STAT6106 Assignment 3

Due on Nov. 8th at 7:30pm

1. Play with the following code, capture a 3D picture as in Slide 9 of lecture-4 to show the regularity of pseudorandom numbers.

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```
# Pseudo-Random-Number-Generator

# out[1] = (a * seed)%%m

# out[i + 1] = (a * out[i])%%m


RNG = function(B = 100, seed = 0, a = 65539, m = 2^31) {
   out = rep(0, B)
   if (seed == 0)
      seed = as.numeric(format(Sys.time(), "%s"))   #Using the computer's clock to set seed
   out[1] = (a * seed)%%m
   for (i in 1:(B - 1)) {
      out[i + 1] = (a * out[i])%%m
   }
   return(out/m)  #standardize it to the range of 0~1
}
RNG(seed = 12345)


#Once it revisits a number that has already come out, it becomes in sync with all the rest:

#Using a 3d scatterplot viewer to see the patterns in Random Numbers

#note: you may need to install this R package “rgl”

#how to install a R package: https://www.youtube.com/watch?v=-fWWqDB9mV0


randu3k=matrix(RNG(seed=12345,B=3000),ncol=3,byrow=TRUE)

library(rgl)
```

plot3d(randu3k)

2. Revise the R code of the above “RNG” function to implement the other two Linear Congruential Generators IMSL and SIMSCRIPT in Slide 5 of lecture-4, set seed as 1 for both, get 1000 random numbers from each, and report the correlation and the pairwise scatterplot (x_i,y_i), where x_i is the i-th number from IMSL, y_i is the i-th number from SIMSCRIPT. (you shall hand in the code, the correlation value and the scatterplot).

3. Write a program to calculate the integral $\int_0^5 e^{x^{0.1}}\,dx$ using the idea in Slide 13 of lecture-4. You shall hand in the code and report your estimated values under sample size n=100,1000,10000.

4. Use Monte Carlo method to estimate the integration $\int_0^{+\infty} |\sin(x)|e^{-x}\,dx$. Use “set.seed(0)” as the first line of your code such that your results can be exactly replicated. Submit your program source code and ten estimates, together with mean and standard deviation of your ten estimates.