

Assignment 1

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Download all latex-tikz codes from

<https://github.com/Krati012/C-and-DS/tree/main/Assignment1>

1 PROBLEM

(Q. 20) The postorder traversal of a binary tree is 8,9,6,7,4,5,2,3,1. The inorder traversal of the same tree is 8,6,9,4,7,2,5,1,3. The height of a tree is the length of the longest path from the root to any leaf. The height of the binary tree above is ____?

2 SOLUTION

Answer: The height of the above binary tree is 4.

Explanation: **Postorder traversal** of a binary tree is a depth-first search in which we first traverse the left subtree, then traverse the right subtree, and finally visit the root node. Whereas in **inorder traversal** we first traverse the left subtree, visit the root and then traverse the right subtree.

If there are n nodes in binary tree, maximum height of the binary tree is $n - 1$ and minimum height is $\text{floor}(\log_2 n)$. For given problem, $n=9$, so maximum height of the binary tree possible is 8 and minimum height possible is 3.

The following algorithm allows us to construct the binary tree from given *inorder* = [8, 6, 9, 4, 7, 2, 5, 1, 3] and *postorder* = [8, 9, 6, 7, 4, 5, 2, 3, 1]:

- First find the last node in *postorder*[], as root always appear in the end of *postorder* traversal. The root is "1" in this problem.
- Search "1" in *inorder*[] to find left and right subtrees of root. Everything on left of "1" in *inorder*[] is in left subtree and everything on right is in right subtree.
- Recur the above process for following two:
 - Recur for *inorder* = [8, 6, 9, 4, 7, 2, 5] and *postorder* = [8, 9, 6, 7, 4, 5, 2]. The created tree will be left child of root.

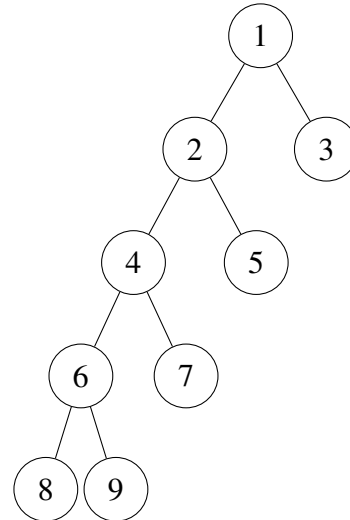


Fig. 0: Constructed Binary Tree

- Recur for *inorder* = [3] and *postorder* = [3]. The created tree will be right child of root.

The following code uses the above algorithm to construct the tree and prints the height of the tree as output.

codes/height_bst.py

The constructed tree from above algorithm is shown in Fig. 0

Thus, we can see that the height of the tree is 4.