

2520 Holedox Moving

During winter, the most hungry and severe time, Holedox sleeps in its lair. When spring comes, Holedox wakes up, moves to the exit of its lair, comes out, and begins its new life.

Holedox is a special snake, but its body is not very long. Its lair is like a maze and can be imagined as a rectangle with $n \times m$ squares. Each square is either a stone or a vacant place, and only vacant places allow Holedox to move in. Using ordered pair of row and column number of the lair, the square of exit located at (1,1).

Holedox's body, whose length is L , can be represented block by block. And let $B_1(r_1, c_1) B_2(r_2, c_2) \dots B_L(r_L, c_L)$ denote its L length body, where B_i is adjacent to B_{i+1} in the lair for $1 \leq i \leq L - 1$, and B_1 is its head, B_L is its tail.

To move in the lair, Holedox chooses an adjacent vacant square of its head, which is neither a stone nor occupied by its body. Then it moves the head into the vacant square, and at the same time, each other block of its body is moved into the square occupied by the corresponding previous block.

For example, in the Figure 2, at the beginning the body of Holedox can be represented as $B_1(4,1)B_2(4,2)B_3(3,2)B_4(3,1)$. During the next step, observing that $B'_1(5,1)$ is the only square that the head can be moved into, Holedox moves its head into $B'_1(5,1)$, then moves B_2 into B_1 , B_3 into B_2 , and B_4 into B_3 . Thus after one step, the body of Holedox locates in $B_1(5,1)B_2(4,1)B_3(4,2)B_4(3,2)$ (see the Figure 3).

Given the map of the lair and the original location of each block of Holedox's body, your task is to write a program to tell the minimal number of steps that Holedox has to take to move its head to reach the square of exit (1,1).

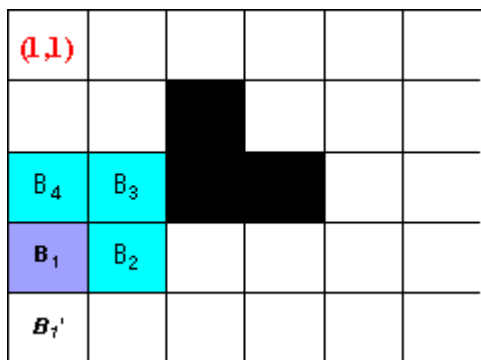


Figure 2: Sample Input

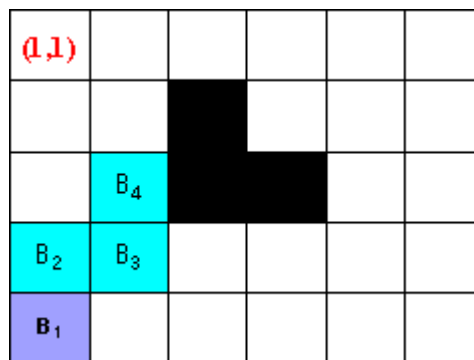


Figure 3: After one step from Figure 2

Input

The input consists of several test cases. The first line of each case contains three integers n , m ($1 \leq n, m \leq 20$) and L ($2 \leq L \leq 8$), representing the number of rows in the lair, the number of columns in the lair and the body length of Holedox, respectively. The next L lines contain a pair of row and column number each, indicating the original position of each block of Holedox's body, from $B_1(r_1, c_1)$ to $B_L(r_L, c_L)$ orderly, where $1 \leq r_i \leq n$, and $1 \leq c_i \leq m$, $1 \leq i \leq L$. The next line contains an integer K , representing the number of squares of stones in the lair. The following K lines contain a pair of row and column number each, indicating the location of each square of stone. Then a blank line follows to separate the cases.

The input is terminated by a line with three zeros.

Note: B_i is always adjacent to B_{i+1} ($1 \leq i \leq L - 1$) and exit square (1,1) will never be a stone.

Output

For each test case output one line containing the test case number followed by the minimal number of steps Holedox has to take. '-1' means no solution for that case.

Note: In the sample case below, the head of Holedox can follow $(4, 1) \rightarrow (5, 1) \rightarrow (5, 2) \rightarrow (5, 3) \rightarrow (4, 3) \rightarrow (4, 2) \rightarrow (4, 1) \rightarrow (3, 1) \rightarrow (2, 1) \rightarrow (1, 1)$ to reach the square of exit with minimal number of step, which is nine.

Sample Input

```
5 6 4
4 1
4 2
3 2
3 1
3
2 3
3 3
3 4
```

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

```
0 0 0
```

Sample Output

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Case 1: 9
Case 2: -1
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