

ENGG7302
Advanced Computational Techniques in
Engineering
Tutorial SP3

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Question 1

Professor X is known for his intemperate moods during a workday. By observing him over a long period of time his colleagues have come up with the following statistics regarding the changes of his state of mind: If he is in an unpleasant mood during a certain hour, the probability that he will continue to be unpleasant during the following hour is 0.4. If he is in a pleasant mood during that hour, the probability that he will continue to be pleasant during the following hour is 0.8.

- (a) Write down the transition probability matrix of the Markov chain of the professor's mind.
- (b) Given that the professor starts the day with any one of these states, calculate by hand the probability of finding him in one of them in the second and third hour of the day.
- (c) Use matlab to check your answer for (b) and perform the calculation after more and more hours of the day. Observe what happens to the transition probability matrix.

Question 2

There are two food stores, A and B, in a certain area, and even though some customers go to the same store every week there are some who often change their preference. An investigation of their preferences shows that with probability 0.15 a customer of store A one week would go over to store B the next week, and with

probability 0.10 a customer of store B one week would go over to store A the next week. Initially 60% of the people buy from store A and 40% from store B. What do we expect to be the percentages after 4 weeks? After sufficiently long time?

Question 3

A telephone receptionist at a department store can process only one call at a time. The two states she can be in are “idle” and “busy”. It is conjectured that a two-state Markov chain model would be reasonable for her work habits, with observations being taken once every 30 sec. The following data were obtained by observing the receptionist’s state of work for a period of 25 min (0-idle; 1-busy):

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- (a) Use this data to estimate a transition probability matrix P for the Markov chain.
- (b) Use Matlab to calculate P^n for large n .

Question 4

Nine white balls are distributed among two boxes, A and B, with 4 in A and 5 in B. A red ball is in either A or B. The game consists of drawing one ball at random from each box and interchanging them without looking at them. After doing this five times, the winner is the one who gives the correct location of the red ball.

- (a) If the red ball is initially in box A, model this game as a Markov chain and find the probability that the ball is in box A at the end of the game.
- (b) What would be the effect on this probability if originally the red ball was in box B?