

## Problem Set 2

**Due dates:** Electronic submission of .pdf files of this homework is due on **1/31/2014 before 11:00am** on ecampus, a signed paper copy of the pdf file is due on **1/31/2014** at the beginning of class.

**Name:** (put your name here)

**Resources.** (All people, books, articles, web pages, etc. that have been consulted when producing your answers to this homework)

On my honor, as an Aggie, I have neither given nor received any unauthorized aid on any portion of the academic work included in this assignment. Furthermore, I have disclosed all resources (people, books, web sites, etc.) that have been used to prepare this homework.

**Signature:** \_\_\_\_\_

**As always: Watch posted videos before the next class.**

**Problem 1** (20 points). Solve Exercise 3.3a on pages 61-62 for the first 18 functions (first three lines).

**Solution.**

**Problem 2.** (15 points) Consider the task of searching a sorted array  $\mathbf{a}[1..n]$  for a given element  $w$ . Show that any algorithm that accesses the array only via comparisons (that is, by asking questions of the form “is  $\mathbf{a}[i] \leq z?$ ”), must take  $\Omega(\log n)$  steps.

**Solution.**

**Problem 3.** (15 points) Give a  $(2n - 1)$  lower bound on the number of comparisons needed to merge two sorted lists  $(a_1, a_2, \dots, a_n)$  and  $(b_1, b_2, \dots, b_n)$  with  $a_1 < a_2 < \dots < a_n$  and  $b_1 < b_2 < \dots < b_n$ . [Hint: Use an adversarial method. Why can't you have in general  $2n - 2$  or fewer comparisons?]

**Solution.**

**Problem 4.** (10 points) Solve Exercise 8.1-4 on page 194 of our textbook.

**Solution.**

**Problem 5** (20 points). Exercise 4.5-1a, b, c, d on page 96

**Solution.**

**Problem 6** (10 points). Generalize Karatsuba's integer multiplication algorithm to numbers with respect to a base  $b \geq 2$ .

**Solution.**

**Problem 7** (10 points). Use the generalized Karatsuba integer multiplication algorithm from the previous question to multiply

$$X = 1234 \quad \text{and} \quad Y = 8765$$

in base  $b = 10$ . [You can either work it out by hand or write a program and print the results each step. Note that you can create LaTeX output.]

**Solution.**

Discussions on ecampus are always encouraged, especially to clarify concepts that were introduced in the lecture. However, discussions of homework problems on ecampus should not contain spoilers. It is okay to ask for clarifications concerning homework questions if needed.

**Checklist:**

- Did you add your name?
- Did you disclose all resources that you have used?  
(This includes all people, books, websites, etc. that you have consulted)
- Did you sign that you followed the Aggie honor code?
- Did you solve all problems?
- Did you submit (a) the pdf file derived from your latex source file of your homework?
- Did you submit (b) a hardcopy of the pdf file in class?