CSCI 503B:
HOMEWORK 1

Show your work. Write neatly.

1. (13pt) Let $f(n) = n$ and $g(n) = n^{1+cos(n)}$. Is $f(n) = O(g(n))$? Is $g(n) = O(f(n))$? Prove your answers.

2. (13pt) You are given f, g, h such that $f(n) = o(g(n))$ and $g(n) = O(h(n))$. Show that $f(n) = o(h(n))$.

3. (13pt) Prove that if $f(n) = o(g(n))$ then $f(n) + g(n) = \Theta(g(n))$. If $f(n) = \omega(g(n))$ is it true that $f(n) - g(n) = \Theta(f(n))$? Prove.

4. (13pt) You are given $f(n) = O(g(n))$ and $h(n) = \Omega(k(n))$. What can you say about $f(h(n))$ in terms of $g(k(n))$? Prove your answer.

5. (48pt) Solve the recurrences – you can use any technique, but you need to show your work explicitly.

   (a) $T(n) = 4T(n/2) + n^2$

   (b) $T(n) = 6T(n/3) + n^2 logn$

   (c) $T(n) = 3T(n/4) + n\ logn$

   (d) $T(n) = 4T(n/2) + n\ logn$

   (e) $T(n) = 3T(n/2) + n$

   (f) $T(n) = T(n-1) + 2^n$, $(T(1) = 3)$