Q SCI 381: Introduction to Probability and Statistics
S. Scherba, Jr. Assignment #3: Review Exercises

The display of data.

NOTE: (*10 points*) Please turn in your work for the Display of Data question from Assignment #2 with this assignment. Clearly label it as Assignment #2 Display of Data Question.

Define the following.

1. (*2 points*) Independent events (requires both a written definition and mathematical formulas – several are possible).

2. (*2 points*) Mutually exclusive events (requires both a written definition and mathematical formulas – several are possible).

Short answer.

3. (*3 points*) For the binomial distribution:
    a. (*1 point*) What are the assumptions we make to use it as a model for the outcome of an experiment?

    b. (*1 point*) What are the parameters (define them in writing), expected value, and standard deviation of the binomial distribution?

    c. (*1 point*) What is the formula for the probability of getting x successes in n independent trials with probability p of success on each trial?

4. (*4 points*) For the Poisson distribution:
    a. (*2 points*) What are the assumptions we make to use it as a model for the outcome of an experiment?

    b. (*1 point*) What is the parameter (define it in writing), expected value, and standard deviation of the Poisson distribution?

    c. (*1 point*) What is the formula for the probability of the number of times, x, an event occurs in a given interval of time, length, or volume?

5. (*6 points*) For the normal distribution:
    a. (*4 points*) What are the four properties of the normal distribution?

b. (*1 point*) What are the parameters of the normal distribution?

c. (*1 point*) What is the formula for the probability distribution (probability density function) of a normally distributed r.v.?

6. (*5 points*) Which of the following random variables are discrete and which are continuous?

   a. The number of students in a section of a statistics course.

   b. The air pressure in automobile tire.

   c. The number of osprey chicks living in a nest.

   d. The weight in kg of bear cubs.

   e. The miles per gallon of randomly selected vehicles on a highway.

7. (*2 points*) Is the following a binomial experiment? Why or why not?

   A committee of 8 men and 3 women wish to select a chairperson and a recorder. They do this by placing their names in a hat and draw two names; the first person whose name is drawn will be the chairperson and the second will become the recorder. We then ask: What is the probability that both positions will be held by women?

Problems (Select one of the following).

8. (*6 points*) A medical doctor finds that 5% of mothers admit to having one or more glasses of wine per day during pregnancy. Fifteen (15) pregnant mothers are randomly selected (with replacement) from admission at a hospital. If $X =$ a random variable represents the number of mothers who admit to having one or more glasses per day during pregnancy, then:

   a. (*2 points*) What probability distribution would you assume as a model for the outcomes of this experiment, i.e., what is the probability distribution of X ? What are the values of the parameters of this distribution?

b. (*1 point*) Using that distribution and the appropriate table in F & P, what is the probability that exactly five (5) mothers will admit to drinking one or more glasses of wine during their pregnancy?

c. (*1 point*) Using that distribution and the appropriate table in F &P, what is the probability that none of the mothers will admit to drinking one or more glasses of wine during their pregnancy?

d. (*1 point*) Based on this sample of 15 pregnant mothers, what is the expected number of mothers who admit to drinking one or more glasses of wine during their pregnancy?

e. (*1 point*) What is the standard deviation about this expected (mean) value?

9. (*6 points*) You have to select the new manager for a team in your technology company. The two main traits you want to look for are Sensitivity (S) and Organizational ability (O). For each trait, there are two levels, High (H) and Low (L), hence, there four possible combinations: High Organizational skill (HO), High Sensitivity (HS), Low sensitivity (LS), and Low organizational skills (LO). You interview 200 applicants. The categories and the number of applicants having each trait turn out as follows: (HO, HS) = 64; (HO, LS) = 16; (LO, HS) = 42; (LO, LS) = 78. Let the event A = HO and the event B = HS.

   a. (*3 points*) Arrange the number of applicants by their level of each trait in the table below (use the above numbers to fill in the table):

	HS	LS	Total
HO			
LO			
Total			

   b. (*1 point*) Calculate $P(A)$.

   c. (*1 point*) Calculate $P(B)$.

d. (*1 point*) Calculate $P(A \cap B)$. Two methods are possible.