MA/CSSE 473 – Design and Analysis of Algorithms

Homework 9B (74 points total) Updated for Winter, 2017

Problems for enlightenment/practice/review (not to turn in, but you should think about them):

How many of them you need to do serious work on depends on you and your background. I do not want to make everyone do one of them for the sake of the (possibly) few who need it. You can hopefully figure out which ones you need to do.

4.4.11 [5.5.4] (multiplication à la Russe)
4.5.2 [5.6.2] (quickselect example and efficiency)

Problems to write up and turn in:

1. (2) 4.4.13 [5.5.7] Calculate J(40) [Josephus problem]

2. (20) 4.4.15ab [5.5.9ab] (a) 5 points. J(n) for n=1,…,15. (b) 15 points. Find the pattern and prove it by induction, based on the recurrence relations.

3. (20) 4.5.11a [5.6.10a] (moldy chocolate) This problem may be harder than first appears to be. You should provide an analysis in terms of m, n, and the (i, j) position of the moldy square For some values of (m, n, i, j), the first player can always win; for others the second player can always win. What is the winning strategy?

   However, if you can't solve the general case, you may get some partial credit by solving the cases that you can solve, and writing about what you tried for other cases.

   "Transform and conquer" is a good way to find a complete solution, so you may want to look ahead to Chapter 6.

   In the past, several students said that this problem took them longer than any previous problem in the course.

4. (10) 6.1.5 [6.1.7] (to sort or not to sort)

5. (10) 6.2.8c (compare Gaussian Elimination to Gauss-Jordan) **You should compute and compare actual number of multiplications, not just say that both are Θ(n^3). Use division when you compare.**

6. (6) 6.3.7 (2-3 tree construction and efficiency) Show the steps in the construction and show your calculation of the average key comparisons.

7. (3) 6.3.8 (2-3 tree vs. binary tree). Include a proof if it is true, or a counterexample if it is false.

8. (3) 6.3.9 (range of a 2-3 tree)