CS 410/586: Quiz 3, 12 April 2011 Name:___KEY_____

No books or notes. Work individually.

You are loading an airplane that can hold 20,000 pounds of cargo. You have *n* cargo containers to go aboard with weights w_1, w_2, …, w_n. The combined weight of the containers is more than 20,000 pounds (so not all containers can go aboard).

For each part below, there is a goal and a greedy rule. Say whether the rule will achieve the goal (when used in a greedy algorithm), and explain why or why not.

Question 1 (5 points): **Goal:** Load the maximum *number* of containers.
Greedy Rule: Choose the *lightest* remaining container to load.
This rule has the greedy choice property. Assume the weights are sorted in increasing order and suppose L is a maximal set of containers that does not include w_1. Then any container in L can be replaced by w_1, since w_1 is no heavier than that container. Thus there is a maximal set that contains the greedy choice.

The problem also has the optimal-substructure property.[I didn't take off points if you omitted this part.] Consider a maximal set of containers L that includes w_1. Then $L' = L - \{w_1\}$ must be the maximal solution for weights $w_2, w_3, \ldots, w_n$ and limit $20{,}000 - w_1$. If there were a better solution than L´ for the subproblem, we could use it to get a better solution for the original problem.

Question 2 (5 points): **Goal:** Load the maximum *weight* of containers.
Greedy Rule: Choose the *heaviest* remaining container to load.
This rule doesn't work. Let the weights be 12,000; 9,000; 9,000. The Greedy Rule would choose 12,000 first, and that's all that will fit. But both 9,000 and 9,000 will fit, with a total weight of 18,000.