CS 763, Fall 2016 due Tuesday October 18

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ASSIGNMENT 3

1. Given a set S of points in the plane, its "onion peeling" consists of a sequence $H_1, \ldots, H_k$ of convex polygons, where H_1 is the convex hull of S, H_2 is the convex hull of S with the points of H_1 removed, etc. Draw yourself a picture. The onion peeling of a set of points can easily be found in $O(n^2)$ time using some of the convex hull algorithms from class.
   (i) Give an $O(n^2)$ time algorithm using the incremental method of adding points by x-order.
   (ii) Give an $O(n^2)$ time algorithm using gift-wrapping (Jarvis's algorithm).
   (iii) Is it easy to use Graham's algorithm to get an $O(n^2)$ time algorithm?
   In all cases, your answers may be brief. [Extra information not needed for this assignment: There is an $O(n \log n)$ time algorithm due to Chazelle.]

2. Consider the following randomized algorithm to find the minimum of n distinct integers. Take a random order $x_1, \ldots, x_n$ of the input numbers. Set $m = \infty$. For $i = 1 \ldots n$, if $x_i < m$ then update m to x_i.
   Use backwards analysis to argue that the expected number of times you update m is $O(\log n)$. (You may use without proof the fact that the Harmonic numbers grow as $O(\log n)$.)