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BTECH
(SEM III) THEORY EXAMINATION 2024-25
BASIC DATA STRUCTURE AND ALGORITHMS

TIME: 3 HRS

M.MARKS: 100

Note: Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

Q no.	Question	CO	Level
a.	Explain Big O notation.	1	2
b.	Discuss Sparse Matrices and their representations.	1	2
c.	Write the underflow condition for linked list.	2	2
d.	Solve Tower of Hanoi for 4 disks.	2	3
e.	Differentiate between BST and heap.	3	4
f.	Discuss height of a binary tree.	3	2
g.	Describe minimum spanning tree.	4	2
h.	Explain adjacency list.	4	2
i.	Discuss time complexity of binary search.	5	2
j.	Differentiate between internal and external sorting.	5	2

SECTION B**2. Attempt any three of the following: 10 x 3 = 30**

a.	Discuss the importance of time complexity and space complexity in algorithm design.	1	3
b.	Why circular queues are better than simple Queues? Write an algorithm to insert and delete an item from circular Queues.	2	3
c.	Draw an AVL tree on following inputs , assume that tree is initially empty 44,55,65,75,80,90,100,110,120,130,40,35,25,20,15,10,5.	3	3
d.	Write and explain the BFS and DFS traversal algorithm.	4	3
e.	Use Quick sort algorithm to sort 15 , 22 , 30 , 10 , 15 , 64 , 1 , 3,9 , 52. Is It a stable sorting algorithm?	5	3

SECTION C**3. Attempt any one part of the following: 10 x 1 = 10**

a.	Solve the following recurrence relation using the master theorem : $T(n)=2T(n/2)+n$ Explain the steps of your solution.	1	3
b.	Given the following 2D array in row-major order : int arr[3][3] = { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} }; Find the memory address of the element arr[2][2] if the base address of the array is 1000 and each integer takes 4 bytes.	1	3



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4. Attempt any one part of the following:		10 x 1 = 10	
a.	Write the procedure for postfix expression evaluation.	2	3
b.	How a polynomial equation can be represented through linked list? Explain the method to add two given polynomial equations using linked list.	2	3
5. Attempt any one part of the following:		10 x 1 = 10	
a.	Define Binary Search Tree? Write a C program to insert new nodes to Binary Search tree	3	3
b.	Explain the B-Tree concept and its advantages over BST. Construct a B-Tree of order 3 with the following keys: 15, 25, 35, 45, 55, 65, 75, 85, 95 .	3	3
6. Attempt any one part of the following:		10 x 1 = 10	
a.	Explain Kruskal's algorithm to find minimum spanning tree in a weighted directed graph with example.	4	3
b.	How can you find shortest path between two nodes in a graph by Dijkstra's Algorithm? Explain by suitable diagram in algorithm.	4	3
7. Attempt any one part of the following:		10 x 1 = 10	
a.	Write a program in C for Binary search. What is the worst case time complexity of Binary search?	5	4
b.	You are given a hash table of size 11, and two hash functions for collision resolution: 1. Primary hash function: $h_1(k) = k \text{ mod } 7$ 2. Secondary hash function: $h_2(k) = 7 - (k \text{ mod } 7)$ The keys to be inserted are: 13, 24, 35, 46, and 57. After inserting all the keys, show the final hash table using double hashing for collision resolution.	5	3