

**Statistics 341**  
**Fall 2008 - Assignment #3**  
**Due Monday, October 6**

1. Problems from Textbook. See course webpage for problems.
2. Go to the course webpage and click on the link **Setting Up Random Variables in R**. In this file is code for setting up the sample space obtained when rolling two dice and using this sample space to obtain the random variable for the sum of the two rolls and for the maximum value of the two rolls. In this problem, we will look at a different random variable, the minimum value of the two rolls.
  - (a) Use R to set up the sample space and to obtain the random variable, the minimum value of the two rolls. Give the theoretical probability distribution function for the minimum value of the two rolls.
  - (b) Use R to summarize the theoretical pdf of the random variable with a histogram. (Hint: you need to use appropriate breaks given the possible values for the random variable.) Include the histogram with your assignment.
  - (c) Describe the histogram in part (b).
  - (d) Use R to find the theoretical mean and standard deviation of the random variable, the minimum value of the two rolls.
3. Go to the course webpage and click on the link **An Introduction to the Concept of Random Variables**. In this file is code for rolling two dice and looking at two different random variables from this sample space, the sum of the two rolls and the maximum value of the two rolls. In this problem, we will look at a different random variable, the minimum value of the two rolls.
  - (a) Use R to roll two dice 10000 times and find the observed probability distribution function for the minimum value of the two rolls. What values will the observed probability distribution function be close to? Why?
  - (b) Use R to make a histogram of the observed probability distribution function. (Hint: you need to use appropriate breaks given the possible values for the random variable.) Include the histogram with your assignment.
  - (c) Describe the histogram in part (b). Your histogram will be similar to the one of the theoretical probability distribution function. Why?
  - (d) Use R to find the observed mean and standard deviation of the minimum value of the two rolls. How close are the observed mean and standard deviation to the theoretical mean and standard deviation?
4. The Powerball Lottery has two bins, one containing numbers 1-55, and the other containing numbers 1-42. Five numbers are drawn without replacement from the first bin, and one number, the Powerball, is drawn from the second bin. The cost of playing the Powerball Lottery game is \$1. There are 9 different ways to win when playing Powerball. They are listed in the table below.

Match	Prize	Number of Ways to Match
5 numbers plus Powerball	Grand Prize	1
5 numbers	\$200,000	41
4 numbers plus Powerball	\$10,000	250
4 numbers	\$100	10,250
3 numbers plus Powerball	\$100	
3 numbers	\$7	
2 numbers plus Powerball	\$7	196,000
1 number plus Powerball	\$4	1,151,500
Powerball	\$3	2,118,760

- How many possible sets of 5 numbers plus the powerball exist in the Powerball Lottery game?
- Find the number of ways to match 3 numbers plus the Powerball.
- Find the number of ways to match 3 numbers.
- How many possible sets of 5 numbers plus the powerball will win you no prize in the Powerball Lottery game?
- Assume the Grand Prize for a particular drawing is \$93.4 million. What is the expected earnings (or loss) when playing the Powerball Lottery for this drawing? (Hint: It costs one dollar to purchase a ticket).
- Write an equation that gives you the expected earnings (or loss) when playing the Powerball Lottery for a given Grand Prize amount.
- Enter your equation into R, and calculate the expected earnings (or loss) when playing the Powerball Lottery for Grand Prizes of 50, 100, 125, 150, 200, 250, 300, 350 and 400 million dollars.
- Using R, obtain a plot of the Grand Prize amount vs. expected earnings (or loss).
- How much would the Grand Prize for a particular drawing have to be in order for the expected earnings to be \$0? Calculate this value and draw this value on your plot.
- In doing these calculations, we have ignored at least one factor in determining how much money you will actually receive from any of these prizes. What have we ignored? How will this factor change the calculations above?