Problem F
Walking on Binary Tree

Time Limit: 2 seconds

You are given an infinite complete binary tree whose vertices are labeled with positive integers. The root is vertex 1, and for every vertex x ($x \geq 2$), its parent is $\left\lfloor \frac{x}{2} \right\rfloor$.

You are also given a string $S = S_0 S_1 \dots S_{N-1}$ of length N. Each character of S is either 'L' or 'R'.

Consider the following process: you are currently at some vertex u, and want to reach vertex v by repeatedly moving through the tree.

On the i-th move (1-indexed), suppose you are at vertex x. You may choose one of the following moves:

Downward move: If $S_{(i-1) \bmod N}$ is 'L', move to vertex $2x$. Otherwise, move to vertex $2x + 1$.

Upward move: You can choose only if $x \geq 2$. Move to vertex $\left\lfloor \frac{x}{2} \right\rfloor$.

Note that you cannot stay at the same vertex.

You are given Q independent queries. In the i-th query, you start at vertex u_i and want to reach vertex v_i.

For each query, determine whether it is possible to reach v_i from u_i. If it is possible, find the minimum number of moves required.

Input

The input is given in the following format:

N
S
Q
u_1 v_1
u_2 v_2
$\vdots$
u_Q v_Q

- $1 \leq N \leq 10^6$
- $1 \leq Q \leq 200\,000$
- $1 \leq u_i, v_i \leq 10^{18}$ $(1 \leq i \leq Q)$
- N, Q, u_i and v_i are integers.
- S is a string of length N consisting of 'L' and 'R'.

Output

Output Q lines. On the i-th line, print the minimum number of moves required to reach v_i from u_i if it is possible; otherwise, print "-1".

Sample Input 1

```
5
LLRLR
3
1 12
9 2
913 2025
```

Sample Output 1

```
7
2
23
```

Sample Input 2

```
1
L
1
1 3
```

Sample Output 2

```
-1
```