Assignment #4 — Due Friday, October 1, 2010, by 4:00 P.M.

Turn in homework to your TA's mailbox using this sheet as the cover page.

Fill in your name and also circle the *lecture section in which you are registered* and circle the *discussion section you expect to attend* to pick up this assignment.

Name:

Lecture 1 (Larget).	**311:** Tu 1:00 - 2:15pm	**312:** Th 8:00 - 9:15am	**313:** We 1:00 - 2:15pm
Lecture 2 (Hanlon).	**321:** Tu 1:00 - 2:15pm	**322:** We 2:30 - 3:45pm	**323:** We 1:00 - 2:15pm

Please answer the following questions.

1. We have three buckets containing balls. Bucket 1 contains one blue ball, two red balls, and three white balls; Bucket 2 contains three blue balls, four red balls, and seven white balls; and Bucket 3 contains 80 blue balls and 20 white balls. We run the following experiment. First we randomly select a bucket in such a way that all three buckets are equally likely. Then we draw a ball at random from the selected bucket.

   (a) What is the probability that the ball is blue.
   (b) What is the probability that the ball is red.
   (c) What is the probability that the ball is white.
   (d) Now suppose that someone has performed this experiment and tells us that the selected ball was blue. What is the probability that it came from Bucket 1? Bucket 2? Bucket 3?

2. The following problems require examination of the graphs of binomial distributions. Use the function `gbinom()` from the file `gbinom.R`. (Use `source()` or a command through the menu to load this function into R.) Your turned-in solution does not need to include the graphs you examine to answer the questions.

   (a) A probability distribution is approximately *symmetric* if the left and right sides around the mean are nearly mirror images. If the left side is spread much more than the right, the distribution is said to be *skewed to the left*, and the opposite condition is called *skewed to the right*. Examine plots of binomial distributions with $p = 0.02$ and $n = 10, 20, 50, 100, 250, 1000$. Describe what happens to skewness as n increases.
   (b) Repeat the previous problem for $p = 0.5$. How is this different from the previous problem?
   (c) Possible values of the binomial distribution range from 0 to n, but most of the probability is often concentrated on a much smaller interval. Using your eye, roughly estimate the length of the interval that contains the middle 99% of the probability for binomial distributions with $p = 0.4$ and $n = 50, 200, 800, 3200$. Also compute the SD for each of these distributions. What is an approximate relationship between the SD and the size of the interval containing 99% of the probability?

3. The brown recluse spider *Loxosceles reclusa* is common in North America and has a nasty bite. In a study of the spider's diet preferences, researchers gave each of 141 spiders a choice between a live cricket and a dead cricket. They found that 98 spiders chose the dead cricket and 43 chose the live one. Use the binomial test to test the null hypothesis that these spiders have no preference between live and dead crickets versus the alternative that they prefer dead crickets. State hypotheses, find a test statistic, and use R to compute a p-value. Summarize your findings in the context of the problem.

4. p. 147, Problem 15 in the textbook.
5. p. 171, Problem 20 in the textbook.