IOITC 2016 TST Day 3

Black And White Tree

You are given a rooted tree in which all the nodes are colored either Black or White. The nodes are named $1, 2, \ldots, n$. The root is always 1. You have to support these operations on it:

- T u: Toggle the colour of node u.

- C u v: Change the parent of u to v. That is, set $P[u] = v$. It is guaranteed that $v < u$, and $u \neq 1$, and hence it remains a tree after this update.

- K u v k: Along the path from u to v, output the kth Black node. Both u and v are considered part of the path. If there are less than k Black nodes on the path, then output -1.

Input

- The first line contains two space separated integers, n and q: the number of vertices in the tree, and the number of operations.

- The next line contains n space separated bits. If the ith bit is 1, it means that node i is initially Black. If it is 0, that means that the node i is initially White.

- The next line contains $n - 1$ space separated integers. The ith integer is the parent of node $i + 1$, ie. $P[i + 1]$. All the initial parents are strictly lesser than the node. That is, for $i > 1$, $P[i] < i$, and hence the input is a tree.

- q lines follow, each being one of the above explained operations.

Output

For every operation of the form K u v k, output the answer for this in a new line.

Test Data

Subtask 1 (4 Points):

- $1 \leq n, q \leq 10^3$

Subtask 2 (14 Points):

- $1 \leq n, q \leq 2 * 10^5$

- It is guaranteed that there are no operations of the form T u or C u v.

Subtask 3 (20 Points):

- $1 \leq n, q \leq 2 * 10^5$

- It is guaranteed that there are no operations of the form C u v.

Subtask 4 (23 Points):

- $1 \leq n, q \leq 2 * 10^5$

- It is guaranteed that there are no operations of the form T u.

Subtask 5 (39 Points):

- $1 \leq n, q \leq 2 * 10^5$

Sample Input 1

```
7 7
1 1 1 1 1 1 1
1 1 1 2 2 4
Q 5 3 2
T 1
Q 7 2 3
C 7 3
T 2
Q 6 7 3
Q 4 1 2
```

Sample Output 1

```
2
2
7
-1
```

Limits

Time: 2 seconds

Memory: 256 MB