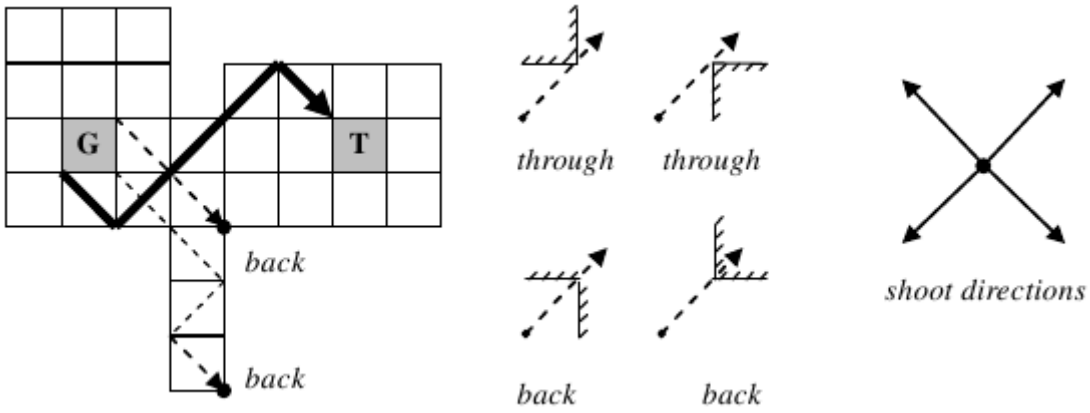
4029 Shoot Your Gun!

There are two rectangular polygons (simple polygons with interior angles of only 90 or 270 degrees) G and T, inside another rectangular polygon M. You can place a gun ***anywhere*** on the boundary of G, then shoot a bullet in one of four diagonal directions, and then touch the boundary of T. You may shoot across an edge of T, but touching only a corner is also allowed. Your bullet is not allowed to touch G again (even touching a corner of G is ***not*** allowed), before touching T.



The edges of M can reflect the bullet. When the bullet touches a vertex of M, it may simply go through it (and not regarded as a reflection), or go back. These special cases are shown in the figure above.

Write a program to find the minimal number of reflections needed from G to T.

Input

The input contains several test cases. The first line of each case contains three positive integers n_G, n_T, n_M ($4 \le n_G, n_T, n_M \le 50$). The next line contains n_G pairs of integers, the coordinates (non-negative integers not greater than 4000) of the vertices of G, in counter-clockwise order. The next two lines describe polygon T and M, in the same format. It is guaranteed that G and T are outside each other (their boundaries will not touch), and are both inside M (they do not touch the boundary of M). The last test case is followed by a single zero, which should not be processed.

Output

For each test case, print the case number and the minimal number of reflections to touch T. If it's impossible, output '`-1`'.

Sample Input

```
4 4 12
1 4 2 4 2 5 1 5
6 4 7 4 7 5 6 5
0 3 3 3 3 0 4 0 4 3 8 3 8 6 4 6 4 5 3 5 3 7 0 7
4 4 4
1 1 2 1 2 2 1 2
```

```
3 1 4 1 4 2 3 2
0 0 5 0 5 3 0 3
4 4 4
1 1 2 1 2 2 1 2
6 1 7 1 7 2 6 2
0 0 8 0 8 3 0 3
0
```

Sample Output

```
Case 1: 2
Case 2: 0
Case 3: 1
```