T/K/TY

Final Assessment Test – November [illegible]

VIT
Vellore Institute of Technology

Course: BCSE202L - Data Structures and Algorithms
Class NBR(s): 0579/4030 /4109
Time: Three Hours

Slot: B2+TB2
Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Understand the fundamental analysis and time complexity for a given problem.
CO2	Articulate linear, non-linear data structures and legal operations permitted on them.
CO3	Identify and apply suitable algorithms for searching and sorting.
CO4	Discover various tree and graph traversals.
CO5	Explicate hashing, heaps and AVL trees and realize their applications.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Consider the recurrence relation defined by $T(n) = 2T(n/2) + n$. Solve this recurrence using iteration technique. **CO1 BL3**

2. A software company is developing a text editor application that uses a stack to manage "Undo" operations. Each user action is stored on the stack so that we can undo the most recent operation easily. Write an algorithm to implement basic stack operations: Push, Pop, and Display using an array. **CO2 BL1, BL3**

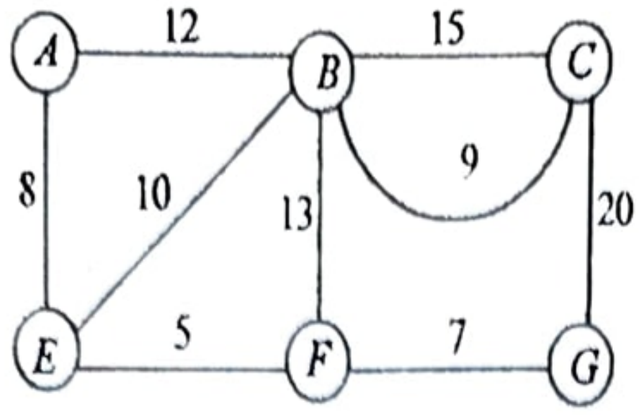
3. An e-commerce application stores product IDs in a sorted array for quick lookup. When a user searches for a product, the system uses Binary Search to find it. Write an algorithm to implement Binary Search, and explain how the algorithm ensures fast retrieval. Also, discuss what modifications would be required if the list were unsorted. **CO3 BL4**

4. Construct an Expression Tree for the arithmetic expression $(A + B) * (C - D) / E$. **CO4 BL3**

   Show all the steps involved in the construction and explain how each of the tree traversals (Inorder, Preorder, and Postorder) represents different forms of the expression.

5.	A social media platform uses graphs to represent users (nodes) and friendships (edges). To suggest new friends, it explores all users connected within a few levels.	CO4	BL1, BL2
	a) Explain how Breadth First Search and Depth First Search can be used to traverse this graph.	[4]	
	b) Write algorithms for both BFS and DFS and compare their traversal order.	[3+3]	
6.	A student database stores roll numbers using a hash table. Due to multiple students having similar roll number patterns, collisions frequently occur.	CO5	BL3
	a) Explain how separate chaining handles collisions in a hash table.	[3]	
	b) Construct a hash table using chaining for the keys {25, 42, 96, 33, 45, 72} with table size = 5 and hash function h(k) = k % 5.	[4]	
	c) Compare linear probing and quadratic probing as open hashing techniques for collision resolution.	[3]	
7.	A company maintains a dynamic database of employee IDs that must remain balanced to ensure quick searching, insertion, and deletion operations. The system uses an AVL tree for this purpose. The following employee IDs are inserted sequentially into the AVL tree: 21, 26, 30, 9, 4, 14, 28, 18, 15, 10, 2, 3, 7. Construct the resulting AVL tree, showing the rotations (if any) required to maintain balance after each insertion.	CO5	BL3
8.	Explain the working principle of Bubble Sort. Illustrate step-by-step sorting for {30, 10, 80, 90, 40, 50, 70} using bubble sort.	CO3	BL3
9.a)	Write an algorithm to perform the following operations in a Singly linked list	CO2	BL1, BL2
	i) Insert a node at the beginning	[3]	
	ii) Delete a node at the end	[3]	
	iii) Search for a given element in the list	[4]	
	OR		
9.b)	A ticket booking portal uses queues to handle requests in order of arrival, but allows premium users to be served from either end. Implement a Double-Ended Queue and write the algorithm to insert and delete elements.	CO2	BL1, BL2

10.a) Construct the Minimum Spanning Tree for the following graph using Prim's Algorithm. **CO4** **BL3**



OR

10.b) A computer system schedules tasks based on their execution priority. Lower priority numbers indicate more urgent tasks. The system uses a min heap based priority queue to determine the next task to execute. **CO4** **BL3**

i) Write an algorithm to insert a new task into the heap based priority queue. **[5]**

ii) Write an algorithm to remove the highest priority task from the queue. **[5]**

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