

Summer Term 2021

## Assignment on Computational Geometry - Sheet 4

Due Date 12. 07. 2021

Due by 12. 07. 2021 via email to [weller@informatik.uni-bremen.de](mailto:weller@informatik.uni-bremen.de)

### Exercise 1 (Convex Sets, 5 Credits)

Show that a convex set  $K$  and a line can intersect in at most one contiguous interval. In other words, the border of  $K$  and the line can have at most 1 or 2 intersection points. (In the case of 1 intersection point, the line is called a *tangent*.)

### Exercise 2 (Convex Hulls, 5 Credits)

Provide a non-inductive proof that the convex hull  $CH(P)$  over a finite set  $P$  of points in  $\mathbb{R}^2$  has a subset of  $P$  as vertices. Hint: you could use the fact that the intersection of convex sets is convex, and you could try to find a suitable set of convex sets, the intersection of which yields  $CH(P)$ .

### Exercise 3 (Graham's Scan, 5 Credits)

Show that the algorithm *Graham's Scan* can handle input points with equal x-coordinate without any changes. Which case needs special treatment?

### Exercise 4 (Clarkson-Shoe Algorithm, 5 Credits)

Given an edge  $e$  with adjacent triangles  $f_1$  and  $f_2$ . Give the geometric predicate for  $e$  being a silhouette edge with respect to some point  $p_r$ . (One of the geometric predicate needed in the Clarkson-Shoe algorithm.)