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Monte Carlo Simulation
Assignment - 5

Ques 1:

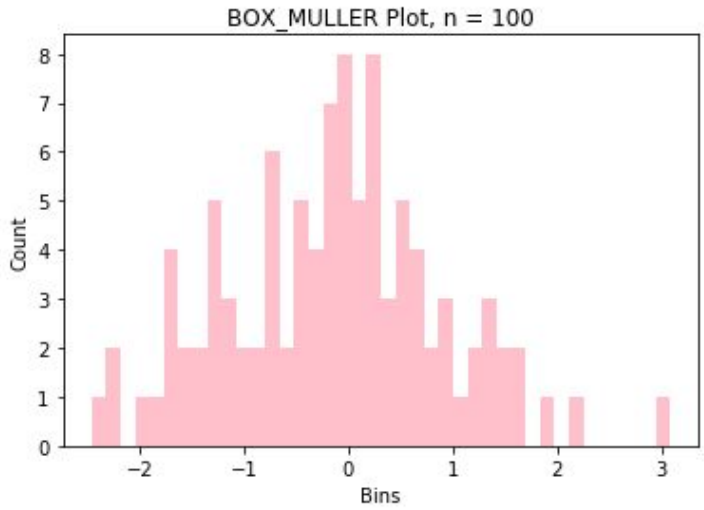
Considering the case of **Box-Muller** method:

a. The mean and variance obtained from samples of 100 and 10000 elements:

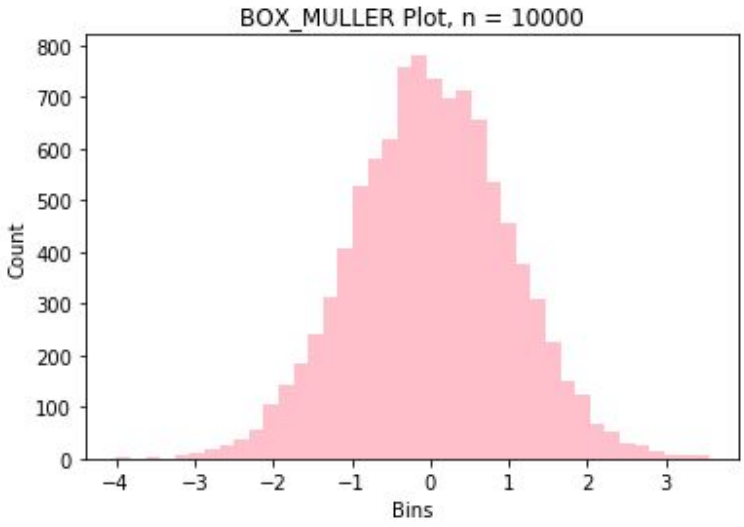
No. of elements	**Mean**	**Variance**
100	-0.129	1.073
10,000	0.0107	0.996

b. Plotted Graphs for the obtained samples:

- Element count = **100**



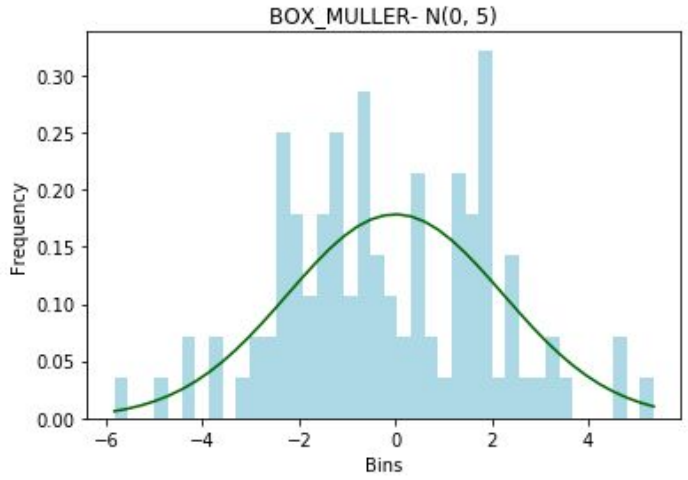
- Element count = **10,000**



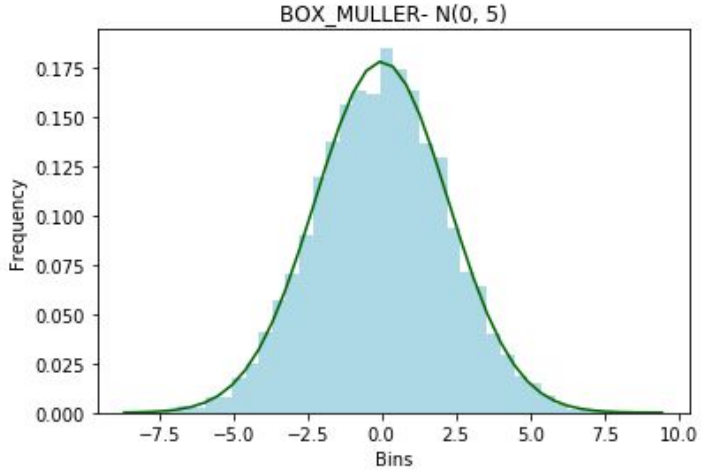
c.

- Plotting the graphs for the **Transformation N(0, 5)**:

  n = 100

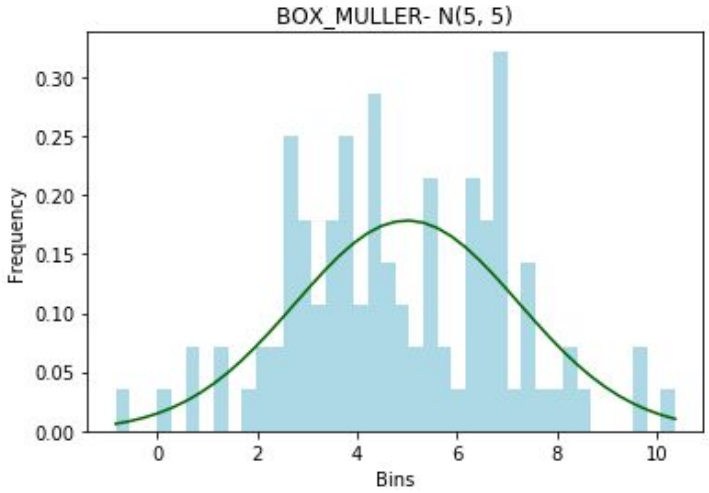


  n = 10,000

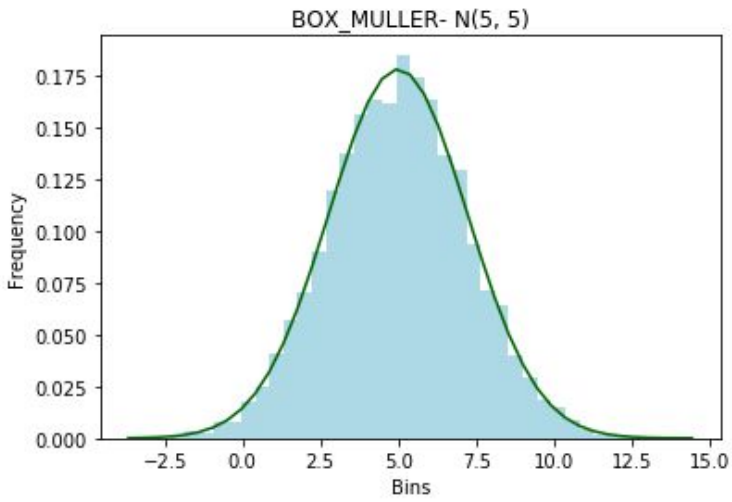


- Plotting the graphs for the **Transformation N(0, 5)**:

  n = 100



n = 10,000



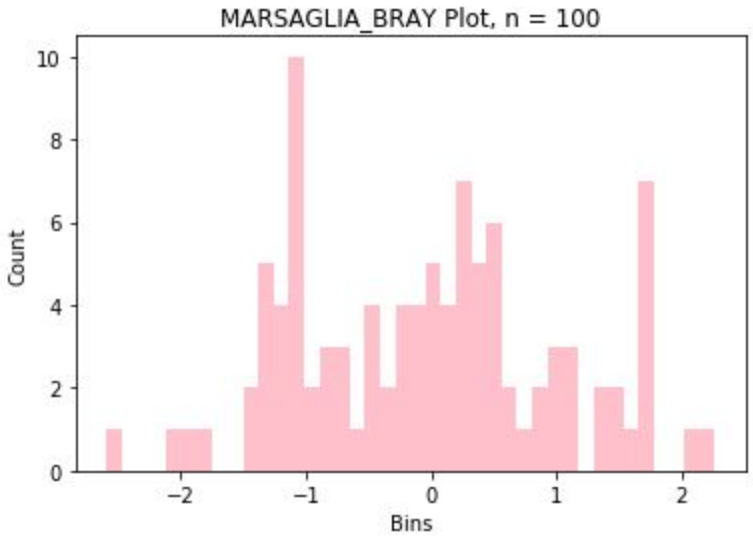
Considering the case of **Marsaglia and Bray** method:

a. The mean and variance obtained from samples of 100 and 10000 elements:

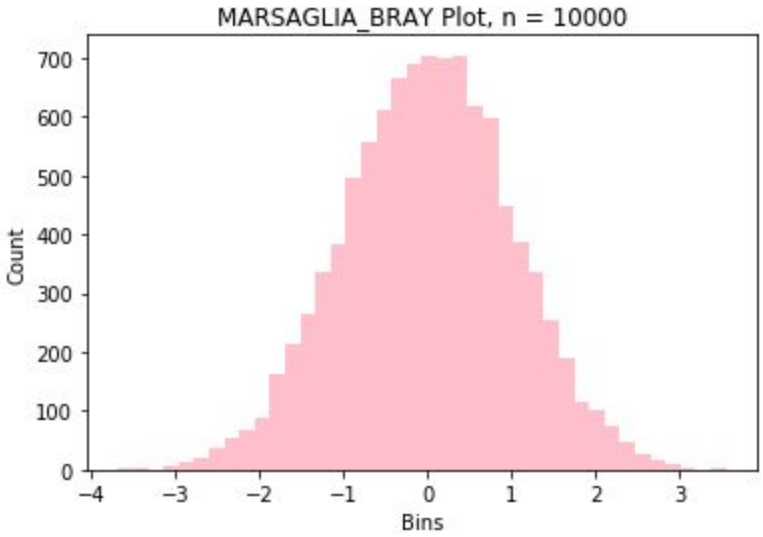
No. of elements	**Mean**	**Variance**
100	-0.042	1.0722
10,000	0.0080	1.0037

b. Plotted Graphs for the obtained samples:

- Element count = **100**

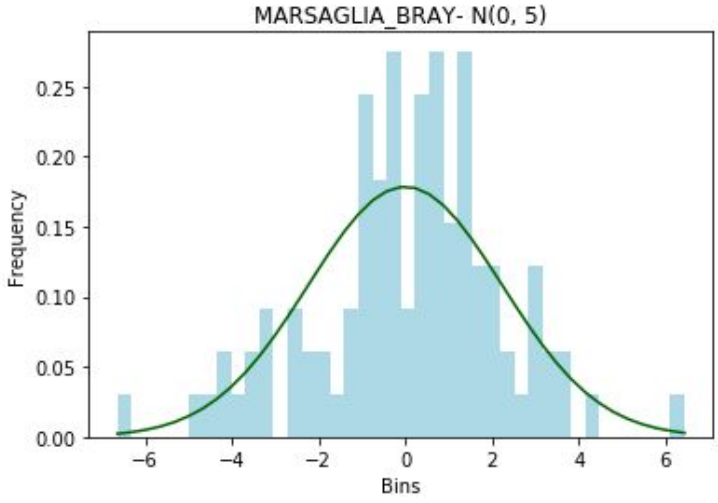


- Element count = **10,000**

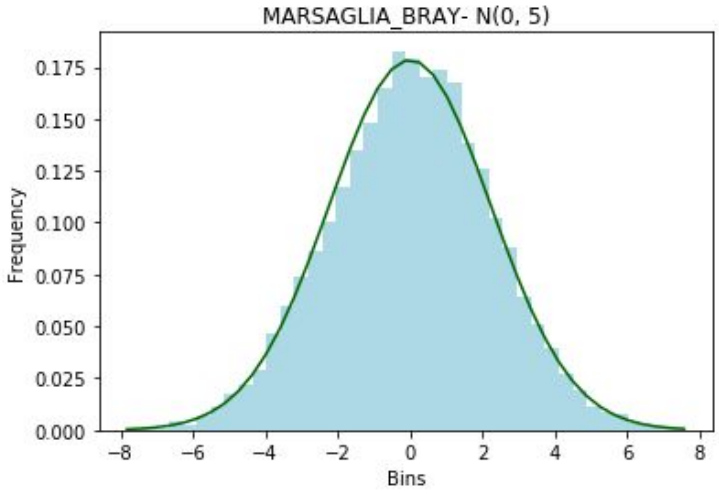


c. Plotting the graphs for the **Transformation N(0, 5)**:

n = 100

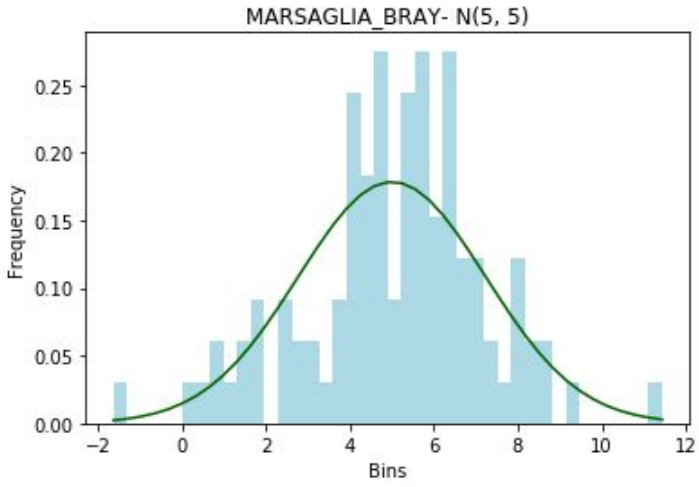


n = 10,000

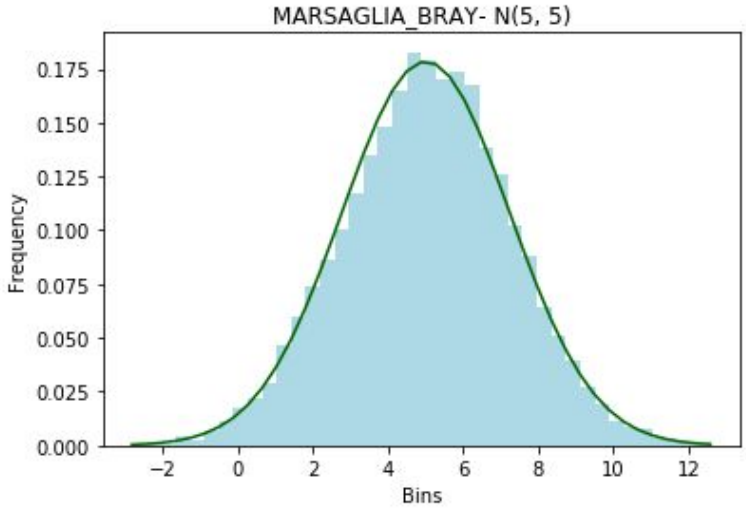


- Plotting the graphs for the **Transformation N(0, 5)**:

n = 100



n = 10,000



Observations:

- For the case of n = 10,000, for both Box-Muller and Marsaglia-Bray method, the obtained sample tends to the actual Normal Distribution

Ques 2:

- The attempt for measuring the time required to generate a 100 elements for both methods failed. This must be happening as the time taken for a 100 elements is miniscule and hence nearly 0
- For n = 10,000, the time statistics are as follows:

Method	Time Taken to Generate 10,000 elements
Box-Muller	15.61 ms
Marsaglia-Bray	31.28 ms

Observations:

- Contrary to what we expected, the computational time for generating elements via Box-Muller method is lesser than that for Marsaglia-Bray method

Ques 3:

- The comparison between 1 - pi/4 and the proportion of rejected values in Marsaglia-Bray method are as follows

Count of elements	Proportion of Rejected Values	(1 - pi/4)
100	0.33334	0.2146
10,000	0.21334	0.2146

Observations:

- As we increase the number of elements in the sample, the value of **(1 - pi/4)** and proportion of rejected values grow closer.