**CMPT 813**
**Homework 2**
Date due September 29, 2011

1. Problem from the text
   (a) (Convex hull) Problem 1.3, 1.10
2. Given a convex polygon $P$ as an array of $n$ vertices in sorted order along the boundary. Show that the following problems can be solved in $O(logn)$ time.
   (a) Given a query point $q$ determine the two bridge points of $P$ from $q$ if they exist.
   (b) Given a query line $h$ determine the intersection points of $h$ with $P$.
3. Convex Hulls
   (a) Given a set $S$ of $n$ points in the plane, its "onion peeling" consists of a sequence $H_1, ..., H_k$ of convex polygons, where $H_i$ is the convex hull $S - \{H_1 \cup H_2 \cup \ldots H_{i-1}\}$. Give an $O(n^2)$ algorithm to find the onion peeling of a set of n points.
   This is easy using results from class. There is an $O(nlogn)$ algorithm due to Chazelle.
   (b) Give an $O(nlogn)$ algorithm to find, given a set of n points in the plane, a smallest width strip, determined by a pair of parallel lines, that contains the point set.
4. Consider a simple polygon $P$ given by a sequence of vertices $\{p_1, p_2, \ldots, p_n\}$. A point $w$ on the boundary of $P$ is visible from $(*, \infty)$ if a vertical bullet shot upwards from $w$ does not intersect the boundary of $P$. Describe an $O(n)$ algorithm to compute all the points of the polygon that are visible from $(*, \infty)$.
5. We say a point $p$ dominates a point $q$ if $q_x > p_x$ and $q_y > p_y$. Given a set $S$ of $n$ distinct points, we are interested in identifying all the points of $S$, say $M$, which are not dominated by any other points of $S$. $M$ is called the maximal set of $S$. Show that $M$ can be computed in $O(nlog|M|)$. Even though Chan's convex hull algorithm can be used here, a divide-and-conquer like approach would be more appropriate.