CSC2421S **Problem Set 2** **Winter/Spring 2005**

Due: Thursday, March 31, beginning of lecture

1. Consider the "greedy algorithm" SRPT given for the $P1|r_j, pmtn|\sum C_j$ scheduling problem. Can you formulate an extension of the priority model so as to capture greedy algorithms for scheduling problems with preemption?

2. (Vazirani, exercise 14.3)

   Give an $O(\log n)$ IP/LP randomized rounding algorithm for the set multicover problem.

3. Consider a polynomial size IP/LP formulation of the $P1|prec|\sum_j w_j C_j$ scheduling problem using the variables $\delta_{i,j}$ whose meaning for $\{0,1\}$ values is that $\delta_{i,j} = 1$ iff job i is scheduled before j. Let $\{C_i^*\}$ be the fractional optimal of this LP. Show that

   $$\sum_{i \in S} p_i C_i^* \geq \frac{1}{2}[(\sum_{i \in S} p_i)^2 + \sum_{i \in S} p_i^2] \quad \forall S \subseteq \{1, \ldots, n\}$$

   and

   $$C_k \geq C_j + p_k \quad \forall j, k : j \leq_{prec} k$$

   Conclude that this IP/LP provides a 2-approximation for the given scheduling problem.