Math 186, Winter 2009, Prof. Tesler
Homework #6, Due WEDNESDAY February 18, 2009

Larsen & Marx **Fourth Edition**: (see hints below on problems marked *)
3.7# 11, 19c, 27b, 42
3.8# 7a*
3.9# 3, 14
3.11# 12(a)
4.4# 1, 2, 5*, 6 **(also include standard deviation in 4.4.2)**
4.5# 1, 4 **(also include standard deviation in 4.5.4)**
and the problem below: H-10.

***Hints on the indicated problems:**

3.8.7. (a) Compute the CDF $F_W(w)$ of $W = XY$. Then compute the PDF $f_W(w) = F_W{}'(w)$.

4.4.5. The formula the question asks you to prove is true for real $t \geq 0$ but not for $t < 0$, so you should also evaluate $F_X(t)$ for real $t < 0$.

Problem H-10. We will compute the mean of the geometric distribution. The book does this using "moments," a topic which we do not have time to cover, so we will do it in a different way. It's possible to compute $E(X^2)$ and then $\mathrm{Var}(X) = E(X^2) - (E(X))^2$ by steps similar to these but a little more complicated.

(a) Show that

$$E(X) = \sum_{k=1}^{\infty} k \cdot q^{k-1} \cdot p$$

where $q = 1 - p$.

(b) Show that the above summation can be rewritten as follows:

$$E(X) = p \cdot \frac{\partial}{\partial q} \sum_{k=1}^{\infty} q^k$$

(c) The sum in part (b) is a geometric series. Evaluate the geometric series, replace the sum in (b) by this value, and do the derivative $\frac{\partial}{\partial q}$. The final answer will be a quotient of polynomials involving p and q; there will not be an infinite sum any more.

(d) Plug in $q = 1 - p$ and simplify to get the final answer.