Forest Frequencies

Time and memory limits: 2 seconds, 512 MB

An ancient forest contains N shrines, numbered from 1 to N, joined by $N-1$ trails. There is exactly one route between any two shrines. Shrine 1 is the forest's central sanctuary, and shrine i has a magic frequency $X[i]$.

The forest's trails have fallen dormant. You can send a magical pulse between any two shrines i and j, awakening every trail along the route between them. This costs $|X[i] - X[j]|$ units of energy. Once awakened, a trail stays awake, and you may send as many pulses as you wish.

For each shrine other than shrine 1, find the minimum total energy needed to awaken every trail along its route to shrine 1. You may also awaken trails elsewhere in the forest.

Consider each shrine separately, starting with all trails dormant.

Subtasks and constraints

Your program will be graded using many secret tests. Every test follows some rules:

- $1 \leq N \leq 200\,000$.
- $1 \leq X[i] \leq N$ for all i.
- $X[i] \neq X[j]$ for all $i \neq j$.
- $1 \leq u, v \leq N$ for every trail (u, v).

The secret tests are divided into subtasks. Your program must correctly solve **every test** within a subtask to earn the marks for that subtask:

- For Subtask 1 (15 marks), the shrines form a path with a trail $(i, i+1)$ for all $1 \leq i < N$ and $|X[1] - X[N]| = 2$.
- For Subtask 2 (25 marks), the shrines form a path with a trail $(i, i+1)$ for all $1 \leq i < N$ and $N \leq 2000$.
- For Subtask 3 (30 marks), the shrines form a path with a trail $(i, i+1)$ for all $1 \leq i < N$.
- For Subtask 4 (30 marks), no special rules apply.

Input

Your solution must read input and print output.

The input follows a specific format:

- The 1st line contains the integer N.
- The 2nd line contains N integers describing the magic frequencies of the shrines. The ith of these is $X[i]$.
- The next $N-1$ lines describe the trails. Each contains two integers u and v, indicating a trail between shrines u and v.

Output

Your program must output $N-1$ lines. The ith line must contain the minimum total energy needed to awaken every trail along the route from shrine $i+1$ to shrine 1. If $N = 1$, output nothing.

Sample input 1

```
5
1 2 3 4 5
1 2
1 3
2 4
2 5
```

Sample output 1

```
1
1
1
2
```

Sample input 2

```
5
1 4 2 5 3
1 2
2 3
3 4
4 5
```

Sample output 2

```
1
1
2
2
```

Sample input 3

```
4
1 3 4 2
1 2
2 3
3 4
```

Sample output 3

```
1
1
1
```

Explanation

- In the 1st sample case, the minimum energy for shrines 2, 3 and 4 is 1, and the minimum energy for shrine 5 is 2.
  - For shrine 2, send a pulse between shrines 1 and 2, spending $|1-2| = 1$ unit of energy. This awakens trail $(1, 2)$.
  - For shrine 3, send a pulse between shrines 2 and 3, spending $|2-3| = 1$ unit of energy. Their route is $2, 1, 3$, so this awakens trail $(1, 3)$ as well as trail $(1, 2)$.
  - For shrine 4, send a pulse between shrines 3 and 4, spending $|3-4| = 1$ unit of energy. Their route is $3, 1, 2, 4$, so this awakens every trail along the route from shrine 4 to shrine 1.
  - For shrine 5, send a pulse between shrines 4 and 5, spending $|4-5| = 1$ unit of energy, to awaken trails $(4, 2)$ and $(2, 5)$. Then send a pulse between shrines 1 and 2, spending $|1-2| = 1$ more unit of energy. The total energy is 2.
- In the 2nd sample case, sending a pulse between shrines 1 and 3 costs 1 and awakens every trail along the routes from shrines 2 and 3 to shrine 1. Then sending a pulse between shrines 3 and 5 costs 1 more and awakens the remaining trails. The minimum energy for shrines 4 and 5 is 2.
- In the 3rd sample case, sending a pulse between shrines 1 and 4 costs 1 and awakens every trail. Every shrine other than shrine 1 therefore has answer 1.