Swap Nodes [Algo] ☆

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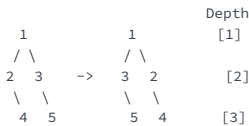
In-order traversal of left tree is 2 4 1 3 5 and of right tree is 3 5 1 2 4.

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 ith 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

- $1 \le n \le 1024$
- $1 \le t \le 100$
- $1 \le k \le n$
- Either $a = -1$ or $2 <= a <= n$
- Either $b = -1$ or $2 <= b <= n$

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Difficulty   Medium
Max Score   40
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- The index of a non-null child will always be greater than that of its parent.
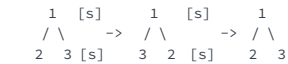
Sample Input 0

```
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
```

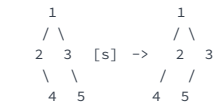**Note:** [s] indicates that a swap operation is done at this depth.

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
```