**MA 222A EXAM #3 April 7, 2016**

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I pledge my honor that I have abided by the Stevens Honor System.

signature: ­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Closed book, closed notes, no electronic access. Answer all questions.**

**PROBLEM 6 IS OPTIONAL, FOR EXTRA CREDIT**

1. A wire-bonding system normally runs with the mean pull strength at 10 pounds. It is known that the pull-strength measurements are normally distributed with a population standard deviation of 1.5 pounds. Periodic samples of size 4 are taken from the process and the process is said to be “out of control” if a sample mean is found to be less than 7.75 pounds. What is the probability that a particular sample mean will be found to be “out of control” (less than 7.75 pounds) if:

a) the mean pull strength is still 10 pounds?

b) the mean pull strength is actually 9 pounds?

2. Two types of coins are produced at a factory: a fair coin, and a biased one that comes up heads 55 percent of the time. We have one of these coins but do not know whether it is a fair coin or a biased one. In order to ascertain which type of coin we have, we shall perform the following statistical test: We shall toss the coin 1000 times. If the coin lands on heads 525 or more times, then we shall conclude that the coin is a biased coin; otherwise we shall conclude that the coin is fair. If the coin is actually fair, what is the probability that we falsely conclude that the coin is a biased one?

3. Each day Ms. X plays a series of games in which at each play of the game she wins $1 with probability 18/38 and loses $1 with probability 20/38.

Her strategy for today is: Start playing, and stop playing if she wins the first game. If she loses the first game, she will play one more game and then stop playing.

What is the expected value of her winnings with this strategy?

4. Consider the following joint probability distribution for the random variables X and Y:

P[ X=0, Y=0 ] = 1/6

P[ X=1, Y=0 ] = 1/12

P[ X=1, Y=1 ] = 1/6

P[ X=2, Y=0 ] = 1/12

P[ X=2, Y=1 ] = 1/3

P[ X=2, Y=2 ] = 1/6

Calculate the variance of X.

5. A hat contains 10 pieces of paper, each with a different person’s name on it. Person A randomly selects 3 names out of the hat, after which the 3 names are returned to the hat and then Person B randomly selects 3 names out of the hat. What is the expected number of names that are selected by both Person A and Person B? *Hint: Use auxiliary (indicator) random variables.*

OPTIONAL PROBLEM, FOR EXTRA CREDIT (20 points!) no partial credit on this problem

X is a continuous random variable that is uniformly distributed between 0 and 1, and Y is a continuous random variable that is uniformly distributed between 0 and 3. A single random sample of each random variable is obtained. What is the probability that the X-value is larger than the Y-value?