Course Code: 23CI0601 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: Data Structures & Algorithms (23CI0601) **Regulation:** R23

Course & Branch: B.Tech – CSIT **Year & Sem:** II Year & I Sem

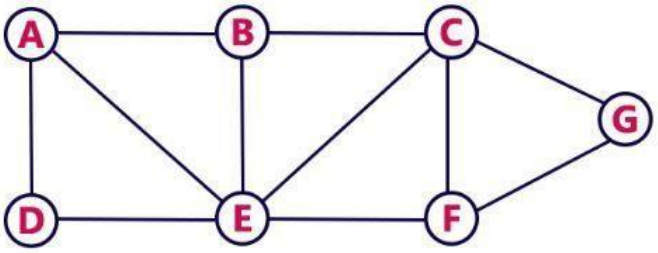
UNIT-I
INTRODUCTION, AVL TREES, B-TREES

1	**a)**	What do you mean by algorithm? List some of the properties of it.	**[L1] [CO1]**	**[2M]**
	b)	Discuss the steps involved in performance analysis.	**[L2] [CO1]**	**[2M]**
	c)	Define Balance Factor.	**[L2] [CO1]**	**[2M]**
	d)	What is an AVL tree? Give one example.	**[L1] [CO1]**	**[2M]**
	e)	What is B-Tree? Give one example.	**[L1] [CO1]**	**[2M]**
2	**a)**	Illustrate an algorithm for Finding sum of natural number.	**[L2] [CO1]**	**[5M]**
	b)	Analyze space complexity and time complexity in detail with example.	**[L4] [CO1]**	**[5M]**
3		What is Asymptotic Notation? Explain different types of notations with examples.	**[L2] [CO1]**	**[10M]**
4		Discuss briefly with suitable example about Big 'O' notation and Theta notation 'Θ'.	**[L2] [CO1]**	**[10M]**
5	**a)**	Discuss factors affecting the time complexity.	**[L2] [CO1]**	**[5M]**
	b)	Compare between Priori analysis and Posteriori analysis.	**[L4] [CO1]**	**[5M]**
6		Explain different AVL rotations with suitable examples.	**[L2] [CO1]**	**[10M]**
7	**a)**	Write the applications and operations of an AVL tree.	**[L3] [CO1]**	**[5M]**
	b)	Define the Balance Factor of a node in an AVL tree. How is it calculated, and what is its significance?	**[L2] [CO1]**	**[5M]**
8		Construct an AVL Tree by inserting numbers from 1 to 8.	**[L6] [CO1]**	**[10M]**
9	**a)**	Write the applications and Operations of the B-Tree.	**[L3] [CO1]**	**[5M]**
	b)	Elaborate the B-Tree Deletion Operation with suitable example.	**[L3] [CO1]**	**[5M]**
10		Construct a B-Tree of order 3 by inserting numbers 1 to 10.	**[L3] [CO1]**	**[10M]**

Course Code: 23CI0601 **R23**

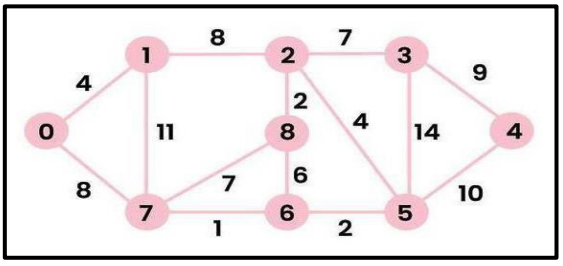
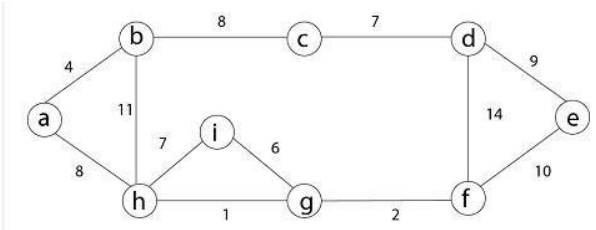
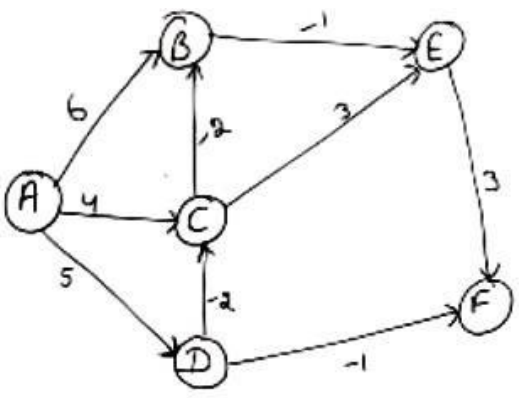
UNIT –II

HEAP TREES, GRAPHS, DIVIDE AND CONQUER

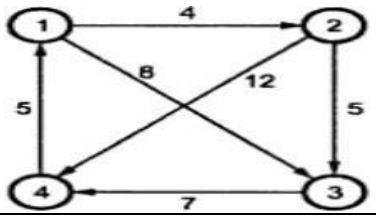
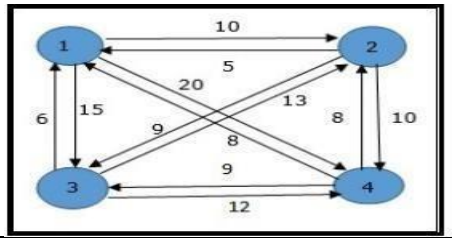
1	**a)**	Define Heapify.	**[L2][CO2]**	**[2M]**
	b)	List out the applications of Heap tree.	**[L1][CO2]**	**[2M]**
	c)	What is directed and undirected graph?	**[L1][CO2]**	**[2M]**
	d)	Define Articulation point?	**[L2][CO2]**	**[2M]**
	e)	Construct Strassen's 2×2 matrix.	**[L3][CO2]**	**[2M]**
2	**a)**	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)**	Compare between Min heap and Max heap.	**[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)**	Discuss Connected components and Bi-connected components along with Applications.	**[L2][CO2]**	**[5M]**
	b)	Sort the records with the following index values in the ascending order using Quick Sort algorithm, 10,80,30,90,40,50 and 60.	**[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 40,20,70,14,60,61,97 and 30.	**[L3][CO2]**	**[10M]**
9	**a)**	Explain the General Method of Divide and Conquer Method.	**[L2][CO2]**	**[5M]**
	b)	Explain about Convex Hull with example.	**[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: 23CI0601 **R23**

UNIT –III
GREEDY METHOD, DYNAMIC PROGRAMMING

1	**a)**	Define greedy method.	**[L2][CO2]**	**[2M]**
	b)	Discuss the disadvantages of greedy method.	**[L2][CO2]**	**[2M]**
	c)	What is Spanning Tree?	**[L1][CO2]**	**[2M]**
	d)	What is 0/1 knapsack problem.	**[L1][CO2]**	**[2M]**
	e)	Explain dynamic programming.	**[L2][CO2]**	**[2M]**
2	a)	Solve 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	**[L3][CO3]**	**[5M]**
	b)	Build any one application of dynamic programming with an example.	**[L3][CO1]**	**[5M]**
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		Construct optimal binary search tree for the given problem n=4,(a1,a2,a3,a4)= (a,b,c,d), P(1,2,3,4,)=(3,3,1,1),Q(0,1,2,3,4)=(2,3,1,1,1).	**[L6][CO3]**	**[10M]**
7		Solve Single Source Shortest Paths problem using dynamic programming. 	**[L3][CO3]**	**[10M]**

Course Code: 23CI0601 **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 between all 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: 23CI0601 **R23**

UNIT –IV

BACKTRACKING, BRANCH AND BOUND

1	**a)**	Define Backtracking.	**[L2][CO2]**	**[2M]**
	b)	Solve 4-Queens problem.	**[L1][CO2]**	**[2M]**
	c)	What is Graph coloring?	**[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)	Recall the Graph Coloring. Explain in detail about graph coloring with an example..	**[L3][CO4]**	**[5M]**
3		Describe how the backtracking method is applied to solve the 8-Queens problem.	**[L5][CO4]**	**[10M]**
4		Compare Back Tracking and Branch and Bound methods by taking an example.	**[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)**	Solve 4 – queens problem by generating state space tree .	**[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	a)	Explain the procedure for Travelling Sales Person Problem using branch and bound.	**[L2][CO4]**	**[5M]**
	b)	Explain the principles of FIFO branch and bound.	**[L2][CO4]**	**[5M]**
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: 23CI0601 **R23**

UNIT –V

NP HARD AND NP COMPLETE PROBLEMS

1	**a)**	Define P class and NP Class.	**[L2][CO2]**	**[2M]**
	b)	What are NP complete and NP Hard?	**[L1][CO2]**	**[2M]**
	c)	State deterministic algorithm?	**[L1][CO2]**	**[2M]**
	d)	Discuss about Non-deterministic algorithm?	**[L2][CO2]**	**[2M]**
	e)	What is Chromatic Number?	**[L1][CO2]**	**[2M]**
2	**a)**	Explain and shows the relationship between P,NP,NP Hard and NP Complete with neat diagram	**[L2][CO5]**	**[5M]**
	b)	Summarize non deterministic algorithm with an example.	**[L3][CO5]**	**[5M]**
3	**a)**	Determine the classes NP-hard and NP-complete problem with example.	**[L3][CO5]**	**[5M]**
	b)	Illustrate the Satisfiability [SAT] problem.	**[L3][CO5]**	**[5M]**
4	**a)**	State and Explain Cook's theorem.	**[L1][CO5]**	**[5M]**
	b)	How to make reduction for 3-SAT to Clique Decision problem? and Explain	**[L1][CO5]**	**[5M]**
5		Explain why Clique Decision Problem is NP-hard with suitable an example.	**[L2][CO5]**	**[10M]**
6		Explain why Chromatic Number Decision Problem is NP-hard in detail with an example.	**[L2][CO5]**	**[10M]**
7	**a)**	Build Traveling salesperson Decision Problem with example.	**[L3][CO5]**	**[5M]**
	b)	Discuss about Chromatic Number Decision Problem in detail.	**[L2][CO5]**	**[5M]**
8		Explain why Traveling Sales person Decision Problem is NP-Hard with an example.	**[L2][CO5]**	**[10M]**
9		Analyze Scheduling Identical Processors in NP Hard Scheduling Problem.	**[L4][CO5]**	**[10M]**
10		Describe Job Shop Scheduling in NP Hard Scheduling Problem.	**[L1][CO5]**	**[10M]**

Prepared by: Mr. Ch. Sivasankar, Assistant Professor, CSIT Dept