Department of Mathematical Sciences
Carnegie Mellon University

21-393 Operations Research II
Test 2

Name:_____

Problem	Points	Score
1	33	
2	33	
3	34	
Total	100	

Q1: (33pts)
A computer is inspected at the end of every hour. It is found to be either working (up) or failed (down). If the computer is found to be up, then the probability of it remaining up for the next hour is 3/4. If the computer is down then it is repaired. Whenever the computer is down, the probability it is up by the next period is 1/2.

1. Construct the transition matrix for the associated Markov chain on the two states {up,down}.

2. Compute the steady state probabilities.

3. Suppose that the computer is up at the beginning of the first period. What is the expected number of periods until it goes down?

Q2: (33pts) Find the optimal ordering strategy for the following inventory system. If you order an amount Q, it costs $AQ^{1/2}$ and arrives at a rate ψ. The inventory cost is I per unit per period. The demand is $\lambda < \psi$ units per period and no stock-outs are allowed.

Q3: (34pts) A system can be in 3 states 1,2,3 and the cost of moving from state i to state j in one period is $c(i,j)$, where the $c(i,j)$ are given in the matrix below. The one period discount factor α is $1/2$.
The aim is to find a policy which simultaneously minimises the discounted cost of operating from any starting state. Start with the policy

$$\pi(1) = 1, \pi(2) = 3, \pi(3) = 2.$$

Evaluate this policy. Is it optimal? If not find an improved policy.
YOU DO NOT NEED TO EVALUATE THIS NEW POLICY OR FIND AN OPTIMAL STRATEGY.
The matrix of costs is

$$\begin{bmatrix} 8 & 3 & 1 \\ 4 & 1 & 6 \\ 5 & 5 & 1 \end{bmatrix}$$