Homework 5

Due Friday, August 17

1. Consider the following problem. You are given two strings X and Y both of length n. Find the longest string that is a substring of both X and Y. For example, if $X = ABBA$ and $Y = BABA$, the longest common substring is AB or BA(your algorithm may find either of these). Your goal is to find a dynamic programming algorithm for this problem.
   (a) Describe how you define the subproblems you will use in your dynamic programming algo.
   (b) Write a recurrence relation between your subproblems
   (c) Write the dynamic programming algorithm based on this recurrence.
   (d) Analyze the running time of your algorithm.
2. You are given a set of n jobs $\{a_1, a_2, \ldots, a_n\}$. Each job has processing time t_i, deadline d_i, and profit p_i. You have one machine which can process one job at a time. If job a_i is completed before its deadline d_i, you receive the profit p_i. If a job is completed after its deadline you receive 0 profit. Find a dynamic programming algorithm that finds the schedule of these jobs that maximizes the profit.
   (a) Describe how you define the subproblems you will use in your dynamic programming algo.
   (b) Write a recurrence relation between your subproblems
   (c) Write the dynamic programming algorithm based on this recurrence.
   (d) Analyze the running time of your algorithm.
3. Exercise 6, on pp. 317-318 of Kleinberg and Tardos
4. Exercise 16, on p. 327 of Kleinberg and Tardos
5. Exercise 22, on pp. 330-331 of Kleinberg and Tardos