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*ceil(rand(100,1)-0.5)-1

>>2*ceil(0.1*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):

>>periodogram(X)
>>pwelch(X,window_filter)
>>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 (>>mean) and variance (>>std or >>var) for A, B, and C
    b) Find the mean of DATA
    c) Find the Covariance Matrix of DATA   (>>cov)

4. Develop the Taylor Series linearized approximation the following equation

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