CS180 Homework 7

Due: 4:00pm, 05/18/2016

1. Suppose $A[1..n]$ is an array of n distinct integers. Each integer $A[i]$ could be positive, negative, or zero. Find a contiguous subarray which has the largest sum. For example, if the $A = [-2, 1, -3, 4, -1, 2, 1, -5, 4]$, then the contiguous subarray with the largest sum is $4, -1, 2, 1$, with sum 6. Design a recursive and an iterative algorithm runs in $O(n)$ time. (Hint: use induction)

2. Given n numbers, find the maximum and the second maximum in about $n + \log n$ steps. (Fact: if the range of the numbers is unbounded, the only thing you can do is using comparison. Therefore, you can't use radix sort here)

3. The Element Uniqueness problem is to determine whether all elements in an array are distinct. If you are only allowed to use comparison, the problem will need at least $O(n \log n)$ time. Based on this fact, prove that there is no algorithm for closest pair problem less than $O(n \log n)$ time if the points are not from a bounded domain (see comment in problem 2), because then you'll be able to answer the Element Uniqueness problem in less than $O(n \log n)$ time, also called $o(n \log n)$- little O of $n \log n$, i.e. function whose asymptotic grows slower than a rate of a constant from $n \log n$, e.g., $n\sqrt{\log n}$.

4. Design a convex hull algorithm in $O(n \log n)$ time using divide and conquer.

★ Homework assignments are **STRICTLY** due on the exact time indicated. Please submit a hard copy of your homework solution with your **Name**, **Bruin ID**, **Discussion Number**, clearly indicated on the first page. If your homework consists of multiple pages, please **staple** them together. Email attachments or other electronic delivery methods are not acceptable.

★ We recommend to use LaTeX, LyX or other word processing software for submitting the homework. This is not a requirement but it helps us to grade the homework and give feedback. For grading, we will take into account both the correctness and the clarity. Your answer are supposed to be in a simple and understandable manner. Sloppy answers are expected to receiver fewer points.

★ Unless specified, you should justify your algorithm with proof of correctness and time complexity.