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Lab No. **01**

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Department : **Mathematics and Computing**

Question 1:)

We can find the next value of x using the formula:

$$x[i+1] = (a * x[i] + b) \bmod(m)$$

$$u[i+1] = x[i+1] / m$$

where $x[0] = \text{seed}$

Output :

a b m	LCGsequence	No of distinct values
3 0 11		
x : 0 ->	0, 0 ,...	1
x : 1 ->	1, 3, 9, 5, 4, 1 ,...	5
x : 2 ->	2, 6, 7, 10, 8, 2 ,...	5
x : 3 ->	3, 9, 5, 4, 1, 3 ,...	5
x : 4 ->	4, 1, 3, 9, 5, 4 ,...	5
x : 5 ->	5, 4, 1, 3, 9, 5 ,...	5
x : 6 ->	6, 7, 10, 8, 2, 6 ,...	5
x : 7 ->	7, 10, 8, 2, 6, 7 ,...	5
x : 8 ->	8, 2, 6, 7, 10, 8 ,...	5
x : 9 ->	9, 5, 4, 1, 3, 9 ,...	5
x : 10 ->	10, 8, 2, 6, 7, 10 ,...	5

a b m	LCGsequence	No of distinct values
6 0 11		
x : 0 ->	0, 0 ,...	1
x : 1 ->	1, 6, 3, 7, 9, 10, 5, 8, 4, 2, 1 ,...	10
x : 2 ->	2, 1, 6, 3, 7, 9, 10, 5, 8, 4, 2 ,...	10
x : 3 ->	3, 7, 9, 10, 5, 8, 4, 2, 1, 6, 3 ,...	10
x : 4 ->	4, 2, 1, 6, 3, 7, 9, 10, 5, 8, 4 ,...	10
x : 5 ->	5, 8, 4, 2, 1, 6, 3, 7, 9, 10, 5 ,...	10
x : 6 ->	6, 3, 7, 9, 10, 5, 8, 4, 2, 1, 6 ,...	10
x : 7 ->	7, 9, 10, 5, 8, 4, 2, 1, 6, 3, 7 ,...	10
x : 8 ->	8, 4, 2, 1, 6, 3, 7, 9, 10, 5, 8 ,...	10
x : 9 ->	9, 10, 5, 8, 4, 2, 1, 6, 3, 7, 9 ,...	10
x : 10 ->	10, 5, 8, 4, 2, 1, 6, 3, 7, 9, 10 ,...	10

Observations :

As any random generator will repeat hence more period is always preferred.

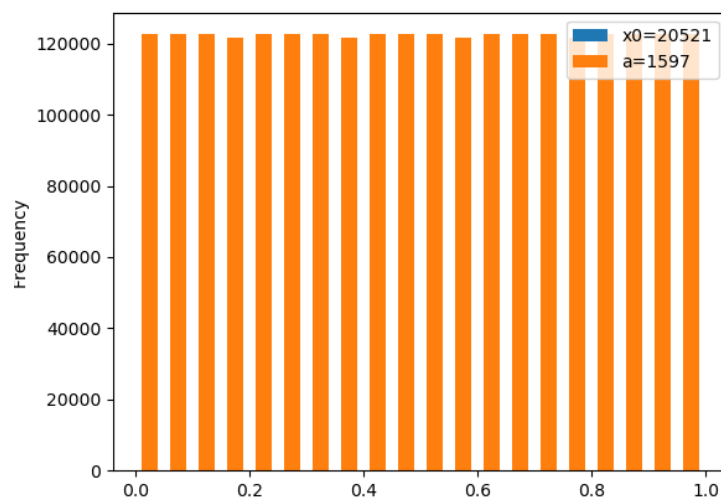
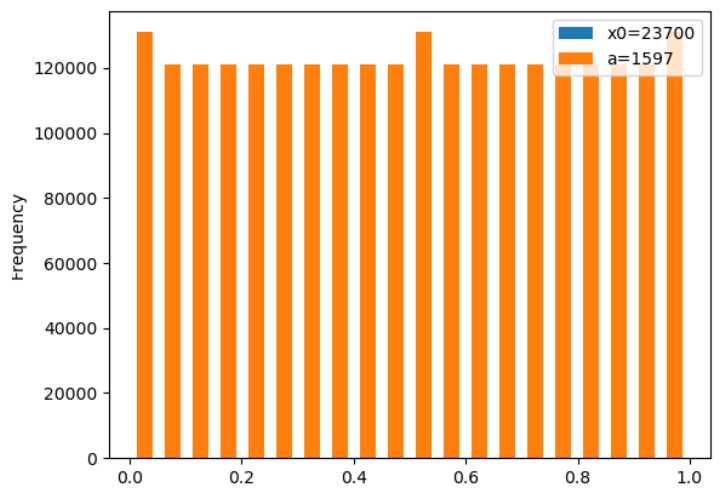
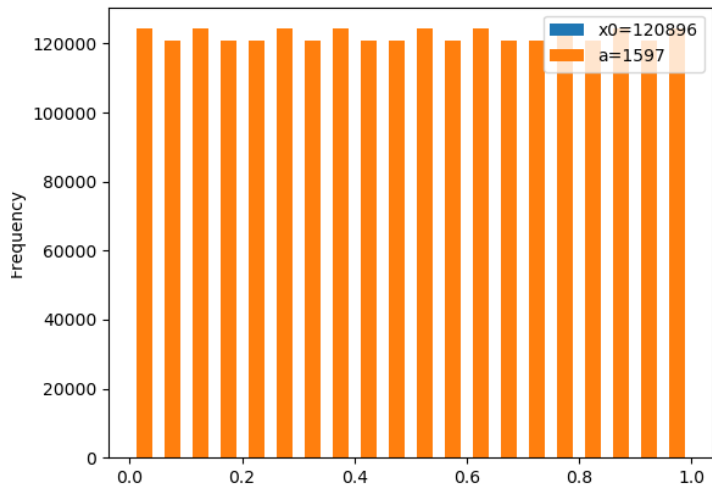
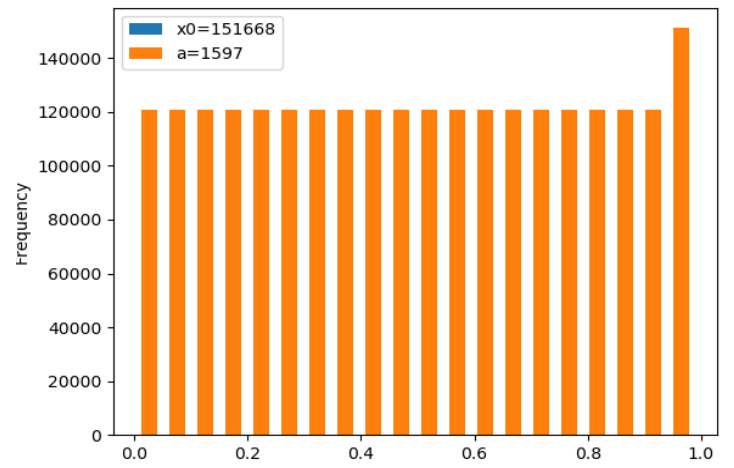
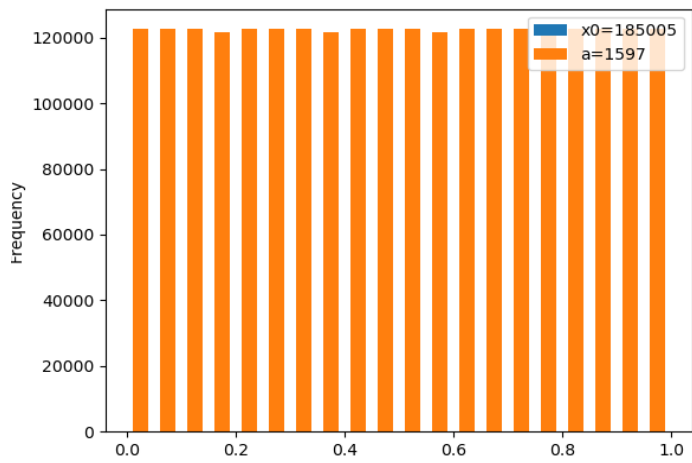
I think the 2nd option will be better as it will have more no of elements before repetition leading to randomness or we can say gap is larger.

Question 2.)

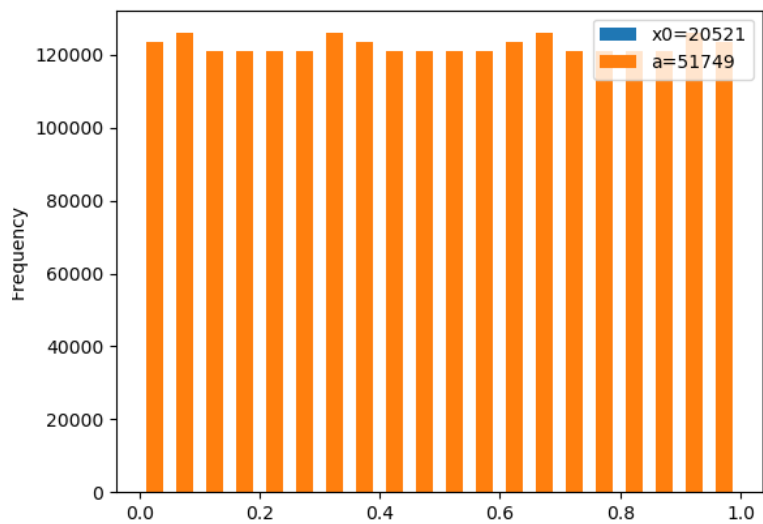
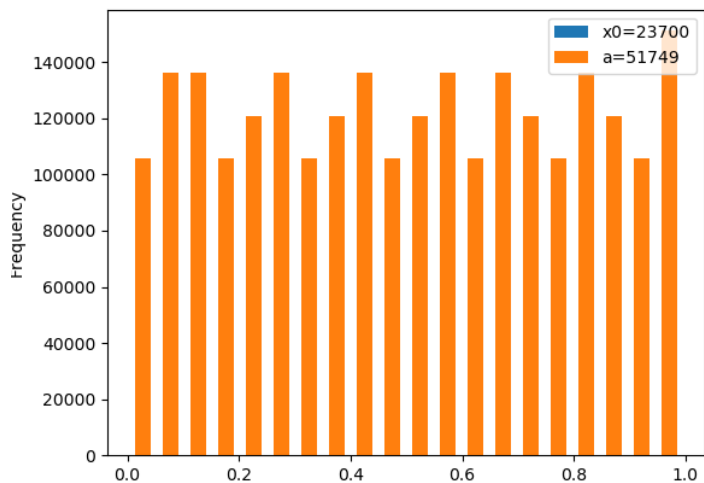
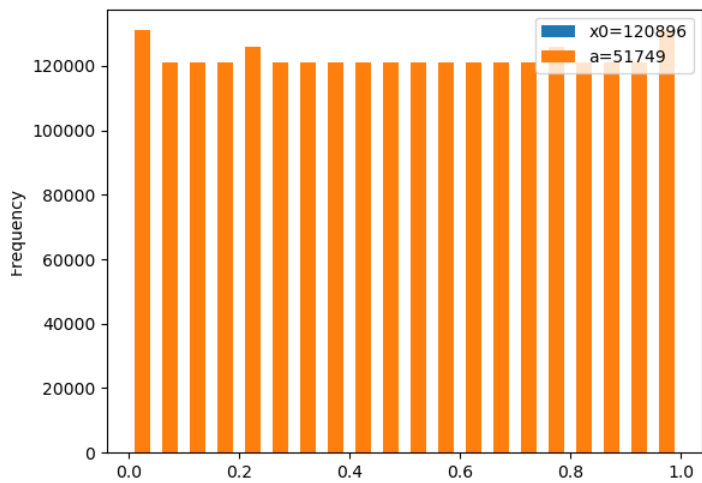
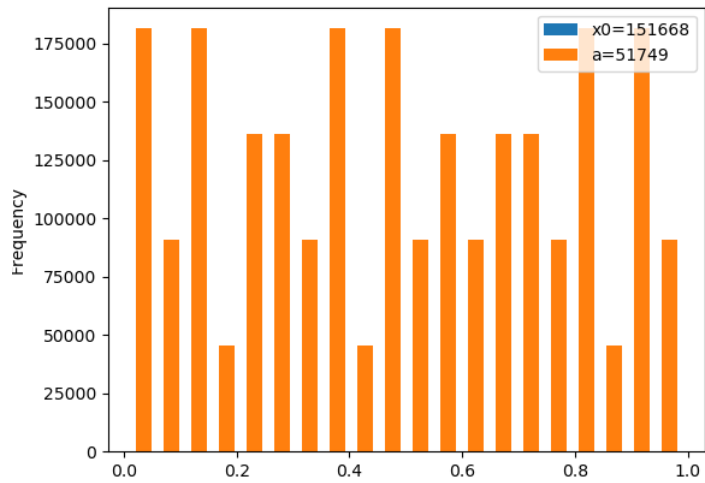
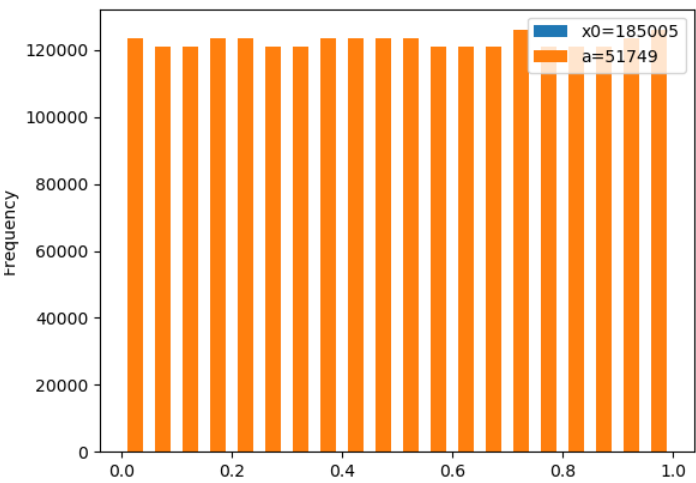
Output :

With $m=244944$,

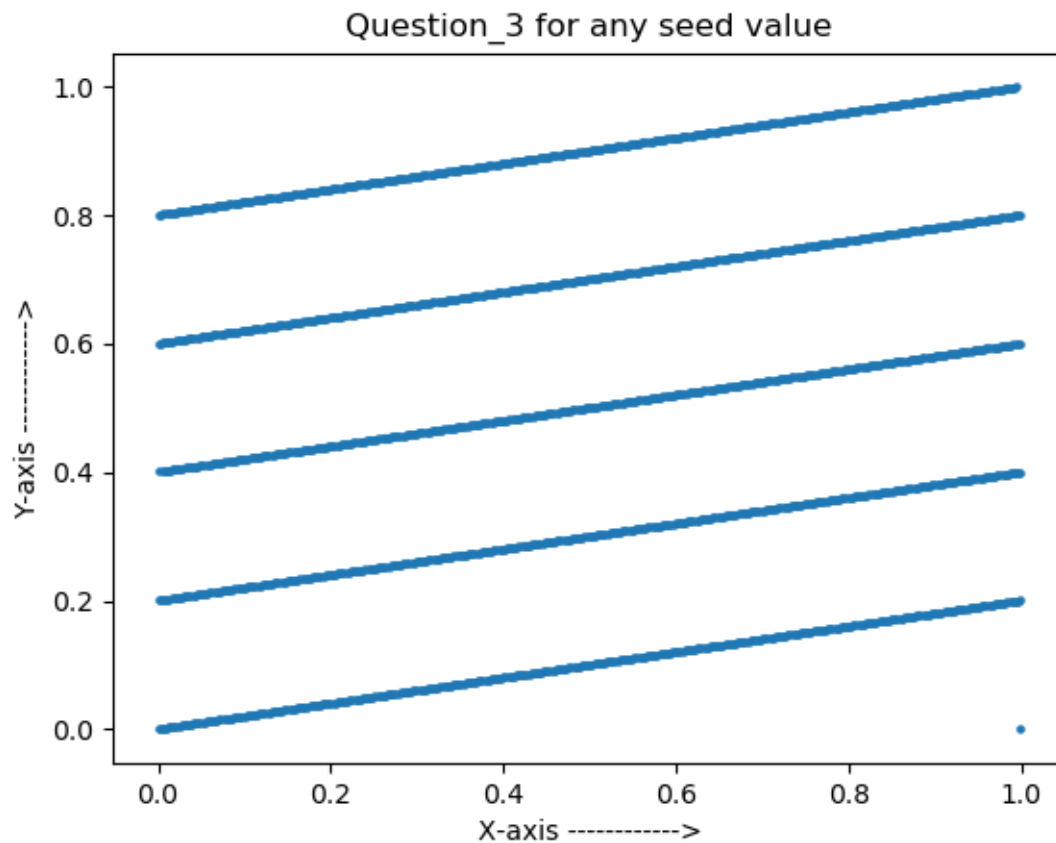
(a) With $a=1597$:



(b) With a=51749:



Question 3.)



Observations :

We can see like for the values of $a=1229$, $b=1$, $m=2048$. When we plot the 2D graph for $(u[i-1], u[i])$ we observe the following which is independent of any seed value used in the function.
-> Parallel lines are being observed.