Eidgenössische Technische Hochschule Zürich
Ecole polytechnique fédérale de Zurich
Politecnico federale di Zurigo
Swiss Federal Institute of Technology Zurich

Institute for Theoretical Computer Science
Dr. B. Gärtner, Dr. M. Hoffmann and Tobias Christ

22.10.2008

Computational Geometry — Exercise Set 6 — HS09

URL: http://www.ti.inf.ethz.ch/ew/courses/CG09/

Exercise 1

Design and analyze a sorting algorithm based on randomized incremental construction in configuration spaces. The input is a set S of numbers, and the output should be the sorted sequence (in increasing order).

a) Define an appropriate configuration space for the problem! In particular, the set of active configurations w.r.t. S should represent the desired sorted sequence.

b) Provide an efficient implementation of the incremental construction algorithm. "Efficient" means that the runtime of the algorithm is asymptotically dominated by the number of conflicts.

c) What is the expected number of conflicts (and thus the asymptotic runtime of your sorting algorithm) for a set S of n numbers?

Exercise 2

You are given

- a star-shaped polygon $P \subset \mathbb{R}^2$, represented as a doubly connected list of its vertices $V(P)$,
- and a point $c \in P$ (not necessarily in $V(P)$), such that for all $p \in P$ the line segment $\overline{cp}$ is contained in P.

Describe an algorithm which triangulates P in linear time. The algorithm could for example output all edges of the triangulation, that are not already edges of the polygon.