CSC2401F **Problem Set 1** **Due: Oct 11, 2001**

1. Assume $DTIME(n^2) = DSPACE(n^2)$. Show $DTIME(n^4) = DSPACE(n^4)$.

2. Let $t_2(n)$ be time constructive and let $lim_{n\to\infty}\frac{t_1(n)\log t_1(n)}{t_2(n)} = 0$. Show that there is a unary language L (i.e. $L \subseteq \{1^n | n \geq 0\}$) such that $L \in DTIME(t_2) - DTIME(t_1)$.

3. (a) Let $t(n)$ be a computable non-decreasing function. Show that there exists a time constuctible non-decreasing function t' such that $t(n) \leq t'(n)$ for all n.

   (b) Let t be time constructible. Show that there is a non decreasing function t' such that $t(n) \leq t'(n)$ for all n and t' is not time constructible.