Discrete and Computational Geometry Winter term 2016/2017
Exercise Sheet 02
University Bonn, Institute of Computer Science I

Deadline: Thursday 03.11.2016, until 12:00 Uhr Discussion: 7.11. - 11.11.

- *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 there are well connected.*
- *It is possible to submit in groups of up to three people.*

Aufgabe 1: Closest Pairs in Spanners (4 Punkte)

Let S denote a finite point set in $\mathbb{R}^d$. Let $1 < t \leq 2$ and let $G = (S, E)$ be a t-spanner with vertex set S and edge set E.

a) Show that for at least one closest pair v, w in S the edge $\{v, w\}$ belongs to E. Furthermore, if $t < 2$, this is even true for all closest pairs.

b) Let p be a nearest neighbor of q in S. Does this imply that $\{p, q\}$ belongs to E?

Aufgabe 2: Packing Argument Variation (4 Punkte)

Let $0 < l \leq L \leq 1$.

How many disjunct axis-parallel boxes $[a_1, b_1] \times [a_2, b_2] \times ... \times [a_d, b_d]$, with $\min_i |b_i - a_i| \geq l$ and $\max_i |b_i - a_i| \leq L$ can intersect the hyper unit cube $[0, 1]^d$?

Aufgabe 3: Spanner computation (4 Punkte)

Consider the point set given below.

Construct a spanning tree for the point set below, which total edge length is at most 5 times as big as the MST.

Tip: Use the connection between WSPD, spanners and $(1+\varepsilon)$-approximation of MST proven in the lecture to choose an appropriate separation constant s and construct a WSPD.