REG.NO.:

SLOT: E2 + TE2

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

Programme Name & Branch :**B.Tech CSE & ALL SPECIALIZATIONS**
Course Code and Course Name :**BACSE105 &Data Structures and Algorithms**

Faculty Name(s) : Prof.VETRISELVI T and others

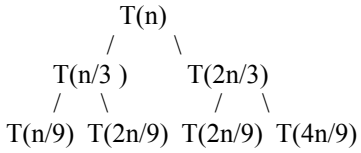
Class Number(s) : VL2025260501379 and others

Date of Examination :**31/01/2026**

Exam Duration :**90 minutes** **Maximum Marks:50**

General instruction(s):

- Answer All Questions

Q. No	Question	Module	Marks	CO	BL
1.	Derive the recurrence relation for the following algorithm and determine its time complexity using the recursion tree method Algorithm F(n) 1. if n <= 1 return 2. F(n/3) 3. F(2n/3) 4. Perform constant work Answer the Recurrence Relation is : Recurrence relation: $T(n) = T(n/3) + T(2n/3) + \Theta(1)$  The recursion stops when the problem size becomes 1. $(2/3)^k n = 1$ $k = \log_{3/2} n = \Theta(\log n)$ So, the height of the recursion tree is $\Theta(\log n)$. Total Time Complexity (Recursion Tree Method) Total work = (work per level) × (number of levels) $= \Theta(1) \times \Theta(\log n)$ $T(n) = \Theta(\log n)$ thereofore Height *level complexity= Θ (nlogn)	1	10	1	4

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2.	a) What is the worst-case complexity of the each of the following code fragments?
	Trace with Cost (3marks)
	
	Two loops in a row:
	for (i = 0; i < N; i++)
	{ sequence of statements
	for(j=0;j<N; j=j+2)
	{sequence of statements}}
	for (j = 0; j < M; j++)
	{ sequence of statements }
	Answer:$O(n^2)$
	
	b) For each of the following loops with a method call, determine the overall complexity. As above, assume that method f takes constant time, and that method g takes time linear in the value of its parameter.
	Justification (3 marks)
	Answer(2Marks)
	Answer:(i). for (j = 0; j < N; j++) f(j); O(1)
	
	(ii). for (j = 0; j < N; j++) g(j); O(n)
	
	(iii) for (j = 0; j < N; j++) g(k);O(1)
		1	10	1	4

3.	Consider a circular queue implemented using an array of size 5. Initially, the queue is empty. First, perform a DEQUEUE operation. Then, perform the following operations in sequence: ENQUEUE the elements 45, 56, 67, 87, 12, and 23. After completing these ENQUEUE operations, perform the DEQUEUE operation twice. Trace each operation clearly, show the result of every DEQUEUE call**,** and display the elements present in the circular queue after each operation**.** Also write the algorithm or pseudocode for the Enqueue and Dequeue operations in the circular queue Circular Queue Using Array (Size = 5) Given: A circular queue of size 5 implemented using an array. Initially, FRONT = REAR = −1, indicating that the queue is empty. Step-by-step trace of operations DEQUEUE −1 Underflow ENQUEUE(45) Inserted ENQUEUE(56) ENQUEUE(67) *ENQUEUE(87)* *ENQUEUE(12) [45 56 67 87 12] all elements are inserted in the rear end* *ENQUEUE(23) [45 56 67 87 12] Overflow* *DEQUEUE () [56 67 87 12] | Removed 45* *DEQUEUE () [* 67 87 12] | Removed 56 Algorithm for ENQUEUE (Circular Queue using Array) ENQUEUE(item) 1. If ((REAR + 1) mod SIZE == FRONT) Print "Queue Overflow" and exit 2. If (FRONT == −1) FRONT = 0 REAR = 0 Else REAR = (REAR + 1) mod SIZE 3. QUEUE[REAR] = item Algorithm for DEQUEUE (Circular Queue using Array) DEQUEUE() 1. If (FRONT == −1) Print "Queue Underflow" and exit 2. item = QUEUE[FRONT] 3. If (FRONT == REAR) FRONT = −1 REAR = −1 Else FRONT = (FRONT + 1) mod SIZE 4. Return item	2	10	2	3

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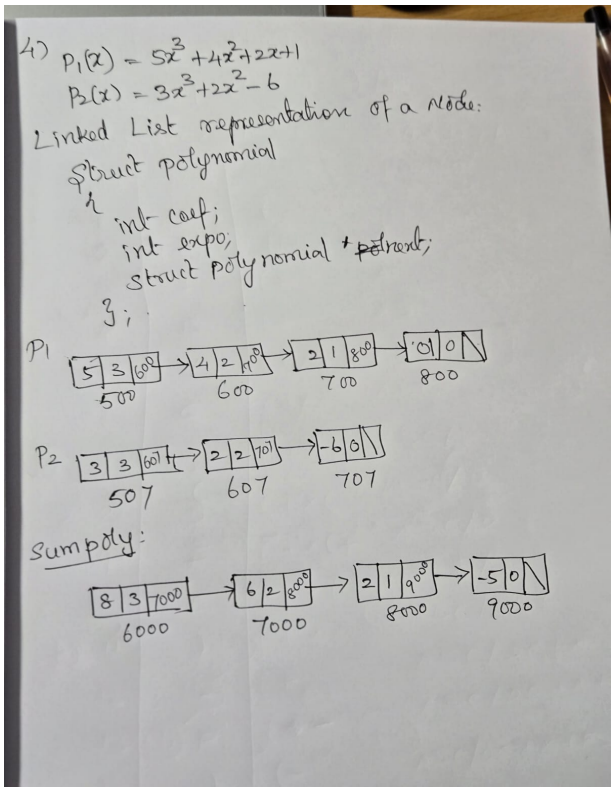
4.	Consider two polynomials P1(x) and P2(x) represented using singly linked lists, where each node stores a coefficient and an exponent. Let P1(x)=5x3+4x2+2x+1 P2(x) = 3x3 + 2x2 -6. Write an algorithm to perform polynomial addition using the linked list representation. Trace the addition process step by step, showing how corresponding nodes (terms with the same exponent) are compared and combined. Draw neat linked list diagrams for P1(x) , P2(x) , and the resultant polynomial. Answer: Algorithm writing 5 marks Trace and explain 5 marks  	2	10	2	3

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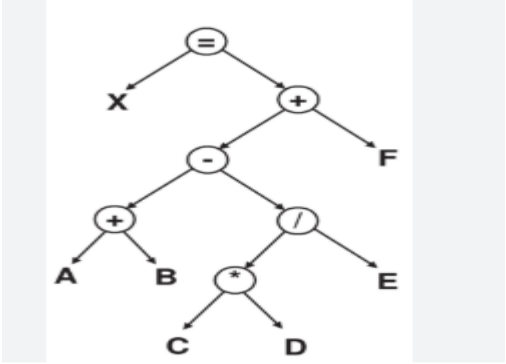
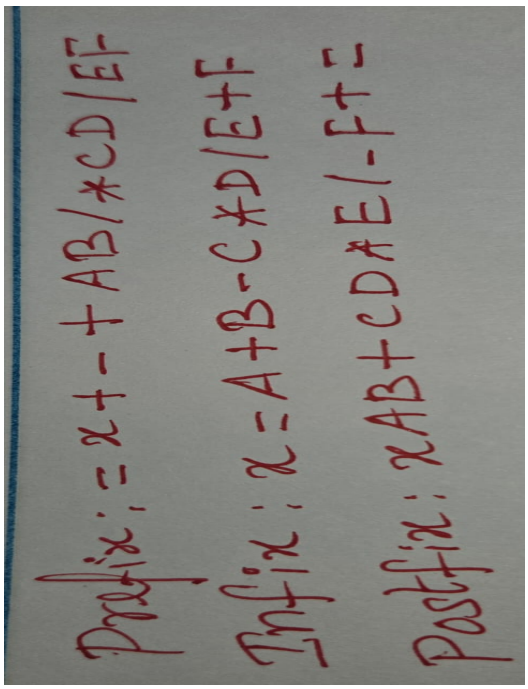
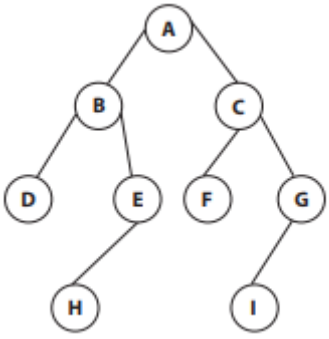
5.	a) Consider the given expression tree. Perform inorder, preorder, and postorder traversals of the tree. Trace each traversal step by step, showing the order in which the nodes are visited, and draw a neat, clearly labeled sketch of the expression tree to support your explanation. (5)   b) Write a algorithm to construct a binary tree from given infix expression to postfix expression: (5) INORDER : D B H E A F C I G PREORDER : A B D E H C F G I Answer: Step by step tracing(3 Marks), final answer (2 Marks).  	2	10	2	3

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