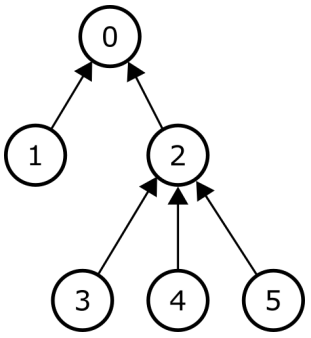
Tree

Consider a **tree** consisting of N **vertices**, numbered from 0 to $N-1$. Vertex 0 is called the **root**. Every vertex, except for the root, has a single **parent**. For every i, such that $1 \leq i < N$, the parent of vertex i is vertex $P[i]$, where $P[i] < i$. We also assume $P[0] = -1$.

For any vertex i ($0 \leq i < N$), the **subtree** of i is the set of the following vertices:

- i, and
- any vertex whose parent is i, and
- any vertex whose parent's parent is i, and
- any vertex whose parent's parent's parent is i, and
- etc.

The picture below shows an example tree consisting of $N = 6$ vertices. Each arrow connects a vertex to its parent, except for the root, which has no parent. The subtree of vertex 2 contains vertices $2, 3, 4$ and 5. The subtree of vertex 0 contains all 6 vertices of the tree and the subtree of vertex 4 contains only vertex 4.



Each vertex is assigned a nonnegative **weight**. We denote the weight of vertex i ($0 \leq i < N$) by $W[i]$.

Your task is to write a program that will answer Q queries, each specified by a pair of integers (L, R). The answer to the query should be computed as follows.

Consider assigning an integer, called a **coefficient**, to each vertex of the tree. Such an assignment is described by a sequence $C[0], \ldots, C[N-1]$, where $C[i]$ ($0 \leq i < N$) is the coefficient assigned to vertex i. Let us call this sequence a **coefficient sequence**. Note that the elements of the coefficient sequence can be negative, 0, or positive.

For a query (L, R), a coefficient sequence is called **valid** if, for every vertex i ($0 \leq i < N$), the following condition holds: the sum of the coefficients of the vertices in the subtree of vertex i is not less than L and not greater than R.

For a given coefficient sequence $C[0], \ldots, C[N-1]$, the **cost** of a vertex i is $|C[i]| \cdot W[i]$, where $|C[i]|$ denotes the absolute value of $C[i]$. Finally, the **total cost** is the sum of the costs of all vertices. Your task is to compute, for each query, the **minimum total cost** that can be attained by some valid coefficient sequence.

Implementation Details

You should implement the following two procedures:

```
void init(std::vector<int> P, std::vector<int> W)
```

- P, W: arrays of integers of length N specifying the parents and the weights.
- This procedure is called exactly once in the beginning of the interaction between the grader and your program in each test case.

```
long long query(int L, int R)
```

- L, R: integers describing a query.
- This procedure is called Q times after the invocation of `init` in each test case.
- This procedure should return the answer to the given query.

Constraints

- $1 \leq N \leq 200\,000$
- $1 \leq Q \leq 100\,000$
- $P[0] = -1$
- $0 \leq P[i] < i$ for each i such that $1 \leq i < N$
- $0 \leq W[i] \leq 1\,000\,000$ for each i such that $0 \leq i < N$
- $1 \leq L \leq R \leq 1\,000\,000$ in each query

Subtasks

Subtask	Score	Additional Constraints
1	10	$Q \leq 10$; $W[P[i]] \leq W[i]$ for each i such that $1 \leq i < N$
2	13	$Q \leq 10$; $N \leq 2\,000$
3	18	$Q \leq 10$; $N \leq 60\,000$
4	7	$W[i] = 1$ for each i such that $0 \leq i < N$
5	11	$W[i] \leq 1$ for each i such that $0 \leq i < N$
6	22	$L = 1$
7	19	No additional constraints.

Examples

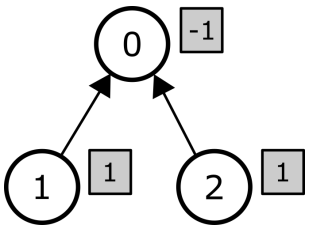
Consider the following calls:

```
init([-1, 0, 0], [1, 1, 1])
```

The tree consists of 3 vertices, the root and its 2 children. All vertices have weight 1.

```
query(1, 1)
```

In this query $L = R = 1$, which means the sum of coefficients in every subtree must be equal to 1. Consider the coefficient sequence $[-1, 1, 1]$. The tree and the corresponding coefficients (in shaded rectangles) are illustrated below.



For every vertex i ($0 \leq i < 3$), the sum of the coefficients of all vertices in the subtree of i is equal to 1. Hence, this coefficient sequence is valid. The total cost is computed as follows:

Vertex	Weight	Coefficient	Cost
0	1	-1	$\lvert -1 \rvert \cdot 1 = 1$
1	1	1	$\lvert 1 \rvert \cdot 1 = 1$
2	1	1	$\lvert 1 \rvert \cdot 1 = 1$

Therefore the total cost is 3. This is the only valid coefficient sequence, therefore this call should return 3.

```
query(1, 2)
```

The minimum total cost for this query is 2, and is attained when the coefficient sequence is $[0, 1, 1]$.

Sample Grader

Input format:

```
N
P[1]  P[2] ...  P[N-1]
W[0]  W[1] ...  W[N-2] W[N-1]
Q
L[0]  R[0]
L[1]  R[1]
...
L[Q-1]  R[Q-1]
```

where $L[j]$ and $R[j]$ (for $0 \leq j < Q$) are the input arguments in the j-th call to `query`. Note that the second line of the input contains **only** $N - 1$ **integers**, as the sample grader does not read the value of $P[0]$.

Output format:

```
A[0]
A[1]
...
A[Q-1]
```

where $A[j]$ (for $0 \leq j < Q$) is the value returned by the j-th call to `query`.