Problem A. The Tree of Haruhi Suzumiya

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

This problem is written to commemorate the victims in Kyoto Animation arson attack on July 18, 2019.

The members in *SOS Dan (**S**ekai o **O**oini Moriageru Tame no **S**uzumiya Haruhi no Dan)* want to assemble a Christmas tree. You know, most Christmas trees are decorations instead of real trees.

The tree contains n vertices which are numbered from 1 to n, where vertex i is of weight w_i. The number of edges on the simple path from vertex i to 1 is denoted as d_i (vertex 1 is important as it is the top vertex). However, the members have various dislikes, so they start discussing:

- Haruhi says, "I dislike the vertex pairs (i, j) that i is an ancestor of j and $w_i > w_j$".
- Kyon says, "I dislike the vertex pairs (i, j) that i is an ancestor of j and $w_i < w_j$".
- Itsuki says, "I dislike the vertex pairs (i, j) that $i < j$ and neither i nor j is an ancestor of the other vertex".
- Mikuru says, "I dislike the vertices that are far away from vertex 1".
- Yuki says nothing.

Now the members are divided into two groups to assemble the tree. Haruhi, Itsuki and Mikuru are in group A while Kyon and Yuki are in group B. Both groups are to choose some vertices to assemble. Finally, each vertex should be chosen by exactly one of the two groups. Let's denote the vertex set chosen by group A as $V(A)$, the vertex set chosen by group B as $V(B)$. So $V(A) \bigcup V(B) = \{1, 2, \cdots, n\}$ and $V(A) \bigcap V(B) = \emptyset$ always hold.

The dislike level of group A (denoted by $D(A)$) is the number of vertex pairs (i, j) that are disliked by at least one of the two members (Haruhi, Itsuku) where $i, j \in V(A)$ add the sum of d_u (the dislike level of Mikuru) where $u \in V(A)$, while the dislike level of group B (denoted by $D(B)$) is the number of vertex pairs (i, j) that are disliked by Kyon where $i, j \in V(B)$.

Formally, $D(A)$ can be computed by definition with following formula:

$$\sum_{i \in V(A)} \sum_{j \in V(A)} [\ (i, j) \text{ is disliked by Haruhi or Itsuki }\ ] + \sum_{u \in V(A)} d_u$$

$D(B)$ can be computed by definition with following formula:

$$\sum_{i \in V(B)} \sum_{j \in V(B)} [\ (i, j) \text{ is disliked by Kyon }\ ]$$

Where $[X]$ equals 1 if the statement X is true, while $[X]$ equals 0 if false.

Yuki wants to know the minimum value of $D(A) + D(B)$ when $|V(B)| = 0, 1, 2, \cdots, n$ respectively.

Input

The first line contains an integer n ($1 \le n \le 500\,000$), denoting the number of vertices in the tree.

The second line contains n integers w_i ($1 \le w_i \le 500\,000$), denoting the weight of vertex i.

Next $n - 1$ lines each contains two integers u, v ($1 \le u, v \le n, u \ne v$), denoting an edge between vertex u and v.

It is guaranteed that input graph forms a tree.

Output

Output $n + 1$ lines, where the i-th line contains an integer denoting the answer when $|V(B)| = i - 1$.

Example

standard input	standard output
4 4 1 2 3 1 2 2 3 2 4	9 5 2 1 2