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Universität Paderborn

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Randomized Algorithms

SS 2018

Homework Assignment 10

Problem 27:
In the shortest pairwise distance problem we are given a set of points V in the 2-dimensional Euclidean space and the problem is to find the pair of points of shortest Euclidean distance in V. Show that this is an LP-type problem and determine its combinatorial dimension.

Problem 28:
In the largest included rectangle problem we are given an arbitrary polygon P in a 2-dimensional Euclidean space that is specified by a sequence of corners $V_P = \{v_1, \ldots, v_n\}$ and the goal is to find a rectangle of largest volume that can be placed inside of P. Show that this is an LP-type problem and determine its combinatorial dimension.

Problem 29:
Consider any integer linear program P with objective function $f(x) = c^T \cdot x$ and constraints $Ax \leq b$ that has a finite number of solutions. Let $\#P$ be the problem of counting the number of feasible solutions for P, i.e., the number of vectors $x \in \mathbb{Z}^n$ that satisfy $Ax \leq b$. Show that if $\#P$ can be solved in polynomial time then the optimal solution of P can be found in polynomial time.

Problem 30:
Prove Theorem 8.3.