Due: Wednesday, November 3, beginning of lecture

NOTE: Each problem set only counts 5% of your mark, but it is important to do your own work (but see below). These assignments will be followed by term tests, each worth 15% of your final grade. You may consult with others concerning the general approach for solving problems on assignments, but you must write up all solutions entirely on your own. As an experiment you may chose to work in pairs and then submit one assignment. Anything else is *plagiarism*, and is subject to the University's Code of Behavior. You will receive 1/5 points for any question/subquestion for which you say "I do not know how to answer this question". You will receive .5/5 points if you just leave the question blank.

1. Problem 2 on pages 172,173 of text.
2. Problem 6 on pages 176,177 of text.
3. Consider the following scheduling problem. A job $J_i = (d_i, p_i, v_i)$ is described by its deadline d_i, its processing time p_i and its value v_i. Assume all parameters are positive integers. We are given n jobs and we want to compute an optimal schedule which is defined as follows. A schedule is a function $\sigma : \{1, \ldots, n\} \rightarrow \{t : 0 \leq t \leq max_i[d_i]\} \cup \{\infty\}$ where $\sigma(i) = t \neq \infty$ means that the i^{th} job has been scheduled to start at time t. A schedule σ is feasible if $[\sigma(i), \sigma(i) + p_i) \cap [\sigma(k), \sigma(k) + p_k) = \emptyset$ for all $i \neq k, \sigma(i) \neq \infty \neq \sigma(k)$. The goal is to maximize the value $v(\sigma) = \sum_{i:\sigma(i)\neq\infty} v_i$ over all feasible schedules. Note: the knapsack problem is a special case of this scheduling problem where $d_i = W$ for all i.
   (a) Show that there is an optimal feasible schedule such that if $\sigma(i) < \sigma(k)$ then $d_i \leq d_k$.
   (b) Suppose all $p_i \leq n^r$ for some positive integer r. Give a polynomial time dynamic programming algorithm to compute the value of an optimal schedule. What is the time complexity of your algorithm?
   (c) Extend the dynamic programming solution so as to compute an optimal schedule; i.e. compute $\sigma(i)$ for $1 \leq i \leq n$.
   (d) Suppose all $v_i \leq n^r$ for some positive integer r. Give a polynomial time dynamic programming algorithm to compute the value of an optimal schedule. What is the time complexity of your algorithm?
4. Problem 2 on page 215 of the text.
5. Problem 3 on page 216 of the text.
6. Problem 5 on page 217 of the text.