MECH 5970/6970 (GPS)
Homework #1
Due: 1/30/2023

1. Chapter 1, Problem 1-4

2. Generate two random sequences that are 100 long and randomly comprised of +1 and -1. There are several ways to do this using the normal Gaussian random signal generator (randn) or the uniformly distributed random signal generator (rand):

   \[ >2*\text{ceil}((\text{rand}(100,1)-0.5)-1) \]
   \[ >2*\text{ceil}(0.1*\text{randn}(100,1))-1 \]

   a) Plot the histogram on each sequence
   b) Plot the spectral analysis on each sequence

   There are multiple methods to make the Power Spectral Density (PSD):

   \[ >\text{periodogram}(X) \]
   \[ >\text{pwelch}(X,\text{window} \_\text{filter}) \]
   \[ >\text{plot(abs(fft}(X)) \]

   c) Plot the autocorrelation each sequence with itself (i.e. a sequence delay cross correlation)
   d) Plot the cross autocorrelation between the two sequences

**Bonus:** Repeat for a sequence that is 1000 long and compare to above.

3. Generate 3 sequences 1000 long:
   A=3+3*randn(1000,1)
   B=5+5*randn(1000,1)
   C=A+B
   DATA=[A B C]

   a) Find the mean (>>\text{mean}) and variance (>>\text{std} or >>\text{var}) for A, B, and C
   b) Find the mean of DATA
   c) Find the Covariance Matrix of DATA (>>\text{cov})

4. Develop the Taylor Series linearized approximation the following equation

   \[ r(x, y) = \sqrt{(x-a)^2 + (y-b)^2} \]