545. Boundary of Binary Tree

Medium 912 1503 Add to List Share

The **boundary** of a binary tree is the concatenation of the **root**, the **left boundary**, the **leaves** ordered from left-to-right, and the **reverse order** of the **right boundary**.

The **left boundary** is the set of nodes defined by the following:

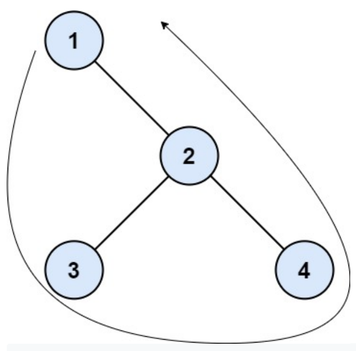
- The root node's left child is in the left boundary. If the root does not have a left child, then the left boundary is **empty**.
- If a node in the left boundary and has a left child, then the left child is in the left boundary.
- If a node is in the left boundary, has **no** left child, but has a right child, then the right child is in the left boundary.
- The leftmost leaf is **not** in the left boundary.

The **right boundary** is similar to the **left boundary**, except it is the right side of the root's right subtree. Again, the leaf is **not** part of the **right boundary**, and the **right boundary** is empty if the root does not have a right child.

The **leaves** are nodes that do not have any children. For this problem, the root is **not** a leaf.

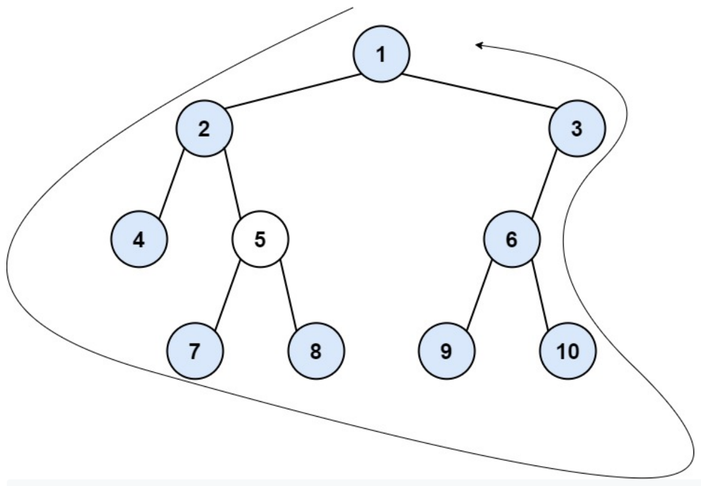
Given the `root` of a binary tree, return *the values of its **boundary***.

Example 1:




```
Input: root = [1,null,2,3,4]
Output: [1,3,4,2]
Explanation:
- The left boundary is empty because the root does not have a left child.
- The right boundary follows the path starting from the root's right child 2 -> 4.
  4 is a leaf, so the right boundary is [2].
- The leaves from left to right are [3,4].
Concatenating everything results in [1] + [] + [3,4] + [2] = [1,3,4,2].
```

Example 2:




```
Input: root = [1,2,3,4,5,6,null,null,null,7,8,9,10]
Output: [1,2,4,7,8,9,10,6,3]
Explanation:
- The left boundary follows the path starting from the root's left child 2 -> 4.
  4 is a leaf, so the left boundary is [2].
- The right boundary follows the path starting from the root's right child 3 -> 6
-> 10.
  10 is a leaf, so the right boundary is [3,6], and in reverse order is [6,3].
- The leaves from left to right are [4,7,8,9,10].
Concatenating everything results in [1] + [2] + [4,7,8,9,10] + [6,3] =
[1,2,4,7,8,9,10,6,3].
```

Constraints:

- The number of nodes in the tree is in the range `[1, 10^4]`.
- `-1000 <= Node.val <= 1000`

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```java
public class Solution {
    public List < Integer > boundaryOfBinaryTree(TreeNode root) {
        List < Integer > left_boundary = new LinkedList < > (), right_boundary = new LinkedList < > (), leaves = new LinkedList < > ();
        preorder(root, left_boundary, right_boundary, leaves, 0);
        left_boundary.addAll(leaves);
        left_boundary.addAll(right_boundary);
        return left_boundary;
    }

    public boolean isLeaf(TreeNode cur) {
        return (cur.left == null && cur.right == null);
    }

    public boolean isRightBoundary(int flag) {
        return (flag == 2);
    }

    public boolean isLeftBoundary(int flag) {
        return (flag == 1);
    }

    public boolean isRoot(int flag) {
        return (flag == 0);
    }

    public int leftChildFlag(TreeNode cur, int flag) {
        if (isLeftBoundary(flag) || isRoot(flag))
            return 1;
        else if (isRightBoundary(flag) && cur.right == null)
            return 2;
        else return 3;
    }

    public int rightChildFlag(TreeNode cur, int flag) {
        if (isRightBoundary(flag) || isRoot(flag))
            return 2;
        else if (isLeftBoundary(flag) && cur.left == null)
            return 1;
        else return 3;
    }
```