WC '18 Contest 4 S4 - Super Luigi Odyssey

Time limit: 3.0s **Memory limit:** 128M

Woburn Challenge 2018-19 Round 4 - Senior Division

Billy has been having a great time playing a demo of Nintendo's next highly-anticipated 3D platforming game, *Super Luigi Odyssey*.

One challenge in the game sees Luigi trapped in a long hallway, which can be represented as a number line with positions increasing towards the rightwards direction. There are N $(1 \leq N \leq 250\,000)$ platforms in it, with the i-th one at position P_i $(0 \leq P_i \leq 10^9)$ and at a height of H_i $(1 \leq H_i \leq 10^9)$ metres. No two platforms are at the same position. Luigi begins on platform 1 (note that this is not necessarily the leftmost platform).

Much to Luigi's concern, the hallway is filled with some deadly lava. Initially, the lava reaches up to a height of 0.5 metres. At any point, a platform is considered to be submerged in lava if the lava's height exceeds the platform's height.

A sequence of M $(1 \leq M \leq 250\,000)$ events will then occur, each having one of three possible types. The type of the i-th event is described by the integer E_i $(1 \leq E_i \leq 3)$.

- If $E_i = 1$, then the lava's height will increase by X_i $(-10^9 \leq X_i \leq 10^9)$ metres. It's guaranteed that this will not cause the lava's height to become negative. If this causes Luigi's current platform to become submerged, then he will immediately perish.
- If $E_i = 2$, then X_i $(1 \leq X_i \leq N)$ lasers in a row will be fired at Luigi. Each laser will force him to jump to the next non-submerged platform to the left of his current one. If there's no such platform, then he'll instead be forced to jump into the lava and perish.
- If $E_i = 3$, then similarly X_i $(1 \leq X_i \leq N)$ lasers in a row will be fired at Luigi, with each one forcing him to jump to the next non-submerged platform (if any) to the right rather than the left.

Luigi is not allowed to move between platforms aside from being forced to by type-2 or type-3 events.

Even if Billy manages to keep Luigi alive through all M events, he may not be out of the woods yet — his success in later challenges will depend on how much of Luigi's energy has been spent. Whenever Luigi jumps from platform i to platform j, he expends $|P_i - P_j|^K$ $(1 \leq K \leq 2)$ units of energy. Note that the amount of energy required doesn't depend on the platforms' relative heights.

Help Billy determine how much energy Luigi will expend throughout all M events (if he will even survive that long). As this may amount to quite a few units of energy, you only need to determine the total modulo $1\,000\,000\,007$.

Subtasks

In test cases worth $6/39$ of the points, $N \leq 2\,000$, $M \leq 2\,000$, and $K = 1$.
In test cases worth another $16/39$ of the points, $K = 1$.

Input Specification

The first line of input consists of three space-separated integers, N, M, and K.
N lines follow, the i-th of which consists of two space-separated integers, P_i and H_i, for $i = 1 \ldots N$.
M lines follow, the i-th of which consists of two space-separated integers, E_i and X_i, for $i = 1 \ldots M$.

Output Specification

Output a single integer, the total number of units of energy which Luigi will expend (modulo $1\,000\,000\,007$), or `-1` if he will be forced to touch the lava and perish at any point.

Sample Input 1

```
5 7 1
4 4
5 5
13 6
0 8
10 8
3 1
1 4
2 1
1 -1
3 4
1 2
2 2
```

Sample Output 1

```
32
```

Sample Input 2

```
2 2 2
0 2
1 1
1 1
3 1
```

Sample Output 2

```
-1
```

Sample Explanation

In the first case, Luigi will be forced to jump along the following sequence of positions:

- Event 1: $4 \to 5$
- Event 3: $5 \to 0$
- Event 5: $0 \to 4 \to 5 \to 10 \to 13$
- Event 7: $13 \to 10 \to 0$

In total, these jumps require 32 units of energy (which is equal to 32 modulo $1\,000\,000\,007$). If K were equal to 2 rather than 1, then 186 units of energy would be required instead.

In the second case, after the lava's height is raised to 1.5 metres, Luigi will have no non-submerged platform to jump to on his right, and so will be forced to jump into the lava and perish.