

5. Flower Shop (1111)

1 sec / 3 sec

100 points

You own a flower shop. The shop's main attraction is a large rooted tree (a computer science one, not a botanical one) consisting of N nodes. The nodes are numbered 0 to $N - 1$, with node 0 serving as the root. Each node in the tree holds a specific type of flower.

Many customers come to admire and photograph this tree. Each customer has a specific type of image in mind: the i -th customer wants to photograph a subtree spanning M_i levels. They know exactly which flower types must appear at each level, but they have not specified the order of the flowers. Now, the customers are asking whether such subtrees exist within the tree.

Recall that the subtree rooted at node v consists of node v itself and all nodes u such that the path connecting u to the root passes through node v .

Input. The first line of the input contains two integers: the number of tree nodes N and the number of queries R ($1 \leq N \leq 10^5$, $1 \leq R \leq 10^5$).

The second line contains N integers $F_0, F_1, \dots, F_{N-1}$, where F_i is the type of the flower at node i ($1 \leq F_i \leq 10^5$).

The third line contains $N - 1$ integers $P_1, P_2, \dots, P_{N-1}$, where P_i is the parent of node i ($0 \leq P_i < N$). It can be assumed that the described graph is indeed a tree.

The R queries follow. The first line of the description for query i contains the required number of subtree levels M_i ($1 \leq M_i \leq N$). Each of the following M_i lines describes one level of the subtree: first, the number of flowers required at level j , denoted by $L_{i,j}$, followed by $L_{i,j}$ integers $T_{i,j,k}$ listing the types of flowers required at that level ($1 \leq L_{i,j} \leq N$, $1 \leq T_{i,j,k} \leq 10^5$). It can be assumed that the sum of $L_{i,j}$ does not exceed $5 \cdot 10^5$ in any test case.

Output. Output one line for each question: the word 'JAH' if the desired subtree exists, or the word 'EI' if it does not.

Example.	Input	Output
	5 2	EI
	1 2 3 3 4	JAH
	0 1 1 3	
	2	
	1 2	
	2 3 3	
	3	
	1 2	
	2 3 3	
	1 4	

There is no subtree that satisfies the conditions of the first question. The closest match is the subtree rooted at node 1, but that subtree also includes a third level.

This subtree does satisfy the conditions of the second question.

Example.	Input	Output
	7 3	JAH
	1 3 5 6 3 3 2	EI
	3 1 0 2 6 2	EI
	3	
	1 5	
	2 3 2	
	1 3	
	3	
	1 5	
	1 2	
	1 3	
	5	
	1 6	
	1 3	
	1 5	
	3 6 3 2	
	1 3	

Example.	Input	Output
	3 1	EI
	1 2 6	
	0 0	
	2	
	1 1	
	2 4 4	

Grading. In this task, tests are divided into groups. Only the solutions that solve **all** the tests in a group correctly will get points for that group. In the test groups, the following additional conditions hold:

0. (0 points) The examples from the task statement.
1. (10 points) $M_i = 1$ for every i .
2. (40 points) $N \leq 10^3$ and the sum of $L_{i,j}$ does not exceed 10^4 in any test case.
3. (50 points) No additional constraints.

You may submit several solutions. Each solution you submit may target one or more test groups (possibly all of them).