ECEn 370

Homework Problem Set 13 (THE LAST ONE!)

Due on Wednesday, April 9, 2014.

From Bertsekas and Tsitsiklis, *Introduction to Probability, 2nd Ed.*

1. (5 pts) Chapter 7 Problem 1.
2. (5 pts) Chapter 7 Problem 3.
3. (5 pts) Chapter 7 Problem 4.
4. (5 pts) Chapter 7 Problem 10.
5. (5 pts) Chapter 7 Problem 11.
6. (5 pts) Chapter 7 Problem 13.
7. MATLAB Problem (25 points)
   Here we will employ some of your linear algebra skills to be able to find steady-state probabilities.
   a) Find the Markov probability matrix **M** associated with Problem 7.13 above.

   b) Perform the following decomposition in MATLAB.

   ```
   [V, D] = eig(M)
   ```

   V is your matrix of eigenvectors. D is your matrix of eigenvalues. What you will notice is that you will have eigenvalues of 1 (steady-state solution) and eigenvalues of <1 which correspond to the transient.

   c) Find the steady-state values by the following code:

   ```
   SS_matrix = V * [0 0 0; 0 0 0; 0 0 1] / V
   ```

   You should then see that you have a steady-state solution which corresponds to the steady-state values that you calculated in Problem 13.

   d) Notice that you can achieve the same by executing the code:

   ```
   V * D^100 / V
   ```

   This is basically just showing how the transients decay.

   e) Then perform the following:

   ```
   M^1000
   ```

   Why does this give you the same result as part d and c?

   f) What happens if you take SS_matrix to the nth power? Why do you get the result that you do?

   g) Consider the matrix, $\mathbf{M} = \begin{bmatrix} 0.2 & 0.8 & 0 \\ 0.3 & 0.6 & 0.1 \\ 0 & 0 & 1 \end{bmatrix}$. What happens to $\mathbf{M}^n$ for large n?

   h) Consider the chain given by $\mathbf{M} = \begin{bmatrix} 1 & 0 & 0 \\ 0.1 & 0.8 & 0.1 \\ 0 & 0 & 1 \end{bmatrix}$. What happens to $\mathbf{M}^n$ for large n? Why?