Problem 109: Hide Your Spies

Difficulty: Hard

Author: Wojciech Kozioł, Mielec, Poland
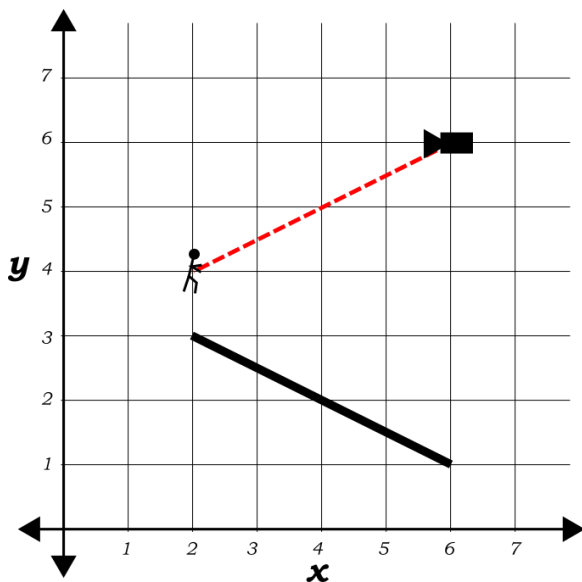
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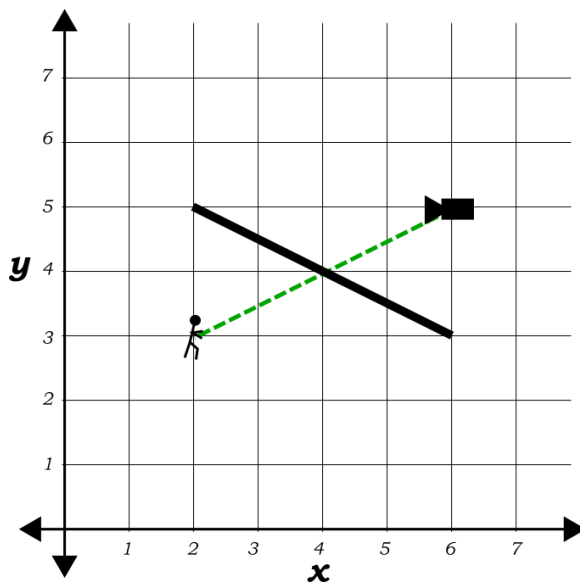
Problem Background

You're working with an intelligence agency to guide a spy through a secret enemy installation. The enemy has cameras positioned throughout the building with a 360° field of view; if your spy is caught on camera, the mission will fail! Fortunately, there are a number of walls blocking the view of the cameras that your spy can hide behind. You need to be able to determine if your spies will be seen based on the position of the cameras, spies, and the walls in the room.

Problem Description

Your mission, should you choose to accept it, is to determine if there is a clear line of sight from a camera at a given set of (x, y) coordinates to a spy located at a different set of coordinates. Several walls will be positioned throughout the room; if a wall intersects a line drawn between the camera and the spy, the spy is hidden and avoids detection. You must write a program that checks if the spy is successfully hidden and reports if he has been detected or not.

The wall's line doesn't intersect the line between the spy and the camera. The spy is detected!

The wall is between the camera and the spy, intersecting that line. The spy remains hidden.

To determine if two lines intersect, you'll need to locate the point at which the lines would intersect if they were continued infinitely in both directions. Remember that a (non-vertical) line can be defined using the equation

$$y = ax + c$$

a is known as the "slope" of the line, and can be calculated from any two points (x_1, y_1) and (x_2, y_2) as follows:

$$a = \frac{y_2 - y_1}{x_2 - x_1}$$

(If $x_2 - x_1 = 0$, then a is undefined, and the line is vertical.) Once you know a, you can calculate c using it and the (x, y) coordinates of one of the points on the line:

$$c = y - ax$$

Complete this process for the two lines you're trying to check for intersection to obtain both of their line equations. You can then use both equations to calculate the (x, y) point at which the lines would intersect. If this point is within the bounds of the points you already knew about, then the wall is blocking the camera's line of sight!

Sample Input

The first line of your program's input, received from the standard input channel, will contain a positive integer representing the number of test cases. Each test case will include the following lines of input:

- A line containing five integers separated by spaces, representing the following information, in order:
    - The X-coordinate of the spy within the current room
    - The Y-coordinate of the spy within the current room
    - The X-coordinate of the camera within the current room
    - The Y-coordinate of the camera within the current room
    - The number of walls in the current room, W
- W lines containing four integers separated by spaces, each line representing information about a wall within the room:
    - The X-coordinate of the start of the wall
    - The Y-coordinate of the start of the wall
    - The X-coordinate of the end of the wall
    - The Y-coordinate of the end of the wall

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

Sample Output

For each test case, your program must output a single line containing either the word "YES" (indicating that the spy was seen by the camera) or "NO" (if the spy evaded detection).

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YES
NO
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