Problem C. Maze

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	256 megabytes

As the title implies, your task in this problem is related to maze, specifically a 2D maze of $\mathbf{N}$ rows and $\mathbf{M}$ columns ($\mathbf{N} \leq \mathbf{M}$), where rows are numbered from 1 to $\mathbf{N}$ from top to bottom, and columns are numbered from 1 to $\mathbf{M}$ from left to right. The cell at the i-th row and the j-th column is denoted by (i, j).

The maze has only one entry which is at $(1, 1)$ and only one exit which is at $(\mathbf{N}, \mathbf{M})$. To simplify things, you are only allowed to move right or down at any step. There might be cells with obstacle which cannot be visited, and there might be cells with treasure which must be visited.

In this problem, you are requested to count the number of valid paths from the starting location to the ending location.

There are $\mathbf{S}$ cells with treasure. The valid path should visit all cells with treasure.

The following cells with obstacle, the valid path cannot visit any cell with obstacle.

- all cells (x, y) meet $x > y$,
- all cells (x, y) meet $\mathbf{M} + x < \mathbf{N} + y$,
- and there are $\mathbf{K}$ additional cells with obstacle.

Input

The first line of the input gives the number of test case, $\mathbf{T}$ ($1 \leq \mathbf{T} \leq 10$). $\mathbf{T}$ test cases follow.

Each test case consists of one line with four integers $\mathbf{N}$, $\mathbf{M}$, $\mathbf{S}$, and $\mathbf{K}$ as described above. ($1 \leq \mathbf{N} \leq \mathbf{M} \leq 100000$, $0 \leq \mathbf{S} \leq 10$, $0 \leq K \leq 20$)

Then, $\mathbf{S}$ lines follow. Each line consists of 2 integers x and y, indicating the cells with treasure in the maze. ($1 \leq x \leq \mathbf{N}$, $1 \leq y \leq \mathbf{M}$, $x \leq y$, $\mathbf{M} + x \geq \mathbf{N} + y$) (no two cells are in the same position)

After that, there are $\mathbf{K}$ lines. Each line consists of 2 integers x and y, indicating the cells with obstacle in the maze. ($1 \leq x \leq \mathbf{N}$, $1 \leq y \leq \mathbf{M}$, $x \leq y$, $\mathbf{M} + x \geq \mathbf{N} + y$) (no two cells are in the same position)

Output

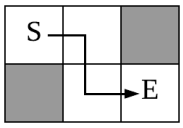
For each test case, output one line containing "Case #x: y", where x is the test case number (starting from 1) and y is the number of valid paths module 1,000,000,007 ($10^9 + 7$).

Example

standard input	standard output
2 2 3 0 0 3 6 1 1 2 4 1 3	Case #1: 1 Case #2: 2

Note

In Sample Case #1, one valid path are:



In Sample Case #2, two valid paths are: