

Corporate life (after hostile takeover)

task: <code>corpo</code>	input file: <code>stdin</code>	output file: <code>stdout</code>
points: 100	time limit: 500 ms	memory limit: 1 GB

JanuszPol is a Polish company which has a long tradition to its name. Recently, though, it fell into dire financial situation, and was eventually taken over by a foreign competitor. The new board decided to completely rebuild the company organization. Until now, it was a typical tree structure:

- There was exactly one executive director, who had no superiors,
- Every other employee had exactly one superior, and there were no cyclic relations.

For every employee x , their *subordinate* is every employee y , who is under x in the tree (there is a sequence of direct superiors from y to x).

After the takeover, the company will employ the same people, and it will also be organized as a tree, but every employee will receive a different position, so the shape of the tree may change completely. The executive director is, however, guaranteed to keep the position. Now everyone is afraid to give orders to anyone else – any moment now, a subordinate may become the superior...

Task

Given the description of the tree before and after the takeover, for every employee x determine the number of the people who were subordinates of x and will remain the subordinates after the takeover.

Input

The first line of the input contains an integer n ($2 \leq n \leq 200\,000$): the number of employees. The employees are numbered from 1 to n , with the person number 1 being the executive director. The second line contains the company structure before the takeover: there are $n - 1$ numbers a_2, a_3, \dots, a_n with a_i being the number of i 's superior. The third line also contains $n - 1$ numbers b_2, b_3, \dots, b_n , where b_i is the superior of i after the takeover. You may assume that both descriptions define a proper tree rooted at 1.

Output

Output a single line containing n numbers – i -th of them should be the number of people who are i 's subordinates in both trees at once.

Subtasks

Subtask	Points	Maximal n
1	30	2 000
2	70	200 000

Samples

input

```
5
1 1 3 3
1 2 3 1
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output

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4 0 1 0 0
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