Time Limit: 2000ms
Memory Limit: 256MB

B - Find a Friend

Submissions Submit

As a way to increase collaboration between employees of different ranks, Manly Software Solutions decided to create friendships inside the company.

The company has n employees, each having an id number from 1 to n, every employee in the company has a manager, except of the CEO who has an id of 1, so the structure of the employees looks like a tree, also every employee has a value p_i representing his personality.

The company wants every employee to make a friendship with a junior of his that is exactly 4 ranks below him(meaning he is the manager of the manager of the manager of the manager of that employee).

Since employees are busy working, they want you to find for every employee the best candidate for creating a friendship with, the best candidate is the employee with the closest personality value(that is the difference between their personality values is minimum), if there are multiple such employees then the one with the lowest id value among them is considered the best candidate.

Given the tree structure of the employees and their personality values, print for each employee the id of his best candidate for friendship making, or state that no such candidate exists.

Input

The first line contains a single integer n($1 \leq n \leq 2 \cdot 10^5$), the number of employees in the company.

The second line contains $n-1$ integers $m_2, m_3, \ldots, m_n$($1 \leq m_i < i$), the manager of the ith employee.

The third line contains n integers $p_1, p_2, \ldots, p_n$($1 \leq p_i \leq 10^9$), the personality of the ith employee.

Output

Print a single line containing n integers, the ith of them being the id of the best candidate for the ith employee, or 0 if there is no such candidate.

Notes

In the first example, the CEO($id = 1$) has two juniors that are exactly four ranks lower than him, employee 5 and 9, the difference of personality with employee 5 is $|3 - 6| = 3$, and with employee 9 is $|3 - 10| = 7$, so employee 5 is his best candidate.

The second employee has two juniors, employee 6 and 10, 10 is the best candidate.

None of the other employees have a junior that is exactly 4 ranks lower than them.

Samples

Input	Output
10 1 2 3 4 5 2 7 8 9 3 20 5 3 6 13 9 3 10 15	5 10 0 0 0 0 0 0 0 0