COMP 170 Discrete Mathematical Tools for CS
2008 Fall Semester – Written Assignment # 8
Distributed: Nov 13, 2008 – Due: Nov 20, 2008

At the top of your solution, please write your (i) name, (ii) student ID #, (iii) email address and (iv) tutorial section.

Some Notes:

- Please write clearly and briefly. For all questions you should also provide a short explanation as to *how* you derived the solution. That is, if the solution is 20, you shouldn't just write down 20. You need to explain *why* it's 20.
- Please follow the guidelines on doing your own work and avoiding plagiarism given on the class home page. Don't forget to *acknowledge* individuals who assisted you, or sources where you found solutions.
- Some of these problems are taken (some modified) from the textbook.
- Please make a *copy* of your assignment before submitting it. If we can't find your paper in the submission pile, we will ask you to resubmit the copy.
- Your solutions can either be submitted at the end of your Thursday lecture section or, before 5PM, in the collection bin in front of Room 4213A.

Problem 1: Show by induction that any solution to a recurrence of the form

$$T(n) \leq 2T\left(\frac{n}{3}\right) + c \log_3 n$$

is $O(n \log_3 n)$. You may assume that n is a power of 3 and $c > 0$.
What happens if you replace 2 with 3? Explain why.
Would it make a difference if you used a different base for the logarithm (only an intuitive explanation is needed here)?

Problem 2: Show by induction that

$$T(n) = \begin{cases} 8T(n/2) + n \log n & n > 1 \\ d & n = 1 \end{cases}$$

has $T(n) = O(n^3)$ for any solution $T(n)$. You may assume that n is a power of 2 and $d > 0$.