

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 appear before repetitions? Which, in your opinion, are the best choices and why?
2. Generate a sequence  $u_i$ ,  $i = 1, 2, \dots, 10000$  with  $m = 244944$ ,  $a = 1597$ ,  $b = 51749$  (choosing  $x_0$  as per your choice). Then group the values in the ranges

$$[0, 0.05), [0.05, 0.10), [0.10, 0.15), \dots, [0.95, 1)$$

and observe their frequencies (*i.e.*, the number of values falling in each group). For 5 different  $x_0$  values, tabulate the frequencies in each case, draw the bar diagrams for these data and put in your observations.

3. Generate a sequence  $u_i$ ,  $i = 1, 2, \dots, 10000$  with  $a = 1229$ ,  $b = 1$ ,  $m = 2048$ . Plot in a two-dimensional graph the points  $(u_{i-1}, u_i)$ , *i.e.*, the points  $(u_1, u_2)$ ,  $(u_2, u_3)$ ,  $(u_3, u_4)$ ,  $\dots$
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***Submission Deadline: August 10, 2021, 11:50 PM***