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687. Longest Univalue Path (/problems/longest-univalue-path/)

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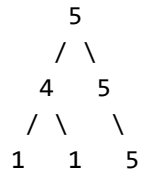
Given a binary tree, find the length of the longest path where each node in the path has the same value. This path may or may not pass through the root.

The length of path between two nodes is represented by the number of edges between them.

Example 1:

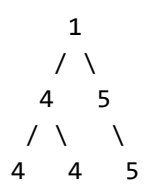
Input:



Output: 2

Example 2:

Input:



Output: 2

Note: The given binary tree has not more than 10000 nodes. The height of the tree is not more than 1000.

Approach #1: Recursion [Accepted]

Intuition

We can think of any path (of nodes with the same values) as up to two arrows extending from it's root.

Specifically, the *root* of a path will be the unique node such that the parent of that node does not appear in the path, and an *arrow* will be a path where the root only has one child node in the path.

Then, for each node, we want to know what is the longest possible arrow extending left, and the longest possible arrow extending right? We can solve this using recursion.

Algorithm

Let `arrow_length(node)` be the length of the longest arrow that extends from the `node`. That will be `1 + arrow_length(node.left)` if `node.left` exists and has the same value as `node`. Similarly for the `node.right` case.

While we are computing arrow lengths, each candidate answer will be the sum of the arrows in both directions from that node. We record these candidate answers and return the best one.

Java | Python

Copy

```java
class Solution {
    int ans;
    public int longestUnivaluePath(TreeNode root) {
        ans = 0;
        arrowLength(root);
        return ans;
    }
    public int arrowLength(TreeNode node) {
        if (node == null) return 0;
        int left = arrowLength(node.left)
        int right = arrowLength(node.right);
        int arrowLeft = 0, arrowRight = 0;
        if (node.left != null && node.left.val == node.val) {
            arrowLeft += left + 1;
        }
        if (node.right != null && node.right.val == node.val) {
            arrowRight += right + 1;
        }
        ans = Math.max(ans, arrowLeft + arrowRight);
        return Math.max(arrowLeft, arrowRight);
    }
}
```

Complexity Analysis

- Time Complexity: $O(N)$, where N is the number of nodes in the tree. We process every node once.
- Space Complexity: $O(H)$, where H is the height of the tree. Our recursive call stack could be up to H layers deep.

Analysis written by: @awice (https://leetcode.com/awice)

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ilyasaber14 (ilyasaber14) ★ 88 December 15, 2018 11:05 PM

This was definitely a poorly worded question.

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Cherie0124 (cherie0124) ★ 14 April 18, 2019 6:57 AM

I do not think this question is easy, it would be middle or even hard.

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vincentT (vincentt) ★ 8 October 20, 2018 4:41 AM

why the result of example 2 is 2?
I thinki it should be 1

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rashmikramesh (rashmikramesh) ★ 9 September 14, 2018 2:53 AM

"ans = Math.max(ans, arrowLeft + arrowRight);" why the addition here of arrowLeft and arrowRight?

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escofresco (escofresco) ★ 16 April 19, 2019 8:59 AM

Just because the solution is easy doesn't mean the problem is.

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sos11 (sos11) ★ 11 February 27, 2019 7:32 AM

Can someone please explain, What is
return Math.max(arrowLeft, arrowRight);
doing ?

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LiamZhou (liamzhou) ★ 5 October 1, 2018 11:37 PM

I think you missed ";" at line 10

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VoltageKart (voltagekart) ★ 7 December 31, 2017 8:14 AM

```
if (node.left != null && node.left.val == node.val) {
arrowLeft += left + 1;
}
```

this is assuming that the node has the same value as the nodes in the longest path (in left subtree) which is not always true

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ribhavh (ribhavh) ★ 16 October 31, 2018 5:11 AM

So basically the path has no specific direction to it i.e it can go up and down?

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BryanBo-Cao (bryanbo-cao) ★ 489 June 21, 2018 7:13 AM

I was told that it was best not to use a global variable like `int ans` .

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