Course Code: 23CS0507 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Advanced Data Structures & Algorithm Analysis (23CS0507) **Regulation:** R23

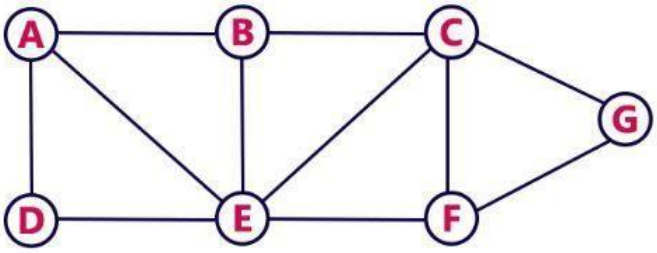
Course & Branch: B.Tech – CSE,CIC,CCC,CAI,CIA,CSM,CAD **Year & Sem:** II Year & I Sem

UNIT-I
INTRODUCTION, AVL TREES, B-TREES

1	**a)**	What is an algorithm?	**[L1][CO3]**	**[2M]**
	b)	Arrange the following function in increasing order. n,logn,n2 ,n3 ,nlogn,2n	**[L2][CO6]**	**[2M]**
	c)	Solve that $(½)n^2-3n= \theta(n^2)$.	**[L3][CO6]**	**[2M]**
	d)	What is the Balance Factor of a node in an AVL tree?	**[L1][CO1]**	**[2M]**
	e)	Name the four types of rotations used in AVL trees.	**[L1][CO1]**	**[2M]**
2	**a)**	Explain asymptotic notations Big O, Big Ω and Big θ with suitable example	**[L2][CO6]**	**[6M]**
	b)	Define an Algorithm and Explain the characteristics of an algorithm.	**[L2][CO3]**	**[4M]**
3		Construct AVL tree for the following data 21,26,30,9,4,14,28,18,15,10,2,3,7	**[L3][CO1]**	**[10M]**
4		Discuss the concept of order of growth used in asymptotic analysis. Compare the growth rates of the following functions using a graph and a tabular representation with large inputs.	**[L4][CO6]**	**[10M]**
5	**a)**	Compare BigO , Big-omega and Big-Theta Notations.	**[L4][CO6]**	**[5M]**
	b)	Difference between AVL Tree and B-Tree.	**[L4][CO1]**	**[5M]**
6		Write the algorithm for matrix multiplication. Perform frequency count analysis and derive its time and space complexities.	**[L4][CO3]**	**[10M]**
7	**a)**	Construct a B-tree of order 3 with the following elements 10,20,15,3,2,16,21,25,30,40	**[L3][CO1]**	**[6M]**
	b)	Given $f(n)=3n^2+2n+1$ prove that $f(n)=\Omega(n^2)$.	**[L4][CO6]**	**[4M]**
8		Analyze Space complexity and Time complexity with an example.	**[L4][CO6]**	**[10M]**
9		Discuss the creation, insertion, and deletion operations of a B-Tree with neat diagrams.	**[L2][CO1]**	**[10M]**
10		Define an AVL Tree. Explain its operations search, insertion, deletion, and rotations in detail with suitable examples and neat diagrams.	**[L2][CO1]**	**[10M]**

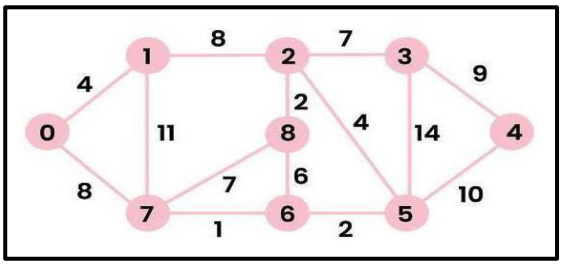
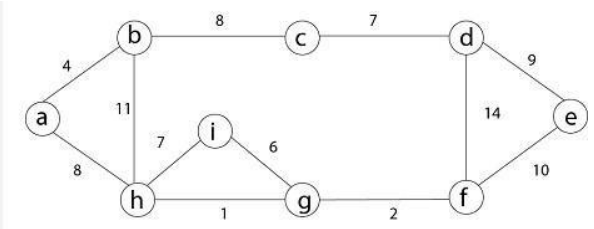
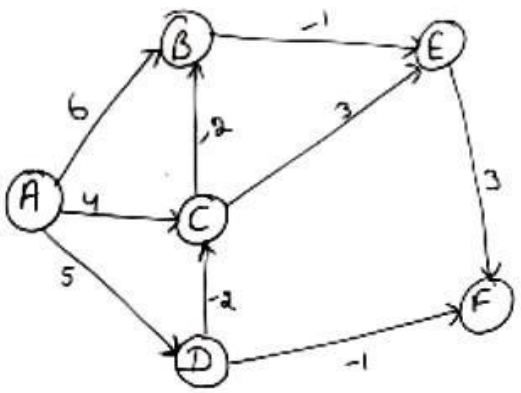
Course Code: 23CS0507 **R23**

UNIT –II
HEAP TREES, GRAPHS, DIVIDE AND CONQUER

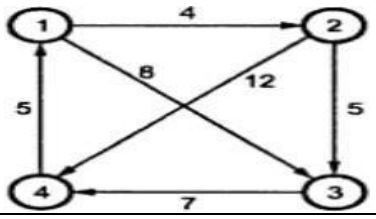
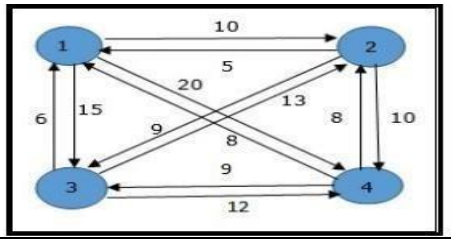
1	**a)**	Define Heapify.	**[L2][CO2]**	**[2M]**
	b)	What is Articulation point?	**[L1][CO2]**	**[2M]**
	c)	What is directed and undirected graph?	**[L1][CO2]**	**[2M]**
	d)	Write the applications of Heap tree.	**[L3][CO2]**	**[2M]**
	e)	Construct Strassen's 2×2 matrix.	**[L3][CO2]**	**[2M]**
2	**a)**	Explain in detail about operations of Heap Tree.	**[L2][CO2]**	**[5M]**
	b)	Construct Max Heap Tree for the following elements 32, 15, 20, 30, 12, 25, 16.	**[L3][CO2]**	**[5M]**
3		Draw the Spanning Tree for the given graph using DFS and BFS algorithm. 	**[L1][CO2]**	**[10M]**
4	**a)**	Define Connected components and Bi-connected components along with Applications	**[L2][CO2]**	**[5M]**
	b)	Explain Graph representations with suitable example.	**[L2][CO2]**	**[5M]**
5		Explain Graph Traversal techniques with neat example.	**[L2][CO2]**	**[10M]**
6	**a)**	Compare between Min heap and Max heap.	**[L5][CO2]**	**[5M]**
	b)	Sort the records with the following index values in the ascending order using Quick Sort algorithm. 9, 7, 5, 11, 12, 2, 14, 3, 10, 6.	**[L2][CO2]**	**[5M]**
7		Analyze the working strategy of merge sort and illustrate the process of Merge Sort algorithm for the given data: 43, 32, 22, 78, 63, 57, 91 and 13	**[L4][CO2]**	**[10M]**
8		Summarize an algorithm for quick sort. Provide a complete analysis of quick sort for given set of numbers 12, 3, 18, 21, 4, 55, 64, 77and 76.	**[L3][CO2]**	**[10M]**
9	**a)**	Explain about Convex Hull with example.	**[L2][CO2]**	**[5M]**
	b)	Explain the General Method of Divide and Conquer Method.	**[L2][CO2]**	**[5M]**
10		$A=\begin{bmatrix} 9 & 4 & 6 & 7 \\ 7 & 8 & 1 & 4 \\ 4 & 3 & 2 & 6 \\ 5 & 3 & 0 & 2 \end{bmatrix}$ $B=\begin{bmatrix} 7 & 6 & 2 & 1 \\ 3 & 9 & 0 & 3 \\ 2 & 5 & 2 & 9 \\ 3 & 2 & 4 & 7 \end{bmatrix}$ Create Stassen's matrix multiplication on A and B. Find the resultant matrix.	**[L6][CO2]**	**[10M]**

Course Code: 23CS0507 **R23**

UNIT –III
GREEDY METHOD, DYNAMIC PROGRAMMING

1	**a)**	Differentiate greedy and dynamic programming.	**[L2][CO2]**	**[2M]**
	b)	Define knapsack problem using greedy approach.	**[L2][CO2]**	**[2M]**
	c)	What is Spanning Tree?	**[L1][CO2]**	**[2M]**
	d)	What is 0/1 knapsack problem.	**[L1][CO2]**	**[2M]**
	e)	Define Job sequencing with deadlines.	**[L2][CO2]**	**[2M]**
2		Elaborate job sequencing with deadlines by using greedy method where given the jobs, their deadlines and associated profits as shown below. Calculate maximum earned profit. **Jobs** J1 J2 J3 J4 J5 J6 **Deadlines** 5 3 3 2 4 2 **Profits** 200 180 190 300 120 100	**[L6][CO3]**	**[10M]**
3		Construct an optimal solution for Knapsack problem, where n=7,M=15 and (p1,p2,p3,p4,p5,p6,p7) = (10,5,15,7,6,18,3) and (w1,w2,w3,w4,w5,w6,w7) = (2,3,5,7,1,4,1) by using Greedy strategy.	**[L3][CO3]**	**[10M]**
4		Implement the Single Source Shortest Path using Dijkstra's algorithm for the given graph. 	**[L4][CO3]**	**[10M]**
5		What is Minimum Cost Spanning Tree? Implement the Kruskal's algorithm and Prims algorithm. 	**[L1][CO3]**	**[10M]**
6	**a)**	Discuss about Optimal binary search tree with suitable example.	**[L2][CO3]**	**[5M]**
	b)	Build any one application of dynamic programming with an example.	**[L6][CO1]**	**[5M]**
7		Solve Single Source Shortest Paths problem using dynamic programming. 	**[L3][CO3]**	**[10M]**

Course Code: 23CS0507 **R23**

8	**a)**	Explain 0/1 knapsack problem by using dynamic programming with an examples.	**[L2][CO3]**	**[5M]**
	b)	Measure the String Editing problem with example.	**[L5][CO3]**	**[5M]**
9		Construct an algorithm for All pairs of shortest path and calculate shortest path betweenall pairs of vertices by using dynamic programming method for the following graph. 	**[L6][CO3]**	**[10M]**
10		Analyze the minimum cost tour for given problem in travelling sales person Concepts by using dynamic programming. 	**[L4][CO3]**	**[10M]**

Course Code: 23CS0507 **R23**

UNIT –IV

BACKTRACKING, BRANCH AND BOUND

1	**a)**	Define Backtracking.	**[L2][CO2]**	**[2M]**
	b)	What is Graph coloring?	**[L1][CO2]**	**[2M]**
	c)	Solve 4-Queens problem.	**[L2][CO2]**	**[2M]**
	d)	What is Branch and Bound?	**[L1][CO2]**	**[2M]**
	e)	State the Container problem.	**[L2][CO2]**	**[2M]**
2	**a)**	Consider a set S= {5,10,12,13,15,18} and d=30. Solve it for obtaining Sum of Subset using Backtracking method.	**[L6][CO4]**	**[5M]**
	b)	Describe how the backtracking method is applied to solve the 8-Queens problem.	**[L3][CO4]**	**[5M]**
3		Recall the Graph Coloring. Explain in detail about graph coloring with an example.	**[L5][CO4]**	**[10M]**
4		Analyze the least cost search approach in branch and bound.	**[L4][CO4]**	**[10M]**
5		Construct the State space tree for the profits={3,5,6,10} and weights={2,3,4,5},n=4 and m=8 (Capacity). Apply the backtracking for 0/1 Knapsack and also find the Maximum profit.	**[L3][CO4]**	**[10M]**
6	**a)**	Explain the principles of FIFO branch and bound.	**[L3][CO4]**	**[5M]**
	b)	Explain the principles of LIFO branch and bound.	**[L2][CO4]**	**[5M]**
7		Find the LC branch and bound solution for the traveling sale person problem whose cost matrix is as follows: $\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}\begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix} \end{array}$	**[L4][CO4]**	**[10M]**
8		Simplify 0/1 knapsack problem and design an algorithm of LC Branch and Bound and find the solution for the knapsack instance of n = 4,(p1, p2, p3, p4) = (10, 10, 12, 18), (w1,w2, w 3, w4) = (2, 4, 6, 9) and M = 15.	**[L4][CO4]**	**[10M]**
9		Construct the LC branch and bound search. Consider knapsack instance n=4 with capacity M=15 such that pi={10,10,12,18}, wi={2,4,6,9}apply FIFO branch and bound technique.	**[L6][CO4]**	**[10M]**
10	**a)**	Describe the general method of branch and bound.	**[L1][CO4]**	**[5M]**
	b)	Explain the role of the state-space tree in branch and bound techniques.	**[L4][CO4]**	**[5M]**

Course Code: 23CS0507 **R23**

UNIT –V

NP HARD AND NP COMPLETE PROBLEMS

1	**a)**	Define P class and NP Class.	**[L2][CO5]**	**[2M]**
	b)	What are NP complete and NP Hard?	**[L1][CO5]**	**[2M]**
	c)	What is Chromatic Number?	**[L1][CO5]**	**[2M]**
	d)	What is deterministic algorithm?	**[L1][CO5]**	**[2M]**
	e)	What is non-deterministic problem?	**[L1][CO5]**	**[2M]**
2		Construct the non-deterministic algorithms with suitable example.	**[L3][CO5]**	**[10M]**
3		Build the non-deterministic sorting algorithm and also analyze its complexity.	**[L6][CO5]**	**[10M]**
4		Determine the classes NP-hard and NP-complete problem with example.	**[L5][CO5]**	**[10M]**
5		State and Explain Cook's theorem.	**[L2][CO5]**	**[10M]**
6		Illustrate the Satisifiability problem and write the algorithm.	**[L4][CO5]**	**[10M]**
7		Explain Traveling Salesperson Decision Problem With example.	**[L4][CO5]**	**[10M]**
8	**a)**	Explain about Chromatic Number Decision Problem in detail.	**[L4][CO5]**	**[5M]**
	b)	Explain about Clique Decision Problem in detail.	**[L4][CO5]**	**[5M]**
9	**a)**	Explain why Clique Decision Problem is NP-Hard. Explain.	**[L4][CO5]**	**[5M]**
	b)	Explain why Traveling Salesperson Decision Problem is NP-Hard. Explain.	**[L3][CO5]**	**[5M]**
10	**a)**	Explain Scheduling Identical Processors in NP Hard Scheduling Problem.	**[L4][CO5]**	**[5M]**
	b)	Describe Job Shop Scheduling in NP Hard Scheduling Problem.	**[L1][CO5]**	**[5M]**

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