TWGSS
OI Team

2025/26 JSOI Practice

SCHEDULE

Date	24 September 2025
Duration	3 hours

PROBLEMS

Problem		Limit: Time	Limit: Memory	Score: Subtasks									Score: Total
TC26A1	Energy Machine	1s	256MB	10	8	7	15	17	18	25			100
TC26A2	Li's Field	1s	256MB	5	8	6	9	10	13	7	17	25	100
TC26A3	Rocket Fly	1s	256MB	3	7	12	13	5	22	38			100
TC26A4	Falling Apart	1s	256MB	8	12	10	9	7	13	18	23		100
												Full Score	400

REMINDERS

- All problems are divided into subtasks. All test cases in a subtask must be passed to get points.
- You may attempt the problems using C++20 or Python 3 (secondary language). It is not guaranteed that the problems are solvable using secondary language.
- Unless otherwise specified, your output will be automatically fixed as follows:
  - Trailing spaces in each line will be removed.
  - An end-of-line character will be added to the end of the output if not present.
- 64-bit integers may be required in some problems, use `long long` in C++ if needed.
- All stories are hypothetically written. In case of coincidences, they are coincidences.

TC26A1 Energy Machine

Score	Limit	
100	1s	256MB

Reporter: "As you can see, the situation here is extremely harsh! It's basically impossible to stand still. The raindrops are hitting my face like needles!"

(Shoe blown away) "My shoes were just blown away by the strong wind!"

(Horse stance) "I need to lean forward or take horse stance to not get blown away!"

(Helmet blown away) Others (cheering): "Woooo!!!"

記者：「相信不用我說你們都見到出面的情況很惡劣！基本上現在站不穩，雨點打在面上好像針刺般痛楚！」

（鞋被吹走）「剛剛我對鞋也被大風吹走！」

（紮馬）「身體要向前傾斜或紮馬才站得穩！」

（頭盔被吹走）旁人（鼓掌）：「Woooo!!!」

Super Typhoon *Kawachi* is approaching Heung Shing! Having the *Joint School Olympiad in Infographic (JSOI)* competition in a few days, you decided to visit Science Museum to learn some more about tropical cyclone to see if the competition will be affected by *Kawachi*.

Upon entering the museum, you are impressed by the enormous "Energy Machine" exhibit that spans across the whole building.

The machine can be represented by a grid with $N \times M$ cells, where top left cell is $(1,1)$ and the bottom right cell is (N,M). In each operation, a ball is placed onto a cell with an initial direction of motion with initial speed of 1 cell per second. It will then interact with different types of cells.

There are 10 types of cell, numbered from 0 to 9.

Type		Name	Specification
0		Wall	The ball will be stopped when the ball tries to pass through the cell.
1		Crossroad Rail	The ball can pass through the cell horizontally or vertically.
2		Horizontal Rail	The ball can pass through it horizontally. The ball will be stopped when the ball tries to pass through the cell vertically.
3		Vertical Rail	The ball can pass through it vertically. The ball will be stopped when the ball tries to pass through the cell horizontally.
4		Top-Right Turning Rail	In this cell, downward movement will become right movement and left movement will become upward movement. The ball will be stopped when the ball tries to pass through the cell from left or bottom side.
5		Bottom-Right Turning Rail	In this cell, upward movement will become right movement and left movement will become downward movement. The ball will be stopped when the ball tries to pass through the cell from left or top side.
6		Bottom-Left Turning Rail	In this cell, upward movement will become left movement and right movement will become downward movement. The ball will be stopped when the ball tries to pass through the cell from right or top side.
7		Top-Left Turning Rail	In this cell, downward movement will become left movement and right movement will become upward movement. The ball will be stopped when the ball tries to pass through the cell from right or bottom side.
8		Slow Horizontal Rail	Same as Horizontal Rail. Except that the ball takes 2 seconds to leave this cell.
9		Slow Vertical Rail	Same as Vertical Rail. Except that the ball takes 2 seconds to leave this cell.

The machine is so advanced that the ball experiences no friction in its motion. It will stop only when it tries to move out-of-bounds or stopped by a cell.

The machine will operate for Q times in a day. Before each operation, the cell (i, j) will reset to its initial type of $g_{(i,j)}$. In the k^{th} operation, the ball is placed on cell (r_k, c_k) with an initial motion in one of the four directions: up (`U`), right (`R`), down (`D`) and left (`L`). Its duration is limited to t_k seconds. In other words, the operation ends either when the ball comes to a stop or t_k seconds has passed.

You are curious, for each operation, what is the number of cells that the ball will travel to, where the same cell can be visited multiple times.

INPUT

The first line consists of two integers N and M, representing the height and width of the grid respectively.

The i^{th} line of the next N lines consists of M single digit number, the j^{th} number $g_{(i,j)}$ represents the type of cell (i, j).

The next line consists of an integer Q.

The k^{th} line of the next Q lines consists of three integers t_k, r_k, c_k and a character d_k, representing the duration (in seconds), the ball's initial position (row, column) and the initial direction in the k^{th} operation respectively.

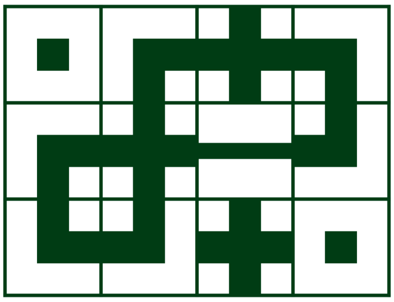
OUTPUT

Output Q lines.

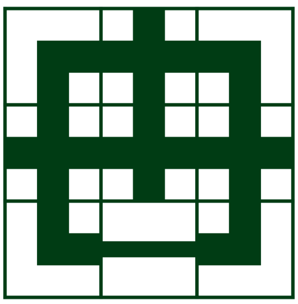
On the k^{th} line, output the number of cells the ball will travel to during the k^{th} operation. Notice that the same cell can be visited multiple times.

SAMPLE TESTS

	Input	Output
1	3 4 0516 5187 4710 5 5 2 2 R 7 3 1 D 7 3 2 U 100 2 4 U 5 1 3 D	5 8 7 92 1



	Input	Output
2	3 3 516 111 487 5 1 1 1 R 1 3 1 R 2 3 1 R 3 3 1 R 111 1 1 R	2 2 2 3 100



CONSTRAINTS

$1 \le N, M, N \times M, Q \le 5 \times 10^5$

$0 \le g_{(i,j)} \le 9$

$1 \le t_k \le 10^9$

$1 \le r_k \le N$

$1 \le c_k \le M$

$d_k =$ `U`, `R`, `D` or `L`

$1 \le g_{(r_k,c_k)} \le 7$

SUBTASKS

	Points	Constraints
1	10	$g_{(i,j)} = 1$
2	8	$0 \le g_{(i,j)} \le 3$
3	7	$0 \le g_{(i,j)} \le 3$ or $8 \le g_{(i,j)} \le 9$ $1 \le N, M \le 100$
4	15	$N = 1$
5	17	$1 \le t_k \le 10$
6	18	$0 \le g_{(i,j)} \le 7$
7	25	No additional constraints

TC26A2 Li's Field

Score	Limit	
100	1s	256MB

Lah, it's now signal no. ~~*8*~~ ***10**, satisfied?*
Go back to work and school as usual tomorrow!

*拿~~八~~**十**號喇 滿意啦？*
聽日準時返工返學喇

After learning about tropical cyclone in the Science Museum *(despite being completely distracted by the Energy Machine)*, you estimate that there is a high chance that the Super Typhoon *Kawachi* will cause the cancellation or postponement of JSOI. Wanting to stop this from happening, you decide to make use of the *Li's Field (李氏力場)* invented by no other than *Mr. Add Times* himself.

Heung Shing can be represented by a $R \times C$ grid. For the *Li's Field* to work, you have found M people with surname *"Li"*. Each of them can press a button at their home, producing an *irresistible force (不可抗力)* of a specific strength helping to change the path of the tropical cyclone. In particular, the home of the i^{th} person is at (r_i, c_i), and the centre strength produced by him is s_i. The field strength on cell (r, c) of the i^{th} person can be calculated by $\max(0, s_i - |r - r_i| - |c - c_i|)$. The actual field strength acting on cell (r, c) is the maximum field strength by any person. Specially, field strength of cells outside of Heung Shing (out-of-bounds) is $10^9 + 7$ regardless the field of any person nearby.

A tropical cyclone will tend to move to cells with less field strength. Its path can be determined by the field strength at the nearby cells. For each minute, suppose the tropical cyclone is located at (r, c) with field strength f_0. Let the field strength on $(r-1, c)$, $(r, c+1)$, $(r+1, c)$ and $(r, c-1)$ be f_u, f_r, f_d and f_l respectively. Let $g(a, b) = \begin{cases} 1 & \text{if } a < b \\ 0 & \text{otherwise} \end{cases}$. It will move to $(r + g(f_d, f_0) - g(f_u, f_0), c + g(f_r, f_0) - g(f_l, f_0))$.

As *Kawachi* is highly unpredictable, you would like to carry out Q simulations to see if *Li's Field* can bounce this Super Typhoon away. Each simulation can be one of the following two types:

Type t	Name	Specification
>	Forward	Suppose *Kawachi* is initially at (x, y), find the position of it k minutes later.
<	Backward	Suppose *Kawachi* is at (x, y) in the end, find the position of it k minutes prior, or no such a position exists. Notice that the position must be inside Heung Shing (not out-of-bounds).

You would like to find out the result of the simulations fast and accurately to get well-prepared facing *Kawachi*.

INPUT

The first line consists of four integers, R, C, M and Q, representing the number of rows, columns, people and simulations respectively.

The i^{th} line of the next M line consists of three integers r_i, c_i and s_i, representing the location (row, column) and the centre strength of the i^{th} person respectively.

The i^{th} line of the next Q line consists of a character t_i, three integers x_i, y_i and k_i, representing the type, location (row, column) and duration of the i^{th} simulation respectively.

OUTPUT

Output Q lines.

On the i^{th} line, output the result of the i^{th} simulation.

If there does not exist any possible location as the result, output `Lie`.

Otherwise, output two integers separated by a space, the row and column of the resultant location.

If there exist more than one possible position, output any of them.

SAMPLE TESTS

	Input	Output
1	6 5 2 3 1 5 4 4 2 5 > 4 3 2 < 5 5 3 < 5 5 4	4 5 4 3 Lie

	1	2	3	4	5
1	1	2	2	3	4
2	2	3	2	2	3
3	3	4	3	2	2
4	4	5	4	3	2
5	3	4	3	2	1
6	2	3	2	1	0

1^{st} simulation: $(4,3) \to (4,4) \to \underline{\mathbf{(4,5)}}$

2^{nd} simulation: $(5,5) \leftarrow (4,5) \leftarrow (4,4) \leftarrow \underline{\mathbf{(4,3)}}$

3^{rd} simulation is impossible

CONSTRAINTS

$1 \le R, C, R \times C, M, Q \le 10^5$

$1 \le r_i, x_i \le R$

$1 \le c_i, y_i \le C$

$t_i =$ `>` or `<`

$1 \le s_i, k_i \le 10^9$

SUBTASKS

	Points	Constraints
1	5	$R = C = 101$ $M = 1$ $r_1 = c_1 = 51$ $1 \le s_i, k_i \le 50$
2	8	$M = 1$
3	6	$R = 1$ $1 \le M \le 1000$
4	9	$R = 1$
5	10	$1 \le k_i \le 50$
6	13	$1 \le M, Q \le 50$ $t_i =$ `>`
7	7	$1 \le Q \le 50$ $t_i =$ `>`
8	17	$t_i =$ `>`
9	25	No additional constraints

TC26A3 Rocket Fly

Score	Limit	
100	1s	256MB

"Human lives on the land, our body structures do not allow us to fly.
Back in ancient times, probably around Zhuge Liang's era, a bird flew by and asked, 'Mr. Zhuge, can you fly?'
Mr. Zhuge, on behalf of all humans, answered, '我有一天會飛！'"

「人類是在陸上生活的動物，我們的身體構造不容許我們飛。
古代可能就是大約諸葛亮那個時代，鳥兒飛過，鳥兒說：『諸葛先生你會飛嗎？』
諸葛先生就代表人類在當時立志，就說：『I can fly one day!』。」

… (Quiet)

…… （冷場）

"That's a joke!"

「爛 gag 嚟㗎！」

"Ohhhhhhh!!!!!" (Claps)

「喔喔喔喔喔喔喔！」（拍手）

Unfortunately, Super Typhoon *Kawachi* is so strong that even *Li's Field* can't stop it. You are so depressed not being able to join JSOI, so you decide to escape from the city… Still not enough, you decide to escape from the Earth! The day has finally arrived, *Mr. Zhuge's* dream finally comes true. You are going to not only fly to the sky, but the outer space, by a rocket!

Asking *Mr. Plus Times* again for help, he bought you the most advanced model of rocket! The rocket consists of N fuel chambers from bottom to top where the i^{th} chamber contains F_i units of fuel. There are also K rocket engines which consume fuel to speed up the rocket. You can separate the rocket into k ($k \le K$) stages by selecting $k-1$ separations $1 = x_1 < x_2 < x_3 < \cdots < x_k < x_{k+1} = N+1$, such that the i^{th} stage would consists of some continuous fuel chambers $x_i, x_i+1, \ldots, x_{i+1}-1$, which sums up to $S_i = F_{x_i} + F_{x_i+1} + \cdots + F_{x_{i+1}-1}$ units of fuel. An engine is then installed on each stage.

"3… 2… 1… Launch!"

After the launch, the 1^{st} stage will boost the rocket's speed by $\dfrac{S_1}{S_1+S_2+\cdots+S_k}$ units before disconnecting from the rocket itself. Then, the 2^{nd} stage will boost the rocket's speed by $\dfrac{S_2}{S_2+S_3+\cdots+S_k}$ units before disconnecting. The process continues until the k^{th} stage is disconnected. In other words, the i^{th} stage will boost the rocket's speed by $\dfrac{S_i}{S_i+S_{i+1}+\cdots+S_k}$ units for all $1 \le i \le k$.

"Aim high!"

You know that higher the speed the rocket is, the higher that it can reach. Therefore, you would like to find out the maximum possible final speed of the rocket under the best method in separating it into stages.

INPUT

The first line consists of two integers N and K, representing the number of fuel chambers and rocket engines respectively.

The second line consists of N integers, the i^{th} integer F_i represents the amount of fuel in the i^{th} chamber.

OUTPUT

Output an integer, the maximum final speed that the rocket can achieve under the best method in separating it into stages.

Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}. Formally, if your answer is a, and the expected answer is b, your answer will be accepted if $\frac{|a-b|}{\max(1,b)} \le 10^{-6}$.

SAMPLE TESTS

	Input	Output
1	1 1 10	1

	Input	Output
2	4 2 1 6 1 8	1.5

Best separation: $\{1,6,1\},\{8\}$
$S=\{1+6+1,8\}=\{8,8\}$
Final speed $=\frac{8}{8+8}+\frac{8}{8}=1.5$

	Input	Output
3	4 3 1 6 1 8	1.548611111

Best separation: $\{1,6\},\{1\},\{8\}$
$S=\{1+6,1,8\}=\{7,1,8\}$
Final speed $=\frac{7}{7+1+8}+\frac{1}{1+8}+\frac{8}{8}=1.548611111$

	Input	Output
4	4 3 11 3 2 4	2.105555555

Best separation: $\{11\},\{3,2\},\{4\}$
$S=\{11,3+2,4\}=\{11,5,4\}$
Final speed $=\frac{11}{11+5+4}+\frac{5}{5+4}+\frac{4}{4}=2.105555555$

CONSTRAINTS

$1 \leq K \leq N \leq 2000$

$1 \leq F_i \leq 10^9$

SUBTASKS

	Points	Constraints
1	3	$K = 1$
2	7	$1 \leq K \leq 2$
3	12	$1 \leq K \leq 3$
4	13	$1 \leq K \leq 4$
5	5	$K = N$
6	22	$1 \leq K \leq N \leq 100$
7	38	No additional constraints

TC26A4 Falling Apart

Score	Limit	
100	1s	256MB

Once upon a falling rock 　　　　*殞石旁的天際*
The sky is my homeland 　　　　*是我的家園*

Riding the ultra-efficient rocket, you successfully reached space. Seeing Heung Shing from the space is truly magical. While enjoying the breathtaking view, you suddenly notice that something is falling down towards the ground. *"Oh no! Those are my rocket parts!"* You totally forgot that the disconnected rocket parts used for boosting will directly fall and crash onto the ground soon... Now, you have no choice but to give warnings to people in Heung Shing to minimise the harm caused by these sudden falling things from the sky *(I guess you would be charged $3000 for throwing rubbish on the street also)*.

Luckily, during your trip up, you did some measurement on the wind brought by Super Typhoon *Kawachi*. You found out that the sky consists of M layers of atmosphere, where the i^{th} layer spans from height l_i to r_i where $1 = l_1 \leq r_1 < l_2 \leq r_2 < \cdots < l_M \leq r_M$. The wind direction and speed are the same within a layer, where the i^{th} layer has the wind velocity of v_i units per second.

Heung Shing can be represented by a strip of land of length N, where locations on the ground spans from $(1, 0)$ to $(N, 0)$. Rocket parts will fall 1 unit down and follow the wind velocity to move horizontally each second. In other words, for a rocket part located at (p, h) in the i^{th} layer of atmosphere, i.e. $l_i \leq h \leq r_i$, where $h > 0$, it will fall to $(p + v_i, h - 1)$. Note that it is possible for a rocket part to have a horizontal position not between 1 and N at some point, which it will fall as normal and still follow the wind velocity of the current layer.

You have observed Q rocket parts falling towards the ground. As there is no depth perception looking down the city, you only know the current horizontal location of each rocket part without knowing its height. For the i^{th} rocket part, its horizontal position is p_i. You would like to find the probability of the rocket part landing at horizontal position e_i. More formally, you would like to know the number of distinct h_0 where $l_1 \leq h_0 \leq r_M$ such that if the rocket part is initially located at (p_i, h_0), it will end up at $(e_i, 0)$. Note that every rocket part is independent, i.e. they will not collide with each other.

INPUT

The first line consists of three integers N, M and Q, representing the length of Heung Shing, number of atmosphere layers and number of rocket parts respectively.

The i^{th} line of the next M lines consists of three integers l_i, r_i and v_i, representing the boundaries (bottom, top) and the wind velocity of the i^{th} layer respectively.

The i^{th} line of the next Q lines consists of two integers p_i and e_i, representing the observed horizontal position and target landing horizontal position of the i^{th} rocket part respectively.

OUTPUT

Output Q lines.

On the i^{th} line, output the number of distinct h_0 where $l_1 \leq h_0 \leq r_M$ such that if the rocket part is initially located at (p_i, h_0), it will end up at $(e_i, 0)$.

SAMPLE TESTS

	Input	Output
1	5 6 4 1 2 -1 3 4 2 5 5 3 7 13 -2 15 17 3 20 20 -4 3 4 4 3 1 1 5 1	1 2 4 1

CONSTRAINTS

$1 \le N, M, Q \le 10^5$

$1 = l_1 \le r_1 < l_2 \le r_2 < \cdots < l_M \le r_M \le 10^9$

$-10^9 \le v_i \le 10^9$

$1 \le p_i, e_i \le N$

SUBTASKS

	Points	Constraints
1	8	$M = 1$
2	12	$1 \le M \le 100$ $l_i = r_i = i$
3	10	$1 \le N \le 100$ $l_i = r_i = i$
4	9	$l_i = r_i = i$
5	7	$p_i = e_i$
6	13	$1 \le v_i \le 10^9$
7	18	$-1 \le v_i \le 1$
8	23	No additional constraints