Pascal's Tree

Input file:	`standard input`
Output file:	`standard output`
Time limit:	7 seconds
Memory limit:	1024 megabytes

You are given a tree consisting of n nodes rooted at node 1, and a permutation* p of length n.

We define a transformation on a sequence of nodes $a_1, a_2, \ldots, a_k$ ($k \geq 2$) that produces a new sequence $a'_1, a'_2, \ldots, a'_{k-1}$, where $a'_i = \text{LCA}^{\dagger}(a_i, a_{i+1})$ for $1 \leq i \leq k-1$.

Let $S_0 = p$. For $i \geq 1$, let S_i be the sequence obtained by applying the transformation to S_{i-1}. Note that S_i has length $n - i$.

Your task is to calculate the sum of elements for each sequence $S_0, S_1, \ldots, S_{n-1}$.

---

* A permutation of length n is a sequence of n integers where each integer from 1 to n appears exactly once. For example, $[1, 3, 2]$ is a permutation, but $[2, 3, 2]$ and $[4, 1, 2]$ are not.

† The LCA (Lowest Common Ancestor) of two nodes in a rooted tree is the deepest node that is an ancestor of both nodes. A node is considered an ancestor of itself.

Input

The first line contains a single integer t ($1 \leq t \leq 10^5$) — the number of test cases.

The first line of each test case contains an integer n ($1 \leq n \leq 10^6$) — the number of nodes.

Each of the next $n - 1$ lines contains two integers u and v ($1 \leq u, v \leq n$) indicating there is an edge between nodes u and v. It is guaranteed that the given edges form a tree.

The last line contains n distinct integers $p_1, p_2, \ldots, p_n$ ($1 \leq p_i \leq n$) — the permutation p.

It is guaranteed that the sum of n over all test cases does not exceed 10^6.

Output

For each test case, print n space-separated integers — the sum of elements of $S_0, S_1, \ldots, S_{n-1}$ respectively.

Example

standard input	standard output
3 3 2 3 1 3 3 2 1 5 1 2 2 5 2 4 3 1 5 4 2 1 3 6 1 3 5 2 4 1 3 5 2 6 6 2 3 5 4 1	6 4 1 15 6 4 2 1 21 10 8 5 2 1

Note

In the second test case, the tree and the transformation process are shown below:

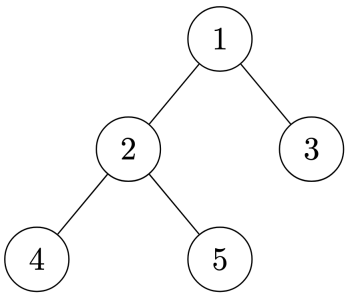

Figure: The tree for the second test case.

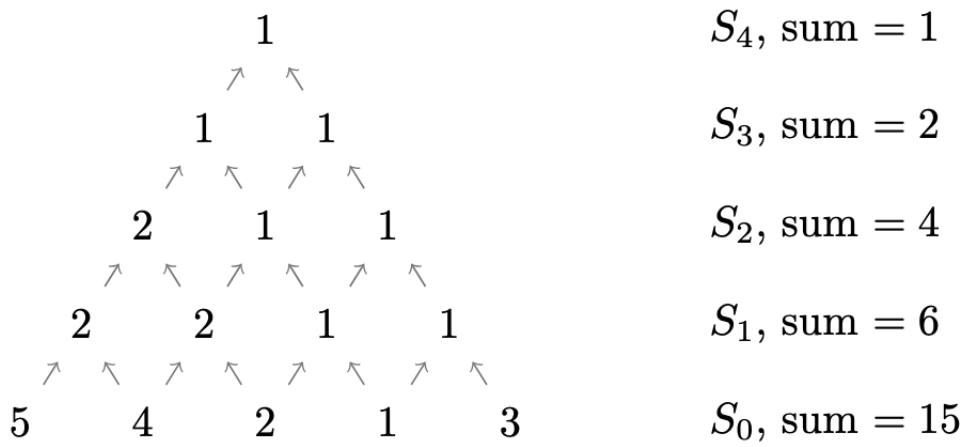

Figure: The transformation process. Each element in S_{i+1} is the LCA of two adjacent elements in S_i.