Dendrology

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Batyr has recently got into studying trees. But he is no dendrologist, so instead of real trees, he studies the properties of connected graphs on n vertices and $n-1$ edges.

Suppose T is an undirected tree on n indexed vertices. Batyr had described a function $f(S)$: the minimal size (the number of nodes) of a connected subgraph of T that contains all vertices in S, where S is an arbitrary subset of vertices of T. In other words, imagine erasing the maximal number of vertices in T such that all the vertices from S would remain connected. The size of the resulting tree would be equal to $f(S)$.

As an advanced researcher, Batyr is not satisfied with such trivialities. He has already picked a tree T and drew it on a whiteboard. He then attached a small magnet with a unique number from 1 to n to every vertex on the board. An index of a vertex and the number on a magnet attached to it can differ: a magnet with number p_i is attached to the vertex i. Therefore, the numbers on the magnets form a permutation $p = [p_1, p_2, \ldots, p_n]$.

Batyr considers subsets $S_{l,r} = \{i : l \le p_i \le r\}$ that consist of vertices that have a number on the attached magnet in the range from l to r ($1 \le l \le r \le n$). Related to these, he is interested in the function $g(p)$ — the sum of $f(S_{l,r})$ over all pairs of l and r.

But the key question of Batyr's research is to analyze the behavior of $g(p)$ under small modifications of the permutation p. He has come up with q modifying queries: j-th query denotes a swap of magnets attached to the end vertices of the c_j-th edge. The modifications compound: the effect of the first $j-1$ modifications is considered when applying the j-th one.

As Batyr's research assistant, you are once again assigned only the boring stuff. You need to calculate the values of $g(p)$ before any and after each modification of the permutation p.

Input

The first line of the input contains two integers n and q ($1 \le n, q \le 10^5$) — the number of vertices in the tree and the number of modifying queries.

The second line contains n unique integers $p_1, p_2, \ldots, p_n$ ($1 \le p_i \le n$) — the numbers on the magnets attached to each vertex.

The next $n-1$ lines contain two integers a_i, b_i ($1 \le a_i, b_i \le n, a_i \ne b_i$) describing the i-th edge of the tree.

The final q lines describe the queries. Each line contains an integer c_i ($1 \le c_i \le n-1$), denoting a swap of the magnets attached to vertices a_{c_i} and b_{c_i}.

Output

The first line of the output must contain the value of $g(p)$ — the sum $f(S_{l,r})$ over all pairs of l and r.

Then for each query, print in the i-th line the value of $g(p)$ after swapping the magnets between vertices a_{c_i} and b_{c_i}.

Scoring

This problem contains 8 subtasks, that meet following requirements:

1. Tests from this statment. Worth 0 points.
2. $n \le 1000$, $q = 0$. It is guaranteed that $a_i = i$, $b_i = i+1$ for all i ($1 \le i < n$). Worth 9 points.
3. $n \le 10^5$, $q = 0$. It is guaranteed that $a_i = 1$, $b_i = i+1$ for all i ($1 \le i < n$). Worth 10 points.

4. $n \le 10^5$, $q = 0$. It is guaranteed that $a_i = i$, $b_i = i + 1$ for all i $(1 \le i < n)$. Worth 11 points.
5. $n \le 1000$, $q = 0$. Worth 16 points.
6. $n, q \le 10^5$. It is guaranteed that $a_i = i$, $b_i = i + 1$ for all i $(1 \le i < n)$. Worth 16 points.
7. $n \le 10^5$, $q = 0$. Worth 20 points.
8. Original problem constraints. Worth 18 points.

Example

standard input	standard output
3 1 3 2 1 1 2 2 3 1	10 11

Note

Let's consider the example above. Initially $p = [3, 2, 1]$.

1. $S_{1,1} = \{3\}$
   $f(S_{1,1})$ is the minimal size of a connected subgaph that contains all vertices in $S_{1,1}$
   $f(S_{1,1}) = 1$
2. $S_{1,2} = \{2, 3\}$; $f(S_{1,2}) = 2$
3. $S_{1,3} = \{1, 2, 3\}$; $f(S_{1,3}) = 3$
4. $S_{2,2} = \{2\}$; $f(S_{2,2}) = 1$
5. $S_{2,3} = \{1, 2\}$; $f(S_{2,3}) = 2$
6. $S_{3,3} = \{1\}$; $f(S_{3,3}) = 1$

$g(p) = 1 + 2 + 3 + 1 + 2 + 1 = 10$.

After the first modification, the magnets on the endpoints of the 1-st edge are swapped. Now p is equal to $[2, 3, 1]$.

1. $S_{1,1} = \{3\}$; $f(S_{1,1}) = 1$
2. $S_{1,2} = \{1, 3\}$; $f(S_{1,2}) = 3$
3. $S_{1,3} = \{1, 2, 3\}$; $f(S_{1,3}) = 3$
4. $S_{2,2} = \{1\}$; $f(S_{2,2}) = 1$
5. $S_{2,3} = \{1, 2\}$; $f(S_{2,3}) = 2$
6. $S_{3,3} = \{2\}$; $f(S_{3,3}) = 1$

$g(p) = 1 + 3 + 3 + 1 + 2 + 1 = 11$.