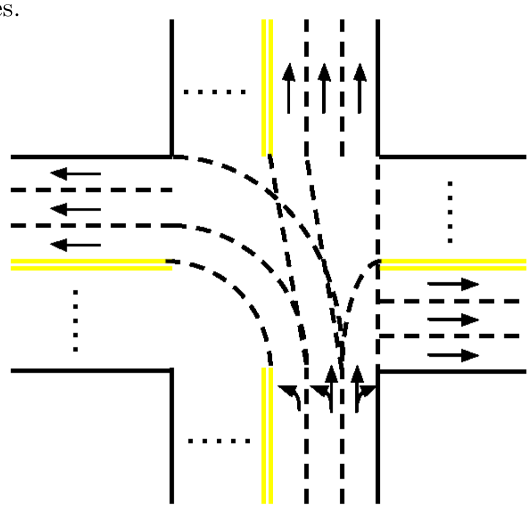
2020/2021 SOUTHERN CALIFORNIA REGIONAL
INTERNATIONAL COLLEGIATE PROGRAMMING CONTEST

Problem ?
Safest Taxi

Consider a town whose road network forms an $N * M$ grid, where adjacent intersections are connected by roads. All roads are bi-directional. Each direction has an associated number - the time needed to travel from one end-point to another.

Each direction of each road consists of one or more lanes. A lane can serve one of the following functions: left-turn, straight, right-turn, or any combination of them. However, a left-turn lane cannot be placed to the right of a straight or right-turn lane, and a straight lane cannot be placed to the right of a right-turn lane. There are no U-turn lanes.



The rules for crossing intersections are illustrated in the above figure (suppose a car enters the intersection from the south). To make a left turn, it must be in one of the L left-turn lanes; let's number them 1 through L from left to right. The traffic rule says Lane i must turn into the i-th lane (counting from the left) of the target road, except that Lane L may turn into the L-th lane or any other lanes to its right.

Similarly, to go straight through an intersection, the car must be in one of the S straight lanes; let's number them 1 through S from left to right. Lane i must go into the i-th lane (counting from the left) of the target road, except that Lane S may go into the S-th lane or any other lanes to its right.

To make a right turn, the car must be in one of the R right-turn lanes. For the convenience of discussion, we consider these lanes and those of the target road *from right to left*. Let's number the right-turn lanes 1 through R from right to left. Lane i must turn into the i-th lane (counting from the right) of the target road, except that Lane R may turn into the R-th lane or any other lanes to its left.

It is guaranteed that if at least one left-turn / straight / right-turn lane is present, the target road must exist and have enough lanes to accommodate the left turn / straight / right turn, respectively. The time spent on crossing intersections is negligible.

In addition, a driver may change lanes in the middle of a road. Note that in the above rules for intersections, it doesn't count as a lane change to drive into any of the legal lanes of the target road. The time spent on lane changes is negligible.

A trip starts and ends at the rightmost lane of the midpoint of roads. The time needed to travel midpoint-to-endpoint is half of endpoint-to-endpoint.

You are running a taxi company called "Safest Taxi" in this town, with the slogan "your safety is in your hands". You let your customers choose the numbers X and Y for their trip, and the driver will make at most X left turns and Y lane changes to accomplish the trip.

What is the shortest time to fulfill each trip given the rules?

input

The first line consists of three integers N ($2 <= N <= 15$), M ($2 <= M <= 15$) and K ($1 <= K <= 3$), separated by a single space. The town's road network has N intersections north-south and M intersections west-east. Each road has K lanes.

The second line consists of a single integer D. The town's road network has D road segments. Every adjacent pair of intersections must appear in the list exactly once.

Each of the next D lines describes a road segment with the following format:

$$R_0\ C_0\ R_1\ C_1\ T\ L_0\ L_1 ... L_{K-1}$$

This describes a road segment going from the intersection at row R_0 column C_0 to the intersection at row R_1 column C_1 ($0 <= R_0, R_1 < N$, $0 <= C_0, C_1 < M$). Rows are numbered 0 through $N-1$ from north to south, and columns are numbered 0 through $M-1$ from west to east. The segment must connect two adjacent intersections, i.e., $\mid R_0 - R_1 \mid + \mid C_0 - C_1 \mid = 1$. The time to travel through the entire segment is T ($2 <= T <= 100$, T must be an even number). The next K strings describe the function of each of the K lanes, from left to right, with the following semantics:

L | Left-turn only

S | Straight only

R | Right-turn only

LR | Left-turn or right-turn

LS | Left-turn or straight

SR | Straight or right-turn

LSR | Left-turn, straight or right-turn

The next line consists of a single integer P ($1 <= P <= 50$), the number of trips to fulfill.

Each of the next P lines describes a trip with the following format:

$$R_{S0}\ C_{S0}\ R_{S1}\ C_{S1}\ R_{D0}\ C_{D0}\ R_{D1}\ C_{D1}\ X\ Y$$

This indicates that the starting point is the midpoint of segment $(R_{S0}, C_{S0}) \rightarrow (R_{S1}, C_{S1})$, and the destination is the midpoint of segment $(R_{D0}, C_{D0}) \rightarrow (R_{D1}, C_{D1})$. Both segments must appear in the above list. Both the starting point and the destination are on the rightmost lane. The customer requests that at most X ($0 <= X <= 4$) left turns and Y ($0 <= Y <= 4$) lane changes are allowed for the trip.

output

Output P lines. The i-th line contains a single integer which is the shortest time to fulfill each trip given the rules, or -1 if no feasible route exists.

sample input

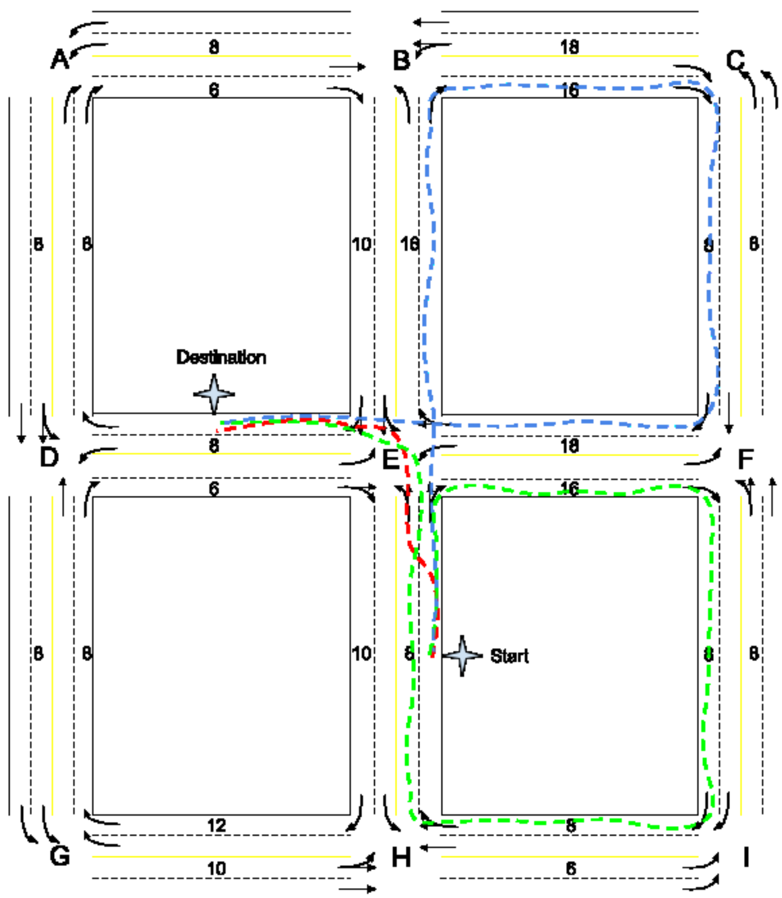
```
3 3 2
24
0 0 0 1 6 S R
0 1 0 0 8 L L
0 1 0 2 16 R R
0 2 0 1 18 LS S
0 0 1 0 8 LS S
1 0 0 0 8 R R
0 1 1 1 10 LS SR
1 1 0 1 16 L R
0 2 1 2 8 S R
1 2 0 2 8 L L
1 0 1 1 6 L SR
1 1 1 0 8 L R
1 1 1 2 16 L R
1 2 1 1 18 L SR
1 0 2 0 8 L L
2 0 1 0 8 S R
1 1 2 1 10 L R
2 1 1 1 8 LS SR
1 2 2 2 8 R R
2 2 1 2 8 LS S
2 0 2 1 10 LS S
2 1 2 0 12 R R
2 1 2 2 6 L L
2 2 2 1 8 S SR
6
2 1 1 1 1 1 1 0 1 1
2 1 1 1 1 1 1 0 1 0
2 1 1 1 1 1 1 0 0 0
0 1 0 2 0 2 0 1 2 0
1 0 0 0 0 0 1 0 2 0
2 1 2 0 2 0 2 1 2 0
```

sample output

```
8
48
66
131
112
95
```

explanation for the sample

The first three lines of the sample output are illustrated in the figure below.



- If $X = 1$ and $Y = 1$, the shortest path is shown in red: make a lane change before reaching E and make a left turn. The total time is $8/2 + 8/2 = 8$;
- If $X = 1$ and $Y = 0$, the shortest path is shown in green: go through E-F-I-H-E and make a left turn. The total time is $8/2 + 16 + 8 + 8 + 8 + 8/2 = 48$;
- If $X = 0$ and $Y = 0$, the shortest path is shown in blue: go through E-B-C-F-E. The total time is $8/2 + 16 + 16 + 8 + 18 + 8/2 = 66$.