Problem 431: Encode N-ary Tree to Binary Tree

Problem Information

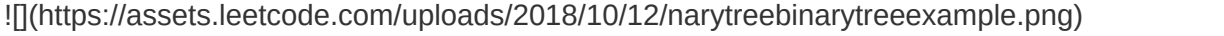
Difficulty: Hard
Acceptance Rate: 80.34%
Paid Only: Yes
Tags: Tree, Depth-First Search, Breadth-First Search, Design, Binary Tree

Problem Description

Design an algorithm to encode an N-ary tree into a binary tree and decode the binary tree to get the original N-ary tree. An N-ary tree is a rooted tree in which each node has no more than N children. Similarly, a binary tree is a rooted tree in which each node has no more than 2 children. There is no restriction on how your encode/decode algorithm should work. You just need to ensure that an N-ary tree can be encoded to a binary tree and this binary tree can be decoded to the original N-nary tree structure.

Nary-Tree input serialization is represented in their level order traversal, each group of children is separated by the null value (See following example).

For example, you may encode the following `3-ary` tree to a binary tree in this way:



Input: root = [1,null,3,2,4,null,5,6]

Note that the above is just an example which _might or might not_ work. You do not necessarily need to follow this format, so please be creative and come up with different approaches yourself.

Example 1:

Input: root = [1,null,3,2,4,null,5,6] **Output:** [1,null,3,2,4,null,5,6]

Example 2:

Input: root =
[1,null,2,3,4,5,null,null,6,7,null,8,null,9,10,null,null,11,null,12,null,13,null,null,14] **Output:**
[1,null,2,3,4,5,null,null,6,7,null,8,null,9,10,null,null,11,null,12,null,13,null,null,14]

Example 3:

Input: root = [] **Output:** []

Constraints:

* The number of nodes in the tree is in the range `[0, 104]`. * `0 <= Node.val <= 104` * The height of the n-ary tree is less than or equal to `1000` * Do not use class member/global/static variables to store states. Your encode and decode algorithms should be stateless.

Code Snippets

C++:

```
/*
// Definition for a Node.
class Node {
public:
int val;
vector<Node*> children;

Node() {}

Node(int _val) {
val = _val;
}

Node(int _val, vector<Node*> _children) {
val = _val;
children = _children;
}
};
*/

/**
* Definition for a binary tree node.
```

```
* struct TreeNode {
* int val;
* TreeNode *left;
* TreeNode *right;
* TreeNode(int x) : val(x), left(NULL), right(NULL) {}
* };
*/

class Codec {
public:
// Encodes an n-ary tree to a binary tree.
TreeNode* encode(Node* root) {

}

// Decodes your binary tree to an n-ary tree.
Node* decode(TreeNode* root) {

}
};

// Your Codec object will be instantiated and called as such:
// Codec codec;
// codec.decode(codec.encode(root));
```

Java:

```
/*
// Definition for a Node.
class Node {
public int val;
public List<Node> children;

public Node() {}

public Node(int _val) {
val = _val;
}

public Node(int _val, List<Node> _children) {
val = _val;
children = _children;
```

```
}
};
*/

/**
* Definition for a binary tree node.
* public class TreeNode {
* int val;
* TreeNode left;
* TreeNode right;
* TreeNode(int x) { val = x; }
* }
*/

class Codec {
// Encodes an n-ary tree to a binary tree.
public TreeNode encode(Node root) {

}

// Decodes your binary tree to an n-ary tree.
public Node decode(TreeNode root) {

}
}

// Your Codec object will be instantiated and called as such:
// Codec codec = new Codec();
// codec.decode(codec.encode(root));
```

Python3:

```
"""
# Definition for a Node.
class Node:
def __init__(self, val: Optional[int] = None, children:
Optional[List['Node']] = None):
self.val = val
self.children = children
"""

"""
```

```
# Definition for a binary tree node.
class TreeNode:
def __init__(self, x):
self.val = x
self.left = None
self.right = None
"""

class Codec:
# Encodes an n-ary tree to a binary tree.
def encode(self, root: 'Optional[Node]') -> Optional[TreeNode]:


# Decodes your binary tree to an n-ary tree.
def decode(self, data: Optional[TreeNode]) -> 'Optional[Node]':


# Your Codec object will be instantiated and called as such:
# codec = Codec()
# codec.decode(codec.encode(root))
```