Homework Assignment #5 - revised

CS 410/584 Algorithm Design & Analysis: Spring 2011

This assignment is due Thursday, 2 June, at the beginning of class. You should work alone on this assignment. However, you are free to discuss the problems on the class mailing list. (Or you can send me email questions directly; please put "CS 584" at the beginning of the subject line.) Please put "410" or "584" on your paper, depending on which section you are registered in.

Reading: Chapters 33 and 34 all, 35.1

Note: On any homework exercise where you are asked to give (or **modify**) an algorithm, you must also provide an English description of how it works and at least one example execution.

Exercises: 33.2-3 (15 points. For the part about whether the modified algorithm finds all intersections, answer two ways: a) using a counting argument; b) giving a specific example where an intersection is missed.), 33-3 (20 points. 584 only).

5A (10 points): Compute the DFT of (0, 1, 2, 3) using the Recursive-FFT algorithm. For each call of the algorithm, show the argument and the return result.

5B (15 points): This question concerns string matching. Suppose a text string has been preprocessed to create a *sorted* list of positions of each character in the string. For example

```
"this is a test text"
```

would have the lists

```
a: 9
e: 12, 17
h: 2
i: 3, 6
s: 4, 7, 13
t: 1, 11, 14, 16, 19
x: 18
space: 5, 8, 10, 15
```

Give an efficient algorithm for finding all occurrences of a pattern in the text if such lists exist for the text. **Hint:** Exploit the sorted order of the lists.

5C (10 points): Give an algorithm to determine if there are 3 (or more) collinear points in a set of n points. Your algorithm should have time complexity in $O(n^2 \lg n)$.

5D (10 points). A *Hamiltonian path* from node v to node w in an undirected graph $G = (V, E)$ is a simple path from v to w that includes every node in V. Consider the language

Ham-Path = $\{\langle G, v, w\rangle \mid$ There is a Hamiltonian path in G from v to $w\}$.

Demonstrate that if Ham-Path is P, then there is a polynomial-time algorithm to actually find a Hamiltonian path from v to w in a graph G, if one exists.