# 1016-351-70
# Probability

Problem Set 4

Assigned 2010 March 30
Due 2010 April 6

**Show your work on all problems!**

## 1 Devore Chapter 3, Problem 64

## 2 Devore Chapter 3, Problem 74

## 3 Devore Chapter 3, Problem 76

## 4 Devore Chapter 3, Problem 86

## 5 Computational Exercise (Extra Credit)

The hypergeometric distribution

$$h(x; n, M, N) = \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}} \tag{5.1}$$

can be approximated by a binomial distribution

$$b(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x} \tag{5.2}$$

with $p = M/N$, when $M$, $N$, and $N - M$ are all large.

**a.** Using a computer, plot the pmfs $h(x; 10, 12, 20)$ and $b(x; 10, .6)$ over the range of possible $x$ values. (Recall that if you use matplotlib, the binomial coëfficient can be imported from scipy with `from scipy import comb`.)

**b.** Using a computer, plot the pmfs $h(x; 10, 120, 200)$ and $b(x; 10, .6)$ over the range of possible $x$ values.

**c.** Another large-number approximation is that the binomial distribution tends towards the Poisson distribution

$$p(x; \lambda) = \frac{e^{-\lambda}\lambda^x}{x!} \ . \tag{5.3}$$

On the same set of axes, plot the Poisson pmf $p(x; 3)$ and the binomial pmfs $b(x; 12, .25)$ and $b(x; 300, .01)$, for $x$ between 0 and 12, inclusive. (If you use matplotlib, you can also import a factorial function from scipy with `from scipy import factorial`. Also, beware that `lambda` is the name of an operator in python, so you will get mysterious syntax errors if you try to define a variable called `lambda`; I call mine `lam` instead.)