AGEC 643
Applied Simulation
Homework 1
Due September 23, 2016

Your homework problems are to be done in Excel. Print all pages showing the calculations documented by =VFORMULA( ). Show row numbers and column numbers on EVERY page. Minimize the pages printed but do not make the characters smaller than 2 mm so I can read it. DO NOT copy your Excel sheets and paste them in Word. Write all explanation by hand on the printed pages or type the explanations in the Excel worksheets.

1. Use the data in Data HWK1 2016.xlsx and answer the questions below. Use the Matrix functions in Simetar to do parts f-l.
    a. Calculate the summary statistics
    b. Estimate trend regressions for all the variables
    c. Forecast the variables for 5 years using the trend regression
    d. Calculate a correlation matrix for the variables
    e. Calculate a covariance matrix for the variables
    f. Calculate the square root of the correlation matrix, call it R. This is called factor a square symmetric matrix.
    g. Transpose the R matrix, or R'
    h. Calculate the product of RR' check to make sure it is the same as the original correlation matrix
    i. Sort the columns of the original data on column 2 from low to high, carrying along all the other columns
    j. Convert the matrix of data to a column vector
    k. Reverse the order of the data in the column matrix
    l. Create a diagonal 10x10 matrix of 1s

2. Prove Simetar is a Pseudo Random Number Generator by comparing =RAND( ) in Excel to =Uniform( ). Run the model two times and save the results for the two runs in one worksheet. Generate two different samples of 500 random values for X ~ U(0,1), compare statistics for the four samples (that is two for RAND( ) and two for Uniform( ) samples) and print a table with the first 25 sampled values for the four samples of X. Explain why Simetar is pseudo random and why Excel's RAND is not, based on the results. Generate a CDF for two of the samples.

3. Compare Monte Carlo to Latin Hypercube sampling by generating two 500 iteration samples of X ~ N(100,20), using =NORM(100,20,USD), one as Monte Carlo (=RAND()) and one as LHC (=UNIFORM()) to generate the USDs. Compare the summary statistics and the CDFs for the two samples vs. the "true" normal distribution, which is a mean of 100 and a standard deviation of 20. Explain why they are different.

3. Calculate the root means square error (RMSE) and the CDFDEV between the Rand() and Uniform() distributions simulated in problem 1 to the "true" Uniform distribution. . The true distribution is an equal increment column of 500 values starting at 0.0 and extending to 1.00, equal set increment for the true distribution are equal to 1/499. You can generate the "true" distribution by hand in Excel. Explain which distribution is the best method to simulate a uniform random number.

4. Given the data for random variable X, estimate the parameters and simulate it using the UPES in Simetar and also simulate X with an Empirical distribution. Make sure you use the common random number for the EMP as you use for other distributions. Print this part of your model with VFORMULA showing the calculations you made. Simulate the random variables and compare their

simulated results to the original historical X distribution below using a CDF and the CDFDEV. Explain which is best. X~(25.0, 30.0, 18.1, 16.5, 28.1, 33.3, 45.0, 40.0, 35.0, 19.0, 25.0, 37.0). Which distribution is best for simulating the X variable?

5. Simulate a simple farm model using the data below:

	Corn	Soybean	Wheat
Yields bu/acre			
Average Yield	190	65	50
Std Dev Yield	30	15	20
Prices $/bu.			
Average Yield	3.40	6.00	4.17
Std Dev Yield	.30	.40	.50
Cost of Production			
$/acre	150.00	100.00	65.00
$/bushel	0.20	0.25	0.30
Acres Planted			
Scenario 1	100	60	40
Scenario 2	80	80	40
Scenario 3	100	100	0
Scenario 4	50	110	40

The Key Output Variable (KOV) is net returns for the farm. Simulate the 4 scenarios using the =SCENARIO() function in Simetar and report the summary statistics, CDFs and PDFs for the KOV.
Be sure to document your model with =VFORMULA() for all of your equations.
Make sure the yields and prices are always positive, i.e., never go negative.