2689. Extract Kth Character From The Rope Tree

Description

You are given the `root` of a binary tree and an integer `k`. Besides the left and right children, every node of this tree has two other properties, a **string** `node.val` containing only lowercase English letters (possibly empty) and a non-negative integer `node.len`. There are two types of nodes in this tree:

- **Leaf**: These nodes have no children, `node.len = 0`, and `node.val` is some **non-empty** string.
- **Internal**: These nodes have at least one child (also at most two children), `node.len > 0`, and `node.val` is an **empty** string.

The tree described above is called a *Rope* binary tree. Now we define `S[node]` recursively as follows:

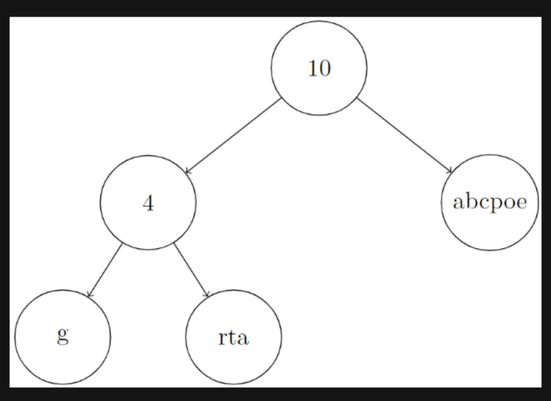
- If `node` is some leaf node, `S[node] = node.val`,
- Otherwise if `node` is some internal node, `S[node] = concat(S[node.left], S[node.right])` and `S[node].length = node.len`.

Return *k-th character of the string* `S[root]`.

Note: If `s` and `p` are two strings, `concat(s, p)` is a string obtained by concatenating `p` to `s`. For example, `concat("ab", "zz") = "abzz"`.

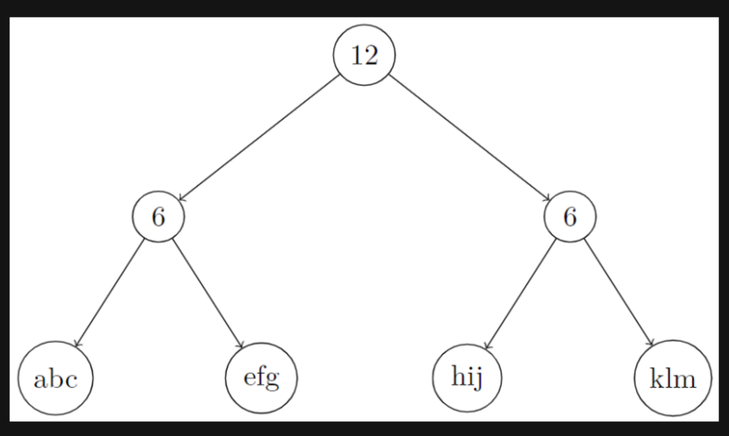
Example 1:

```
Input: root = [10,4,"abcpoe","g","rta"], k = 6
Output: "b"
Explanation: In the picture below, we put an integer on internal nodes that represents node.len, and a string on leaf nodes that represents
node.val.
You can see that S[root] = concat(concat("g", "rta"), "abcpoe") = "grtaabcpoe". So S[root][5], which represents 6th character of it, is equal to
"b".
```



Example 2:

```
Input: root = [12,6,6,"abc","efg","hij","klm"], k = 3
Output: "c"
Explanation: In the picture below, we put an integer on internal nodes that represents node.len, and a string on leaf nodes that represents
node.val.
You can see that S[root] = concat(concat("abc", "efg"), concat("hij", "klm")) = "abcefghijklm". So S[root][2], which represents the 3rd character of
it, is equal to "c".
```



Example 3:

```
Input: root = ["ropetree"], k = 8
Output: "e"
Explanation: In the picture below, we put an integer on internal nodes that represents node.len, and a string on leaf nodes that represents
node.val.
You can see that S[root] = "ropetree". So S[root][7], which represents 8th character of it, is equal to "e".
```

Constraints:

- The number of nodes in the tree is in the range `[1, 10^3]`
- `node.val` contains only lowercase English letters
- `0 <= node.val.length <= 50`
- `0 <= node.len <= 10^4`
- for leaf nodes, `node.len = 0` and `node.val` is non-empty
- for internal nodes, `node.len > 0` and `node.val` is empty
- `1 <= k <= S[root].length`