MA 226 (2018) **Monte Carlo Simulation** **Lab 01**

General Instructions for MA 226 (Applicable for all lab assignments for the first part of the course)

- *Please create a folder with the last two digits of your Roll Number, IITG Email ID and the Lab Assignment Number in maths1 server under your home directory as per the instructions in the following example. For example, if your Roll Number is '160123099', your IITG Email ID is 'x.yz' and the Lab Assignment is 'Lab 01' then you have to create a folder '***99x.yzMA226lab01***' under your home directory in the maths1 server (172.16.68.1).*
  This is very important, since files outside this folder will not be collected and will as such be treated as "The student has not submitted the lab assignment".
- *Your program should be written in such a way that there is only one program for each question and all the outputs for each question should be displayed by running the program once only.*
- *Put down all your observations and outputs of the questions asked in a single word document. Finally create a pdf file from the word file.*
- *All your programs and output files (in word and pdf format) must be put inside the folder that you created as per the instructions above (You may work on the assignment in your local machine, but all the relevant files must finally be put inside the folder on the maths1 server).*

All the following problems are for the following general linear congruence generator :

$$\begin{aligned} x_{i+1} &= (ax_i + b) \bmod m \\ u_{i+1} &= x_{i+1}/m.. \end{aligned}$$

1. Generate the sequence of numbers x_i for $a = 6,\ b = 0,\ m = 11$ and x_0 ranging from 0 to 10. Also, generate the sequence of numbers x_i for $a = 3,\ b = 0,\ m = 11$, and x_0 ranging from 0 to 10. Observe the sequence of numbers generated and observe the repetition of values. Tabulate these for each group of values. How many distinct values are appearing before repetitions? Which, in your view, are the best choices and why?

2. Generate a sequence u_i with $m = 244944,\ a = 1597,\ 51749$ (take x_0 as per your choice). Try to group the values in the ranges $0 - 0.05,\ 0.05 - 0.10,\ 0.10 - 0.15, ...$ and see their frequencies (i.e. the number of values falling in a group). For at least 5 different values of the number of values generated, tabulate the frequencies in each case, draw bar diagrams of these data and put in your observations.

3. Generate a sequence u_i with $a = 1229,\ b = 1,\ m = 2048$. Plot in a two-dimensional graph the points (u_{i-1}, u_i), i.e., the points (u_1, u_2), (u_2, u_3), (u_3, u_4),...What are your observations?