss its Key Features and Properties.	3M	CO1	L1
	(b) Explain the purpose of rotations in AVL tree insertion. Design an algorithm for inserting a node into an AVL Tree.	7 M	CO1	L2
7	(a) What is an AVL Tree? Discuss its Key Features and Properties.	3M	CO1	L1
	(b) Explain the deletion operation in AVL trees. What challenges arise, and how are they addressed through rotations? Provide examples.	7 M	CO1	L2
8	Analyze the time complexity of insertion, deletion, and search operations in AVL trees. How does balancing affect the efficiency of these operations?	10M	CO1	L3
9	What are the properties of B-Trees? Insert elements with keys 62, 5, 85 and 75 one at a time into the order-5 B-Tree shown in figure. Show the new tree after each element is inserted.  Delete the elements with keys 45, 40, 10 from the tree.	10M	CO1	L2

10		10M	CO1	L2

SHORT ANSWER QUESTIONS

		MARKS	CO	LEVEL
1	Define asymptotic notation and list its types with examples	2M	CO1	L1
2	What is the difference between time complexity and space complexity?	2M	CO1	L2
3	What is meant by the balance factor and how to calculate the balance factor of a node?	2M	CO1	L1
4	What are the Applications of AVL trees?	2M	CO1	L1
5	How does the balance factor help maintain the balance in AVL trees?	2M	CO1	L2
6	What is the maximum number of keys a B-tree of order m can store at a single node?	2M	CO1	L1
7	State the advantages of AVL trees over B-trees.	2M	CO1	L1
8	State one advantage of B-trees over AVL trees.	2M	CO1	L1
9	What is meant by a rotation operation and list the rotations used in AVL tree insertion.	2M	CO1	L1
10	What are the applications of B Trees?	2M	CO1	L1

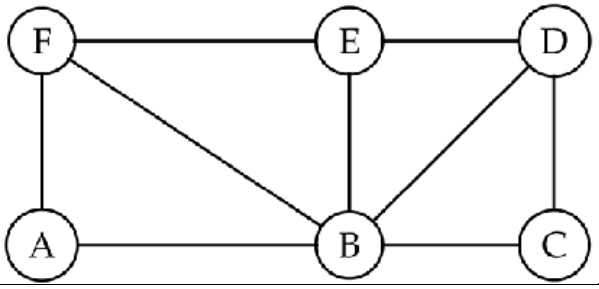
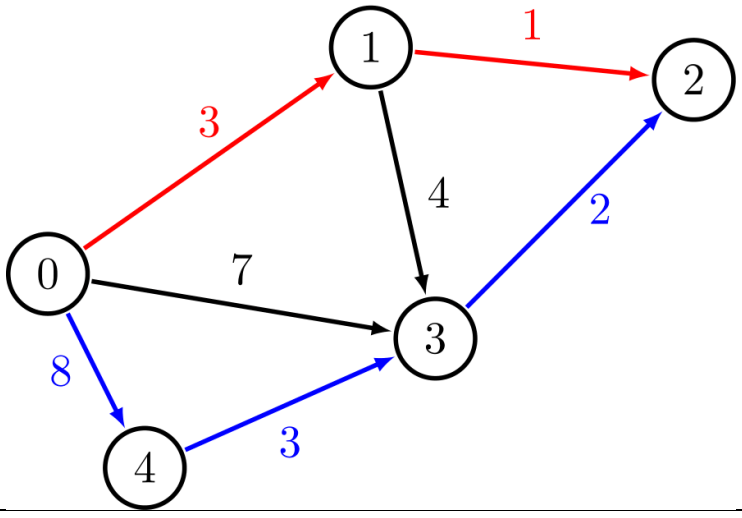
UNIT-II

ESSAY QUESTIONS

		MARKS	CO	LEVEL
1	(a) Construct a **min-heap** for the following list of elements – (1, 4, 5, 6, 7, 9, 3, 40, 20, 2, 70, 100)	5 M	CO2	L2
	(b) Describe how graphs are represented in memory using adjacency matrices and lists. Which representation is more efficient for sparse graphs, and why?	5 M	CO2	L2
2	(a) Construct a max-heap for the following list of elements – (1, 4, 5, 6, 7, 9, 3, 40, 20, 2, 70, 100)	5 M	CO2	L2
	(b) Describe how graphs are represented in memory using adjacency matrices and lists. Which representation is more efficient for sparse graphs, and why?	5 M	CO2	L2
3	What is a heap? Discuss about Heap operations along with suitable examples.	10M	CO2	L2
4	(a) Explain the Depth-First Search (DFS) algorithm. Provide a step-by-step example of how DFS explores a graph.	7 M	CO2	L2
	(b) Write a short note biconnected components	3 M	CO2	L1
5	(a) Explain the Breadth-First Search (BFS) algorithm. Provide a step-by-step example of how BFS explores a graph.	7M	CO2	L2
	(b) Write a short note biconnected components	3 M	CO2	L1

6	Describe the process of finding all connected components in an undirected graph using DFS or BFS.	10M	CO2	L2
7	(a) Explain the general method of divide and conquer.	4 M	CO2	L1
	(b) Summarize the process of Merge Sort algorithm and show how the algorithm works on the following data – (100, 300, 150, 450, 250, 350, 200, 400, 500)	6 M	CO2	L2
8	Design an algorithm to sort n elements of an array a using MergeSort technique and analyze its time complexity.	10M	CO2	L3
9	(a) Summarize the process of Quick Sort algorithm and show how the algorithm works on the following data – (5, 1, 8, 3, 4, 2, 6, 7, 9)	5M	CO2	L2
	(b) Describe the Divide and Conquer approach to find the Convex Hull of a set of points. Provide an example to illustrate the algorithm.	5 M	CO2	L2
10	Design an algorithm to sort n elements of an array a using QuickSort technique and analyze it time complexity for worst-case inputs.	10M	CO2	L3
11	Explain Strassen's Matrix Multiplication algorithm in detail. How does it improve the efficiency of matrix multiplication compared to the traditional approach?	10M	CO2	L2

SHORT ANSWER QUESTIONS

		MARKS	CO	LEVEL
1	What are the applications of Heaps?	2M	CO2	L1
2	What is meant by a connected component?	2M	CO2	L1
3	Represent the following graph using the adjacency matrix. 	2M	CO2	L2
4	Represent the following graph using adjacency list. 	2M	CO2	L2

5	Define an articulation point. Draw a graph and specify the articulation points in that graph.	2M	CO2	L1
6	How is a heap represented in memory?	2M	CO2	L1
7	List the three main steps of the Divide and Conquer paradigm.	2M	CO2	L1
8	What is the time complexity of merging two sorted subarrays in Merge Sort?	2M	CO2	L1
9	What problem does Strassen's algorithm solve, and how is it more efficient than the standard method?	2M	CO2	L2
10	What is meant by a biconnected graph and a biconnected component.	2M	CO2	L1