Name: Notes

SA402 · Dynamic and Stochastic Models Fall 2019 · Uhan

Quiz 6 – 21 October 2019

Problem	Weight	Score
1	1	
2	1	
3	1	
4	1	
Total		/ 40

Instructions. You have 20 minutes to complete this quiz. You may use your calculator. You may not use any other materials (e.g., notes, homework, books).

Show all your work. To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

For this quiz, consider the following setting.

You are a consultant for a political pollster in Simplexville. Each year, the citizens of Simplexville vote for one of three parties: (1) the Primal Party, (2) the Dual Party, or (3) the Infeasible Party.

Based on historical data, you have determined that voting behavior in Simplexville can be modeled as a Markov chain with states $\mathcal{M} = \{1, 2, 3\}$ (1 = Primal, 2 = Dual, 3 = Infeasible), and with each time step corresponding to one year. The one-step transition matrix is

$$\mathbf{P} = \begin{bmatrix} 0.70 & 0.20 & 0.10 \\ 0.10 & 0.80 & 0.10 \\ 0.30 & 0.30 & 0.40 \end{bmatrix}$$

For example, of those that voted for the Dual Party in this year's election, 10% will vote Primal next year, 80% will vote Dual, and 10% will vote Infeasible.

Suppose in this year's election, 45% voted Primal, 50% voted Dual, and 5% voted Infeasible.

Problem 1. Note that the diagonal entries of $\mathbf{P}$ are larger than the off-diagonal entries. What does that mean in this setting?

- Take a look at Problem 1a from Lesson 11 for a similar question.

Problem 2. What is the probability that a citizen votes for the Primal Party 4 years from now, given that the citizen voted for the Primal Party this year?

- Take a look at Problem 1b or Problem 2c from Lesson 11A for similar questions.

Here is the one-step transition matrix from the previous page, for your convenience:

$$\mathbf{P} = \begin{bmatrix} 0.70 & 0.20 & 0.10 \\ 0.10 & 0.80 & 0.10 \\ 0.30 & 0.30 & 0.40 \end{bmatrix}$$

Problem 3. What is the probability that a randomly selected citizen votes for the Dual Party 4 years from now?

- Take a look at Problem 1c or Problem 2d from Lesson 11A for similar questions.
- Note that the problem gives you initial state probabilities: 45% voted Primal, 50% voted Dual, and 5% voted Infeasible in this year's election.

Problem 4. What is the probability that a citizen votes for the Primal Party this year, votes either Primal or Dual for the next 3 years, and then votes for the Infeasible Party 4 years from now?

- Take a look at Problem 1d or 2e from Lesson 11A for similar questions.