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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: 3**

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

Course Code: 23AM3PCDST **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.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	PO	Marks
			UNIT - I			
1	a)		What is memory allocation? With suitable example explain static memory allocation technique with its drawback.	CO1	PO1	**07**
	b)		Explain the difference between linear and non-linear data structures with suitable examples.	CO1	PO1	**06**
	c)		Write a Python code to add a node between the existing nodes in the singly linked list (SLL) and display the list.	CO1	PO1	**07**
			OR			
2	a)		Discuss various types of dynamic memory allocation functions with suitable examples for each.	CO1	PO1	**07**
	b)		With a code snippet explain the process of adding a node at the end of a singly linked list and display the contents of SLL	CO1	PO1	**07**
	c)		Define data structures. Differentiate primitive and non-primitive data structure with suitable example.	CO1	PO1	**06**
			UNIT - II			
3	a)		Deduce the contents of empty stack after the execution of the following operations in sequence: Push(6), Push(8), Push(-1),Pop(),Push(7),Pop(),Pop()	CO2	PO2	**04**
	b)		Given the infix expression A + B * C / D - F + A ^ E convert it to postfix expression. Provide a clear explanation of each step involved in the conversion process.	CO3	PO2	**08**
	c)		Elaborate the following operations performed on Doubly Linked List (DLL) with a code snippet: i. Adding a node at the beginning of the linked list. ii. Deleting the node at the end of linked list.	CO2	PO2	**08**
			OR			
4	a)		Evaluate the postfix expression:	CO3	PO2	**07**

			6 2 3 + - 3 8 2 / + * 2 & 3 + Show the contents of stack at each step.			
		b)	Write Python function to perform insertion of a node at front and deletion of a node from the rear end of a circular linked list	*CO2*	*PO2*	**07**
		c)	Elaborate the Steps required for converting infix to postfix expression	*CO2*	*PO1*	**06**
			UNIT - III			
	5	a)	Define queue and elaborate the fundamental operations associated with it.	*CO1*	*PO1*	**06**
		b)	Write a recursive program to print the Fibonacci series upto 'n' terms.	*CO3*	*PO2*	**06**
		c)	Provide a code snippet to perform the following operations on a circular queue. i. Enqueue ii. Dequeue	*CO2*	*PO2*	**08**
			OR			
	6	a)	Write a simple recursive program to calculate the factorial of a non-negative integer.	*CO2*	*PO2*	**06**
		b)	In a coffee shop, customers arrive to place their orders. Customers C1 and C2 arrive and join the line, followed by C4. The first person at the front of the line is served and leaves the shop. Customer C5 then arrives and joins the end of the line. After C2 is served, C4 places the order and leaves the shop. The last customer to arrive at the counter is, but has not yet been served. Create a pictorial representation of each stage of the given scenario.	*CO3*	*PO2*	**06**
		c)	Write a Python program to implement a dynamic queue using a singly linked list without a fixed size.	*CO1*	*PO2*	**08**
			UNIT - IV			
	7	a)	Define binary search tree. Draw the BST for the following input: 14, 15, 4, 9, 7, 18, 3, 5, 16, 20, 17, 29, 21, 19, 2,12, 27.	*CO3*	*PO2*	**10**
		b)	Define Complete binary tree with an example. Provide a code snippet to traverse the tree using in-order, pre-order and post-order.	*CO3*	*PO1*	**10**
			OR			
	8	a)	What is the advantage of the threaded binary tree over binary tree? construct double threaded binary tree for the following inputs: 10, 8, 7, 9, 15, 12 and 18.	*CO3*	*PO2*	**10**
		b)	Given in-order and post-order traversals of a binary search tree, construct the binary search tree and perform pre-order traversal: In-order: 10, 30, 40, 50, 60, 70, 90 post-order : 10, 40, 30, 60, 90, 70, 50	*CO3*	*PO2*	**10**

			UNIT - V			
	9	a)	Describe the concept of a Red-Black Tree and outline its key properties. Highlight the importance of its balance and color rules in preserving the tree's structure.	*CO1*	*PO1*	**05**
		b)	Explain the concept of a Splay Tree along with its rotations.	*CO1*	*PO1*	**05**
		c)	Given the following set of numbers {63, 9, 19, 27, 18, 108, 99, 81} construct an AVL tree by inserting each number into the tree one by one.	*CO3*	*PO2*	**10**
			OR			
	10	a)	What is an AVL Tree? Describe its rotations and outline the advantages of AVL Trees over Binary Search Tree (BST)	*CO1*	*PO1*	**05**
		b)	Construct a splay tree by inserting elements 16, 27, 9, 11, 36, 54, 81 and 63.	*CO3*	*PO2*	**10**
		c)	Describe the concepts of height and balance factor of a node in an AVL tree by providing a simple example.	*CO1*	*PO1*	**05**

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