CSC 2401F 2003, Assignment 2
Due: Nov. 13, 10:10 AM

1. Let A be NP-complete.

   (a) If $B \in P$ and $A \cap B = \emptyset$, prove that $A \cup B$ is NP-complete.

   (b) Is the condition $A \cap B = \emptyset$ necessary in part (a).

2. Consider the graph colouring optimization problem GCO and its natural decision problem GCD.

   (a) Show that $GCO \leq^T_{polytime} GCD$.

   (b) Given that it is NP-hard to decide if a graph is 3-colourable, show that it is NP-hard to obtain a polynomial time c-approximation algorithm for any constant c.

   Note: It is actually NP-hard to obtain a polynomial time $n^{1-\epsilon}$-approximation for any $\epsilon > 0$ but that is a difficult result using the PCP framework. The problem here can be solved using some relatively elementary graph theoretic ideas.

3. More to follow.