

Data Structures and Algorithms

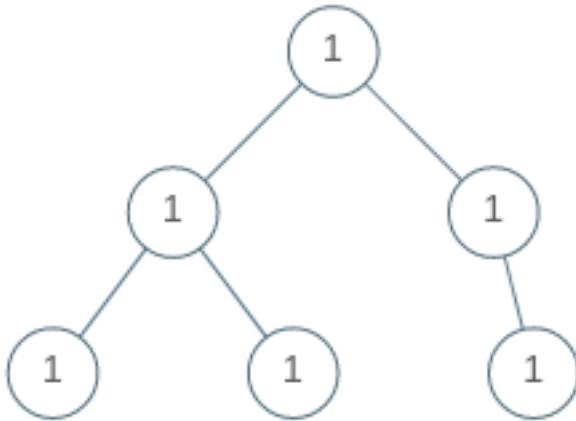
Lab 08 – Binary Tree

Exercises/Tasks:

1. A binary tree is **uni-valued** if every node in the tree has the same value.

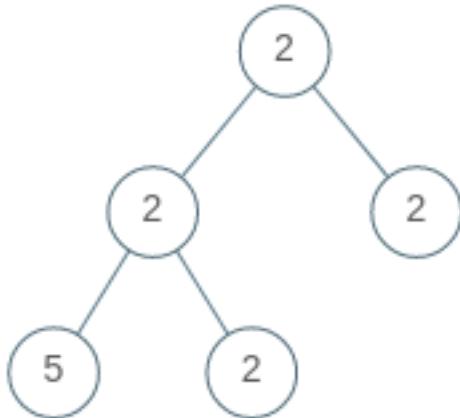
Given the root of a binary tree, return **true** if the given tree is uni-valued, or **false** otherwise.

Example 1:



Output: true

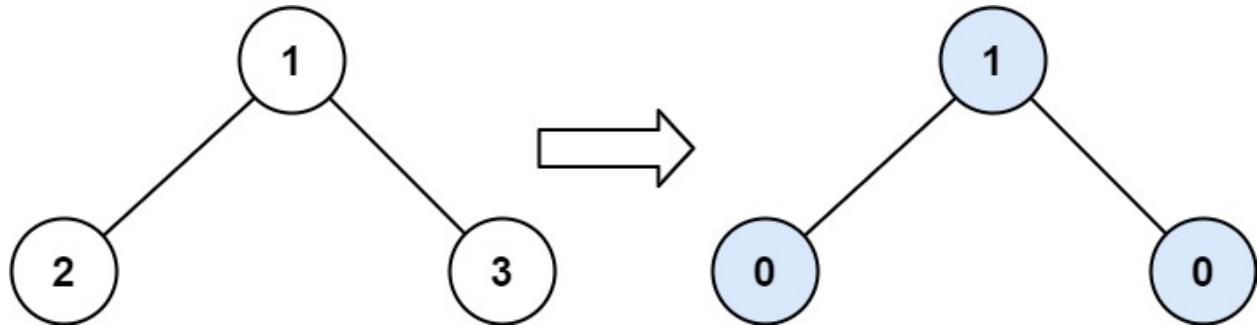
Example 2:



Output: false

2. The **tilt** of a tree node is the **absolute difference** between the sum of all left subtree node **values** and all right subtree node **values**. If a node does not have a left child, then the sum of the left subtree node **values** is treated as 0. The rule is similar if the node does not have a right child.

Example 1:



Input: root = [1,2,3]

Output: 1

Explanation:

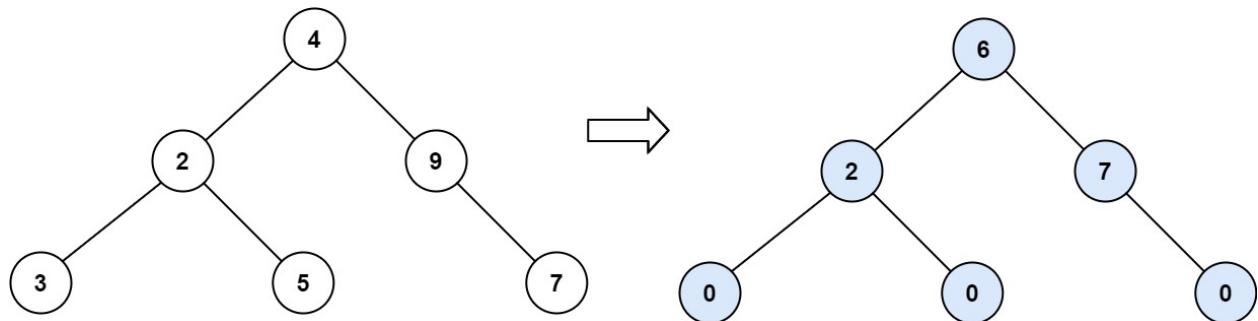
Tilt of node 2 : $|0-0| = 0$ (no children)

Tilt of node 3 : $|0-0| = 0$ (no children)

Tilt of node 1 : $|2-3| = 1$ (left subtree is just left child, so sum is 2; right subtree is just right child, so sum is 3)

Sum of every tilt : $0 + 0 + 1 = 1$

Example 2:



Input: root = [4,2,9,3,5,null,7]

Output: 15

Explanation:

Tilt of node 3 : $|0-0| = 0$ (no children)

Tilt of node 5 : $|0-0| = 0$ (no children)

Tilt of node 7 : $|0-0| = 0$ (no children)

Tilt of node 2 : $|3-5| = 2$ (left subtree is just left child, so sum is 3; right subtree is just right child, so sum is 5)

Tilt of node 9 : $|0-7| = 7$ (no left child, so sum is 0; right subtree is just right child, so sum is 7)

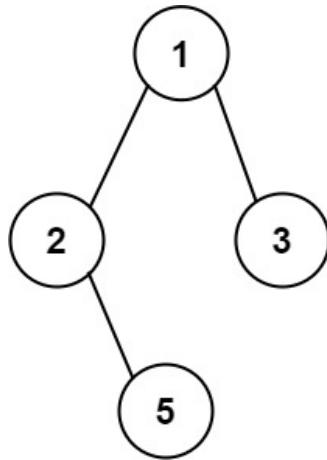
Tilt of node 4 : $|(3+5+2)-(9+7)| = |10-16| = 6$ (left subtree values are 3, 5, and 2, which sums to 10; right subtree values are 9 and 7, which sums to 16)

Sum of every tilt : $0 + 0 + 0 + 2 + 7 + 6 = 15$

3. Given the root of a binary tree, return all root-to-leaf paths in any order.

A leaf is a node with no children.

Example 1:



Input: root = [1,2,3,null,5]

Output: ["1->2->5","1->3"]

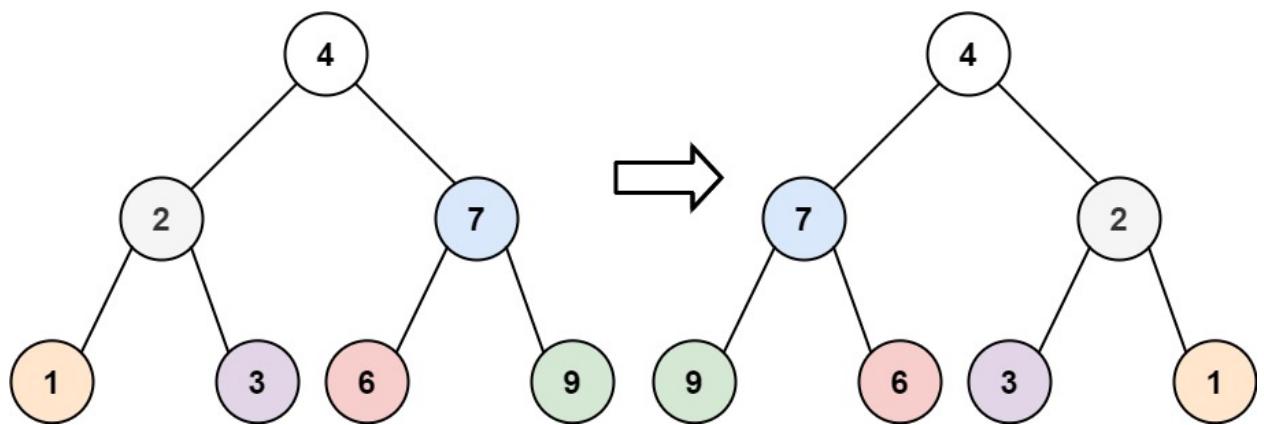
Example 2:

Input: root = [1]

Output: ["1"]

4. Given the root of a binary tree, invert the tree, and return *its root*.

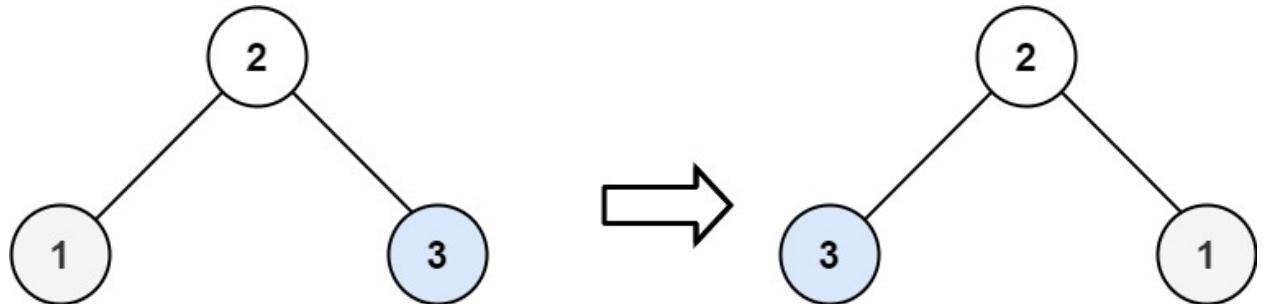
Example 1:



Input: root = [4,2,7,1,3,6,9]

Output: [4,7,2,9,6,3,1]

Example 2:



Input: root = [2,1,3]

Output: [2,3,1]