**ECE 3522: Stochastic Processes in Signals and Systems**

# Computer Assignment (CA) No. 8: Central LiMIT Theorem

The goal of this assignment is to demonstrate an application of the Central Limit Theorem.

The tasks to be accomplished are:

1. Generate a sum of uniformly distributed mutually independent random variables:



Write this as a function in MATLAB with arguments that include the number of random variables (*n*), the number of total samples generated (*N*), and the range of the uniform random number generator (e.g., min=-1, max=1).

1. In the main part of your program, write a loop for *n=1,100*, and call this function for *N=10,000* with a range of [*-1,1*]. For each iteration, compute the mean and variance of the output sequence, *Sn*, and plot the RMS error between a Gaussian fit of this distribution and the actual distribution (I hope you are using your code from a previous homework assignment in a function!).
2. Plot the RMS error as a function of the value of *n*. Also display the actual distribution and overlay its Gaussian fit for *n=1*, *n=10* and *n=100*.
3. Consider the following technique for generating a Gaussian distribution from a uniform random number generator: <http://en.wikipedia.org/wiki/Box%E2%80%93Muller_transform>. Generate *N=10,000* random numbers using this technique, estimate a pdf, and compare the result using the RMS error to (2) for *n=10*, *N=10,000*, range=[*0,1*]. Time the code in both cases using MATLABs built-in timing tools. Which technique gives the better fit? Which technique is faster? How low can you set *n* to get comparable performance in both time and RMS error?

Discuss how (1)-(3) demonstrates the Central Limit Theorem.