EECS 861
Homework 4

1. The joint distribution of X_1 and X_2 is
   $f_{X_1,X_2}(x_1,x_2) = 3x_1$ for $0 < x_1 < 1$ $0 < x_2 < x_1$ and $f_{X_1,X_2}(x_1,x_2) = 0$ otherwise
   a. Find the marginal pdf of X_1
   b. Find $f_{X_2|X_1}(x_2 \mid x_1)$
   c. Find $E[X_2|X_1=1/2]$
   d. Find $Var[X_2|X_1=1/2]$
2. X and Y are S.I. RVs with means and standard deviations of μ_X, μ_Y, σ_X, σ_Y.
   Let Z = X+Y + c. Find the mean and variance of Z.
3. Chapter 2: Problem 2.33 a
4. Chapter 2: Problem 2.34
5. Chapter 2: Problem 2.35 a, b
6. Chapter 2: Problem 2.42
7. For the bivariate Gaussian random vector X given in problem 2.47. Find
   a. $E[X_1]$, $Var[X_1]$, $E[X_2]$, $Var[X_2]$
   b. $\rho_{X_1X_2}$
   c. $E[X_1| X_2=1]$, $Var[X_1| X_2=1]$,
   d. $P(X_1>2| X_2=1)$
8. For the bivariate Gaussian random vector X given in problem 2.47
   Find a transformation B, Z=BX, where the Z_1 and Z_2 are identically distributed and statistically independent with unit variance.
9. X is a RV with mean and standard deviation of $\mu_X=0$ and σ_X. Y=aX+b. Find ρ_{XY}
10. Plot and analyze the following data sets. Create a scatter plot and estimate ρ_{XY}, the covariance and correlation matrixes for each data set below. For estimators see http://demonstrations.wolfram.com/CorrelationAndCovarianceOfRandomDiscreteSignal
    What can you say about ρ_{XY} from visual examination of the scatter plot?
    a. Data set http://www.ittc.ku.edu/~frost/EECS_861/EECS_861_HW_Fall_2017/Homework-4-10a.csv
    b. Data set http://www.ittc.ku.edu/~frost/EECS_861/EECS_861_HW_Fall_2017/Homework-4-10b.csv
    c. Data set http://www.ittc.ku.edu/~frost/EECS_861/EECS_861_HW_Fall_2017/Homework-4-10c.csv