Math 4397/6397, Fall 2009
Problem Set 3, due Thursday, Sep 17

Problem 1. When at the free-throw line for two shots, a basketball player makes at least one free throw 90% of the time. 80% of the time, the player makes the first shot, while 70% of the time both shots succeed.

a. Does it appear that the player's second shot success is independent of the first?

b. What is the conditional probability that the player makes the second shot given that the first succeeds? What is the conditional probability if the first shot misses?

Problem 2. This part is to get started simulating in R. Simulate the outcomes for $1,000$ random, uniformly distributed variables with density

$$f(x) = \begin{cases} 0.1 & , \text{ if } 0 \leq x \leq 10 \\ 0 & , \text{ else} \end{cases}$$

and do the following:

a. Calculate their sample mean, sample variance and sample standard error of the mean.

b. Compare with the mean and variance of the random variable with density f, and compare the sample standard error of the mean with the standard error of the mean obtained from the density.

c. Plot a histogram of the outcomes.

Hint: Use the functions `runif`, `mean`, `var` and `hist`.

Problem 3. Entering the code

```
temp <- matrix(sample(1 : 6, 1000 * 10, replace = TRUE), 1000)
xBar <- apply(temp, 1, mean)
```

in R produces $1,000$ averages of 10 die rolls. That is, it's like taking ten dice, rolling them, averaging the results and repeating this $1,000$ times.

a. Enter this in R. Plot a histogram of the resulting 1000 sample averages.

b. Let R compute the 1000 sample variances and plot a histogram.

c. Take the sample mean of `xBar`. What should this value be close to? (Explain your reasoning.)

d. Take the sample variance of `xBar`. What should this value be close to? (Compare with what you would expect.)

Hint: Use the functions `mean` and `var`.