STA 504 Homework #2

Due: Monday, September 18

Show your work to earn full credit. You are encouraged to work with your peers on assignments. The write-up must be your own.

Caution: The problem labels in the following may not be different from those used in the textbook.

Problems are chosen from Section 3.1: Definitions of random variables and their probability distributions.

You need to use some of the concepts we covered in Chapter 2 to solve some of these problems.

3.3 A group of four components is known to contain two defectives. An inspector tests the components one at a time until the two defectives are located. Once she locates the two defectives, she stops testing, but the second defective is tested to ensure accuracy. Let Y denote the number of the test on which the second defective is found. Find the probability distribution for Y.

3.6 Five balls, numbered 1, 2, 3, 4, and 5, are placed in an urn. Two balls are randomly selected from the five, and their numbers noted. Find the probability distribution for the following:

a The *largest* of the two sampled numbers

b The *sum* of the two sampled numbers

3.9 In order to verify the accuracy of their financial accounts, companies use auditors on a regular basis to verify accounting entries. The company's employees make erroneous entries 5% of the time. Suppose that an auditor randomly checks three entries.

a Find the probability distribution for Y, the number of errors detected by the auditor.

b Construct a probability histogram for $p(y)$.

c Find the probability that the auditor will detect more than one error.

3.11 Persons entering a blood bank are such that 1 in 3 have type O^+ blood and 1 in 15 have type O^- blood. Consider three randomly selected donors for the blood bank. Let X denote the number of donors with type O^+ blood and Y denote the number with type O^- blood. Find the probability distributions for X and Y. Also find the probability distribution for $X + Y$, the number of donors who have type O blood.

Calculus Review

Answer the following questions for the given function below.

$$f(x) = \frac{e^{ax+b}}{1 + e^{ax+b}}$$

(1). Specify the domain and range of this function.

(2). Is this an odd function or even function? Justify your answer.

(3). Find the derivative of the function;

(4). Is this function monotonic? Justify your answer using the definition of the monotonic function.

(5). If your answer in (2) is Yes, find the inverse function of f(x), denoted by f⁻¹(x). Please also specify the domain and the range of f⁻¹(x). Compare the domain and range of f(x) with that of f⁻¹(x).