Dr. Ulf-Peter Schroeder

Paderborn, 3. Mai 2017
Abgabe: Keine!

Übungen zur Vorlesung

Methoden des Algorithmenentwurfs

SS 2017

Blatt 2

Aufgabe 4:
You're consulting for a small computation-intensive investment company, and they have the following type of problem that they want to solve over and over. A typical instance of the problem is the following. They're doing a simulation in which they look at n consecutive days of a given stock, at some point in the past. Let's number the days $i = 1, 2, \ldots, n$; for each day i, they have a price $p(i)$ per share for the stock on that day. (We'll assume for simplicity that the price was fixed during each day.) Suppose during this time period, they wanted to buy 1000 shares on some day and sell all these shares on some (later) day. They want to know: When should they have bought and when should they have sold in order to have made as much money as possible? (If there was no way to make money during the n days, you should report this instead.) Show how to find the correct numbers i and j in time $O(n \log n)$ by a Divide&Conquer approach. For simplicity you can assume that $n = 2^k$ for some $k \in \mathbb{N}$.

Aufgabe 5:
Professor Smothers claims that there is a scheme that allows the closest-pair algorithm to check only 7 (instead of 12) points following each point s_i in the sorted list of points in the 2δ-strip. Try to prove this fact.

Aufgabe 6:
The convex hull of a set of points P in the plane is the smallest convex polygon CH for which each point in P is either on the boundary of CH or in its interior. A k-vertex polygon $Poly$ is represented by the sequence $(p_0, p_1, \ldots, p_{k-1})$ of its vertices in order of their appearance on the boundary of $Poly$. Develop a Divide&Conquer method to compute the convex hull CH of P in $O(n \log n)$, where $n = |P|$.