Root to Node Min

April 2024

Question

Consider a binary tree with n vertices. Each vertex is represented by an index and a value. The indices range from 0 to $n-1$. The binary tree is represented in the form of a parent array p where p_i is the parent of the vertex with index i. The parent of the root node is -1. Find out the minimum of values of the vertices from the root node to itself, for every vertex.

Input

First line of input contains the number of nodes n. $n \leq 10^5$
The second line of input contains the parent array.$-1 \leq p[i] \leq n-1$
The third line of input contains value array $1 \leq value[i] \leq 10^9$

Output

Output sum of values of nodes from root to every node, seperated by space.

Note

Input 1

5
-1 0 1 2 3
2 4 5 4 3

Output 1

2 2 2 2 2

Input 2

5
-1 0 0 1 1
9 4 2 3 10

Output 2

9 4 2 3 4