Homework 1, Due Monday September 13

1. For each of the following pairs of functions $f(n)$ and $g(n)$, give the values of n_0, $f(n_0)$ and $g(n_0)$ where n_0 is the smallest positive integer such that $f(n_0) \geq g(n_0)$.

   Hint: you may need to use a calculator. Use the log identity

   $$\log_2 x = \frac{\log_{10} x}{\log_{10} 2}$$

   if your calculator does not take logs in base 2.

   (a) $f(n) = n$ and $g(n) = 50 \lg^2 n$
   (b) $f(n) = 2^{n/2}$ and $g(n) = n^{18}$
   (c) $f(n) = n^{1/5}$ and $g(n) = \lg^{12} n$

2. Prove that the following statements are correct:

   (a) $5n^2 - 6n = \Theta(n^2)$
   (b) $n! = O(n^n)$
   (c) $n^{1.001} + n \lg n = \Theta(n^{1.001})$

3. Show that the following statements are incorrect:

   (a) $10n^2 + 9 = O(n)$
   (b) $n^2 / \lg n = \Theta(n^2)$

Homework 2, Due Monday September 20

1. Prove by induction that for $x \neq 1$ and $n \geq 0$ that

   $$\sum_{i=0}^{n} x^i = \frac{x^{n+1} - 1}{x - 1}.$$

2. Show that $\sum_{i=0}^{n} i^2 = \Theta(n^3)$.

3. Exercise 4.1-5, page 57.

   Hint: use the fact that $\log(0.75n) > \log(n/2 + 17)$ for large enough n.

4. Exercise 4.2-1, page 60.

Homework 3, Due Monday September 27

1. Problem 4-1, page 72.

   In the cases where you use the Master Theorem, clearly state which case you are using and the asymptotic bounds on $T(n)$.

2. Exercise 7.5-4, page 151.

3. Exercise 7.5-5, page 151.

4. Problem 7-1, page 152.

Homework 4, Due Monday October 4

1. Problem 8-3, page 169.

2. Problem 8-4, page 169–170.

3. Exercise 9.3-4, page 180.