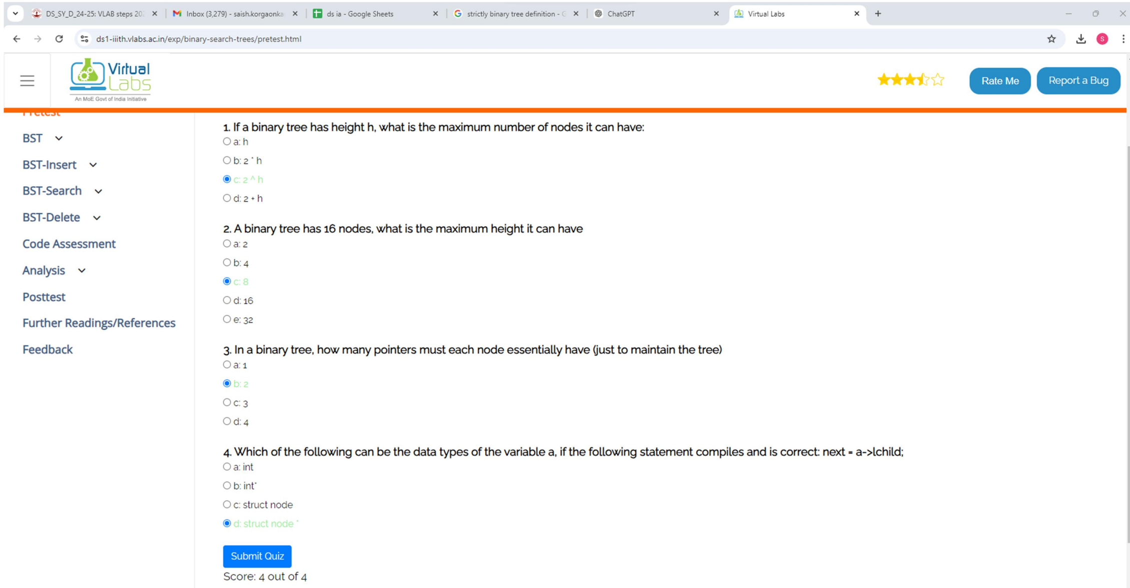
<u>Vlab-1</u>



ds1-iiith.vlabs.ac.in/exp/binary-search-trees/pretest.html
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1. If a binary tree has height h, what is the maximum number of nodes it can have:
a: h
b: 2 * h
c: 2 ^ h
d: 2 + h
2. A binary tree has 16 nodes, what is the maximum height it can have
a: 2
b: 4
c: 8
d: 16
e: 32
3. In a binary tree, how many pointers must each node essentially have (just to maintain the tree)
a: 1
b: 2
c: 3
d: 4
4. Which of the following can be the data types of the variable a, if the following statement compiles and is correct: next = a->lchild;
a: int
b: int*
c: struct node
d: struct node *
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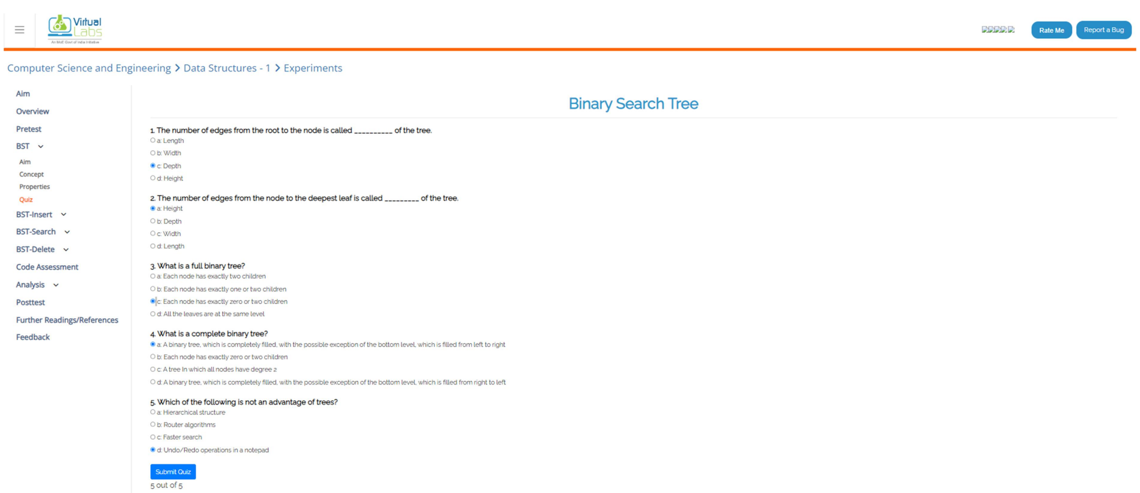
Score: 4 out of 4



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Binary Search Tree
1. The number of edges from the root to the node is called __________ of the tree.
a: Length
b: Width
c: Depth
d: Height
2. The number of edges from the node to the deepest leaf is called _________ of the tree.
a: Height
b: Depth
c: Width
d: Length
3. What is a full binary tree?
a: Each node has exactly two children
b: Each node has exactly one or two children
c: Each node has exactly zero or two children
d: All the leaves are at the same level
4. What is a complete binary tree?
a: A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from left to right
b: Each node has exactly zero or two children
c: A tree In which all nodes have degree 2
d: A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from right to left
5. Which of the following is not an advantage of trees?
a: Hierarchical structure
b: Router algorithms
c: Faster search
d: Undo/Redo operations in a notepad
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Binary Search Tree

Choose difficulty: ☑ Beginner ☑ Intermediate

1. If you are given only the inorder traversal of a binary tree, you can construct the tree uniquely from it.
- a: True
- b: False

2. Which of the following sets uniquely determine a binary tree
- a: In Order Traversal
- b: Post Order Traversal
- c: In Order and Pre Order Traversal
- d: Pre Order

3. Simulate the insertion of the following numbers in your binary search tree in order. Compute the resulting height of the tree: [1, 2, 3, 4, 5, 6, 7, 8]
- a: 8
- b: 6
- c: 5
- d: 4

4. Simulate the insertion of the following numbers in your binary search tree in order. Compute the resulting height of the tree: [4, 2, 6, 3, 1, 5, 8, 7]
- a: 8
- b: 6
- c: 5
- d: 4

5. Simulate the insertion of the following numbers in your binary search tree in order. Compute the resulting height of the tree: [4, 2, 6, 3, 1, 5, 7, 8]
- a: 8
- b: 6
- c: 4
- d: 3

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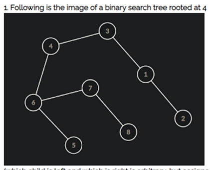
Binary Search Tree

Choose difficulty: ☑ Intermediate ☑ Advanced

1. Following is the image of a binary search tree rooted at 4



(which child is left and which is right is arbitrary, but assigned so to maintain validity of the tree). Which of the following can be the nodes you visit when searching for the number 10.
- a: 4 6 7 10
- b: 4 6 7 8 Explanation
- c: 4 3 1 2
- d: 4 6 5 10

2. To find the smallest element in the subtree of a given node, we:
- a: Go recursively into the left child of the current node, and stop when no left child exists. Explanation
- b: Go recursively into the left child of the current node, go to the right child otherwise, and stop when neither one exists.
- c: Go recursively into the right child of the current node, and stop when no left child exists.
- d: Go recursively into the right child of the current node, go to the right child otherwise, and stop when neither one exists.

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Binary Search Tree

Choose difficulty: ☑ Beginner ☑ Intermediate

1. If a node has 2 children, how can we delete the value in that node:
- a: By swapping it's value with the rightmost node in it's left subtree, then deleting that rightmost node. Explanation
- b: By swapping it's value with the leftmost node in it's right subtree.
- c: By swapping it's value with the rightmost node in it's left subtree, then deleting the node which originally contained the target value.
- d: By swapping it's value with the leftmost node in it's right subtree, then deleting the node which originally contained the target value.

2. If a node has 1 child to the right, but not left child, how can we delete it:
- a: By swapping it's value with the leftmost node in it's right subtree, then deleting that leftmost node.
- b: By assigning it's child's parent as it's parent, by assigning it's parents right child as it's right child, and then deleting itself.
- c: By just deleting the target node and making the pointers null if they were pointing to the node being deleted.
- d: By swapping the value of this node with the root of the tree and then deleting the root node.

3. In a real BST, delete takes O(log n) time. Assume that you discover an oracle which can search, compute min or max of a subtree, in a binary search tree in O(1) time. What will the time complexity of the optimal deletion algorithm using this oracle:
- a: O(1) Explanation
- b: O(log n)
- c: O(log(log(n))
- d: O(n)

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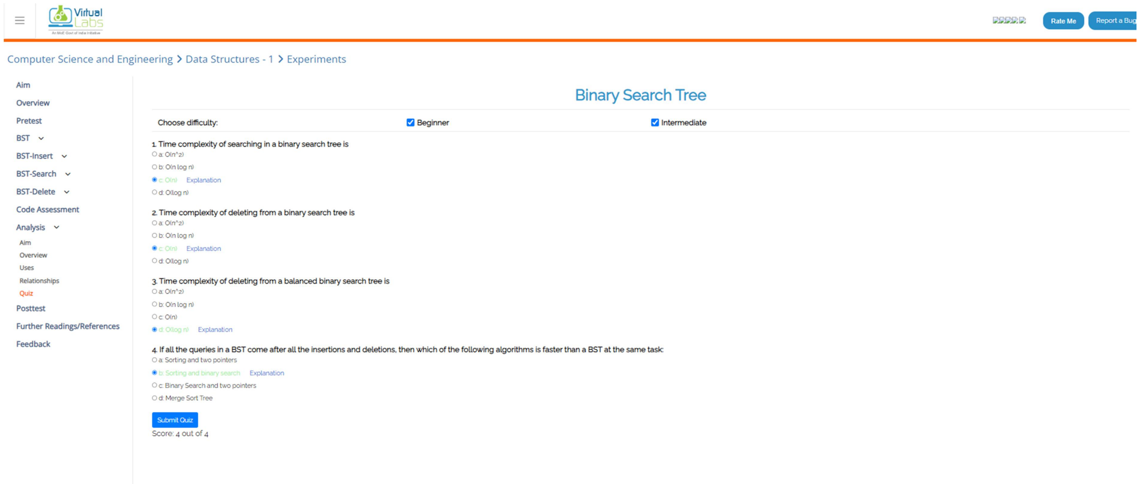
Score: 3 out of 3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Binary Search Tree
Choose difficulty:
Beginner
Intermediate
1. Time complexity of searching in a binary search tree is
a: O(n^2)
b: O(n log n)
c: O(n) Explanation
d: O(log n)
2. Time complexity of deleting from a binary search tree is
a: O(n^2)
b: O(n log n)
c: O(n) Explanation
d: O(log n)
3. Time complexity of deleting from a balanced binary search tree is
a: O(n^2)
b: O(n log n)
c: O(n)
d: O(log n) Explanation
4. If all the queries in a BST come after all the insertions and deletions, then which of the following algorithms is faster than a BST at the same task:
a: Sorting and two pointers
b: Sorting and binary search Explanation
c: Binary Search and two pointers
d: Merge Sort Tree
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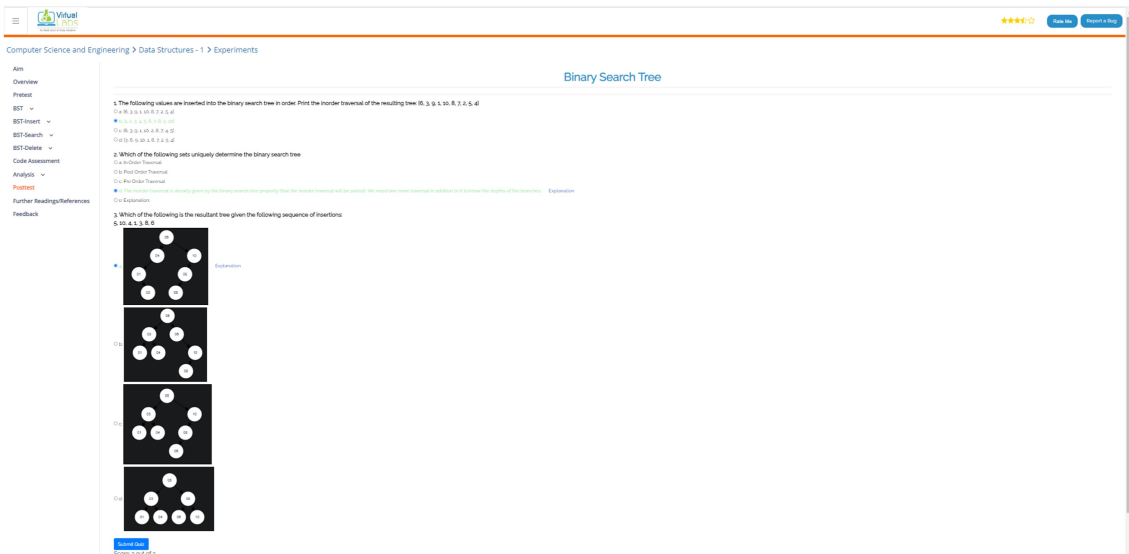
Score: 4 out of 4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Binary Search Tree
1. The following values are inserted into the binary search tree in order. Print the inorder traversal of the resulting tree: [6, 3, 9, 1, 10, 8, 7, 2, 5, 4]
a: [6, 3, 9, 1, 10, 8, 7, 2, 5, 4]
b: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
c: [6, 3, 9, 1, 10, 2, 8, 7, 4, 5]
d: [3, 6, 9, 10, 1, 8, 7, 2, 5, 4]
2. Which of the following sets uniquely determine the binary search tree
a: In Order Traversal
b: Post Order Traversal
c: Pre Order Traversal
d: The inorder traversal is already given by the binary search tree property (that the inorder traversal will be sorted). We need one more traversal in addition to it to know the depths of the branches. Explanation
e: Explanation:
3. Which of the following is the resultant tree given the following sequence of insertions:
5, 10, 4, 1, 3, 8, 6
a: Explanation
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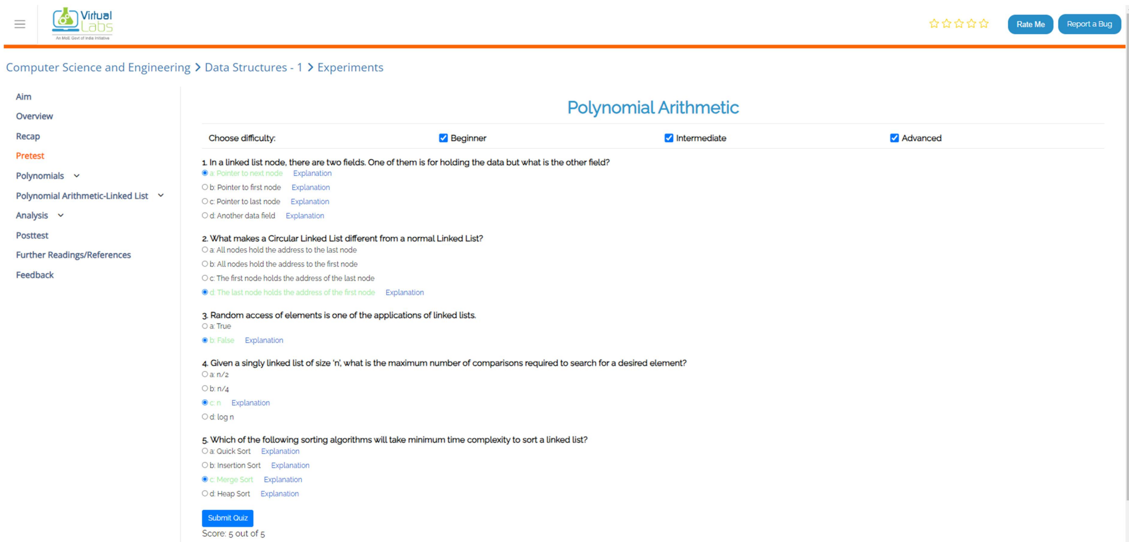
Score: 3 out of 3

Vlab – 2



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Polynomial Arithmetic
Choose difficulty:
Beginner
Intermediate
Advanced
1. In a linked list node, there are two fields. One of them is for holding the data but what is the other field?
a: Pointer to next node Explanation
b: Pointer to first node Explanation
c: Pointer to last node Explanation
d: Another data field Explanation
2. What makes a Circular Linked List different from a normal Linked List?
a: All nodes hold the address to the last node
b: All nodes hold the address to the first node
c: The first node holds the address of the last node
d: The last node holds the address of the first node Explanation
3. Random access of elements is one of the applications of linked lists.
a: True
b: False Explanation
4. Given a singly linked list of size 'n', what is the maximum number of comparisons required to search for a desired element?
a: n/2
b: n/4
c: n Explanation
d: log n
5. Which of the following sorting algorithms will take minimum time complexity to sort a linked list?
a: Quick Sort Explanation
b: Insertion Sort Explanation
c: Merge Sort Explanation
d: Heap Sort Explanation
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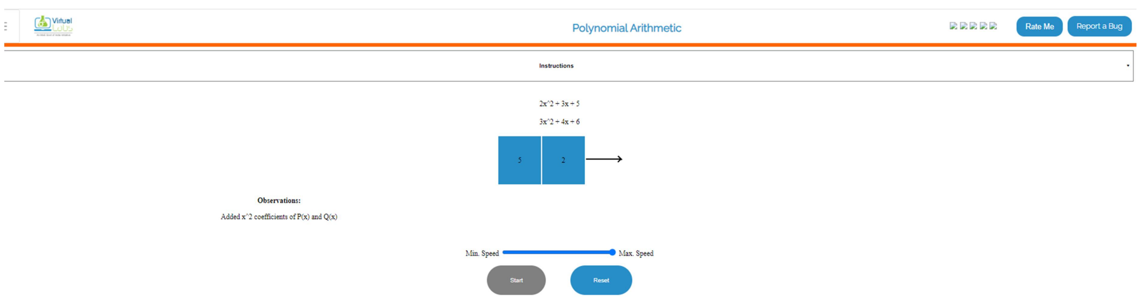
Score: 5 out of 5



Polynomial Arithmetic
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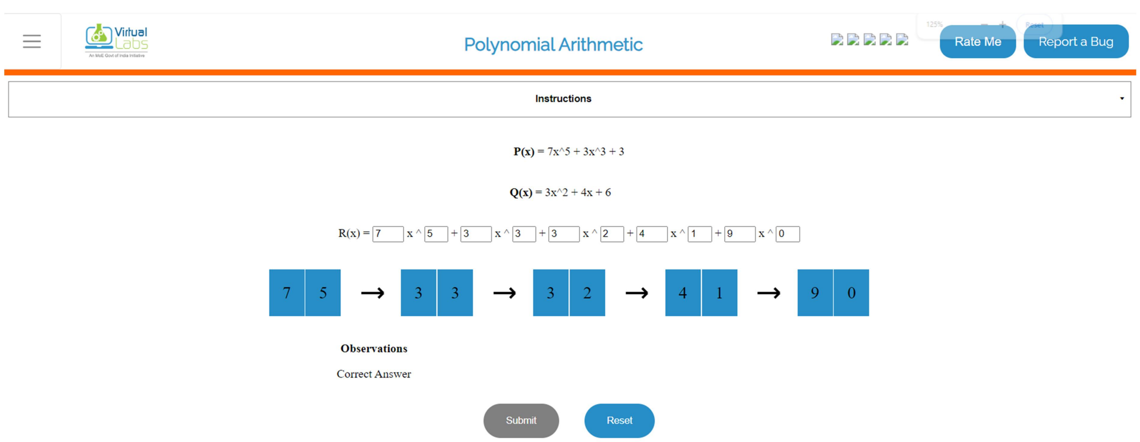
Instructions
2x^2 + 3x + 5
3x^2 + 4x + 6
5
2
Observations:
Added x^2 coefficients of P(x) and Q(x)
Min. Speed
Max. Speed
Start
Reset



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Polynomial Arithmetic
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Instructions
P(x) = 7x^5 + 3x^3 + 3
Q(x) = 3x^2 + 4x + 6
R(x) = 7 x ^ 5 + 3 x ^ 3 + 3 x ^ 2 + 4 x ^ 1 + 9 x ^ 0
7 5
3 3
3 2
4 1
9 0
Observations
Correct Answer
Submit
Reset

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Polynomial Arithmetic

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Instructions

P(x) = 9x^4 + 13x^3 + 6

Q(x) = 3x^2 + 6x + 3

R(x) = 9 x ^ 4 + 13 x ^ 3 + 3 x ^ 2 + 6 x ^ 1 + 9 x ^ 0

9	4	→	13	3	→	3	2	→	6	1	→	9	0

Observations

Correct Answer

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Polynomial Arithmetic

1. How is a polynomial stored using a linked list?
   - a: Both exponent and coefficient are stored as a tuple in a linked list node
   - b: Only coefficient is stored in the linked list node
   - c: Only exponent is stored in the linked list node
   - d: None of these

2. In multiplication of polynomials using linked lists, what is the next step after multiplying each term of one polynomial with the other polynomial?
   - a: Subtract the terms having the same coefficient Explanation
   - b: Add the terms having the same coefficient Explanation
   - c: Add the terms having the same exponent Explanation
   - d: Multiply the terms having the same exponent again Explanation

3. How is addition on polynomial expressions performed using linked lists?
   - a: Subtract the coefficients having the same power component Explanation
   - b: Add the coefficients that have the same power component
   - c: Add the power components that have the same coefficient Explanation
   - d: Add the sum of all power components and the sum of all coefficients Explanation

4. How is subtraction on polynomial expressions performed using linked lists?
   - a: Subtract the coefficients having the same power component
   - b: Add the coefficients that have the same power component Explanation
   - c: Subtract the power components that have the same coefficient Explanation
   - d: Subtract the sum of all power components and the sum of all coefficients Explanation

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Polynomial Arithmetic

Choose difficulty: ☑ Beginner ☑ Intermediate

1. What is the worst case analysis used for?
   - a: Used to find an upper bound on algorithm performance for large problems (large n) Explanation
   - b: Used to find the upper bound on algorithm performance for small problems (small n) Explanation
   - c: Used to find the lower bound on algorithm performance for small problems (small n) Explanation
   - d: None of these

2. Time complexity expresses the relation between the size of the input and runtime for the algorithm
   - a: True
   - b: False

3. Given two polynomials converted to linked list representation with nodes 'm' and 'n' respectively. What is the time complexity for adding them?
   - a: O (m)
   - b: O (n)
   - c: O (m+n) Explanation
   - d: O (log n)

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Score: 3 out of 3

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Polynomial Arithmetic

Choose difficulty: ☑ Beginner ☑ Intermediate ☑ Advanced

1. In a simple linked list node representing a polynomial expression, we need to keep track of either the exponent or the coefficient in a node.

○ a: True Explanation

◉ b: False

2. A single pointer variable is enough for polynomial arithmetic using linked lists.

○ a: True Explanation

◉ b: False Explanation

3. If the last term of a polynomial expression does not have an exponent part and only a coefficient, i.e., it is only a number, then how is it represented in a linked list node?

○ a: The tuple would consist of two zeros Explanation

◉ b: The tuple would have the coefficient and for the exponent we store zero Explanation

○ c: The tuple would have the coefficient stored twice Explanation

○ d: We need not represent in a linked list node as it does not have an exponent part Explanation

4. Polynomial Arithmetic operations can be implemented in Arrays using the same logic as implementing in Linked Lists, i.e., keeping track of Coefficients and Exponents.

◉ a: True Explanation

○ b: False Explanation

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