

Dynamic Adjustment

Input file: *standard input*
Output file: *standard output*
Time limit: 3 seconds
Memory limit: 1024 mebibytes

For an array $a_1, a_2, \dots, a_m$ of integers, let $f(a_1, a_2, \dots, a_m)$ be the smallest possible value of

$$\sum_{i=1}^m |a_i - b_i|$$

over all integer arrays $b_1, b_2, \dots, b_m$ with $b_1 \leq b_2 \leq \dots \leq b_m$. The values b_i may be arbitrary integers.

You are given an array $x_1, x_2, \dots, x_n$ and a permutation $p_1, p_2, \dots, p_n$ of the integers from 1 to n .

For each i from 1 to n , consider the indices $p_1, p_2, \dots, p_i$ sorted in increasing order, say $q_1 < q_2 < \dots < q_i$, and let a be the array $x_{q_1}, x_{q_2}, \dots, x_{q_i}$ of length i . In other words, a consists of the elements of x at the first i positions of the permutation, taken in the order in which they occur in x . Compute $f(a)$ for every i .

Input

The first line contains a single integer n ($1 \leq n \leq 200\,000$): the length of the array.

The second line contains n integers $x_1, x_2, \dots, x_n$ ($-10^9 \leq x_i \leq 10^9$).

The third line contains n distinct integers $p_1, p_2, \dots, p_n$ ($1 \leq p_i \leq n$).

Output

Print n integers separated by spaces: the i -th of them must be the value of $f(a)$ for the array a built from $p_1, p_2, \dots, p_i$.

Examples

<i>standard input</i>	<i>standard output</i>
5 5 4 3 2 1 1 2 3 4 5	0 1 2 4 6
3 3 2 1 1 3 2	0 2 2

Note

Arrays in the first example:

- $[5], [5, 4], [5, 4, 3], [5, 4, 3, 2], [5, 4, 3, 2, 1]$

Arrays in the second example:

- $[3], [3, 1], [3, 2, 1]$

For $[3, 1]$, changing both values to 1 (or both to 2, or both to 3) costs 2. After the middle element is inserted, changing $[3, 2, 1]$ to $[2, 2, 2]$ also costs 2.