

# Chairs

time limit per test: 1 second (3 seconds for Python)  
memory limit per test: 256 megabytes  
input: standard input  
output: standard output  
points: 100 · problem code: chairs

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Ian is in his FIT2004 class, and wants to ask the TA for help to solve a 67-dimensional dynamic programming problem. The classroom can be modelled as an  $n \times m$  rectangle, with the bottom left located at  $(1, 1)$ , and the top right located at  $(n, m)$ . Note that coordinates along the edge of the rectangle are inside the classroom.

Unfortunately there are  $k$  chairs blocking his way, located at distinct coordinates.

Ian, from any coordinate  $(c_1, c_2)$ , can move to any adjacent coordinate **inside** the classroom:

- $(c_1 + 1, c_2)$
- $(c_1 - 1, c_2)$
- $(c_1, c_2 + 1)$
- $(c_1, c_2 - 1)$

When moving, Ian has a set of specific interactions:

- Step from the ground onto the top of the chair, which requires 1 unit of energy.
- Step from a chair onto the ground, which requires 1 unit of energy.
- Step from a chair onto a chair, which does not require energy.
- Step from the ground onto the ground, which does not require energy.

All interactions take 1 second of time.

Ian is currently at position  $(a, b)$ , and the TA is located at position  $(c, d)$ .

Since Ian values his time and energy, he would like to know the minimum energy he must use to reach the TA in at most  $t$  seconds.

## Input

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The first line contains  $n, m$ .

The next line contains  $a, b, c, d, k, t$ .

The next  $k$  lines each contain  $(x_i, y_i)$ , the coordinates of the  $i$ -th chair.

## Output

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Output a single number, the minimum energy that Ian must use to move from  $(a, b)$  to  $(c, d)$  in at most  $t$  seconds, or  $-1$  if Ian cannot reach the TA in time.

## Constraints

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- $3 \leq n \cdot m \leq 10^3$
- $1 \leq a, c \leq n$
- $1 \leq b, d \leq m$
- $0 \leq k \leq n \cdot m - 2$
- $(x_i, y_i) \neq (a, b)$
- $(x_i, y_i) \neq (c, d)$
- $(x_i, y_i)$  are **distinct**
- $1 \leq t \leq 10^4$

## Example 1

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### Input

```
3 3
1 1 3 3 3 5
1 2
2 2
3 2
```

### Output

```
2
```

### Explanation

Ian can take the path  $(1, 1) \rightarrow (2, 1) \rightarrow (2, 2) \rightarrow (2, 3) \rightarrow (3, 3)$ .

Moving from  $(2, 1) \rightarrow (2, 2)$  requires stepping from the ground onto a chair, which uses 1 energy.

Moving from  $(2, 2) \rightarrow (2, 3)$  requires stepping from a chair onto the ground, which uses 1 energy.

In total, Ian uses  $1 + 1 = 2$  energy, and reaches the TA within 5 seconds.

It can be shown that this path minimises Ian's energy usage.

## Example 2

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### Input

```
3 3
1 1 1 3 2 6
1 2
2 2
```

### Output

```
0
```

## Example 3

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### Input

```
3 3
1 1 3 3 7 4
1 2
1 3
2 1
2 2
2 3
3 1
3 2
```

### Output

```
2
```