Problem Set 4 Exercise #18: Lines

Reference: Lecture 11 notes

Learning objectives: Array of structures; Sorting

Estimated completion time: 45 minutes

Problem statement:

You are given a list of points on a 2-dimensional plane, each point represented by its x- and y-coordinates. You are to sort the points in ascending order of their x-coordinates, and for those with the same x-coordinate, in ascending order of their y-coordinates.

Write a program **lines.c** that defines a structure type **`point_t`** whose members are the *x*- and *y*-coordinates (integers) of a point.

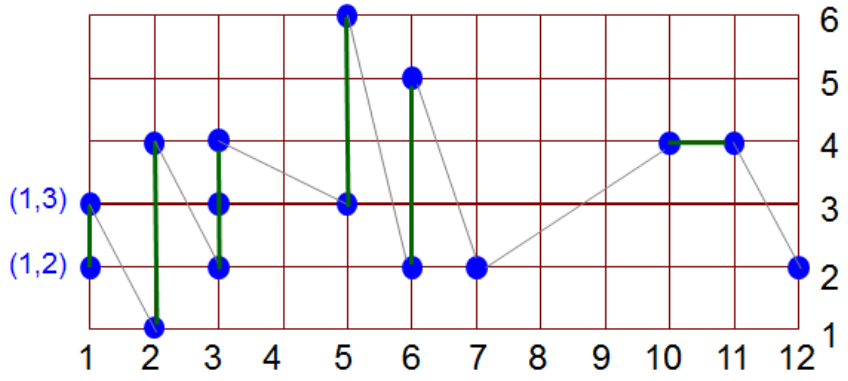
Your program should include a function **`read_points()`** to read the number of points and points' data into an array of points, and return the number of points read.

You may assume that there are at most 20 points and no two points are identical.

Write a function **`sort_points()`** to sort all points according to the criteria given above.

After sorting the points, imagine that you trace the points in their order in the sorted array. Write a function **`trace_lines()`** to compute the sum of the lengths of those lines that are either horizontal or vertical.

For example, for sample run #1 below, , here are the points after sorting: (1,2), (1,3), (2,1), (2,4), (3,2), (3,3), (3,4), (5,3), (5,6), (6,2), (6,5), (7,2), (10,4), (11,4), (12,2). The diagram below shows the tracing of the points. The vertical and horizontal lines are marked in green. The sum of lengths of horizontal and vertical lines is 13.



Sum of lengths of horizontal and vertical lines = 1 + 3 + 2 + 3 + 3 + 1 = 13

Sample run #1:

```
Enter the number of points: 15
Enter x- and y-coordinates of 15 points:
5 3
2 4
11 4
3 2
1 2
10 4
3 4
6 5
5 6
3 3
1 3
6 2
12 2
7 2
2 1
After sort:
Point # 0: (1,2)
Point # 1: (1,3)
Point # 2: (2,1)
Point # 3: (2,4)
Point # 4: (3,2)
Point # 5: (3,3)
Point # 6: (3,4)
Point # 7: (5,3)
Point # 8: (5,6)
Point # 9: (6,2)
Point #10: (6,5)
Point #11: (7,2)
Point #12: (10,4)
Point #13: (11,4)
Point #14: (12,2)
Sum of lengths of vertical and horizontal lines = 13
```

Sample run #2:

```
Enter the number of points: 3
Enter x- and y-coordinates of 3 points:
-10 -5
-5 3
7 -4
After sort:
Point # 0: (-10,-5)
Point # 1: (-5,3)
Point # 2: (7,-4)
Sum of lengths of vertical and horizontal lines = 0
```