Homework 4

Notes on Algorithm

March 20, 2012

We describe here for our reference an algorithm we discused in class for the following problem: Given a set P of n points, find, for each point $q \in P$, its closest point in $P \setminus \{q\}$. The following algorithm assumes that $P = \{p_1, \ldots, p_n\}$ is input in increasing order of x-coordinate. It is moderately clever in avoiding inspecting certain pairs of points. Let $d(p, q)$ denote the Euclidean distance between points p and q. The algorithm stores the the nearest point to p_i in nearest$[i]$.

Algorithm 1 All-Nearest(P)

for all $i \in \{1, \ldots, n-1\}$ **do**
    nearest$[i] \leftarrow p_{i+1}$
    for all $j \in \{i+2, \ldots, n\}$ **do**
        if $p_j.x - p_i.x > d(p_i, \text{nearest}[i])$, break;
        if $d(p_i, p_j) < d(p_i, \text{nearest}[i])$, nearest$[i] \leftarrow p_j$.
    for all $j \in \{i-1, \ldots, 1\}$ **do**
        if $p_i.x - p_j.x > d(p_i, \text{nearest}[i])$, break;
        if $d(p_i, p_j) < d(p_i, \text{nearest}[i])$, nearest$[i] \leftarrow p_j$.
(For brevity, the computation of nearest$[n]$ is omitted.)