Discrete and Computational Geometry Winter term 2016/2017
Exercise Sheet 10
University Bonn, Institute of Computer Science I

Deadline: Tuesday 17.1.2016, until 12:00 Uhr | Discussion: 23.01. - 27.01.

- *Please give your solutions directly to the tutor or put them in the postbox at LBH next to E.01 until the deadline. Write your names well visible and readable on the first page. If your solutions consists of multiple pages, make sure they are well connected.*
- *It is possible to submit in groups of up to three people.*

Aufgabe 1: Minkowski Sum (Recap) (4 Points)

Let A and B be bounded, convex sets. Prove that the Minkowski sum $A \oplus B$ is convex and bounded, too.

Aufgabe 2: Sweep for Union of convex sets (4 Points)

It was mentioned in the lecture, that you can construct the union of m convex sets in $O(m \log^2 m)$ time using a combination of *Divide & Conquer* and *Sweep*.

Work out the details of the merge step: Describe a Sweep algorithm that computes the union of two bounded sets A and B where, A and B are themselves the unions of convex sets.

Aufgabe 3: Convexity and disjointness of robot obstacles (4 Points)

In the lecture we used a variation of the following argument:

Let P_i and P_j be convex, disjoint polygonal obstacles and R be a convex, polygonal robot. Then $P_i \oplus (-R)$ and $P_j \oplus (-R)$ have exactly two shared outer tangents and therefore at most 2 edge intersections.

Now show, that convexity and disjointness are necessary by giving examples for the following:

a) Disjoint, but not convex P_i and P_j for some R, such that $P_i \oplus (-R)$ and $P_j \oplus (-R)$ have more than 2 edge intersections (but not necessarily more than two shared outer tangents).

b) Convex, but not disjoint P_i and P_j for some R, such that $P_i \oplus (-R)$ and $P_j \oplus (-R)$ have more than 2 edge intersections.