Hikers

Input file: `standard input`
Output file: `standard output`
Time limit: 2 seconds
Memory limit: 256 megabytes

Near the great city of Almaty, there is a glorious mountain which attracts a lot of hikers. The mountain can be described as a tree† which consists of n nodes. Each node of the tree is a flat surface where hikers can relax and take a break. Node 1 is the peak of the mountain, which is the ultimate destination. From each node numbered v besides the peak, there is a single upward route that leads to some other node $u < v$. Thus, if you start at any node and keep going upward, you will eventually reach the peak. This exactly resembles the structure of a tree.

On a great Sunday morning, m different groups of hikers decided to conquer the mountain. Each group consists of hikers who are currently occupying a connected area of the mountain. That area can be formally described as a connected subgraph† of the tree. You know that none of the groups have met each other yet, thus on a particular node v there can only be people who belong to the same group.

The day passes along and the groups are moving towards the peak. Their movement can be described as a sequence of q events. Each event is given as an arbitrary node v of the tree. Every hiker that is currently standing at some node below† v will take the route upward and move higher along the tree. Note that hikers located at node v will stay at this node.

After a certain event, two people from different groups may meet each other at the same node. In this case, both groups get to know each other and from that moment onwards they keep hiking as a single group.

As a distant observer of the movement of hikers, you are entertained by the fact that some groups will meet each other very early, while others might not even meet until they reach the peak. After each of the q events, you wonder: how many distinct hiker groups are still there?

† A tree is a connected undirected graph with n nodes and $n - 1$ edges.

† A connected subgraph of a tree is a subset (group) of its nodes that also forms a tree.

† A node u is below some other node v if v is on the route from u to mountain's peak.

Input

First line contains a single integer n — the number of nodes in the tree, or alternatively, the number of flat surfaces of the mountain ($3 \le n \le 3 \cdot 10^5$).

Second line contains a sequence of $n - 1$ integers $p_2, \ldots, p_n$. A value p_i represents the parent of node i, i.e. next node on the route from i to mountain's peak ($1 \le p_i < i$).

Next line contains a single integer m — the number of different groups of hikers ($2 \le m \le n$).

Each of the next m lines describes a group. The first integer k is the size of the group. It is followed by exactly k integers $l_1, \ldots, l_k$ which describe the locations of each group member ($1 \le k \le 3 \cdot 10^5$, $1 \le l_i \le n$). It is guaranteed that each group is occupying a valid connected subgraph of the tree. It is also guaranteed that all hikers which occupy the same node belong to the same group.

The total number of hikers $\sum k$ does not exceed $3 \cdot 10^5$.

Next line contains a single integer q — the number of events ($1 \le q \le 3 \cdot 10^5$).

Last line contains exactly q integers $v_1, \ldots, v_q$ — nodes that describe each event ($1 \le v_i \le n$). The detailed description of each event can be found above.

Output

You have to output q lines, each containing a single integer — the number of distinct groups after each event.

Scoring

This problem contains 6 subtasks.

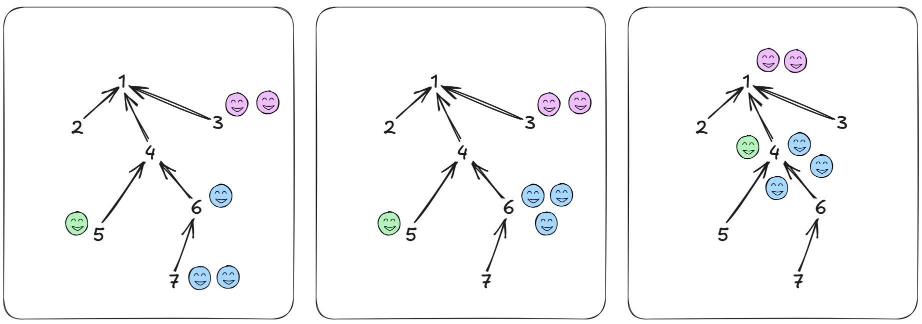
Subtask	Additional Constraints	Points
0	Examples	0
1	$n, q, \sum k \leq 10^3$	12
2	$p_i = \lfloor \frac{i}{2} \rfloor$ and $n = 2^k - 1$ for some k	13
3	$p_i = i - 1$	18
4	$v_i = 1$ in all events	14
5	$n, q, \sum k \leq 10^5$	24
6	—	19

Examples

standard input	standard output
7 1 1 1 4 4 6 3 2 3 3 1 5 3 7 6 7 4 6 1 2 1	3 2 2 1
5 1 1 1 2 3 4 1 4 1 3 2 2 2 1 5 3 3 1 1	3 2 1

Note

Let's break down the first example. Pictures below show the mountain, represented as a tree. Hikers are painted in different colors to distinguish their groups.



The three pictures, from left to right, represent states before all events, after the first event and after the second event. Note that in the last picture, two different groups (colored blue and green on the picture) have met at the node 4. After this point, they will be traveling as a single group, thus the number of distinct groups will reduce by 1 and the answer for this event will be 2.