

Problem C. Company Queries II

Time limit 1000 ms

Mem limit 524288 kB

A company has n employees, who form a tree hierarchy where each employee has a boss, except for the general director.

Your task is to process q queries of the form: who is the lowest common boss of employees a and b in the hierarchy?

Input

The first input line has two integers n and q : the number of employees and queries. The employees are numbered $1, 2, \dots, n$, and employee 1 is the general director.

The next line has $n - 1$ integers e_2, e_3, \dots, e_n : for each employee $2, 3, \dots, n$ their boss.

Finally, there are q lines describing the queries. Each line has two integers a and b : who is the lowest common boss of employees a and b ?

Output

Print the answer for each query.

Constraints

- $1 \leq n, q \leq 2 \cdot 10^5$
- $1 \leq e_i \leq i - 1$
- $1 \leq a, b \leq n$

Sample

Input	Output
5 3 1 1 3 3 4 5 2 5 1 4	3 1 1