



Problem K

Tree Quiz

Time limit: 4 seconds

Your friend wants to quiz you. You are given a *rooted tree* with n nodes, numbered from 1 to n . For every node i , its parent is node p_i , except for the *root* (the node without a parent) which has $p_i = 0$. Node u is an *ancestor* of node v if either $u = v$, or node u is an ancestor of the parent of node v (if it exists).

We say that node z is a *common ancestor* of nodes x and y if node z is an ancestor of both nodes x and y . We say that node z is the *lowest common ancestor* of nodes x and y if it is a common ancestor of nodes x and y , and every common ancestor of nodes x and y is also an ancestor of node z . We denote the lowest common ancestor of nodes x and y by $LCA(x, y)$. In particular, $LCA(x, x) = x$.

Your friend would like to run the following pseudocode:

```
let L be an empty array
for x = 1 to n
  for y = 1 to n
    append ((x - 1) * n * n + (LCA(x, y) - 1) * n + (y - 1)) to L
sort L in non-decreasing order
```

Your friend has q questions, numbered from 1 to q . In question j , you are given an integer k_j and asked to find the k_j -th element of the array L . Note that L is 1-indexed, so the indices range from 1 to n^2 , inclusive. To pass the quiz, you have to answer all of the questions.

Input

The first line of input contains two integers n and q ($1 \leq n \leq 100\,000$; $1 \leq q \leq 100\,000$). The second line contains n integers p_1, p_2, \dots, p_n ($0 \leq p_i \leq n$ for all i). It is guaranteed that the given values represent a rooted tree. Each of the next q lines contains an integer. The j -th line contains k_j ($1 \leq k_j \leq n^2$).

Output

For each question in order, output an integer representing the answer to the question.

Sample Input #1	Sample Output #1
5 3	0
3 0 2 2 3	82
1	124
18	
25	

Explanation for the sample input/output #1

The tree in the input is illustrated by Figure K.1.

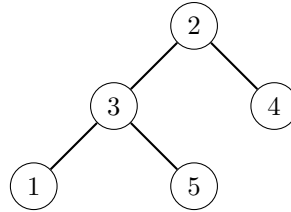


Figure K.1: Illustration of the tree in sample input #1.

The elements of L are

(0, 6, 8, 12, 14, 30, 31, 32, 33, 34, 56, 58, 60, 62, 64, 80, 81, 82, 84, 93, 106, 108, 110, 112, 124).