CpSc 8400: Design and Analysis of Algorithms

Instructor: Dr. Brian Dean — Spring 2016
Webpage: `http://www.cs.clemson.edu/~bcdean/` — TTh 12:30-1:45
Handout 6: Homework #3, Due Thursday 2/11/13 — McAdams 119

Some of the questions in this assignment ask you to "describe" an algorithm. You should generally do this in a clear, concise fashion in English, although you can also use pseudocode *if this adds clarity to your presentation*. Diagrams are also recommended if they help to clarify the operation of your algorithm. Any time you describe an algorithm, you should also say a few words about why it is correct (especially if this involves subtle or non-obvious observations) and also analyze its running time. Your write-ups generally do not need to be too lengthy as long as all the important details are present. Don't forget that typesetting is required, and do not forget to list your collaborators.

For the problems from the draft of the textbook, please check the course website for the most recent version, since it may be subject to frequent updates. Make sure the problem title below matches the problem in the book you are solving, since occasionally an update to the book will cause the problem numbers to shift slightly.

3-1. Computing the Coefficients of a Polynomial Given its Roots. Please do problem 462 in the textbook draft (in the FFT chapter).

3-2. The Post Office Problem. Please do problem 60 (both parts) in chapter 3 (the sorting chapter) of the textbook draft.

3-3. Building a House. You have just purchased a new rectangular-shaped lot of land, containing n trees. Given the (x, y) coordinates of each tree (think of each tree as a point), please describe an $O(n \log n)$ algorithm for finding a sub-rectangle of maximum area within your lot that (i) contains no trees inside it, and (ii) has at least one of its four edges coincide with the edge of the lot (i.e., at least one edge of the house must run directly along the edge of the lot for some amount of distance).

3-4. Counting Dominated Points in 3D. In 3D, a point (x, y, z) dominates the point (x', y', z') if $x \geq x'$, $y \geq y'$, and $z \geq z'$. Please give an $O(n \log n)$ algorithm for counting the number of dominated points in a 3D set of n input points.