

**Computational Geometry****Exercise Set 7****HS07**URL: <http://www.ti.inf.ethz.ch/ew/courses/CG07/>**Exercise 1 (10 points)**

Let  $P = (p_0, \dots, p_{n-1})$  be a sequence of  $n$  points in  $\mathbb{R}^2$ . Someone claims that you can check by means of the following algorithm whether or not  $P$  describes the boundary of a convex polygon in counter clockwise order:

```
bool is_convex( $p_0, \dots, p_{n-1}$ ) {  
    for (int  $i = 0$ ;  $i <= n - 1$ ;  $i = i + 1$ )  
        if (rightturn( $p_i, p_{(i+1) \bmod n}, p_{(i+2) \bmod n}$ ))  
            return false;  
    return true;  
}
```

Disprove his claim and describe a correct algorithm for the solution of the problem.

**Exercise 2 (10 points)**

Let  $S$  be a set of  $n$  segments that are either horizontal or vertical. Describe an  $O(n \log n)$  time and  $O(n)$  space algorithm that counts the number of pairs in  $\binom{S}{2}$  that intersect.

**Exercise 3 (10 points)**

You are given  $n$  axis-parallel rectangles in  $\mathbb{R}^2$  with their bottom sides lying on the  $x$ -axis. Construct their union in  $O(n \log n)$  time.