

LeetCode 1372: Longest ZigZag Path in a Binary Tree

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Problem

You are given the `root` of a binary tree.

A ZigZag path for a binary tree is defined as follow:

Choose any node in the binary tree and a direction (right or left).

- If the current direction is right, move to the right child of the current node; otherwise, move to the left child.
- Change the direction from right to left or from left to right.
- Repeat the second and third steps until you can't move in the tree.

Return the longest ZigZag path contained in that tree

Difficulty: *Medium*

Terminology

Zigzag length is defined as the number of nodes visited - 1. (A single node has a length of 0).

Solution

Heads up, this question might be a little tricky to understand, I know I found this really hard so reach out to me if you need clarification on anything!

If we are going to want to find the longest zig-zag path in a binary tree, we will need to traverse in a zig-zag pattern. To do so we can create a helper function called `DFS` which takes the parameters `node`, `depth`, and `goRight`. `node` is simply the node we are at in the binary tree, `depth` is a counter for how deep we are in the tree and `goRight` is a flag variable to tell us if we need to go right this iteration or not. So how does this function work? Well what it does is it will first compare the current maximum depth with the depth traversed so far, the larger becoming the maximum depth. Then we check to see if the node we are at is a node at all, if it is then we check the `goRight` attribute, if `true` (i.e. we need to go right) then we call `DFS` again for `node.right` (the right node), `depth+1` (since we are maintaining the zigzag pattern we add to the depth) and `false` (since we went right this time we go left next time). We also make another call to `DFS` as `DFS(node.left,0,True)` Because the left node could contain a sub-tree with the largest zigzag pattern. if `goRight = false` then we do the same thing as before except we reverse `node.left` and `node.right`.

Code



```
1  # this code is supplied for us :3
2  class TreeNode:
3      def __init__(self, val=0, left=None, right=None):
4          self.val = val
5          self.left = left
6          self.right = right
7  class Solution:
8      def longestZigZag(self, root: Optional[TreeNode]) -> int:
9          self.length = 0
10         def DFS(node, depth, goRight):
11             self.length = max(self.length, depth)
12             if node:
13                 if goRight:
14                     DFS(node.right, depth + 1, False)
15                     DFS(node.left, 0, True)
16                 else:
17                     DFS(node.left, depth + 1, True)
18                     DFS(node.right, 0, False)
19             DFS(root.left, 0, True)
20             DFS(root.right, 0, False)
21         return self.length
```

Figure 1: image

Analysis

Time Complexity

This code will look at all nodes in the binary tree, since there are n node we get:

$$\mathcal{O}(n)$$

Space Complexity

We create no extra space in our solution, hence:

$$\mathcal{O}(1)$$