ISyE 4803 Exam #2
Summer 2010

Name

Please be neat and show all your work so that I can give you partial credit. GOOD LUCK AND HAVE A WONDERFUL SUMMER.

Question 1
Question 2
Total

1. (60) Each quarter the marketing manager of a retail store divides customers into two classes based on their purchase behavior in the previous quarter. Denote the classes as L for low and H for high. The manager wishes to determine to which classes of customers he should send quarterly catalogs. The cost of sending a catalog is \$15 per customer and the expected purchase depends on the customer's class and the manager's action. If a customer is in class L and receives a catalog, then the expected purchase in the current quarter is \$20 and if a class L customer does not receive a catalog his expected purchase is \$10. If a customer is in class H and receives a catalog, then his expected purchase is \$50, and if a class H customer does not receive a catalog his expected purchase is \$25. The decision whether or not to send a catalog to a customer also affects the customer's classification in the subsequent quarter. If a customer is class L at the start of the present quarter, then the probability he is in class L at the subsequent quarter is 0.3 if he receives a catalog and 0.5 if he does not. If a customer is class H in the current period, then the probability that he remains in class H in subsequent period is 0.8 if he receives a catalog and 0.4 if he does not. The objective of the store manager is to maximize his long run average award.

a. (20) Provide the primal and dual LP formulations to find the long-run average optimal policy.

b. (40) Compute the long-run average optimal policy using policy iteration.

2. (40) Consider a model with $S = \{s_1, s_2\}$. The set of actions in state s_1 is $A_{s_1} = \{a_{1,1}, a_{1,2}\}$ and the set of actions in state s_2 is $A_{s_2} = \{a_{2,1}, a_{2,2}\}$. We have $r^{a_{1,1}}(s_1) = 5$, $r^{a_{1,2}}(s_1) = 10$, $r^{a_{2,1}}(s_2) = -1$, and $r^{a_{2,2}}(s_2) = 2$ and $p^{a_{1,1}} s_1, s_1 = 0.5$, $p^{a_{1,2}}_{s_1,s_2} = 1$, $p^{a_{2,1}}_{s_2,s_1} = 0.8$, and $p^{a_{2,2}}_{s_2,s_1} = 0.1$. Find the deterministic policy that maximizes the total expected reward over three periods if the terminal reward for both states is 0.