MA323-Monte Carlo Simulation

ASSIGNMENT 2

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QUS1-

a) **The Linear Congruence Generator is used to**

generate the first 17 values of Ui of the form :

$x_{i+1} = (ax_i + b) \bmod m$

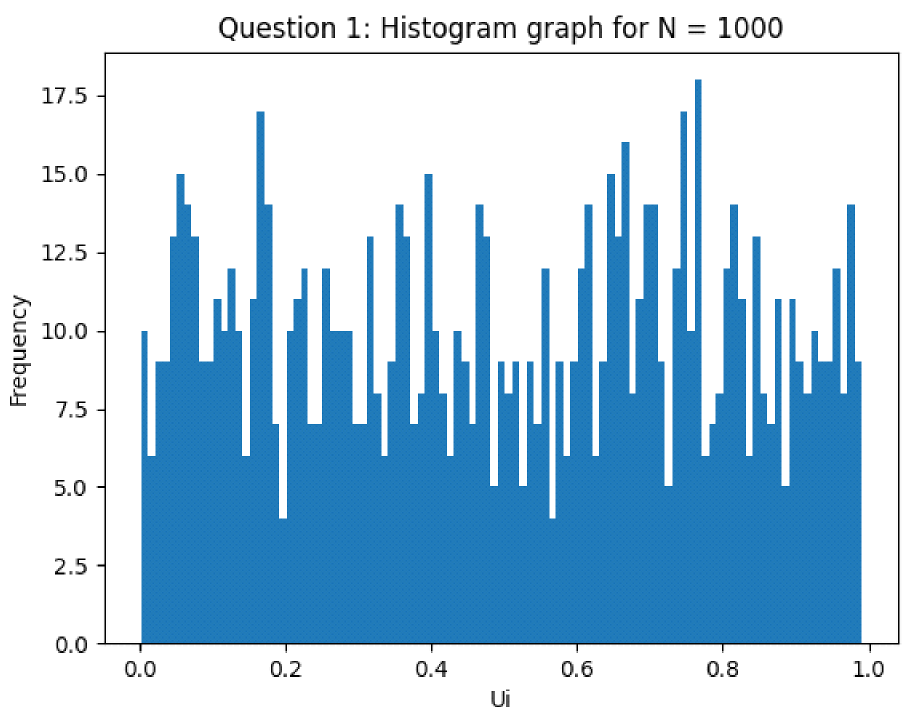
$u_{i+1} = x_{i+1}/m$

with a = 1229, b = 1, m = 2048.

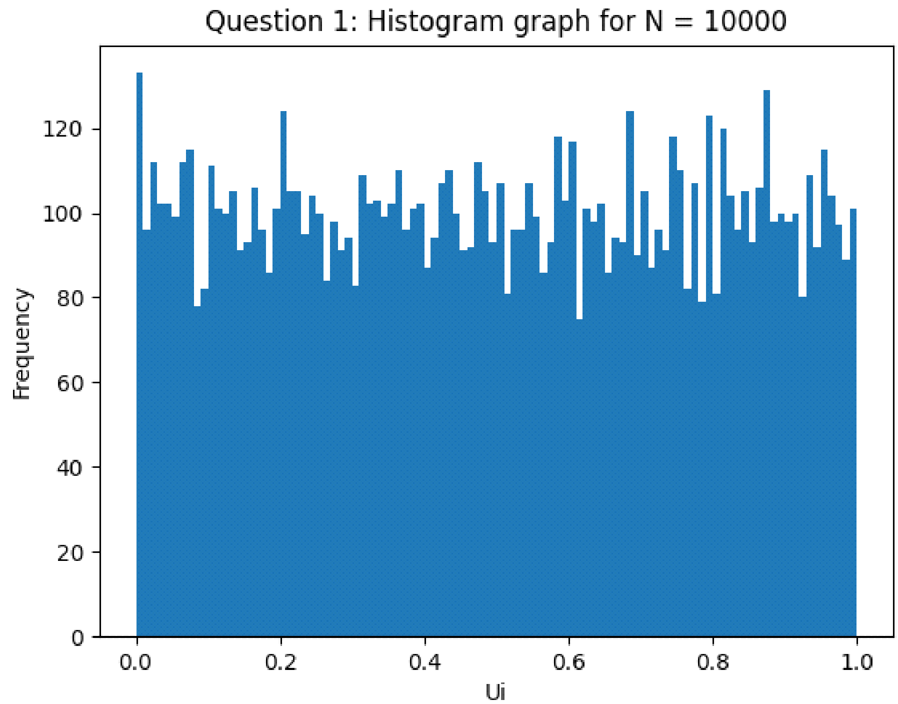
b) Generated the values of U18, U19, . . . , UN for N = 1000, 10000, and 100000

c) histogram for different n valuse-

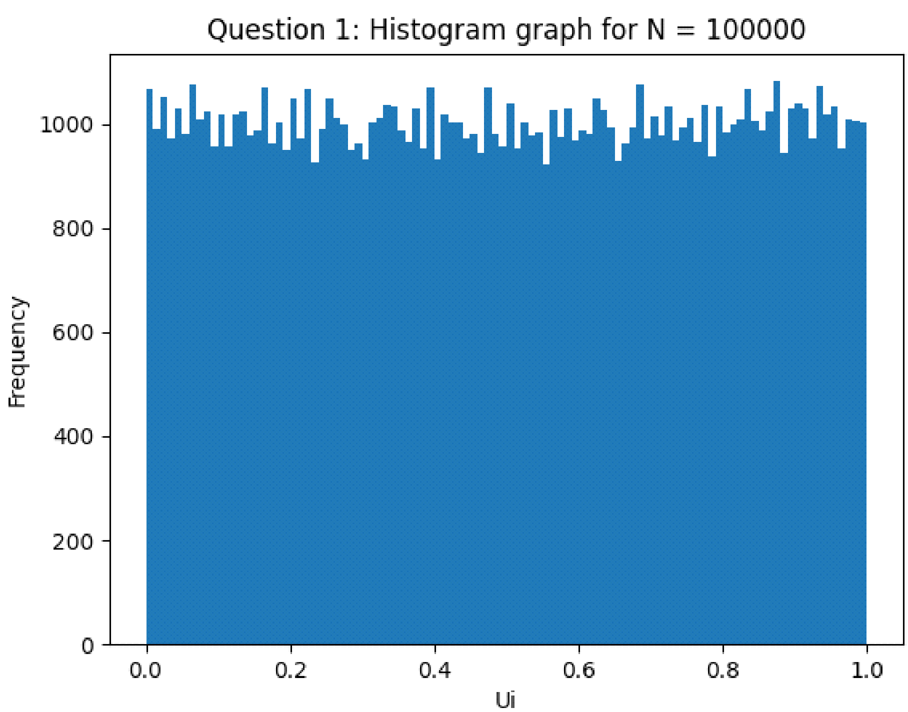
For N=1000 as follow



For N=10000 as follow



For N=100000 as follow



Observations-

The histogram suggest that the random generator follows

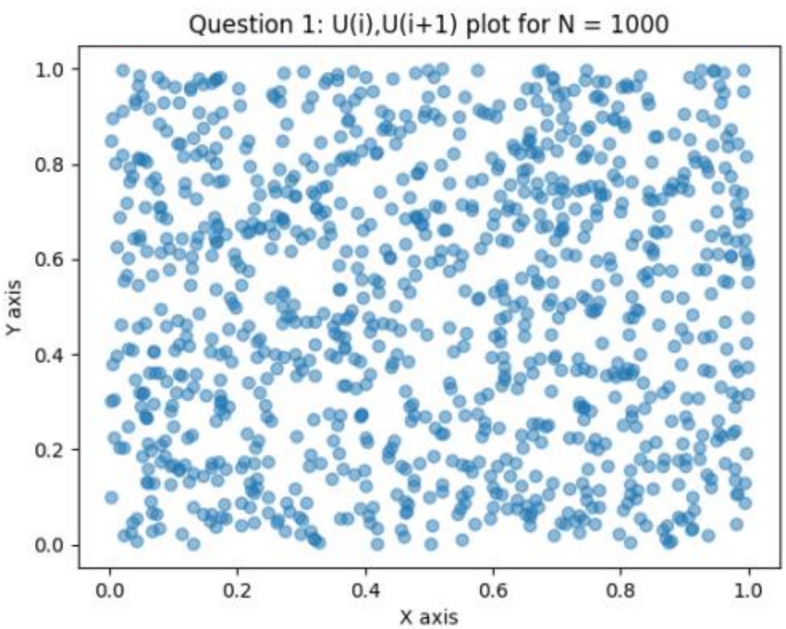
the 2 properties of the ideal random generator:

a) Each Ui is uniformly distributed between 0 and 1.

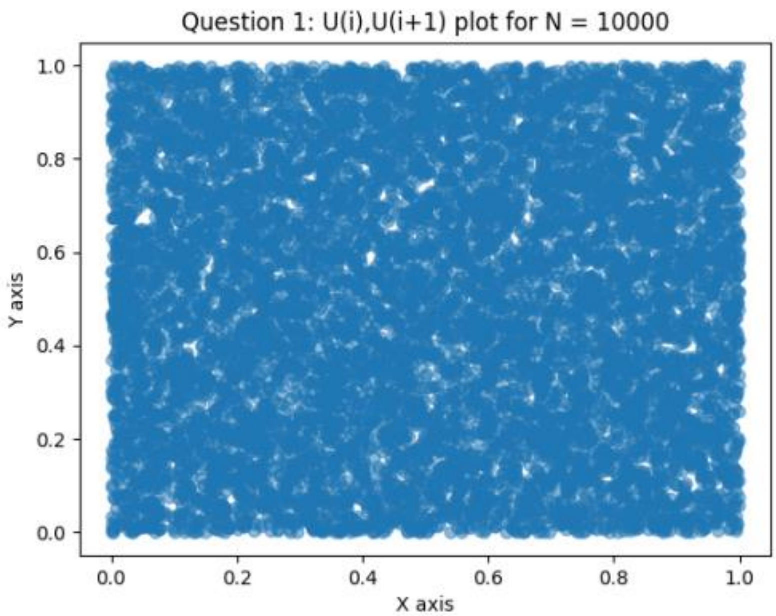
b) The Ui are mutually independent.

d) Plot (Ui , Ui+1) for all N values

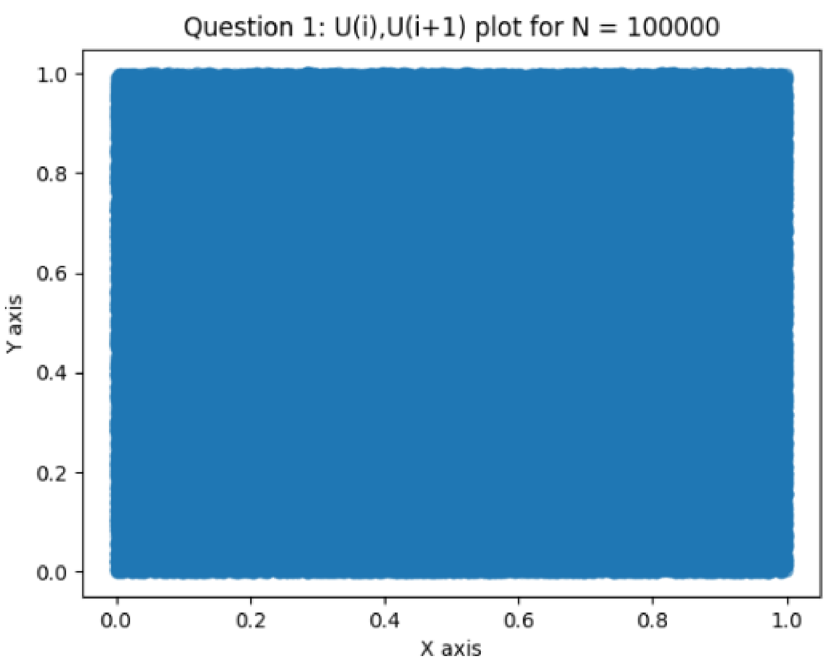
for N=1000,attached below-



for N=10000,attached below-



for N=100000,attached below-



Observations:

The (U_i , U_{i+1}) plot suggests that the U_i d'not follow any particular/specific pattern. Hence, they are almost completely random.

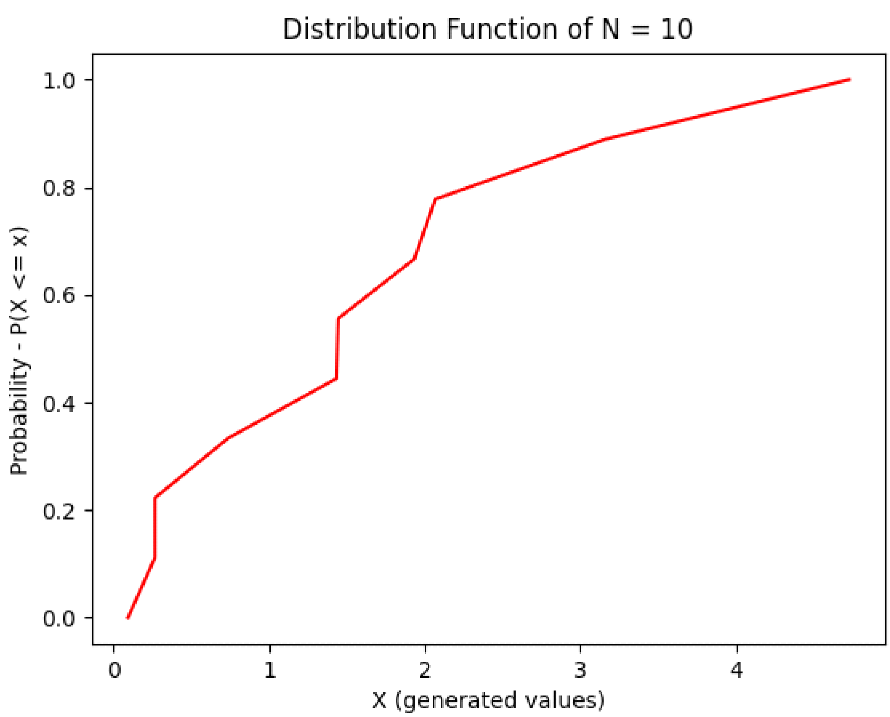
QUS 2-

I assumed that ,the Mean (ɵ) = π / 2

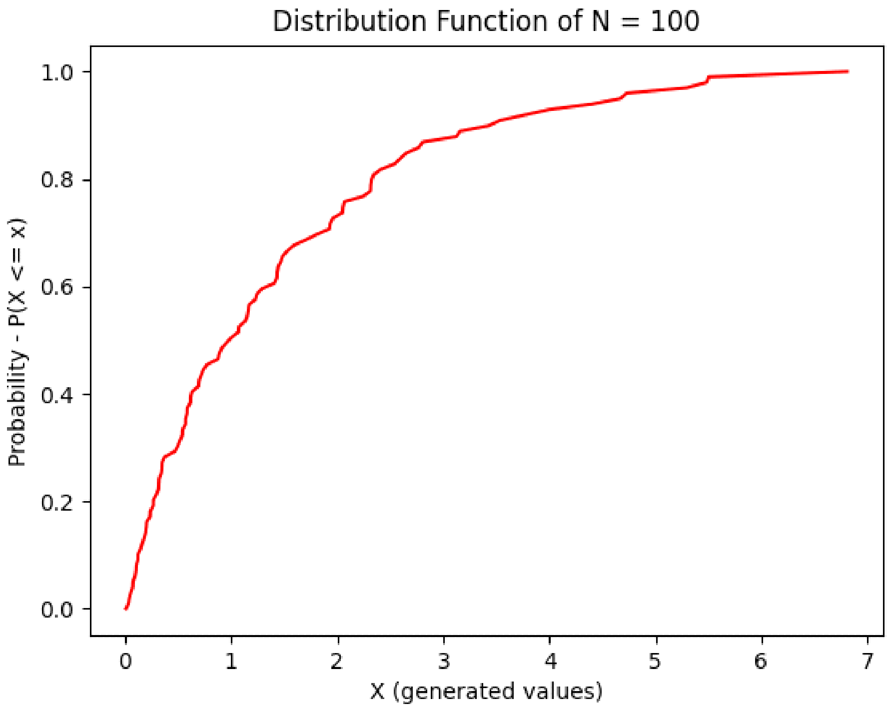
so for different values of N that is given below

N = 10, 100, 1000, 10000, 100000.

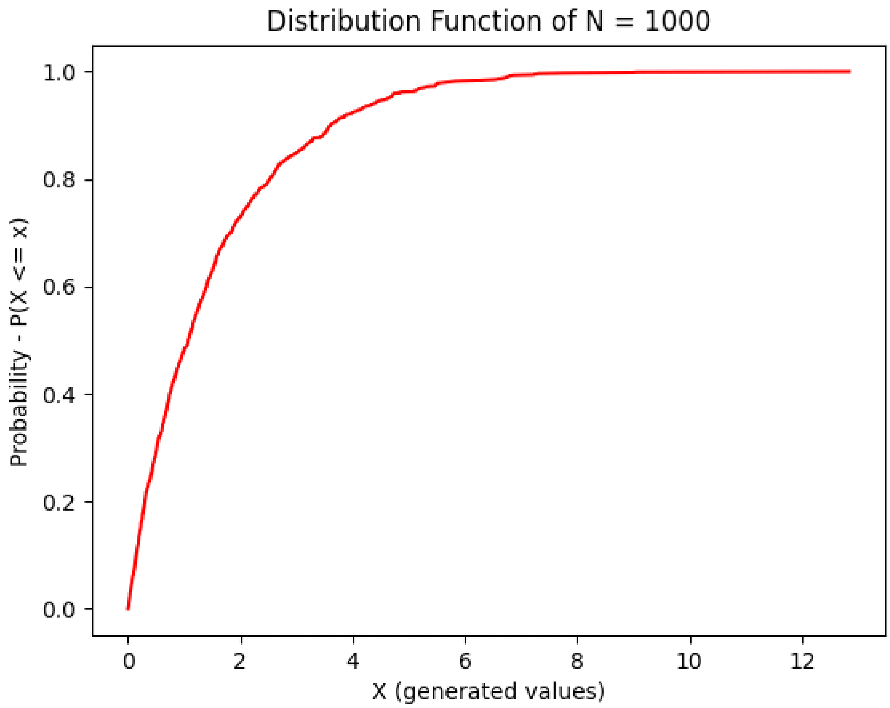
For N=10 as follow-



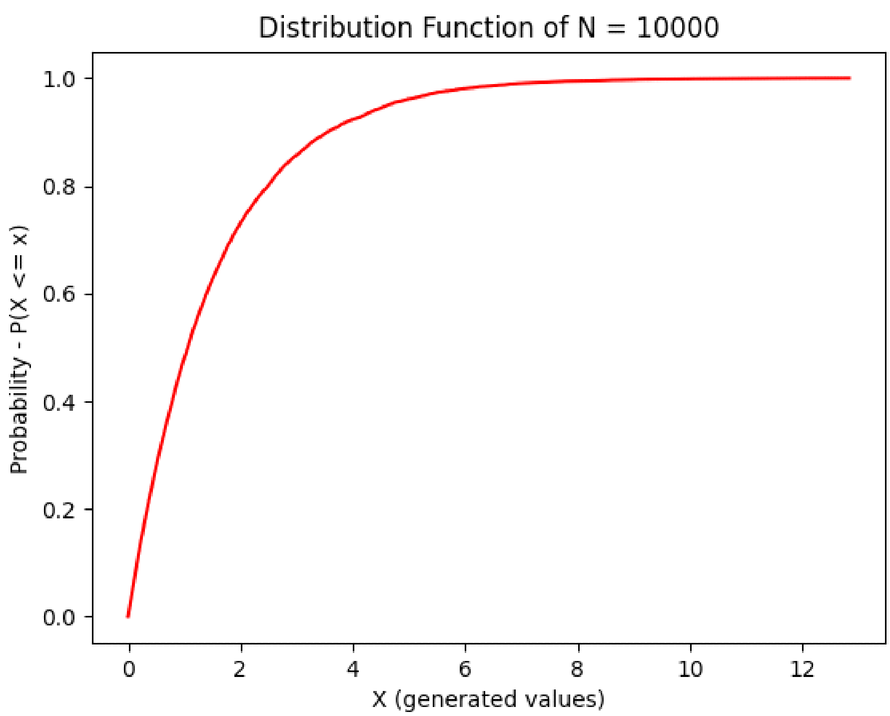
For N=100 as follow,



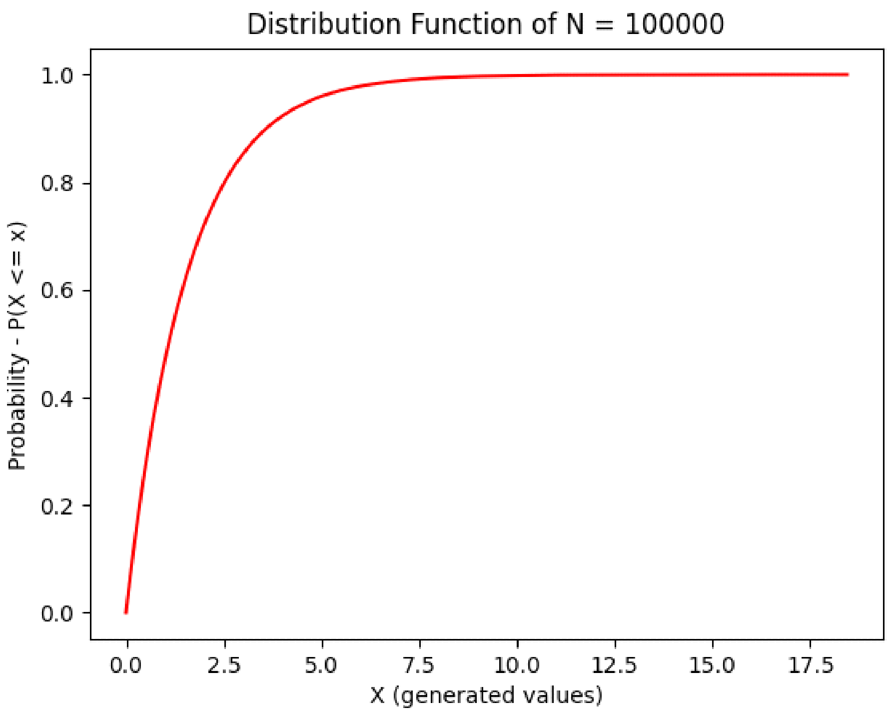
For N=1000 as follow



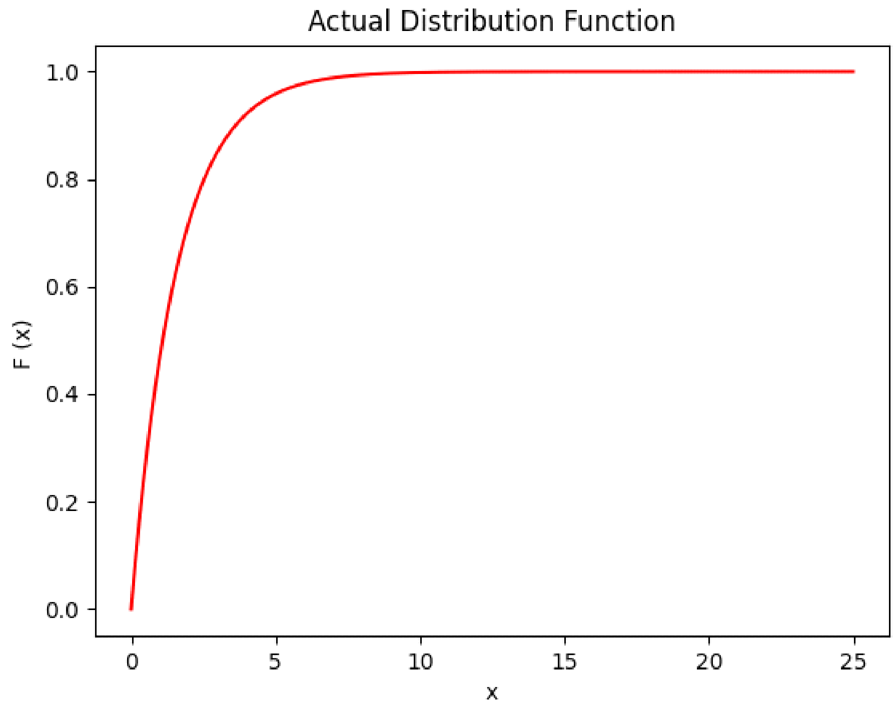
For N=10000 as follow



For N=10000 as follow



Actual Distribution function as follows-



Actual Mean = 1.5707963267948966

Actual Variance = 2.4674011002723395

Table below-

N	Mean	Variable
10	1.613160826095664	1.9168020190182393
100	1.4368828596650938	2.066560680583305
1000	1.527608770849963	2.3312738492502976
10000	1.5354517674732717	2.342475561946338
100000	1.5644662674427838	2.4328267137230175

Observations:

when we increase the number of generated values , the corresponding mean and variance of the generated values converge to the actual mean and variance.

It is also evident from the distribution function of the X for

different values of sample count(N) which approaches the plot of F(x) as sample count increases continuously. It follows the Law of Large Numbers.

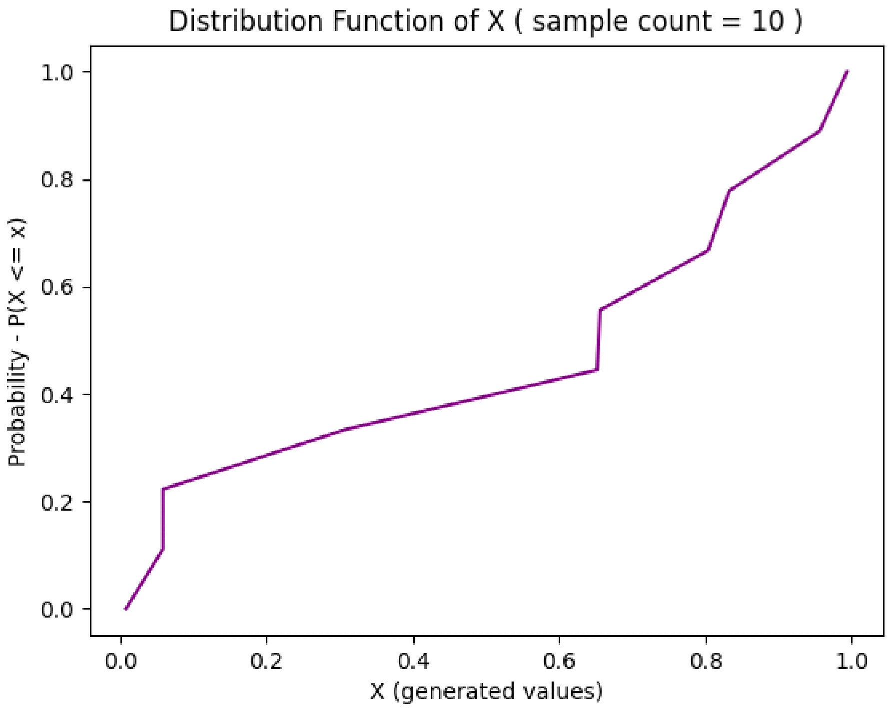
QUS 3-

a) Generated X1, X2,X3,X4 . . . , XN from the above distribution for different N values as given below-

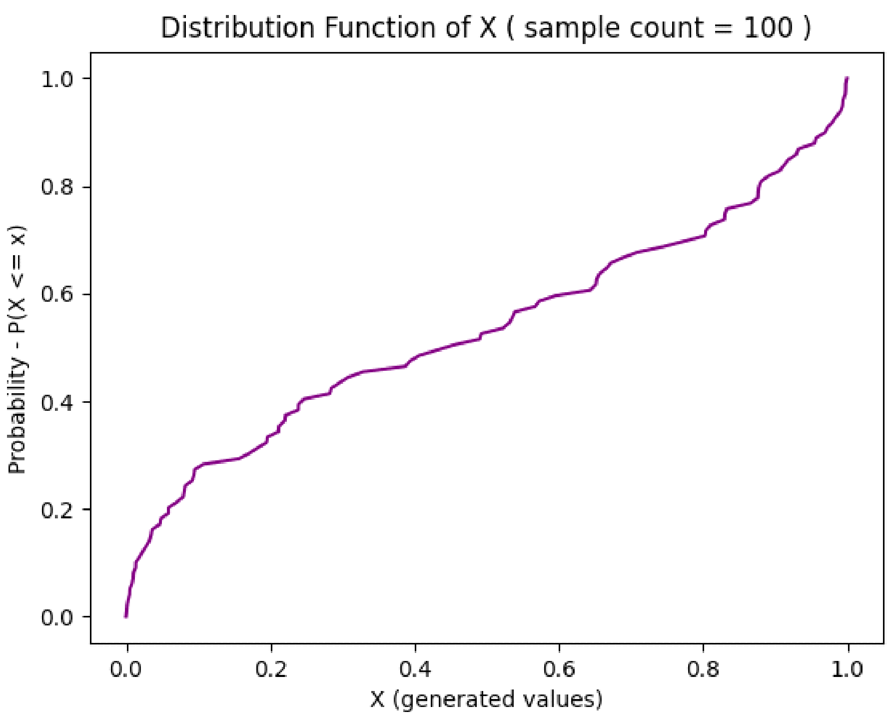
N = 10, 100, 1000, 10000, 100000.

b) Plot distribution functions for all N-

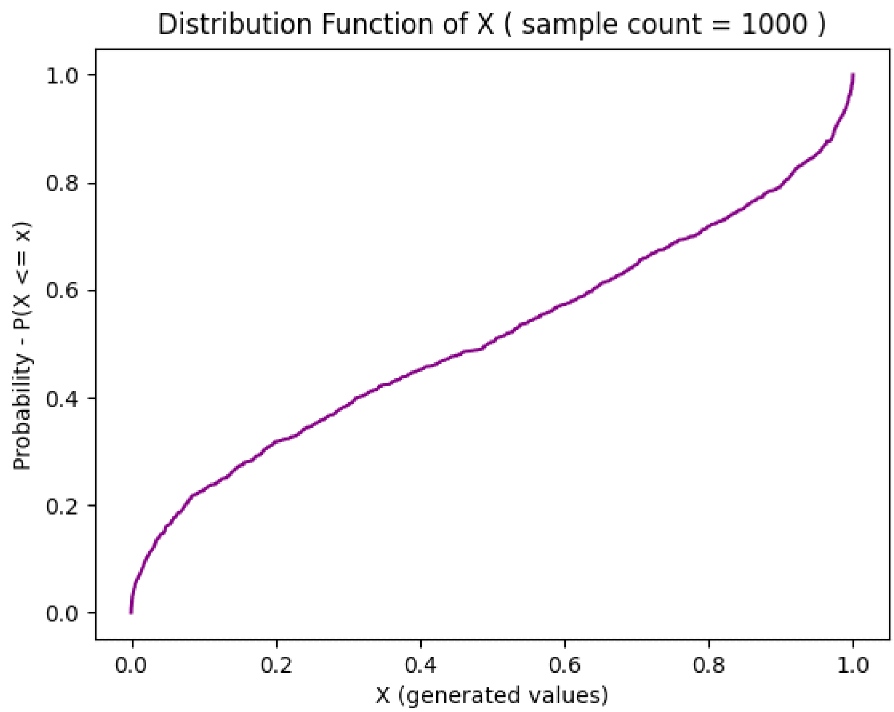
For N=10 as follow,



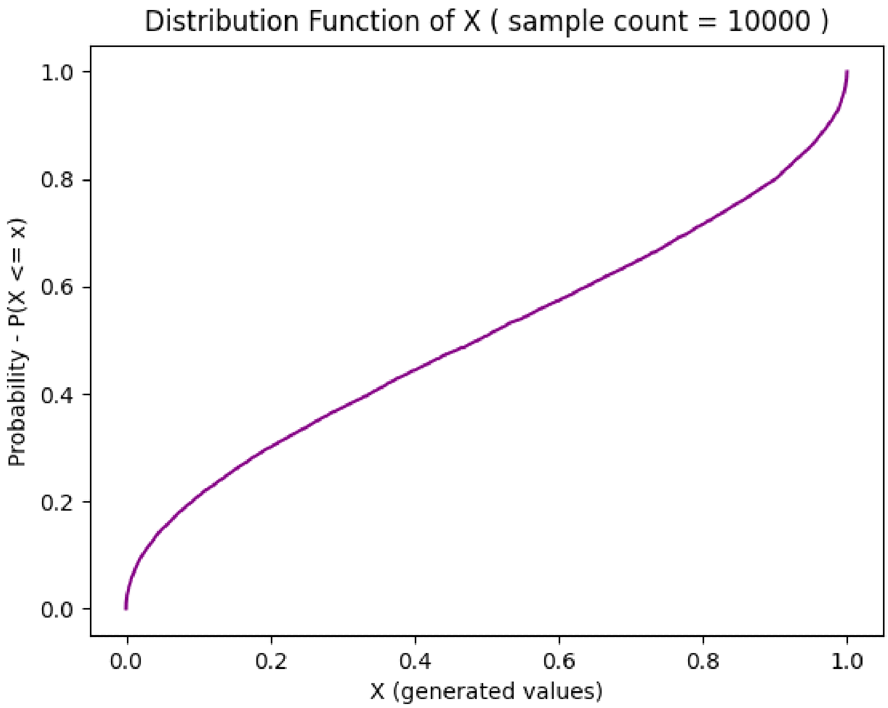
For N=100 as follow,



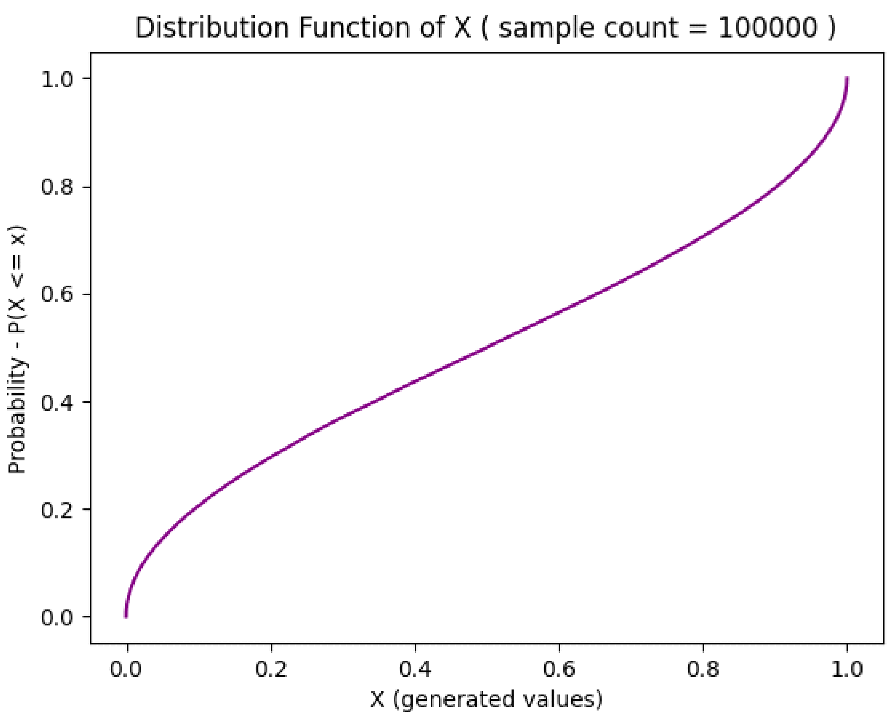
For N=1000 as follow,



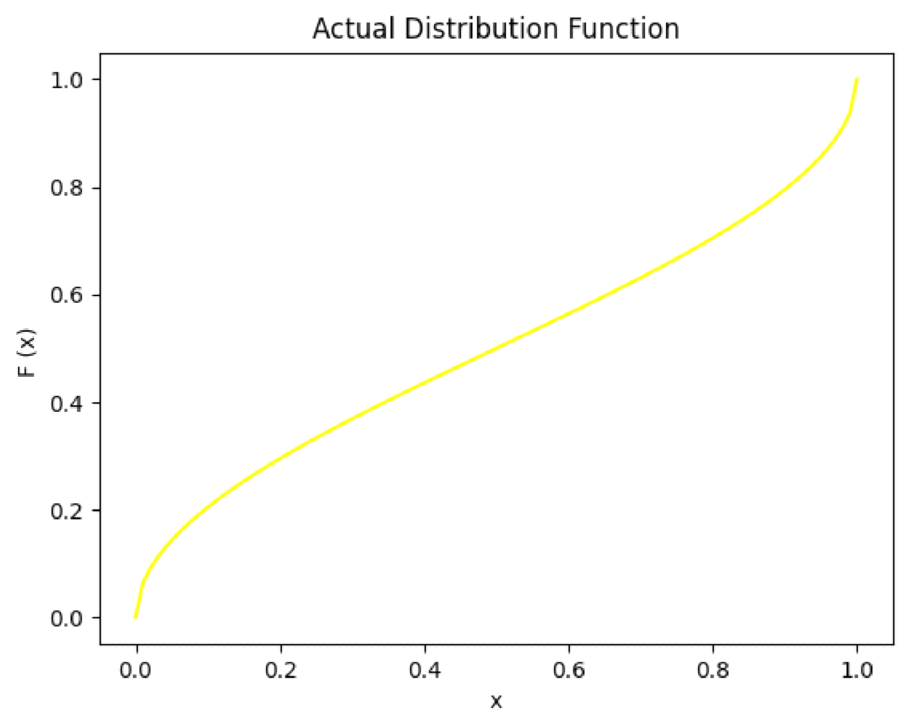
For N=10000 as follow,



For N=100000 as follow



Actual Distribution function plot as follows-



c) Table Below-

N	Mean	Variable
10	0.5330218847871611	0.13603351783787718
100	0.4649330111462657	0.13098678304171854
1000	0.4883304419967129	0.12727982689751888
10000	0.4928587988765897	0.12416196616477684
100000	0.4995406384332094	0.1248815445370180

Observations:

1. The distribution function of X is identical to the cdf F(x) in which

random variable X was generated. because F(x)

is a continuous strictly increasing function and U is a uniform

distribution function on [0, 1]. so, $F^{-1}(U)$ will be a sample from F.

2. The distribution function of X approaches the plot of F(x) because the sample count increases continuously.

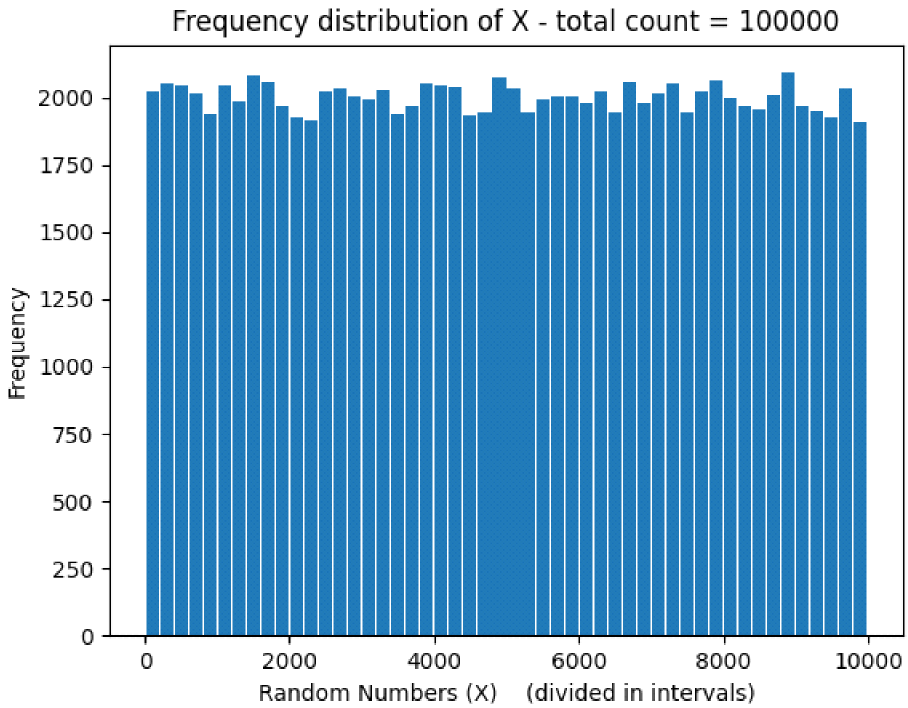
QUS 4-

● Generated random variables from a discrete distribution,

generate 100000 random numbers from a discrete uniform

distribution on {1, 3, 5, . . . , 9999}.

Frequency graph for N=100000 as follows,


Frequency distribution of X - total count = 100000
Frequency
0
250
500
750
1000
1250
1500
1750
2000
0
2000
4000
6000
8000
10000
Random Numbers (X)   (divided in intervals)