EE257/GP258 **Lab/Homework #8**
Applied Optimization Laboratory Handout #22
Due: Thurs., Mar. 7

Problem 1 – Gaussian random variables.

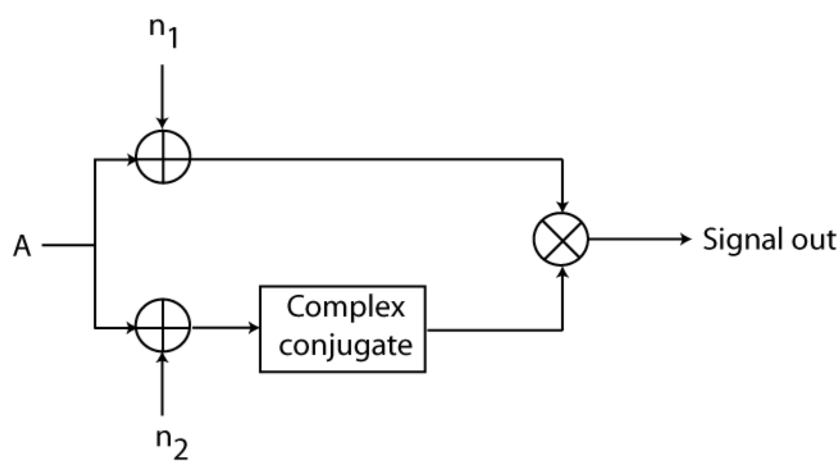
Create a subroutine to generate Gaussian random variables. The Fortran 90 built-in functions "sum" and "random_number" will be useful for you.

a) Compute a histogram such that the uncertainty of the peak value of the histogram is less than 0.5%.

b) From your histogram, compute the mean, second, and third moments of the distribution. From these calculate the variance and standard deviation and see if they match the predicted values for a zero mean, unit variance Gaussian.

Problem 2 – Gaussian process.

Consider the following system model:



Here A is a real number, and n_1 and n_2 are complex Gaussian random variables with variance 0.5 in each of the real and imaginary parts.

a) Compute the pdfs for the amplitude and phase of the output for A=1 and A=10. Use sufficient random draws such that the uncertainty of the peak in the pdf is less than 0.5%.

b) Plot the mean and standard deviation of the amplitude, and the standard deviation of the phase, of the output signal for A ranging from 1 to 100 by ones. Use the same number of random draws as the largest number you needed in part a) of this problem.

Problem 3 – Gaussian signal in Gaussian noise.

Repeat problem 2 but instead of a constant value for A, let A itself be a Gaussian random variable with standard deviation equal to the values we used for constant A. For example, in part a) compute amplitude and phase pdfs where A is a Gaussian rv with standard deviation of 1, and then of 10. For part b) derive the same curve as above for the standard deviation of A ranging from 1 to 100.

Problem 4 – Computing π.

Compute π to 5 significant figures using the method described in class. Use parallel computing methods to speed up your calculation.