

Name:

SA402 – Dynamic and Stochastic Models  
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Fall 2016

## Quiz – 19 October 2016

**Instructions.** You have 15 minutes to complete this quiz. You may use your calculator. You may not use any other materials (e.g., notes, homework, books).

Standard	Problems	Score
E1	1a	
E2	1b, 1c	

**Problem 1.** An automated guided vehicle (AGV) transports parts between four locations: a release station A, machining station B, machining station C, and an output buffer D. The movement of the AGV can be described as making trips from location to location based on requests to move parts. Consider a Markov chain in which the states 1, 2, 3, 4 correspond to locations A, B, C, D, respectively, and each time step corresponds to one trip of the AGV.

a. Suppose the AGV moves according to the following:

- If the AGV is at the output buffer D, it is equally likely to move next to any of the other three locations.
- If the AGV is at the release station A, it is equally likely to move next to machining station B or C.
- If the AGV is at either of the machining stations (B or C), it is equally likely to move to the release station A or the output buffer D.

What is the one-step transition probability matrix?

(over)

For the remainder of this problem, suppose that the one-step transition probability matrix is

$$\mathbf{P} = \begin{pmatrix} 0 & 1/3 & 2/3 & 0 \\ 2/5 & 0 & 1/5 & 2/5 \\ 1/4 & 1/2 & 0 & 1/4 \\ 0 & 2/3 & 1/3 & 0 \end{pmatrix}$$

- b. Suppose at the beginning of the day, the AGV is equally likely to be at any of the four locations. What is the probability that it will be at the output buffer D in 4 trips?
- c. Suppose the AGV is currently at machining station B. What is the probability that the AGV then travels between machining stations B and C for 4 trips, and then finally visits the output buffer D in the 5th trip?