EE4013
C and Data Structures

EE18BTECH11050

Krati Arela

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Assignment 1

GATE 2018 Paper-CS section 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 _____?

Solution

The height of the above binary tree is **4**.

Postorder traversal

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.

Inorder traversal

In **inorder traversal** we first traverse the left subtree, visit the root and then traverse the right subtree.

Height of a binary tree

Given n nodes in a binary tree, maximum and minimum height of the binary tree are:

Maximum height

$$h_{max} = n - 1$$

Minimum height

$$h_{min} = floor(log_2 n) = ceil(log_2(n+1) - 1)$$

Minimum height of a binary tree

A complete binary tree will have minimum height. Given n,

$$2^{h_{min}} \leq n \leq 2^{h_{min}+1} - 1$$

$$\implies h_{min} \leq log_2 n, h_{min} \geq log_2(n+1) - 1$$

$$\implies h_{min} = floor(log_2 n) = ceil(log_2(n+1) - 1)$$

Here $n = 9$, so $h_{max} = 8$ and $h_{min} = 3$.

Algorithm

- The last node in postorder[] is the root, which is "1" in this case
- Search "1" in inorder[] to find left and right subtrees of root.
- 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.
  - Recur for $inorder = [3]$ and $postorder = [3]$. The created tree will be right child of root.

Binary Tree

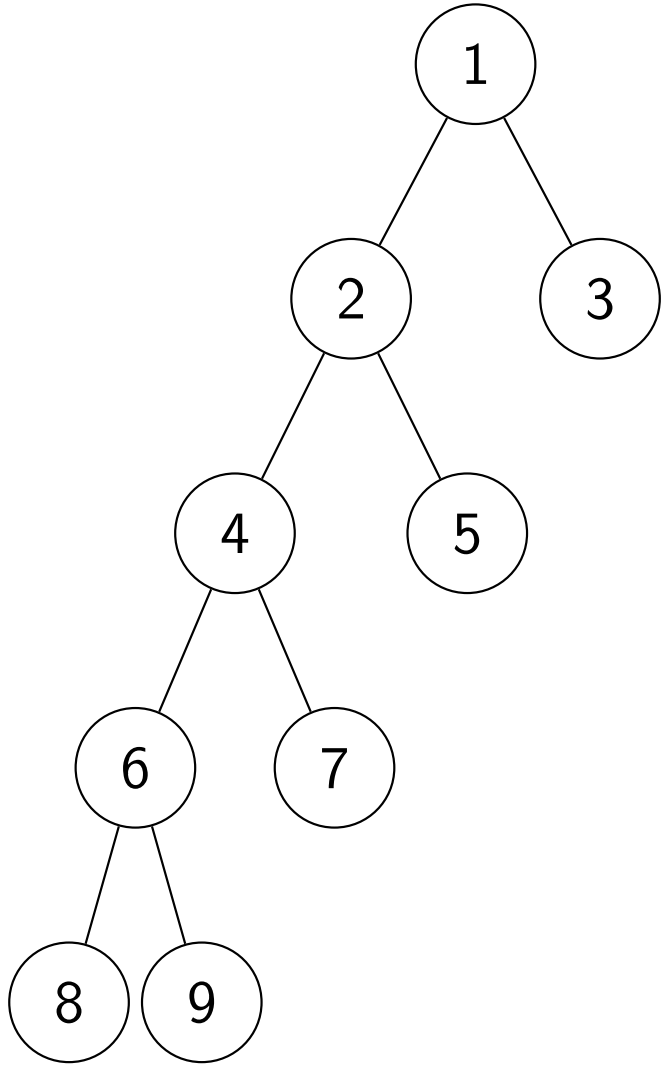

Figure 1: Constructed Binary Tree

Binary Tree

The constructed tree from given algorithm shows that height of tree is 4.