CSC 2421S 2003, Assignment 1   Due: Feb 11

1. Let Δ be the maximum degree and n the number of nodes in a graph G.

   (a) Modify the H_Δ approximation lower bound for the "obvious" degree based greedy vertex cover algorithm so that the bound (or something close to it) holds even if a kind adversary resolves every "tie" in favour of the algorithm.

   (b) Modify the H_Δ lower bound so as to show a $\Omega(H_n)$ lower bound for the obvious degree based greedy vertex cover algorithm.

2. Show that for every fixed f, there is a set cover instance such that the integrality gap of the given IP/LP formulation is close to f.

3. This is question 14.1 in Vazirani. Modify the IP/LP rounding algorithm for set cover so that it picks all sets S such that $x_S > 0$ in the fractional solution. Show that this modified algorithm also achieves an f-approximation algorithm where f is the maximum frequency.
   Hint: Use the primal complementary slackness conditions to prove this.