Old Christmas Lights II

Your grandparents have decided to come visit you for Christmas! However, you notice that they are squinting as they look at your Christmas tree!

Being the computer science nerd that you are, your Christmas tree is a tree with N nodes, the i^{th} of which has a light with a brightness of c_i. The *similarity* of a path is the minimum non-negative difference between the brightnesses of any two distinct nodes on the path. Given that your grandparents look at Q paths, can you tell them what the *similarity* of each path is?

Constraints

For all subtasks:
$1 \leq c_i \leq 10^9$
$1 \leq a_i, b_i, u_i, v_i \leq N$
$u_i \neq v_i$

Subtask 1 [10%]

$2 \leq N, Q \leq 100$

Subtask 2 [10%]

$2 \leq N, Q \leq 3\,000$

Subtask 3 [80%]

$2 \leq N, Q \leq 50\,000$

Input Specification

The first line of input will contain two space-separated integers, N and Q.
The next line of input will contain N space-separated integers, $c_1, c_2, \ldots c_N$.
The next $N-1$ lines will contain two space-separated integers, a_i and b_i, indicating that there is an edge between nodes a_i and b_i.
The next Q lines will each contain two space-separated integers, u_i and v_i, indicating that your grandparents look at the path u_i to v_i.

Output Specification

Output Q lines. The i^{th} line should contain a single integer: the similarity of the path from u_i to v_i.

Sample Input

```
5 3
1 8 7 5 6
2 4
4 1
3 1
1 5
2 3
4 3
5 2
```

Sample Output

```
1
2
1
```