CSEP 521 – Applied Algorithm
Spring 2003
Homework 6.
Due date: 5/14/03 (see submission instructions in course web-page).

1. (35 pts.) An Edge-coloring of a graph G=(V,E) is an assignment, c, of colors (integers) to the edges such that if e_1 and e_2 share an endpoint then $c(e_1) \neq c(e_2)$. Let Δ be the maximal degree of some vertex in G. Suggest an algorithm that colors the edges with at most 2Δ-1 colors. Prove that your algorithm produces a legal edge-coloring and that the maximal number of edges used is 2Δ-1.

2. (30 pts.) In class we proved that Vertex Cover is NP-hard by showing that Max-Clique polynomially reduces to it (see slides 40-42 of Lecture 5). We also saw an approximation algorithm for vertex cover that finds a vertex cover of size at most twice the minimum size (see slides 29-30 of Lecture 6). Does this relationship imply that there is an approximation algorithm with constant ratio bound for the clique problem? *Explain.*

3. (35 pts.) As a result of the next high-tech crisis, your company is closed and you choose a new career in a farm. You have n potatoes with weights $b_1, b_2, \ldots, b_n$ grams that you wish to pack into packages. Each package must contain at least L grams of potatoes so you won't get sued for false advertising. Your goal is to maximize the number of packages that you fill to L or more grams. Consider the obvious greedy algorithm that considers the potatoes in an arbitrary order, and adds potatoes to the same package until that package is full. Show that this is a 2-approximation algorithm. That is, the algorithm fills at least 1/2 as many packages as optimal. Given m, describe an instance with $n=\Theta(m)$ potatoes for which the 2-ratio is as tight as possible.