# CS 3500 Section A, Spring 2000

# Homework 6 – due Tuesday, March 21

**Problem 1** Consider the following 18 functions of $n$:

| | | |
|---|---|---|
| $\sqrt{n}$ | $n$ | $2^n$ |
| $n \log n$ | $7n^5 - n^3 + n$ | $n^2 + \log n$ |
| $n^2$ | $n^3$ | $\log n$ |
| $n^{1/3} + \log n$ | $(\log n)^2$ | $\sqrt[3]{n}$ |
| $\ln n$ | $n/logn$ | $\log \log n$ |
| $(1/3)^n$ | $(3/2)^n$ | 6 |

Group these functions so that $f(n)$ and $g(n)$ are in the same group if and only if $f(n) = O(g(n))$ and $g(n) = O(f(n))$, then list the groups in increasing order.
The main rules to keep in mind when asymptotically comparing functions are:

- Any exponential function grows faster than any polynomial function, which grows faster than any poly-logarithmic function;
- The base of logarithms does not matter asymptotically, but the base of exponentials and the degree of polynomials matter.

**Problem 2** **a)** Evaluate the sum $\sum_{i=0}^{n}(i \cdot 2^i)$

**b)** Exercise 3.1–7, page 46 of CLR.
(Read Section 3.1 if you need to refresh your memory on summations.)

**Problem 3** Exercise 3.2–1, page 52 of CLR. (Read Section 3.2 as needed.)

**Problem 4** Use the substitution method to show that the solution to the recurrence

$$T(n) = T(n-1) + n$$

is $T(n) = O(n^2)$.

**Problem 5** Use the iteration method to show that the solution to the recurrence

$$T(n) = T(n-1) + n$$

is $T(n) = \Theta(n^2)$.

**Problem 6** Use the Master theorem to solve Problem 4–1 (a,c,d,e)