1. Write up details of the solution to Ch.6, problem 18 (done in groups in class last Friday). Explain the steps.

2. A mason is contracted to build a patio retaining wall. The base of the wall is a row of 50 bricks, each supposedly 10 inches long separated by a 1/2 inch joint. Suppose that the actual length of each brick is random, each with expected value 10 and standard deviation 1/32 and each joint is random with mean 1/2 and standard deviation 1/16. Let $L$ be the length of the resulting wall. Find the expected value, variance and standard deviation of $L$. What assumption do you need to make to do this?

3. In class we first showed that for two independent random variables $E(aX + bY) = aE(X) + bE(Y)$ and $V(aX + bY) = a^2V(X) + b^2V(Y)$. Show how to go from this to the statements in the notes that if $X_1, \ldots, X_n$ are independent then $E(\sum_i a_iX_i) = \sum_i a_iE(X_i)$ and $V(\sum_i a_iX_i) = \sum_i a_i^2V(X_i) = a_1^2V(X_1) + \ldots + a_n^2V(X_n)$.

4. First show that $\text{Cov}(aX + b, cY + d) = ac\text{Cov}(X, Y)$. Then show that $\rho(aX + b, cY + d) = \rho(X, Y)$ if $a$ and $c$ are the same sign and $\rho(aX + b, cY + d) = -\rho(X, Y)$ if $a$ and $c$ are different signs (and so except for the possible sign change linear transforming variables does not change correlation.)

5. Ch. 7, Problem 37.

6. Suppose $X$ and $Y$ are jointly continuous with pdf $f_{X,Y}(x, y)$. Suppose that $E(X|Y = y) = c$, a constant. This means that $\int_x x f_{X|Y}(x|y)dx = \int_x x f_{X,Y}(x,y) / f_Y(y) dx = c$. Show that this means that $E(X) = \int_x \int_y x f_{X,Y}(x,y) dy dx = c$ and $E(XY) = cE(Y)$ and hence $\text{Cov}(X,Y) = 0$. Hint: in taking expectations with respect to the joint distribution note that $f_{X,Y}(x, y) = f_{X|Y}(x|y) f_Y(y)$.

7. Ch. 7, problem 22 (outlined in class).

8. Consider the GPA/ACT example done in class. Write out the details on getting the conditional distribution of $Y$ (GPA) given $X$ (ACT) = 20, including giving the mean and variance of $Y$ given $X = 20$ and showing how to compute $P(Y > 3|X = 20)$.

Complete.