F - Shortest Path Query

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Time Limit: 4 sec / Memory Limit: 1024 MiB

Score : 525 points

Problem Statement

You are given a grid with three rows and N columns. Denote the cell at the i-th row from the top and j-th column from the left as cell (i, j). Cell (i, j) is a wall cell if $S_{i,j}$ is #, and an empty cell and passable if it is ..

You are given Q queries, which you should process in order.

Each query gives integers r and c, and you should flip the state of cell (r, c). That is, if cell (r, c) is a wall cell, make it an empty cell, and if it is an empty cell, make it a wall cell. Then, output the answer to the following problem:

> Consider moving from cell $(1, 1)$ to cell $(3, N)$ by repeatedly moving to an empty cell adjacent up, down, left, or right. Determine whether cell $(3, N)$ is reachable, and if reachable, find the minimum number of moves.

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $S_{i,j}$ is # or .
- $S_{1,1} = S_{3,N} =$.
- $1 \leq Q \leq 2 \times 10^5$

- $1 \leq r \leq 3$
- $1 \leq c \leq N$
- $(r, c) \neq (1, 1), (3, N)$
- N, Q, r, c are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{aligned}
&N \\
&S_{1,1}S_{1,2}\dots S_{1,N} \\
&S_{2,1}S_{2,2}\dots S_{2,N} \\
&S_{3,1}S_{3,2}\dots S_{3,N} \\
&Q \\
&\mathrm{query}_1 \\
&\mathrm{query}_2 \\
&\vdots \\
&\mathrm{query}_Q
\end{aligned}
$$

Each query is given in the following format:

$$
r \quad c
$$

Output

Print Q lines.

On the i-th line $(1 \leq i \leq Q)$, if cell $(3, N)$ is unreachable from cell $(1, 1)$ in the i-th query, print `-1`; if reachable, print the minimum number of moves.

Sample Input 1 Copy

Copy

```
5
.#...
.#.#.
...#.
3
1 2
1 2
2 3
```

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Sample Output 1 Copy

```
6
10
-1
```

In the first query, flip the state of cell $(1, 2)$. As a result, the state of each cell becomes:

```
.....
.#.#.
...#.
```

At this time, by moving from cell $(1, 1)$ through cells $(1, 2), (1, 3), (1, 4), (1, 5), (2, 5), (3, 5)$ in order, you can reach cell $(3, 5)$ in six moves.

In the second query, flip the state of cell $(1, 2)$. As a result, the state of each cell becomes:

```
.#...
.#.#.
...#.
```

At this time, by moving from cell $(1, 1)$ through cells $(2, 1), (3, 1), (3, 2), (3, 3), (2, 3), (1, 3), (1, 4), (1, 5), (2, 5), (3, 5)$ in order, you can reach cell $(3, 5)$ in ten moves.

In the third query, flip the state of cell $(2, 3)$. As a result, the state of each cell becomes:

```
.#...
.###.
...#.
```

At this time, no matter how you move, you cannot reach cell $(3, 5)$ from cell $(1, 1)$.

Sample Input 2 Copy

```
7
.#.....
.#..#..
...#...
6
2 5
3 4
3 5
2 5
1 4
1 4
```

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Sample Output 2 Copy

```
10
8
10
12
-1
12
```

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