Fast LCA

Time limit: 2.0s **Memory limit:** 40M

Recently, Angie's math teacher began teaching the class about trees (the graph theory kind, of course). As homework, he gave everyone a rooted tree of N nodes (the root node is 1) and asked them to do Q LCA queries on the tree (each query is in the form `x y`, and its answer is the LCA of nodes x and y in the tree). **Since he didn't have the funds to make proper test data for his trees, he generated them randomly with the following algorithm: for every node i $(2 \leq i \leq N)$, he picked a uniform random integer in the range $[1, i)$ to be its parent node.**

Angie is feeling very demotivated and doesn't want to do her work. Can you solve the queries for her?

Constraints

$2 \leq x, y \leq N \leq 6 \times 10^6$

$1 \leq Q \leq 10^6$

$1 \leq p_i < i$ for all $2 \leq i \leq N$

Input Specification

The first line contains the integers N and Q.

The second line contains $N-1$ integers $p_2, p_3, \ldots, p_N$, the parents of nodes $2, 3, \ldots, N$ respectively. Note that node 1 does not have a parent as it's the root node of the tree.

The next Q lines each contain a query of the form `x y`.

Output Specification

For each query, output its answer on a new line.

Sample Input

```
10 5
1 2 1 1 4 2 1 6 9
3 9
10 7
4 4
1 3
2 3
```

Sample Output

```
1
1
4
1
2
```

Explanation

The tree from the sample input: