

MATH 245, Spring 2016
PRACTICE PROBLEMS
in preparation for Exam 2 on Wednesday, May 11, 2016.

The exam covers:

- *Concepts of Mathematical Modeling*, Sections 1.5, 5.1, 5.3A, and pp. 108–110.
- All topics since the first exam, including and not limited to: probability, Leslie matrices, Markov chains, random walks, Monte Carlo models, and computer simulations.
- The topics in Mathematica tutorials 5–7; **be sure to completely understand the waiting room simulation** and the following commands: RandomInteger, RandomReal, If, For, Histogram, Tally
- Go back over Homeworks 3 and 4 and the comprehension questions in the Mathematica tutorials.

Below are some questions that practice concepts from the class.

- Book questions: 1.5.1 and 1.5.2

Q1. Give the definitions of *sample space* and *random variable*.

Q2. Determine the system reliability of the following communication system. There are two different methods of communicating; at least one method must succeed in order for the system to succeed. The first method is by an FM radio, which has reliability 75%. The second method is by a satellite radio; both a physical transmitter must transmit the signal (with 90% reliability) AND the satellite dish must retransmit the signal (with 95% reliability) in order for the satellite radio to succeed.

Q3. (7 pts) Read the story below.

In the Dark Ages, Harvard and Yale admitted only male students. Assume that, at that time, 80 percent of the sons of Harvard men went to Harvard and the rest went to Yale, and 60 percent of the sons of Yale men went to Yale and the rest went to Harvard.

- (a) Set up a Markov Chain model to simulate this situation.
- (b) Suppose that in the first generation, there are 100 students at each college, and that each man has one son. What would be the distribution of college students in the next generation?
- (c) Determine the equilibrium distribution of Harvard and Yale students.

Here are some *Mathematica* questions that test concepts for this exam:

M1. Give the syntax of the `For` command. Make sure to describe the input and output of the command.

- M2.** How would you use a For loop to roll 50 120-sided dice? How does this compare to the method you used in Homework #4?
- M3.** What does % represent in Mathematica? What would happen if you evaluated it by itself?
- M4.** Give a pseudocode description of how you might use a computer to simulate the situation in Question **Q2** in order to calculate the expected reliability of the system.