MA323(Lab-02)

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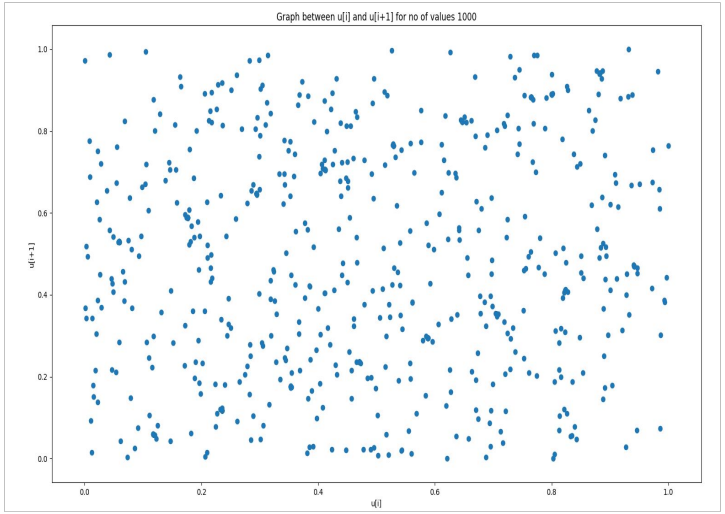
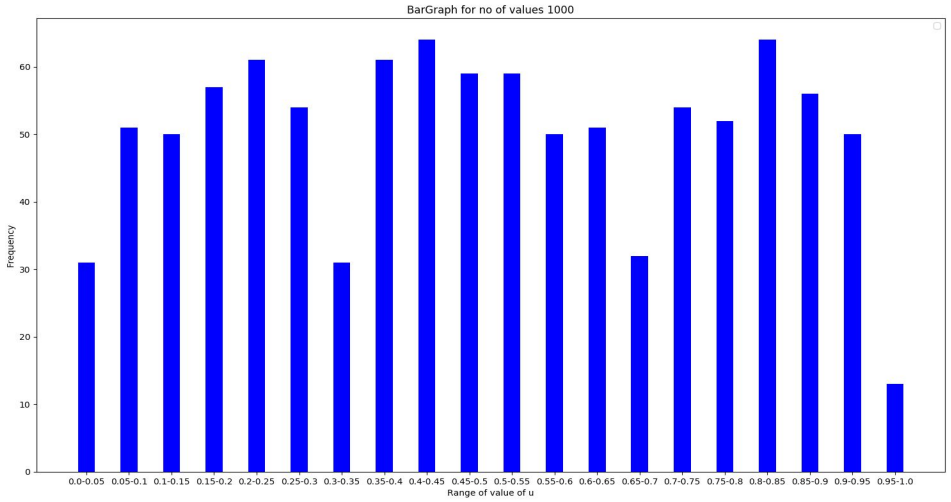
Problem 1

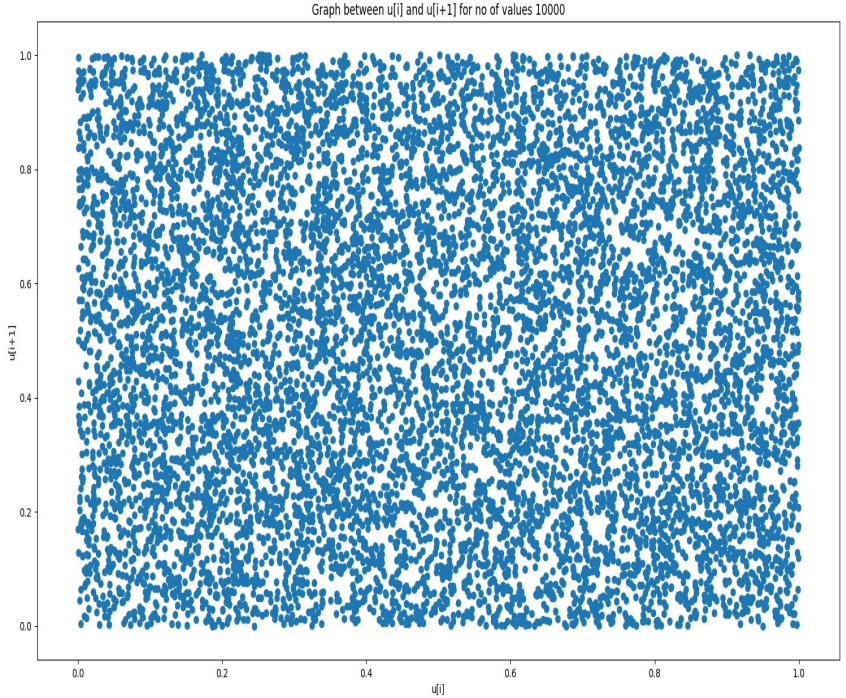
Initially First 17 values of u are generated using linear congruence(a= 31, m= 17, x0= 1). Then given Fibonacci generator was used to generate more values.

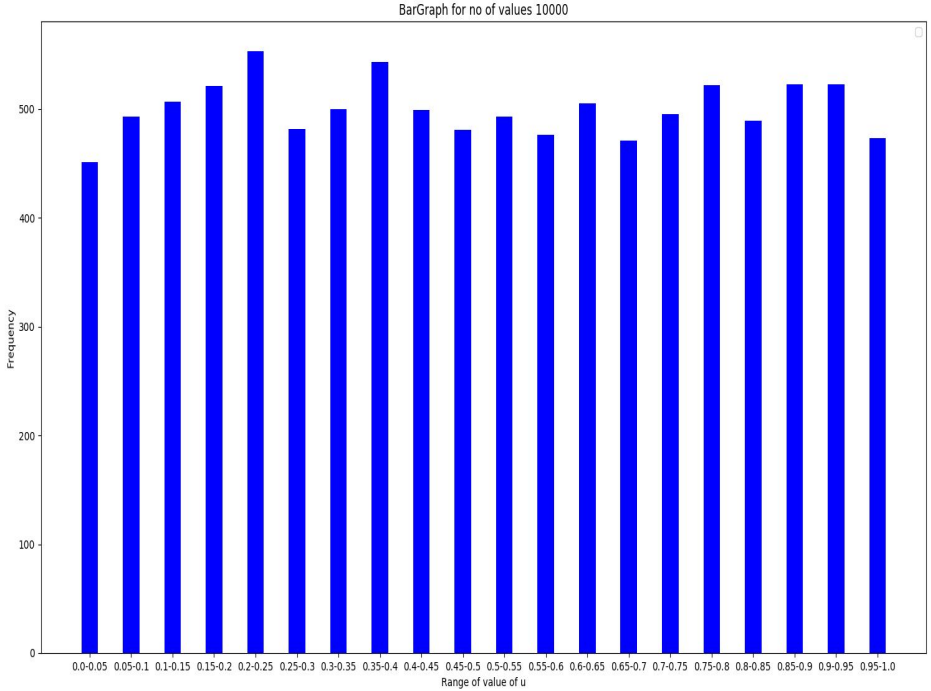
Part 1) No. of values generated by Lagged Fibonacci Generator are 1000. Values are seen in scatter plot and the bar graph is used to show the frequency in ranges from 0.00 to 1.00. It is clear that values are not uniformly distributed in the different intervals.



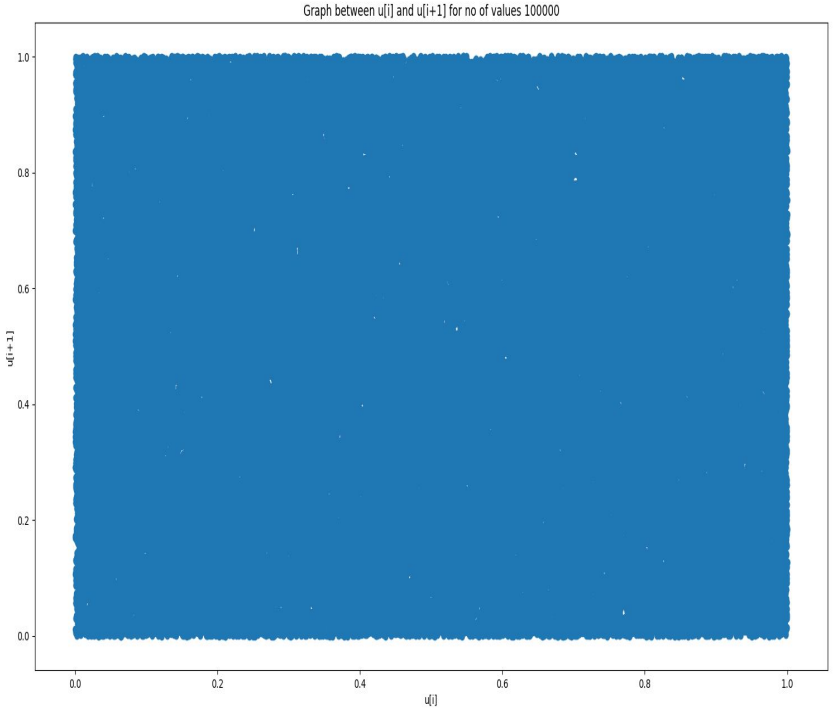


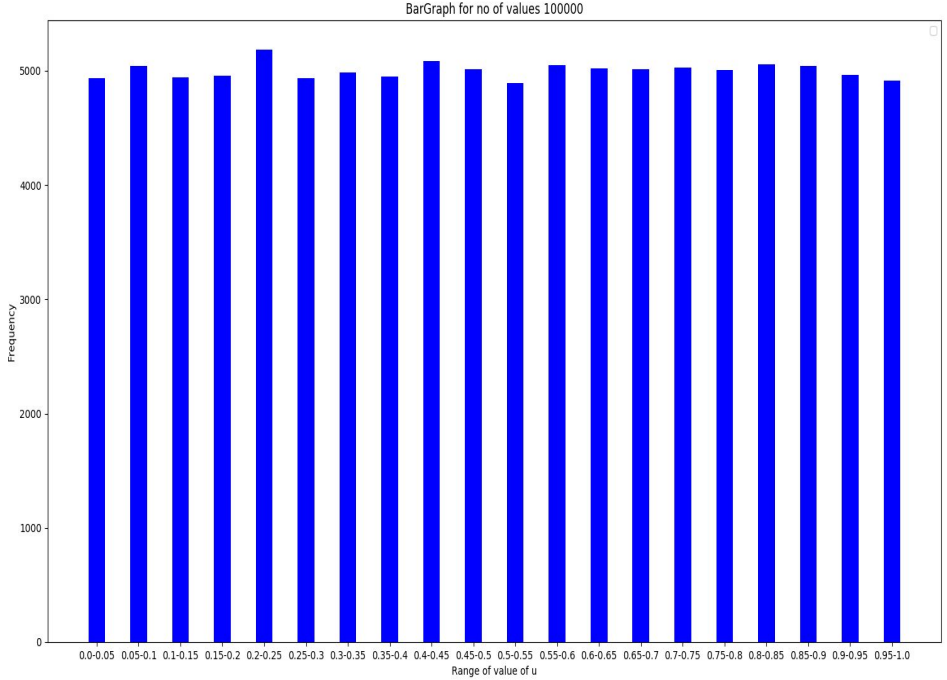
Part 2) No. of values generated by Lagged Fibonacci Generator are 10,000. As seen in the scatter plot, plot grows denser which implies that values have not yet start repeating, implies that period length is large and also uniformity in intervals increase(as shown in the bar graph).





Part 3) No. of values generated by Lagged Fibonacci Generator are 1,00,000. Observations from 2 graph are becoming more clear as scatter plot grows more denser. And also now bar graph is uniform which implies given generator can be used as a random number generator as it has a large period.





Problem 2

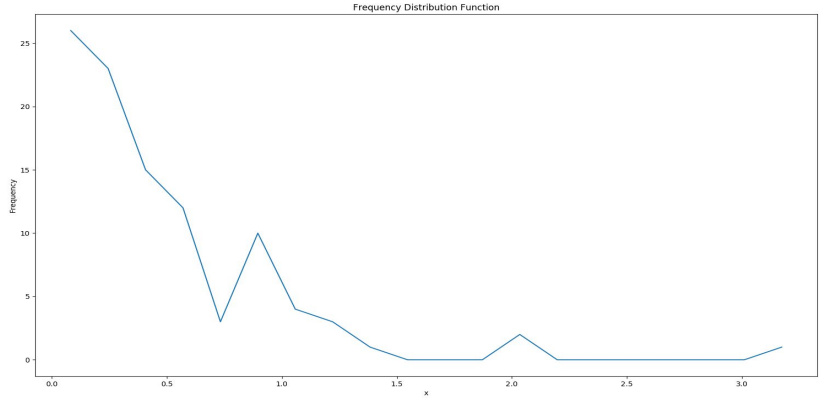
Mean for given distribution is equal to value of Theta(which is taken as 0.5), which gives 0.25 as value of variance.
U[0,1] is generated by Linear Congruence generator(a= 1597, b= 51749, m= 244944).
Sample mean and variance slowly converge to actual mean and variance(as shown below in table). Also, the plot of distribution function converges to plot f given CDF for larger values of number of observations.

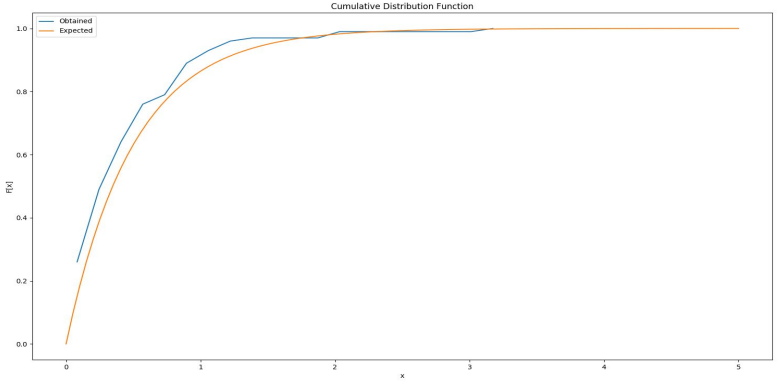
```
Expected Mean     : 0.5
Expected Variance : 0.25


      Obtained Mean and Variance:
      No. of values     Mean      Variance
      100               0.48      0.2377
      1000              0.47      0.2049
      10000             0.50      0.2568
      100000            0.50      0.2476
```

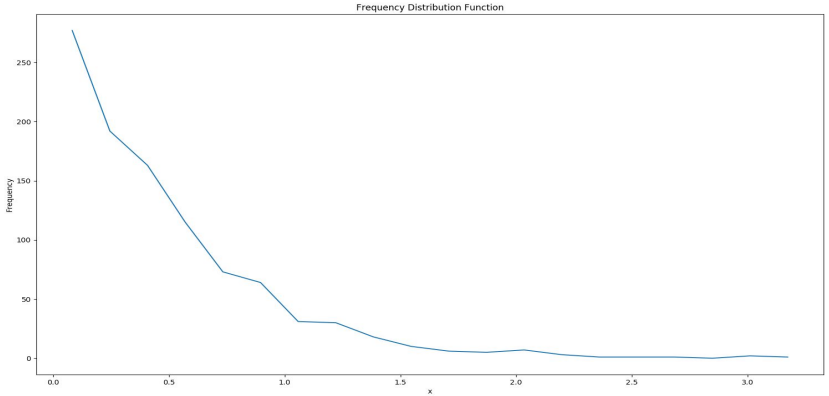
Following are Frequency distribution function and Cumulative distribution function corresponding to different values of no. of observations(100,1000,10000,100000).
In CDF, red label correspond to expected CDF(given function) and blue label correspond to obtained CDF.
It's clear that blue label converge to red label as number of values of observation increases.

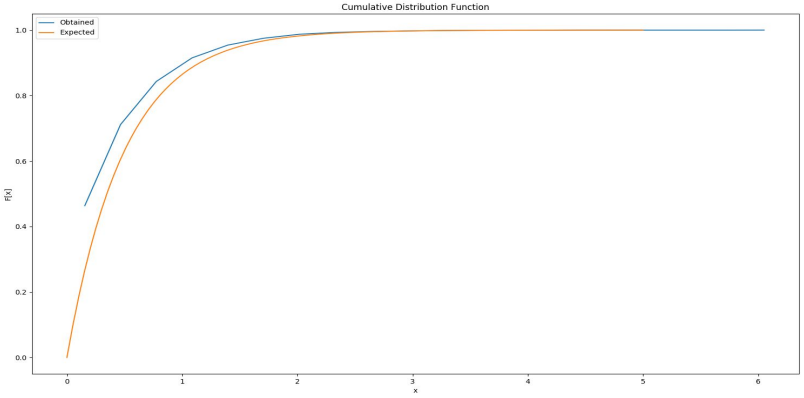
Part 1:Distribution with 100 elements



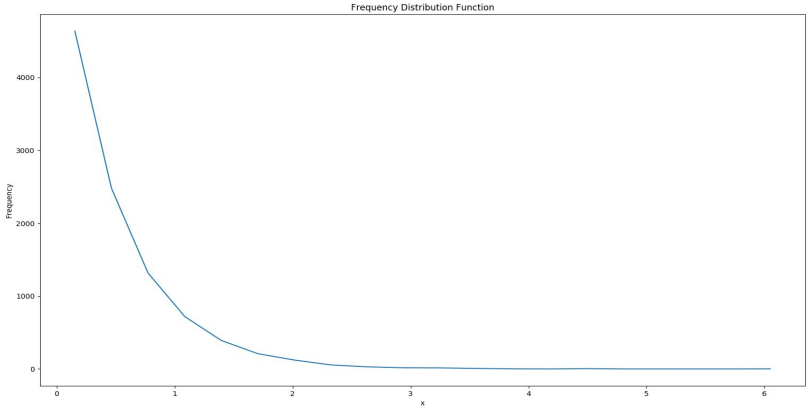


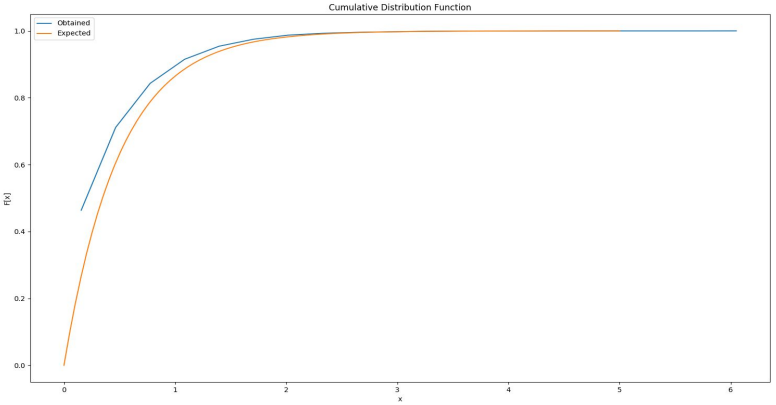
Part 2:Distribution with 1000 elements



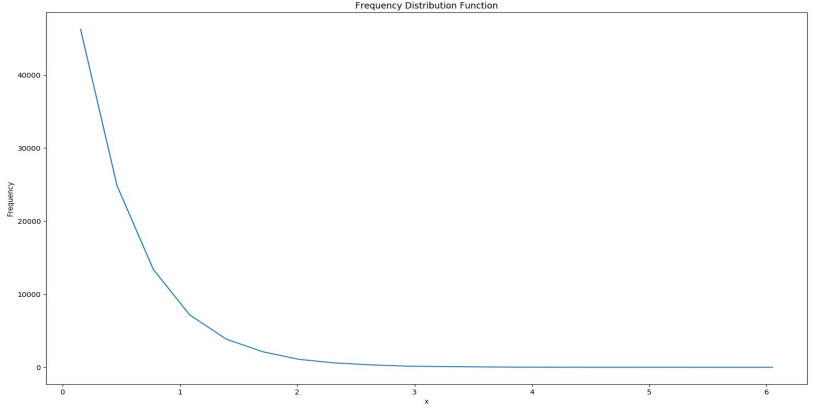


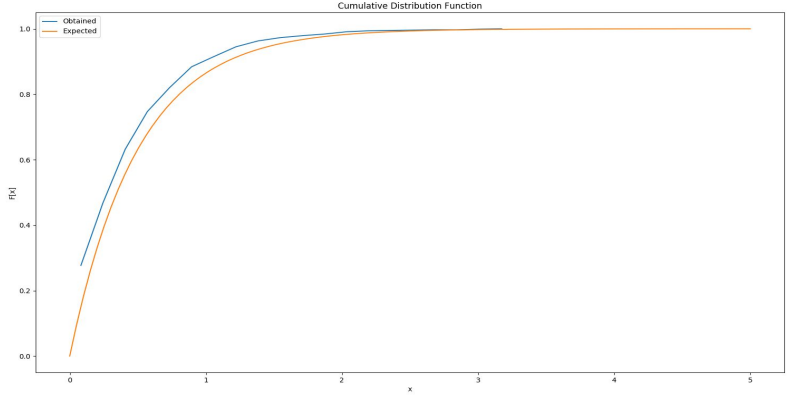
Part 3:Distribution with 10000 elements





Part 4:Distribution with 100000 elements





Problem 3

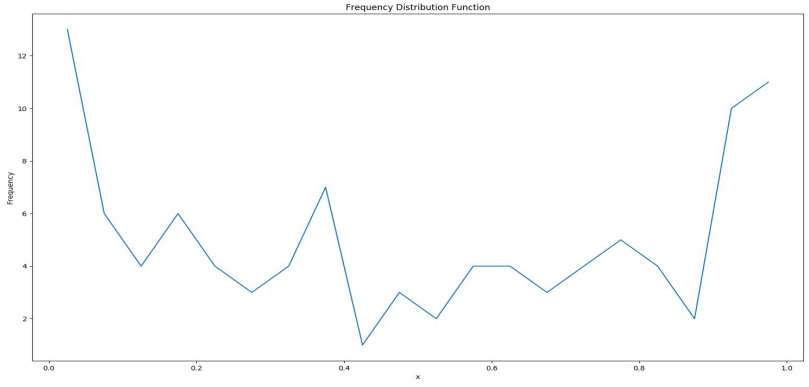
Mean for given distribution is equal 0.5, which gives 0.25 as value of variance.
U[0,1] is generated by Linear Congruence generator(a= 1597, b= 51749, m= 244944).
Sample mean and variance slowly converge to actual mean and variance(as shown below in table). Also, the plot of distribution function converges to plot f given CDF for larger values of number of observations.

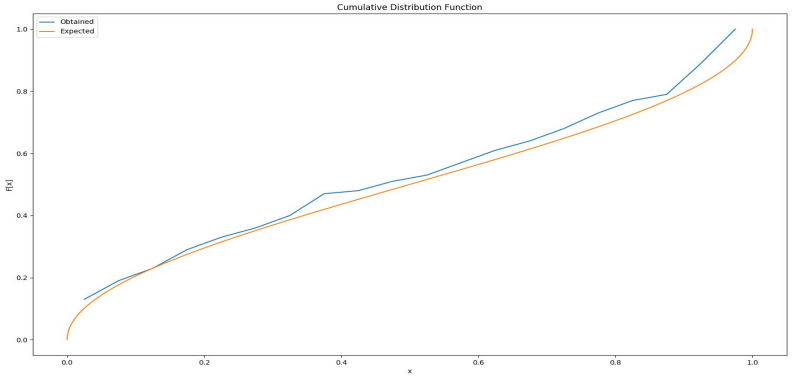
Obtained Mean and Variance:

No. of values	Mean	Variance
100	0.49	0.1192
1000	0.49	0.1215
10000	0.50	0.1248
100000	0.50	0.1250

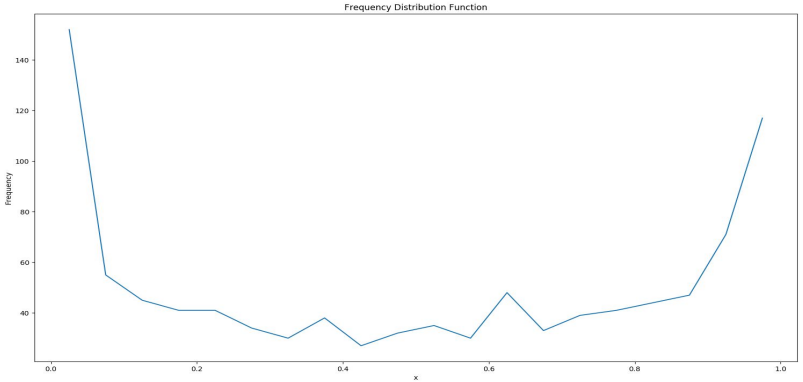
Following are Frequency distribution function and Cumulative distribution function corresponding to different values of no. of observations(100,1000,10000,100000).
In CDF, red label correspond to expected CDF(given function) and blue label correspond to obtained CDF.
It’s clear that blue label converge to red label as number of values of observation increases.

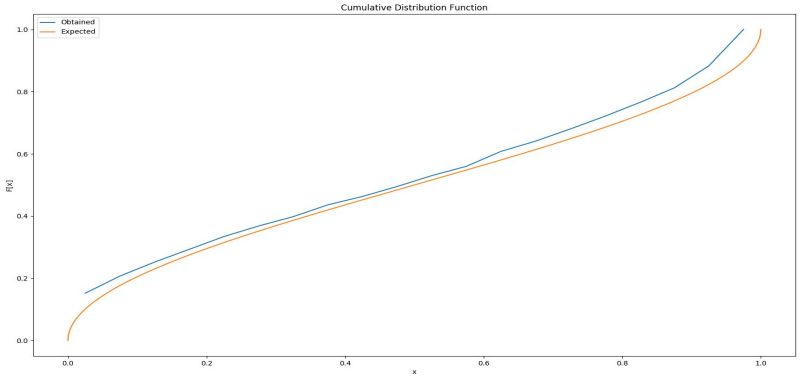
Part 1:Distribution with 100 elements



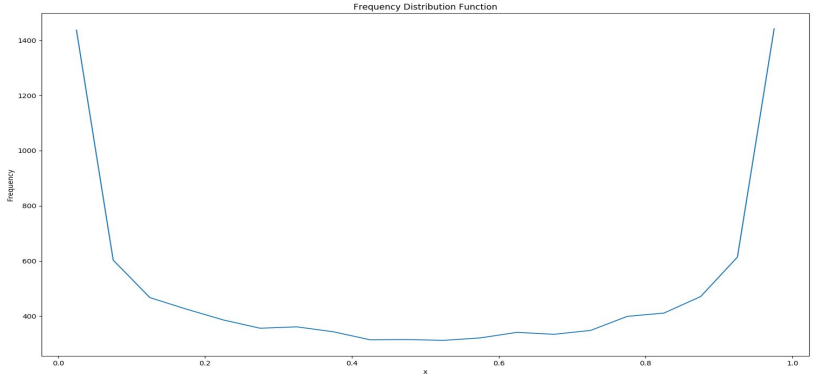


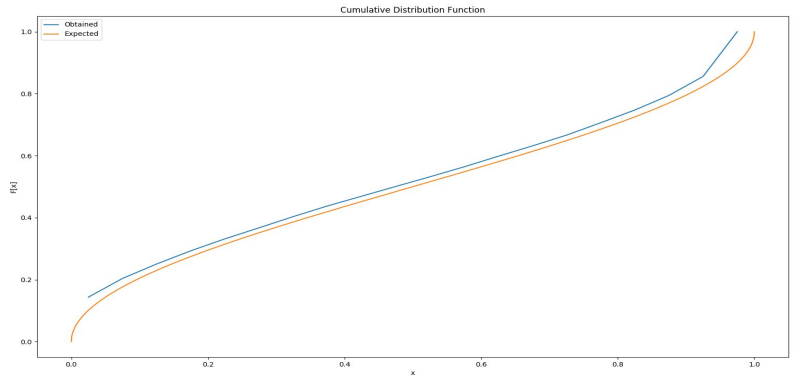
Part 2:Distribution with 1000 elements



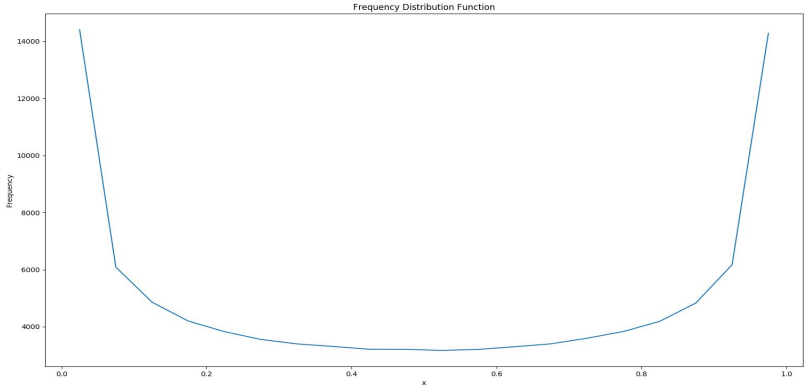


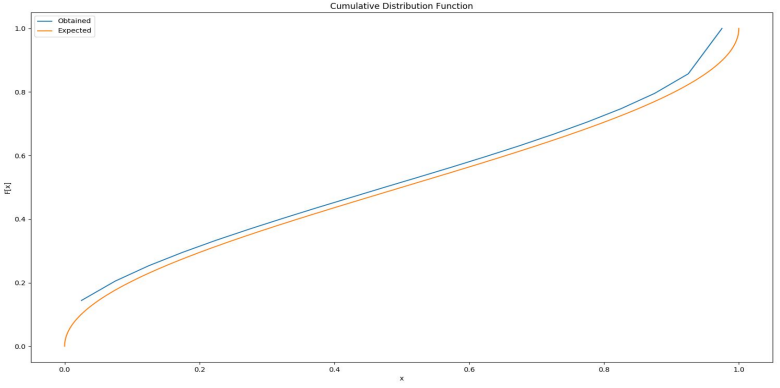
Part 3:Distribution with 10000 elements





Part 4:Distribution with 100000 elements





The sample mean and variance obtained for part4 are not exactly equal to actual values.
They are approaching towards actual value, if we increase the number of values of observations then it might become equal to actual values.