Algorithms, Winter 2010-11, Bonus Problems 1
due Monday 01/17/11, 4pm

Problem 1

Prove that any comparison-based convex hull algorithm needs to make $\Omega(n \log n)$ steps. (Recall that an algorithm is comparison-based if its `if`-statements use comparisons, for example comparing angles of two lines to find which angle is smaller, or comparing an angle with 180 degrees to see if the angle is obtuse.)

Problem 2

Read the description of Problem 2 from Homework 2. Imagine the DVD stacks are arranged in a circle, not a line. In other words, on the right of stack n is stack 1. Design an algorithm for this problem that is faster than $O(n^2)$. Sketch the proof of correctness of your algorithm and estimate its running time.

Problem 3

We are given an array A with n elements and a number C. Assume that the sum of the elements in A is larger than C. We would like to compute the smallest number of elements from A whose sum is at least C. (For example, if $A = [8, 3, 9, 2, 7, 1, 5]$ and $C = 18$ then the answer is 3.) Design an $O(n)$ algorithm for this problem and argue its correctness and running time.