Cultivation

In 21XX, the residents of the IOI planet plan to immigrate to a recently discovered planet.

The new planet has a field, which is a rectangular grid with R rows and C columns. The columns are parallel to the south-north direction, and the rows are parallel to the east-west direction. The cell in the i-th row from north and the j-th column from west is called the cell (i, j). The north-west corner of the field is the cell $(1, 1)$, and the south-east corner is the cell (R, C). In each year, the residents of the IOI planet choose the direction of the wind blowing on the field. The direction is one of east, west, south, or north.

To engage in agriculture in the new planet, they will plant "JOI grasses" in all over the field in the new planet. In the spring of the first year of immigration, N cells in the field have JOI grasses.

The range of JOI grasses are expanded by the wind. Each summer, the seeds of JOI grasses are blown by the wind to the direction chosen by the residents of the IOI planet. The seeds move one cell to the direction of the wind, and they land on. If the seeds land on a cell of the field without JOI grasses, it will have JOI grasses in the spring of the next year. Once a cell has JOI grasses, it will keep JOI grasses in the future.

We want to calculate the minimum number of years until all the cells in the field have JOI grasses if we adjust the direction of the wind appropriately.

Task

Write a program which calculates the minimum number of years until all the cells in the field have JOI grasses if we adjust the direction of the wind appropriately.

Input

Read the following data from the standard input.

- The first line of input contains two space separated integers R, C. This means the field is a rectangular grid with R rows and C columns.
- The second line of input contains an integer N, the number of cells in the field which have JOI grasses in the spring of the first year of immigration.
- The i-th line ($1 \leq i \leq N$) of the following N lines contains two space separated integers S_i, E_i. This means the cell (S_i, E_i) has JOI grasses in the spring of the first year of immigration.

Output

Write one line to the standard output. The output contains the minimum number of years until all the cells in the field have JOI grasses if we adjust the direction of the wind appropriately.

Constraints

All input data satisfy the following conditions.

- $1 \leq N \leq 300$.
- $1 \leq R \leq 1\,000\,000\,000$.
- $1 \leq C \leq 1\,000\,000\,000$.
- $1 \leq S_i \leq R$ $(1 \leq i \leq N)$.
- $1 \leq E_i \leq C$ $(1 \leq i \leq N)$.
- In the spring of the first year of immigration, there is a cell in the field without JOI grasses.
- $(S_i, E_i) \neq (S_j, E_j)$ $(1 \leq i < j \leq N)$.

Subtask

There are 6 subtasks. The score and additional constraints of each subtask are as follows:

Subtask 1 [5 points]

- $R \leq 4$.
- $C \leq 4$.

Subtask 2 [10 points]

- $R \leq 40$.
- $C \leq 40$.

Subtask 3 [15 points]

- $R \leq 40$.

Subtask 4 [30 points]

- $N \leq 25$.

Subtask 5 [20 points]

- $N \leq 100$.

Subtask 6 [20 points]

There are no additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
3 4 3 1 2 1 4 2 3	3

In Sample Input 1, the following cells have JOI grasses in the spring of the first year of immigration.

	0		0
		0	

The field in the new planet; cells with '0' have JOI grasses in the spring of the first year of immigration.

In this sample input, if we choose the directions of the wind for the first 3 years are west, south, south, then all the cells will have JOI grasses in the spring after 3 years. The numbers in the following table describe when each cell has JOI grasses in the spring. This is the minimum number of years.

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

Sample Input 2	Sample Output 2
4 4 4 1 1 1 4 4 1 4 4	4

Port Facility

Many containers are transported by ships to the JOI Port every day. They are transported to all over the country by trucks.

The JOI Port is very narrow. It has only two areas where we can put containers. In each area, we can put any number of containers vertically.

For safety reasons, when a container is transported by a ship, we have to put it on one of the areas. If some containers are already put there, we have to put it on the top of them. When we transport a container by a truck, we have to take a container from the top of the containers on one of the areas.

Today, N containers will be transported to the JOI Port. All of them will be transported by trucks.

Your task is to manage the facilities of the JOI Port. For each container, you know when it will come and when it will leave. Write a program which calculates the number of ways to put and take containers modulo 1 000 000 007.

Task

Given the number of containers transported to the JOI Port and the time for each container to come and leave, write a program which calculates the number of ways to put and take containers satisfying the conditions modulo 1 000 000 007.

Input

Read the following data from the standard input.

- The first line of input contains an integer N, the number of containers transported to the JOI Port.
- The i-th line ($1 \leq i \leq N$) of the following N lines contains two space separated integers A_i, B_i. This means the i-th container will come to the JOI Port at time A_i, and leave the JOI Port by a truck at time B_i.

Output

Write one line to the standard output. The output contains the number of ways to put and take containers satisfying the conditions modulo 1 000 000 007.

Constraints

All input data satisfy the following conditions.

- $1 \leq N \leq 1\,000\,000$.
- $1 \leq A_i \leq 2N$ $(1 \leq i \leq N)$.
- $1 \leq B_i \leq 2N$ $(1 \leq i \leq N)$.
- $A_i < B_i$ $(1 \leq i \leq N)$.
- The $2N$ integers $A_1, \cdots, A_N, B_1, \cdots, B_N$ are different from each other.

Subtask

There are 4 subtasks. The score and additional constraints of each subtask are as follows:

Subtask 1 [10 points]

- $N \leq 20$.

Subtask 2 [12 points]

- $N \leq 2\,000$.

Subtask 3 [56 points]

- $N \leq 100\,000$.

Subtask 4 [22 points]

There are no additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
4 1 3 2 5 4 8 6 7	4

There are 4 ways to put and take containers. Denote the areas by A, B. The following ways to put containers satisfy the condition.

- Put $1, 2, 3, 4$-th container to the area A,B,A,A, respectively.
- Put $1, 2, 3, 4$-th container to the area A,B,A,B, respectively.
- Put $1, 2, 3, 4$-th container to the area B,A,B,A, respectively.
- Put $1, 2, 3, 4$-th container to the area B,A,B,B, respectively.

Sample Input 2	Sample Output 2
3 1 4 2 5 3 6	0

Sample Input 3	Sample Output 3
5 1 4 2 10 6 9 7 8 3 5	8

Sample Input 4	Sample Output 4
8 1 15 2 5 3 8 4 6 14 16 7 9 10 13 11 12	16

Sparklers

JOI-kun and his friends will play with sparklers. In total, there are N people including JOI-kun and his friends. If one sets fire to a sparkler, it keeps the fire for exactly T seconds.

In the beginning, JOI-kun and his friends are standing separately along a straight street running from east to west. JOI-kun and his friends are numbered from 1 to N. For each i, j with $i < j$, the i-th person is standing in the west of the j-th person, or the i-th person and the j-th person are standing in the same place. The distance from the i-th person to the westernmost person (i.e. the first person) is X_i meters. JOI-kun is the K-th person.

When they start to play with sparklers, they notice that the lighter does not have enough fuel. They can set fire to one sparkler only.

So, they decide to set fire to JOI-kun's sparkler first. Then, they will set fire to other sparklers by touching them to burning sparklers.

Since a sparkler keeps the fire for T seconds only, JOI-kun and his friends have to cooperate together to spread the fire to sparklers. When they set fire to a sparkler from a burning sparkler, the following conditions must be satisfied:

- They must touch a sparkler to a burning sparkler within T seconds after setting fire. They can do so after exactly T seconds have passed.
- The sparkler they are planning to set fire must not be burnt before.
- The person who has a burning sparkler and the person who has a sparkler without fire must be in the same place.

We ignore the amount of waiting time for setting fire from one sparkler to another.

Since JOI-kun and his friends are standing separately in the beginning, they have to move appropriately to spread the fire. They can run at any speed to the west or east. But, it is dangerous to run too fast when they are playing. Hence, they will make a rule that their speed must not exceed s meters per second. Here, s is a non-negative integer.

How should they set the speed limit to spread fire to all sparklers?

Task

Given the time a sparkler keeps fire and the initial positions of JOI-kun and his friends, write a program which calculates the minimum integer s so that they can spread fire to all sparklers if the speed limit is s meters per second.

Input

Read the following data from the standard input.

- The first line of input contains three space separated integers N, K, T. This means there are N people, JOI-kun is the K-th person, and a sparkler keeps the fire for T seconds.
- The i-th line ($1 \leq i \leq N$) of the following N lines contains an integer X_i. This means the distance from the i-th person to the westernmost person is X_i meters in the beginning.

Output

Write one line to the standard output. The output contains the minimum integer s so that they can spread fire to all sparklers if the speed limit is s meters per second.

Constraints

All input data satisfy the following conditions.

- $1 \leq K \leq N \leq 100\,000$.
- $1 \leq T \leq 1\,000\,000\,000$.
- $0 \leq X_i \leq 1\,000\,000\,000$ ($1 \leq i \leq N$).
- $X_1 = 0$.
- $X_i \leq X_j$ ($1 \leq i \leq j \leq N$).

Subtask

There are 3 subtasks. The score and additional constraints of each subtask are as follows:

Subtask 1 [30 points]

- $N \leq 20$.

Subtask 2 [20 points]

- $N \leq 1\,000$.

Subtask 3 [50 points]

There are no additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
3 2 50 0 200 300	2

In this sample input, the speed limit can be 2 meters per second.

The first person moves to the east, the second person moves to the west, and the third person moves to the west; their speed is 2 meters per second. After 50 seconds, the second person gives fire to the first person.

Then, the first person moves to the east, and the third person moves to the west; their speed is 2 meters per second. After 25 seconds, the first person gives fire to the third person.

If the speed limit is 1 meter per second, they can not spread fire to all sparklers.

Sample Input 2	Sample Output 2
3 2 10 0 200 300	8

In this sample input, the speed limit can be 8 meters per second.

The first person moves to the east, the second person moves to the east, and the third person moves to the west; their speed is 8 meters per second.

After 3 seconds, the second person stops moving. The first and third people keep moving.

After 6.5 more seconds, the second and third people come to the same place. But they do not spread fire. The second and third people stop moving. The first person keeps moving.

After 0.5 more second, the second person gives fire to the third person. The first person keeps moving. The third person moves to the west; his speed is 8 meters per second.

After 9 more seconds, the first and third people come to the same place. The third person gives fire to the first person.

If the speed limit is 7 meters per second, they can not spread fire to all sparklers.

Sample Input 3	Sample Output 3
20 6 1 0 2 13 27 35 46 63 74 80 88 100 101 109 110 119 138 139 154 172 192	6