**Fordham University**

**Gabelli School of Business**

**QFGB-8925: Simulation Applications**

ASSIGNMENT 1: Due: 3/24

1. Develop a Linear Congruent Random Number Generator (L’Ecuyer, P. 1988, Communications of the ACM, vol. 31, pp. 742–774.) with two modulus algorithm. Use the generator to generate (SEED = -1000):
   1. 100 Random numbers between 1 and 1000 and plot a histogram.
   2. 10,000 Random numbers between 0 and 1 and plot a histogram
   3. What pattern do you observe.
2. Uniform Distributions: Playing Roulette. Simulate a Roulette game with a bet on numbers (ignore colors and zeros). Each bet is for $1 based on the last two numbers of your student ID. If the student ID number is 0, bet on 1. If the last two numbers of your student ID number is greater than 36, bet on 36.
   * + If your number is drawn you win $36 [Profit = $35]
     + If another number is drawn you get 0. [Loss = -$1]
   1. Assume that the roulette is fair and has 36 slots. Each slot has an equal probability. Use your random number generator above and generate draws between 1 and 36. Confirm the distribution of the random numbers using a histogram.
   2. Using simulations, calculate the expected Profit/Loss for 10 plays of Roulette. Also simulate for 100 plays and 1,000 plays. Calculate the mean and standard deviation of the Profit/Loss. In each
   3. Redo the simulations for an “unfair” roulette. The payoffs are the same, but now the roulette has 37 slots (Add a 0 slot) or 38 slots (add 0 and 00 slots).
3. Use the random number generator to simulate draws from a normal distribution. Use the inverse-normal technique show in Glasserman. Simulate 10,000 draws and draw a histogram of the distribution.
4. Pick a stock that starts with the same letter as your first name (if you don’t find a stock, use the last letter of your first name). Preferably the stock should pay a dividend. Use finance.yahoo.com to find option prices on the stock of your choice. Pick an option maturity between 3 and 6 months. The stock will pay at least one dividend over the life of the option. Choose five options that have a strike price above/below the current strike price.
   1. Calculate the implied volatility using the Black-Scholes model.
   2. Calculate the implied volatility using Monte Carlo simulations. Is there a pattern to the implied volatility that you can see?

**RAN 2: TWO TANDOM N UMBERS & SHUFFLE**





**NORMALLY DISTRIBUTED RANDOM NUMBERS: THE INVERSE NORMAL**

