Lab Assignment - 3

Instructor: Dr. Arabin Kumar Dey

1 Due date:

- 25/1/2013.

2 Notes:

- Make a proper documentation preferably in latex or using some other software and submit the printout of the report in .pdf form.

- Each student needs to write his/ her own solutions, even though discussions of the assignments between students are encouraged.

3 Assignments:

1. Implement the linear congruence generator $x_{i+1} = ax_i \mod m$ to generate a sequence x_i and hence uniform random numbers u_i . Make use of the following set of values of a and m: (a) a = 16807 and $m = 2^{31} - 1$. (b) a = 40692 and m = 2147483399. (c) a = 40014 and m = 2147483563.

   Group the values into equidistant ranges for the values of u_i. Tabulate the proportions and draw a bar diagram for the above. What do you observe ? Do it for 1000, 10000 and 100000 values.

For part (a) do the following: Plot the values (u_i, u_{i+1}) on a unit square. Now, zoom into the range $u_i \in [0, 0.001]$. What are your observations ?

2. Consider the extended Fibonacci generator :

$$U_i = (U_{i-17} + U_{i-5}) \mod 2^{31}.$$

(a) Use the linear congruence generator to generate the first 17 values of U_i . (b) Then generate the values of U_i (say for 1000, 10000 and 100000 values). (c) For each of the above set of values plot (U_i, U_{i+1}). (d) Observe (give the values) the convergence of the sample mean and sample variance towards actual values, and generate a probability distribution with, say, 1000 values generated. (e) Compute the autocorrelation of lags 1, 2, 3, 4, and 5 with 1000 generated values.