

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

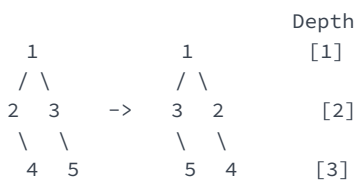
1. Traverse the left subtree.
2. Visit root.
3. Traverse the right subtree.

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.



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 $h \in [k, 2k, 3k, \dots]$. 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

- $1 \leq n \leq 1024$
- $1 \leq t \leq 100$
- $1 \leq k \leq n$
- Either $a = -1$ or $2 \leq a \leq n$
- Either $b = -1$ or $2 \leq b \leq n$
- 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.



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

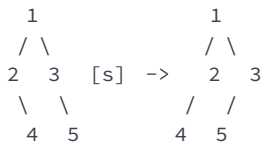
1
```

Sample Output 1

4 2 1 5 3

Explanation 1

Swapping child nodes of node 2 and 3 we get



Sample Input 2

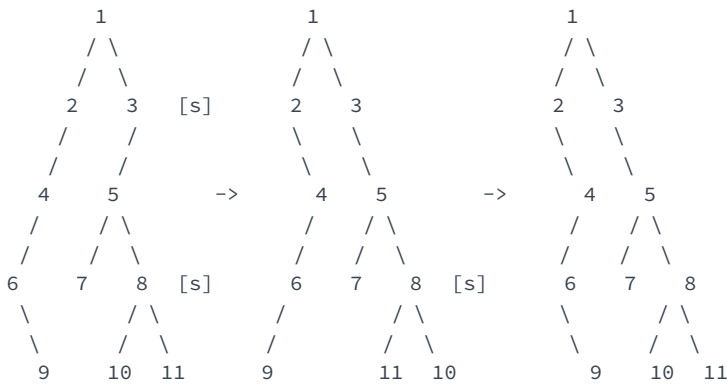
11
2 3
4 -1
5 -1
6 -1
7 8
-1 9
-1 -1
10 11
-1 -1
-1 -1
-1 -1
2
2
4

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 using System.CodeDom.Compiler;
2 using System.Collections.Generic;
3 using System.Collections;
4 using System.ComponentModel;
5 using System.Diagnostics.CodeAnalysis;
6 using System.Globalization;
7 using System.IO;
8 using System.Linq;
9 using System.Reflection;
10 using System.Runtime.Serialization;
11 using System.Text.RegularExpressions;
12 using System.Text;
13 using System;
14
15 class Result
16 {
17
18     /*
19      * Complete the 'swapNodes' function below.
20      *
21      * The function is expected to return a 2D_INTEGER_ARRAY.
22      * The function accepts following parameters:
23      * 1. 2D_INTEGER_ARRAY indexes
24      * 2. INTEGER_ARRAY queries
25      */
26
27     public static List<List<int>> swapNodes(List<List<int>> indexes, List<int> queries)
```

Line: 67 Col: 1

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