103. Binary Tree Zigzag Level Order Traversal

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- **Breadth-first Search** + Queue + Tree
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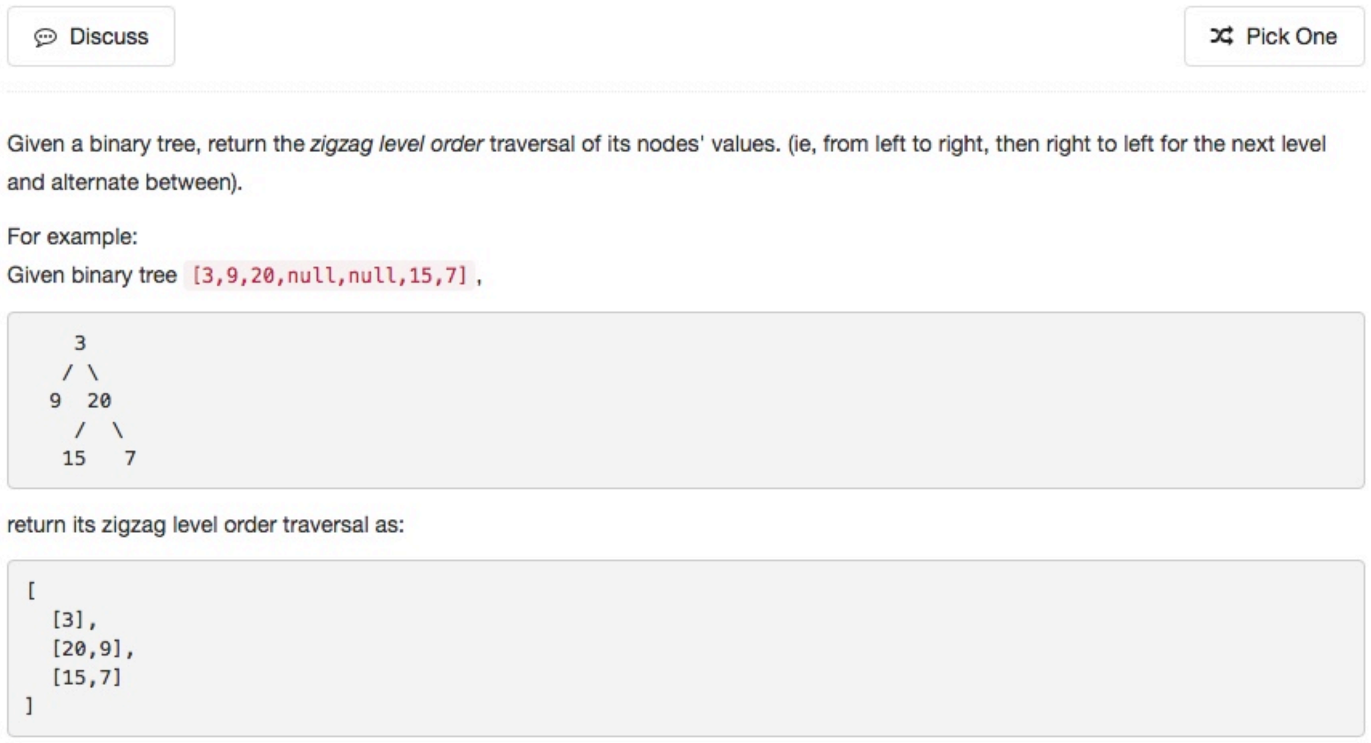
Description



Given a binary tree, return the *zigzag level order* traversal of its nodes' values. (ie, from left to right, then right to left for the next level and alternate between).

For example:
Given binary tree `[3,9,20,null,null,15,7]`,

```
    3
   / \
  9  20
    /  \
   15   7
```

return its zigzag level order traversal as:

```
[
  [3],
  [20,9],
  [15,7]
]
```

1. Thought line

2. Breadth-first Search + Queue + Tree

```cpp
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     int val;
 *     TreeNode *left;
 *     TreeNode *right;
 *     TreeNode(int x) : val(x), left(NULL), right(NULL) {}
 * };
 */
class Solution {
public:
    vector<vector<int>> zigzagLevelOrder(TreeNode* root) {
        vector<vector<int>> result;
        queue<TreeNode*> que;
        if (root!=nullptr) que.emplace(root);
        bool flag = true;
        while (!que.empty() || que.front()!=nullptr){
            queue<TreeNode*> tempQue;
            vector<int> tempVec;
            while (!que.empty()){
                if (flag)
                    tempVec.push_back(que.front()->val);
                else
                    tempVec.insert(tempVec.begin(), que.front()->val);
                if (que.front()->left!=nullptr ) tempQue.push(que.front()->left);
                if (que.front()->right!=nullptr) tempQue.push(que.front()->right);
                que.pop();
            }
            if(!tempVec.empty()) result.push_back(tempVec);
            else break;
            if(!tempQue.empty()) que.swap(tempQue);
            else break;
            flag = !flag;

        }
        return result;
    }
};
```

3. Breadth-first Search + Stack + Tree