**MAT 271E Probability and Statistics Final Exam 2014 120 minutes**

Do all 4 problems. Show your work for credit. Write your name on all returned sheets

1. Let  where  are zero mean random variables with variances  and correlation coefficient .
   1. Determine , the variance of random variable  in terms of these parameters and constants . (15 pts)
   2. For given  and , determine the minimum value of . State the condition on linear dependence that achieves this minimum variance value. (10 pts)
2. 21 voltage measurements are taken at the output terminals of a dc power supply. A sample mean voltage of 11.8 volts is computed.
   1. Describe a range of voltages within which the output mean voltage lies with probability of 0.9. Assume that the sample standard deviation is 0.3. (10 pts)
   2. If we take more measurements does the range within which the output mean voltage lies with probability of 0.9 narrow or widen? Explain why. (5 pts)
   3. Test the hypothesis that the output mean voltage is 12 volts. Assume a significance level of  for the test. (10 pts)
3. A cab was involved in a hit and run accident at night. Two cab companies, the Green and the Blue, operate in the city. You are given the following data:
4. 85% of the cabs in the city are Green and 15% are Blue.
5. A witness identified the cab as Blue. The court tested the reliability of the witness under the same circumstances that existed on the night of the accident and concluded that the witness correctly identified each one of the two colors 80% of the time and failed 20% of the time.

What is the probability that the cab involved in the accident was Blue rather than Green? (25 pts)

4. The joint densityof two random variables is given as 

a. If we are told that the random variable  assumes the value 1, what is the expected value of the random variable ? (15 pts)

b. Are the two random variables X, Y statistically independent? Explain. (10 pts)