Swap Nodes [Algo]

HackerRank

A binary tree is a tree which is characterized by one of the following properties:

- It can be empty (null).
- It contains a root node only.
- It contains a root node with a left subtree, a right subtree, or both. These subtrees are also binary trees.

In-order traversal is performed as

1. Traverse the left subtree.
2. Visit root.
3. Traverse the right subtree.

For this in-order traversal, start from the left child of the root node and keep exploring the left subtree until you reach a leaf. When you reach a leaf, back up to its parent, check for a right child and visit it if there is one. If there is not a child, you've explored its left and right subtrees fully. If there is a right child, traverse its left subtree then its right in the same manner. Keep doing this until you have traversed the entire tree. You will only store the values of a node as you visit when one of the following is true:

- it is the first node visited, the first time visited
- it is a leaf, should only be visited once
- all of its subtrees have been explored, should only be visited once while this is true
- it is the root of the tree, the first time visited

Swapping: Swapping subtrees of a node means that if initially node has left subtree `L` and right subtree `R`, then after swapping, the left subtree will be `R` and the right subtree, `L`.

For example, in the following tree, we swap children of node `1`.

```
                                Depth
    1               1            [1]
   / \             / \
  2   3     ->    3   2          [2]
   \   \           \   \
    4   5           5   4        [3]
```

In-order traversal of left tree is `2 4 1 3 5` and of right tree is `3 5 1 2 4`.

Swap operation:

We define depth of a node as follows:

- The root node is at depth *1*.
- If the depth of the parent node is `d`, then the depth of current node will be `d+1`.

Given a tree and an integer, `k`, in one operation, we need to swap the subtrees of all the nodes at each depth `h`, where `h ∈ [k, 2k, 3k,...]`. In other words, if `h` is a multiple of `k`, swap the left and right subtrees of that level.

You are given a tree of `n` nodes where nodes are indexed from `[1..n]` and it is rooted at `1`. You have to perform `t` swap operations on it, and after each swap operation print the in-order traversal of the current state of the tree.

Function Description

Complete the *swapNodes* function in the editor below. It should return a two-dimensional array where each element is an array of integers representing the node indices of an in-order traversal after a swap operation.

swapNodes has the following parameter(s):
- *indexes*: an array of integers representing index values of each $node[i]$, beginning with $node[1]$, the first element, as the root.
- *queries*: an array of integers, each representing a k value.

Input Format
The first line contains `n`, number of nodes in the tree.

Each of the next `n` lines contains two integers, `a b`, where `a` is the index of left child, and `b` is the index of right child of i^{th} node.

Note: `-1` is used to represent a null node.

The next line contains an integer, `t`, the size of $queries$.
Each of the next `t` lines contains an integer $queries[i]$, each being a value k.

Output Format
For each `k`, perform the swap operation and store the indices of your in-order traversal to your result array. After all swap operations have been performed, return your result array for printing.

Constraints

- $1 \leq n \leq 1024$
- $1 \leq t \leq 100$
- $1 \leq k \leq n$
- Either $a = -1$ or $2 <= a <= n$
- Either $b = -1$ or $2 <= b <= n$
- The index of a non-null child will always be greater than that of its parent.

Sample Input 0

```
3
2 3
-1 -1
```

```
-1 -1
2
1
1
```

Sample Output 0

```
3 1 2
2 1 3
```

Explanation 0

As nodes *2* and *3* have no children, swapping will not have any effect on them. We only have to swap the child nodes of the root node.

```
    1   [s]       1    [s]       1
   / \      ->   / \        ->  / \
  2   3 [s]     3   2  [s]     2   3
```

Note: `[s]` indicates that a swap operation is done at this depth.

Sample Input 1

```
5
2 3
-1 4
-1 5
-1 -1
-1 -1
1
2
```

Sample Output 1

```
4 2 1 5 3
```

Explanation 1

Swapping child nodes of node *2* and *3* we get

```
    1                  1
   / \                / \
  2   3   [s]  ->    2   3
   \   \            /   /
    4   5          4   5
```

Sample Input 2

```
11
2 3
4 -1
5 -1
6 -1
7 8
```

```
-1 9
-1 -1
10 11
-1 -1
-1 -1
-1 -1
2
2
4
```

Sample Output 2

```
2 9 6 4 1 3 7 5 11 8 10
2 6 9 4 1 3 7 5 10 8 11
```

Explanation 2

Here we perform swap operations at the nodes whose depth is either *2* or *4* for $K = 2$ and then at nodes whose depth is *4* for $K = 4$.

```
         1                     1                          1
        / \                   / \                        / \
       /   \                 /   \                      /   \
      2     3    [s]        2     3                    2     3
     /      /                \     \                    \     \
    /      /                  \     \                    \     \
   4      5          ->        4     5          ->        4     5
  /      / \                  /     / \                  /     / \
 /      /   \                /     /   \                /     /   \
6      7     8   [s]        6     7     8   [s]        6     7     8
 \          / \            /           / \              \         / \
  \        /   \          /           /   \              \       /   \
   9      10   11        9           11   10              9     10   11
```