Jumping Path

Time limit: 10 seconds

You are given a rooted tree where each vertex is labeled with a non-negative integer.

Define a *Jumping Path* of vertices to be a sequence of vertices $v_1, v_2, \ldots, v_k$ where v_i is an ancestor of v_j for all $i < j$. Note that v_i is an ancestor of v_{i+1}, but not necessarily the parent of v_{i+1} (hence the *jumping* part of a *jumping path*).

Compute two quantities:

- The length (number of vertices) of the longest *jumping path* where the labels of the vertices are nondecreasing.
- The number of *jumping paths* of that length where the labels of the vertices are nondecreasing.

Input

The first line of input contains an integer $\boldsymbol{n}$ ($1 \leq \boldsymbol{n} \leq 10^6$), which is the number of vertices in the tree. Vertices are numbered from 1 to $\boldsymbol{n}$, with vertex 1 being the tree root.

Each of the next $\boldsymbol{n}$ lines contains an integer $\boldsymbol{x}$ ($0 \leq \boldsymbol{x} \leq 10^6$), which are the labels of the vertices, in order.

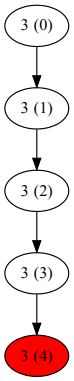
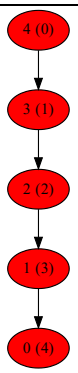
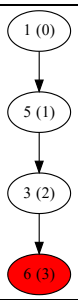
Each of the next $\boldsymbol{n} - 1$ lines contains an integer $\boldsymbol{p}$ ($1 \leq \boldsymbol{p} \leq \boldsymbol{n}$), which are the parents of nodes 2 through $\boldsymbol{n}$, in order.

It is guaranteed that the vertices form a single tree, i.e., they are connected and acyclic.

Output

Output a single line with two integers separated by a space.

The first integer is length of the longest *jumping path* where the labels of the vertices are nondecreasing. The second integer is the number of *jumping paths* of that length where the labels of the vertices are nondecreasing. As the second integer may be large, give its value modulo 11092019.

Sample Input	Sample Output	Diagram
5 3 3 3 3 3 1 2 3 4	5 1	
5 4 3 2 1 0 1 2 3 4	1 5	
4 1 5 3 6 1 2 3	3 2	

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