MATH 2610
Discrete Mathematics for Computer Science
Wednesday February, 17 2005

I will collect homework next Wednesday so that you can ask me some questions about this assignment (or any other assignment for that matter). Please note, Ms. Gay was kind enough to point out an error in the last homework set. I have since corrected it (problem number (4) was screwed up) and reposted the corrected version on the web. The questions below come from section 2.2 in the book.

(1) Determine whether each of the functions is $O(x)$.
   (a) $f(x) = 10$
   (b) $f(x) = 3x + 7$
   (c) $f(x) = x^2 + x + 1$
   (d) $f(x) = 5\log(x)$
(2) Use the definition of the fact that $f(x)$ is $O(g(x))$ to show that $x^4 + 9x^3 + 4x + 7$ is $O(x^4)$.
(3) Show that $(x^2 + 1)/(x + 1)$ is $O(x)$.
(4) Find the least integer n so that $f(x)$ is $O(x^n)$ for each of these functions.
   (a) $f(x) = 2x^3 + x^2\log(x)$
   (b) $f(x) = 3x^3 + (\log(x))^4$
   (c) $f(x) = (x^4 + x^2 + 1)/(x^3 + 1)$
   (d) $f(x) = (x^4 + 5\log(x))/(x^4 + 1)$
(5) Show that 2^n is $O(3^n)$ but that 3^n is not $O(2^n)$.
(6) Explain what it means for a function to be $O(1)$.
(7) Explain what it means for a function to be $\Omega(1)$.
(8) Explain what it means for a function to be $\Theta(1)$.
(9) If $f_1(x)$ and $f_2(x)$ are functions from the set of positive integers to the set of positive real numbers and $f_1(x)$ and $f_2(x)$ are both $\Theta(g(x))$, is $(f_1 - f_2)(x)$ also $\Theta(g(x))$? Either prove that it is or give a counter example.