B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E.   **Semester: III**

Branch: Artificial Intelligence & Machine Learning   **Duration: 3 hrs.**

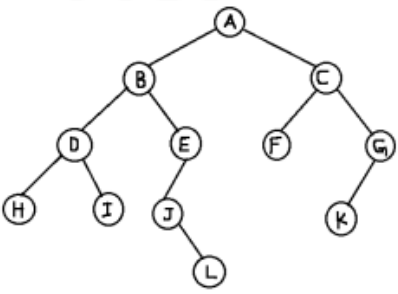**Course Code: 22AM3PCDST**   **Max Marks: 100**

Course: Data Structures

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I	*CO*	*PO*	**Marks**
1	a)		Write user defined functions to demonstrate the following operations on a Singly Linked List (SLL) with header node. i. Insert an item at the front end ii. Delete an item from the front end	*CO1*	*PO1*	**08**
	b)		Elaborate the hierarchy of basic classification of data structures with respect to memory allocation and usage.	*CO1*	*PO1*	**08**
	c)		How does static memory allocation differ from dynamic memory allocation? Explain.	*CO1*	*PO1*	**04**
			OR			
2	a)		List and explain the applications of Singly Linked List (SLL)	*CO1*	*PO1*	**04**
	b)		Write a program to perform the following operations on Singly Linked List (SLL). i. Insert rear ii. Delete rear iii. Display the elements of SLL.	*CO1*	*PO1*	**08**
	c)		Elaborate malloc(), calloc(), realloc() and free() functions along with their syntax and examples.	*CO1*	*PO1*	**08**
			UNIT - II			
3	a)		Illustrate the process of evaluation of the given postfix expression: 2 3 1 * + 9 - using a stack trace.	*CO1*	*PO1*	**08**
	b)		Write user defined functions to demonstrate the following operations on a Circular Doubly Linked List (CDLL). i. Insert an item at the front end ii. Delete an item from the rear end	*CO1*	*PO1*	**08**
	c)		Is it possible to confirm the correctness of parenthesis matching in a given string using the concept of arrays? Pictorially illustrate the sequence for the string "(4{3+1}"	*CO1*	*PO2*	**04**
			OR			

	4	a)	Illustrate the process of conversion of given infix expression: a*c+(b/d)^e to postfix representation using a stack trace.	CO1	PO2	**08**

		b)	Write user defined functions to demonstrate the following operations on a Doubly Linked List (DLL).
			   i. Concatenation of 2 DLL
			  ii. Display
				CO1	PO1	**08**

		c)	Explain any 2 basic stack operations.	CO1	PO1	**04**
			UNIT - III			

	5	a)	Write a recursive code to determine
			   i. Factorial of a given number
			  ii. n^{th} Fibonacci number
				CO2	PO1	**08**

		b)	Perform the following operations: insert(3), insert(4), insert(5), delete, insert(6), insert(7), insert(8), insert(9) on the circular queue with capacity 5 and determine the final items on the queue. Represent each and every step pictorially and explain the process.	CO2	PO2	**08**
		c)	What are the advantages of using a dequeue over a standard queue or stack?	CO2	PO1	**04**
			OR			
	6	a)	List and explain applications of queues used to solve real time problems.	CO2	PO1	**04**
		b)	Write a program to implement a priority queue where elements with higher values have higher priority.	CO2	PO1	**08**

		c)	Write a code snippet to implement following deque operations:
			   i. To insert elements at the rear end
			  ii. To delete elements between the nodes
				CO2	PO1	**08**

			UNIT - IV			
	7	a)	Construct a Binary Search Tree for the sequence: 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24 and perform inorder & preorder traversals on it.	CO3	PO3	**10**
		b)	Illustrate the concepts of left and right threaded Binary Tree.	CO3	PO3	**05**
		c)	Justify the statement "The Maximum number of nodes in a binary tree of height 'h' is $2^h – 1$"	CO3	PO3	**05**
			OR			

	8	a)	Differentiate the following types of binary trees:
			   i. Full Binary Tree
			  ii. Degenerate Binary Tree
			  iii. Skewed Binary Trees
				CO3	PO3	**06**

		b)	Perform In-order, Pre-order, and Post-order traversals for the given tree below, and clearly write out the resulting sequences.	CO3	PO3	**06**

				CO3	PO3	
		c)	Given in-order and pre-order traversals of a Binary Tree, construct the Binary Tree and return its root: In-order = [3, 1, 4, 0, 5, 2] Pre-order = [0, 1, 3, 4, 2, 5]	*CO3*	*PO3*	**08**
			UNIT - V			
9	a)		Construct a Red-Black tree by inserting the elements: 8, 18, 5, 15, 17, 25, 40, 80 in the same order by representing the process pictorially at every step.	*CO3*	*PO3*	**10**
	b)		Elaborate on the rules to be followed during construction of a AVL tree.	*CO3*	*PO3*	**06**
	c)		Differentiate between Zig and Zig-Zig operations of a splay tree.	*CO3*	*PO3*	**04**
			OR			
10	a)		Construct a AVL tree by inserting the elements: 21, 26, 30, 9, 4, 14, 28, 18, 15, 10 in the given order.	*CO3*	*PO3*	**10**
	b)		Elaborate on the rules to be followed during construction of a Red Black tree.	*CO3*	*PO3*	**06**
	c)		Write any 4 real time applications of splay trees.	*CO3*	*PO3*	**04**

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