

Introduction to Mathematical Modeling

Professor:

Dr. Joanna Bieri

joanna_bieri@redlands.edu

OFFICE: AHN229

Markov Models

Goal: Use Matlab to analyze the following Markov models.

PART 1 - For each of the systems drawn here

(a). Write down the recurrence relations for the system and explain what is happening in the system.

$$\begin{aligned}x_1(n+1) &= \\x_2(n+1) &= \end{aligned}$$

(b). Write the system in matrix form:

$$\vec{x}_{n+1} = T\vec{x}_n$$

(c). Using Matlab:

- Enter the matrix T:

$$\begin{aligned}T(1,:) &= [\quad , \quad]; \\T(2,:) &= [\quad , \quad]; \end{aligned}$$

- Find eigenvalues and eigenvectors:

$$[d, v] = \text{eig}(T)$$

- Normalize the dominant eigenvector (located in column a - you will have to decide what this number is.):

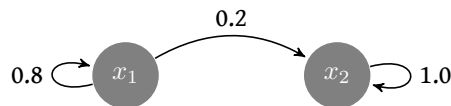
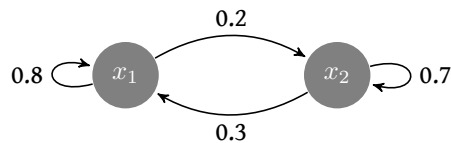
$$\text{Norm} = d(:, a) ./ \text{sum}(d(:, a))$$

- What does the normalized eigenvector tell you about your system?

(d) Find L such that it $\bar{x} = L\bar{x}$ where $L \sim T^{100}$. (In Matlab type: $L = T^{100}$.)

(e) Does L match what you found from your normalized eigenvector?

(f) In the one of the systems, we call x_2 an “absorbing state”. Which one and why?



PART 2.

For the following matrix, Markov system, are there any absorbing states? How do you know? Draw a state diagram for the system. What can you learn about this system from Matlab?

$$\vec{x}_{n+1} = \begin{bmatrix} .2 & 0 & .1 & 0 \\ .1 & 1 & .9 & 0 \\ .3 & 0 & 0 & .2 \\ .4 & 0 & 0 & .8 \end{bmatrix} \vec{x}_n$$

HOMEWORK 7 (Last One!) - Please hand in your answers to this worksheet AND a printed copy of your code with your own comments about what the code is doing.