CS 170: Problem Set 8

Due: October 21, 2011, 4:00 p.m.

Instructions: Turn this in to the class homework boxes in 283 Soda by 4:00 p.m. on Friday, October 21, 2011. Please begin your answer to each question on a new sheet of paper and make sure each sheet is labeled with your name, SID, section number, GSI name, the assignment number, the question number, and "CS 170 – Fall 2011."

Because each problem will be graded by a different reader, please **turn in each question in a different box in 283 Soda.** Question i goes in the box labeled "CS 170 — i."

Please read the class webpage for rules regarding collaboration (encouraged!) and cheating (forbidden!) on homework.

DPV = Dasgupta, Papadimitriou, and Vazirani.

1. DPV 5.30 [10 points]
2. **Job Scheduling** [15 points]

   You are given a set of n jobs, each runs in unit time. Job i has an integer-valued deadline time $d_i \geq 0$ and a real-valued penalty $p_i \geq 0$. Jobs may be scheduled to start at any non-negative integer time (0, 1, 2, etc), and only one job may run at a time. If job i completes at or before time d_i, then it incurs no penalty; otherwise, it is late and incurs penalty p_i. The goal is to schedule all jobs so as to minimize the total penalty incurred.

   For each of the following greedy algorithms, either prove that it is correct, or give a simple counterexample (with at most three jobs) to show that it fails.

   (a) Among unscheduled jobs that can be scheduled on time, consider the one whose deadline is the earliest (breaking ties with the highest penalty), and schedule it at the earliest available time. Repeat.

   (b) Among unscheduled jobs that can be scheduled on time, consider the one whose penalty is the highest (breaking ties with the earliest deadline), and schedule it at the earliest available time. Repeat.

   (c) Among unscheduled jobs that can be scheduled on time, consider the one whose penalty is the highest (breaking ties arbitrarily), and schedule it at the latest available time before its deadline. Repeat.
3. DPV 5.22 [15 points]
4. DPV 5.33 [10 points]
5. DPV 5.26 [10 points]