Danil and a Part-time Job

CodeForces - 877E

Danil decided to earn some money, so he had found a part-time job. The interview have went well, so now he is a light switcher.

Danil works in a rooted tree (undirected connected acyclic graph) with n vertices, vertex 1 is the root of the tree. There is a room in each vertex, light can be switched on or off in each room. Danil's duties include switching light in all rooms of the subtree of the vertex. It means that if light is switched on in some room of the subtree, he should switch it off. Otherwise, he should switch it on.

Unfortunately (or fortunately), Danil is very lazy. He knows that his boss is not going to personally check the work. Instead, he will send Danil tasks using `Workforces` personal messages.

There are two types of tasks:

1. `pow v` describes a task to switch lights in the subtree of vertex v.
2. `get v` describes a task to count the number of rooms in the subtree of v, in which the light is turned on. Danil should send the answer to his boss using `Workforces` messages.

A subtree of vertex v is a set of vertices for which the shortest path from them to the root passes through v. In particular, the vertex v is in the subtree of v.

Danil is not going to perform his duties. He asks you to write a program, which answers the boss instead of him.

Input

The first line contains a single integer n ($1 \le n \le 200\,000$) — the number of vertices in the tree.

The second line contains n - 1 space-separated integers $p_2, p_3, \ldots, p_n$ ($1 \le p_i < i$), where p_i is the ancestor of vertex i.

The third line contains n space-separated integers $t_1, t_2, \ldots, t_n$ ($0 \le t_i \le 1$), where t_i is 1, if the light is turned on in vertex i and 0 otherwise.

The fourth line contains a single integer q ($1 \le q \le 200\,000$) — the number of tasks.

The next q lines are `get v` or `pow v` ($1 \le v \le n$) — the tasks described above.

Output

For each task `get v` print the number of rooms in the subtree of v, in which the light is turned on.

Sample 1

Input	Output
4 1 1 1 1 0 0 1 9 get 1 get 2 get 3 get 4 pow 1 get 1 get 2 get 3 get 4	2 0 0 1 2 1 1 0

Note

The tree before the task `pow 1`.

The tree after the task `pow 1`.

Problem A
Radio Prize
Time limit: 3 seconds

All boring tree-shaped lands are alike, while all exciting tree-shaped lands are exciting in their own special ways. What makes Treeland more exciting than the other tree-shaped lands are the raddest radio hosts in the local area: Root and Leaf. Every morning on FM 32.33 (repeating of course), Root and Leaf of The Full Depth Morning Show serve up the hottest celebrity gossip and traffic updates.

The region of Treeland is made of n cities, connected by $n-1$ roads such that between every pair of cities there is exactly one simple path. The ith road connects cities u_i and v_i, and has a toll of w_i.

To reward their loyal listeners, The Full Depth Morning Show is giving away a number of travel packages! Root and Leaf will choose $n-1$ lucky residents from the city that sends them the most fan mail. Each of those residents then gets a distinct ticket to a different city in Treeland.

Each city in Treeland has its own tax on prizes: t_i. Let $d_{u,v}$ be the sum of the tolls on each road on the only simple path from city u to v. For a trip from city u to city v, the cost of that trip is then $(t_u + t_v)d_{u,v}$.

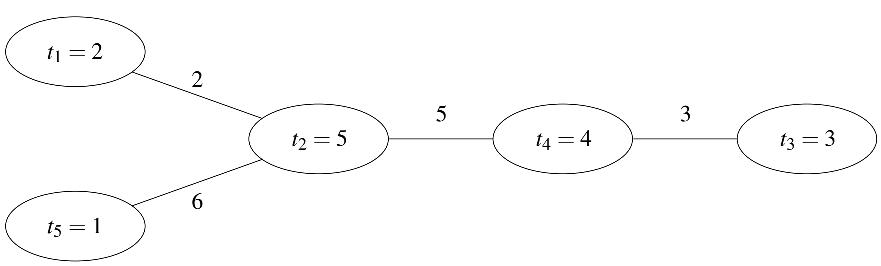

Figure A.1: The map of Treeland corresponding to the first sample input.

The shock jocks haven't quite thought through how much their prize is worth. They need to prepare a report to the radio executives, to summarize the expected costs. For each city that could win the prize, what is the total cost of purchasing all the tickets?

Input

The first line of input is a single integer n ($1 \leq n \leq 100\,000$). The next line has n space-separated integers t_i ($1 \leq t_i \leq 1\,000$), the tax in each city. The following $n-1$ lines each have 3 integers, u_i, v_i, w_i, meaning the ith road connects cities u_i and v_i ($1 \leq u_i, v_i \leq n$), with a toll of w_i ($1 \leq w_i \leq 1\,000$).

Output

Output n lines. On the ith line, output a single integer: the cost of purchasing tickets if city i wins the contest.

Sample Input 1

```
5
2 5 3 4 1
1 2 2
2 4 5
4 3 3
5 2 6
```

Sample Output 1

```
130
159
191
163
171
```

Sample Input 2

```
6
4 3 3 4 3 3
1 3 2
2 1 1
1 4 6
4 5 6
6 4 2
```

Sample Output 2

```
209
206
232
209
336
232
```

Rooted Subtrees

Kattis - rootedsubtrees

A *tree* is a connected, acyclic, undirected graph with n nodes and $n-1$ edges. There is exactly one path between any pair of nodes. A *rooted tree* is a tree with a particular node selected as the root.

Let T be a tree and T_r be that tree rooted at node r. The *subtree* of u in T_r is the set of all nodes v where the path from r to v contains u (including u itself). In this problem, we denote the set of nodes in the subtree of u in the tree rooted at r as $T_r(u)$.

You are given q queries. Each query consists of two (not necessarily different) nodes, r and p. A set of nodes S is "obtainable" if and only if it can be expressed as the intersection of a subtree in the tree rooted at r and a subtree in the tree rooted at p. Formally, a set S is "obtainable" if and only if there exist nodes u and v where $S = T_r(u) \cap T_p(v)$.

For a given pair of roots, count the number of different non-empty obtainable sets. Two sets are different if and only if there is an element that appears in one, but not the other.

Input

The first line contains two space-separated integers n and q ($1 \leq n, q \leq 2 \cdot 10^5$), where n is the number of nodes in the tree and q is the number of queries to be answered. The nodes are numbered from 1 to n.

Each of the next $n-1$ lines contains two space-separated integers u and v ($1 \leq u, v \leq n$, $u \neq v$), indicating an undirected edge between nodes u and v. It is guaranteed that this set of edges forms a valid tree.

Each of the next q lines contains two space-separated integers r and p ($1 \leq r, p \leq n$), which are the nodes of the roots for the given query.

Output

For each query output a single integer, which is the number of distinct obtainable sets of nodes that can be generated by the above procedure.

Sample Explanation

The possible rootings of the first tree are

Considering the rootings at 1 and 3, the 8 obtainable sets are:

1. $\{1\}$ by choosing $u = 1, v = 1$,
2. $\{1, 2, 4, 5\}$ by choosing $u = 1, v = 2$,
3. $\{1, 2, 3, 4, 5\}$ by choosing $u = 1, v = 3$,
4. $\{2, 3, 4, 5\}$ by choosing $u = 2, v = 3$,
5. $\{2, 4, 5\}$ by choosing $u = 2, v = 2$,
6. $\{3\}$ by choosing $u = 3, v = 3$,
7. $\{4, 5\}$ by choosing $u = 2, v = 4$,
8. and $\{5\}$ by choosing $u = 5, v = 5$.

If the rootings are instead at 4 and 5, there are only 6 obtainable sets:

1. $\{1\}$ by choosing $u = 1, v = 1$,
2. $\{1, 2, 3\}$ by choosing $u = 2, v = 4$,
3. $\{1, 2, 3, 4\}$ by choosing $u = 4, v = 4$,
4. $\{1, 2, 3, 4, 5\}$ by choosing $u = 4, v = 5$,
5. $\{3\}$ by choosing $u = 3, v = 2$,
6. and $\{5\}$ by choosing $u = 5, v = 5$.

For some of these, there are other ways to choose u and v to arrive at the same set.

Sample 1

Input	Output
5 2 1 2 2 3 2 4 4 5 1 3 4 5	8 6