

S & S Assignment 6

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1. Write down as a difference equation with non-linearity; take a and c as 5 digit prime numbers and plot output for 1000 values.

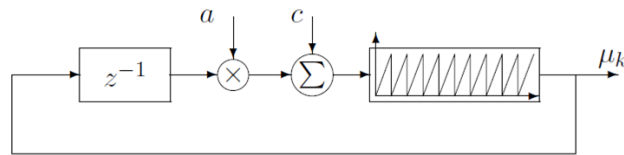


Figure 1: Linear congrential generator (LCG)

Sol:- The non-linear function in the above block diagram is modulo function.

- First input is μ_k .
- When it passes through z^{-1} , it becomes μ_{k-1} , further multiplied with 'a' becomes $a\mu_{k-1}$.
- Further added with 'c' results in $a\mu_{k-1} + c$.
- Now the new input to the modulo function is $a\mu_{k-1} + c$. When it is passed through modulo function, the output is $(a\mu_{k-1} + c) \bmod n$.
- Therefore, the difference equation is

$$\mu_k = (a\mu_{k-1} + c) \bmod n$$

where 'a' and 'c' are 5 digit prime numbers and

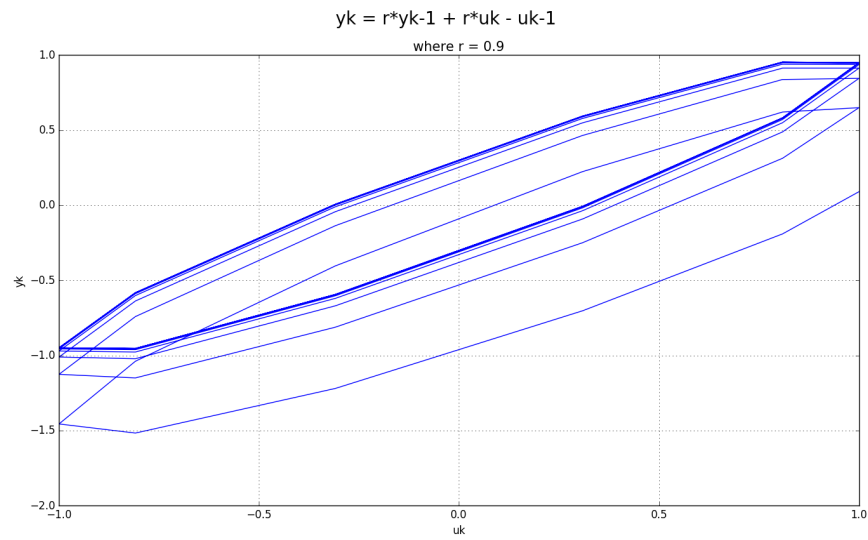
$$k \in [0, 1000]$$

Constraints on the values are:

- $10000 < a < m$
- $10000 < c < m$
- $0 < \mu_{k-1} < m$

Data points:

x	y
1	0
2	0
3	99997
4	79981
5	37828
6	99886
7	68509
8	24484
9	58666
10	80515
..	..
..	..



- 2 Use u_k as cosine wave with $f = 0.1$, $u_k = \cos(2\pi f k)$ for 100 values get y_k and plot u_k and y_k for the below difference equation

$$y_k = r \cdot y_{k-1} + r \cdot \mu_{k-1} - \mu_k$$

u_k	y_k
1.0	0.09
0.809	-0.19
0.309	-0.702
-0.309	-1.219
-0.809	-1.516
-1.0	-1.456
-0.809	-1.038
-0.309	-0.403
0.309	0.223
0.809	0.620
..	..
..	..

