CSE 431/531 Homework Assignment 3

Due in class on Thursday, March 01

February 15, 2007

There are totally 7 problems, 10 points each. You should do them all. We will grade only 5 problems chosen at my discretion. If it so happens that you don’t do one of the problems we don’t grade, then no points will be deducted. To “disprove” a statement, you must find a counter example to show that the statement is wrong. In general, your answers should be short but concise. (This will come with experience.)

**When asked to devise an algorithm** please follow the format (a) brief description of idea, (b) pseudo-code, (c) proof of correctness if applicable, and (d) analyze the running time.

**Problem 1.** Professors Howard, Fine, and Howard have proposed the following “elegant” sorting algorithm:

```
STOOGE-SORT(A, i, j)
3: end if
4: if i + 1 ≥ j then
5:   Return
6: end if
7: k ← ⌊(j − i + 1)/3⌋ // First two-third
8: STOOGE-SORT(A, i, j − k) // Last two-third
9: STOOGE-SORT(A, i + k, j) // First two-third again
```

(a) Argue that, if \( n \) is the length of the array \( A \), then \( \text{STOOGE-SORT}(A, 1, n) \) correctly sorts the input array \( A[1..n] \).

(b) Give a recurrence for the worst case running time of \( \text{STOOGE-SORT} \) and a tight asymptotic (\( \Theta \)-notation) bound on the worst case running time.

(c) Compare the worst case running time of \( \text{STOOGE-SORT} \) with that of \( \text{MERGE-SORT} \). Do the professors deserve tenure?

**Problem 2.** Given two sorted arrays \( A \) and \( B \) of size \( n \) each. Give an algorithm to find the median of all \( 2n \) numbers in \( A \) and \( B \) in \( O(\lg n) \)-time. Please be precise on the indices when you write your pseudo-code for this problem.

**Problem 3.** Textbook, chapter 5, exercise 2 (page 246).

**Problem 4.** Textbook, chapter 5, exercise 3 (page 246).

**Problem 5.** Textbook, chapter 5, exercise 4 (page 247).

**Problem 6.** Textbook, chapter 5, exercise 5 (page 248).

**Problem 7.** Textbook, chapter 5, exercise 6 (page 248).