Practice Questions concerning the new material:

1. The mass of cereal in a box has a standard bell curve with mean 16.5 ounces and variance 0.151 ounces^2

a) What is the distribution including the parameters?

b) What is the probability that the box of cereal has a mass that is between 16 and 18 ounces?

c) What are the limits for the central 57% of the mass of the cereal?

2. The distribution of the errors of two instruments, X and Y, in a laboratory are independent of each other. In addition, each of the distributions has a normal distribution. If X has a mean of 0.02 with a variance of 0.03 and Y has mean of 0.01 with a variance of 0.015, what is the joint distribution of the errors of the two instruments? (Hint: Think about how to prove if two variables are independent.)

3. Let the joint probability density function of X and Y be given by

$$f_{X,Y}(x,y) = \begin{cases} \frac{6}{5}(x + y^2) & if\ 0 < x < 1, 0 < y < 1 \\ 0 & else \end{cases}$$

a) What is the probability that X is less than Y?

b) Calculate the marginal PDF of X.

c) Are X and Y independent? Why or why not?

d) Calculate the conditional PDF of Y given X = x.

e) Determine the conditional expectation of Y for each possible value of X.

f) Determine the conditional variance of Y when X = 0.2.

4. On average, a light bulb works for 5 years.

a) What is the distribution, including parameters? (Note: work includes determining what the parameter is.)

b) What is the probability that the light bulb will last for more than 7 years?

c) What is the variance for the length of time that the light bulb will last? (Please indicate from where you are obtaining your answer – this is the work.)