Ma323-LAB 05

Name: Harsh Yadav **Roll. No.**: 180123015 **Dept.**: Mathematics and Computing
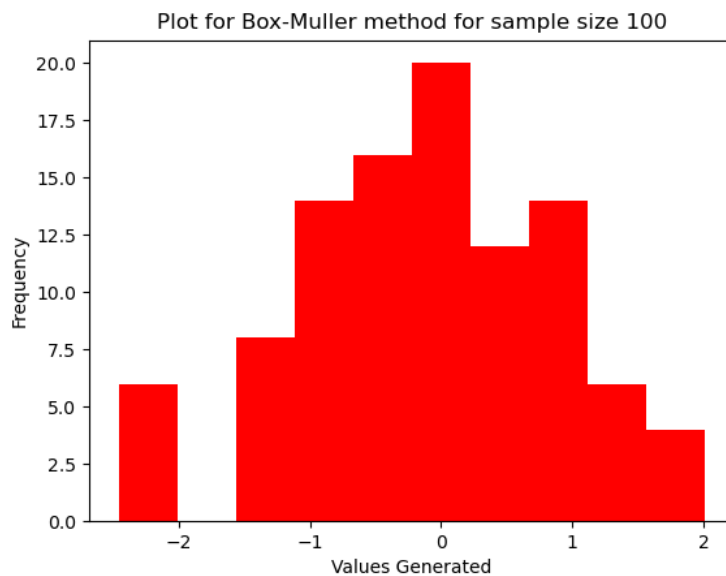
Submission Date: 07-10-2020

Question 1(a) and 1(b):

1. Sample generated with Box-Muller method:

  ➢ Size=100
    Sample Mean: -0.1492188702185614
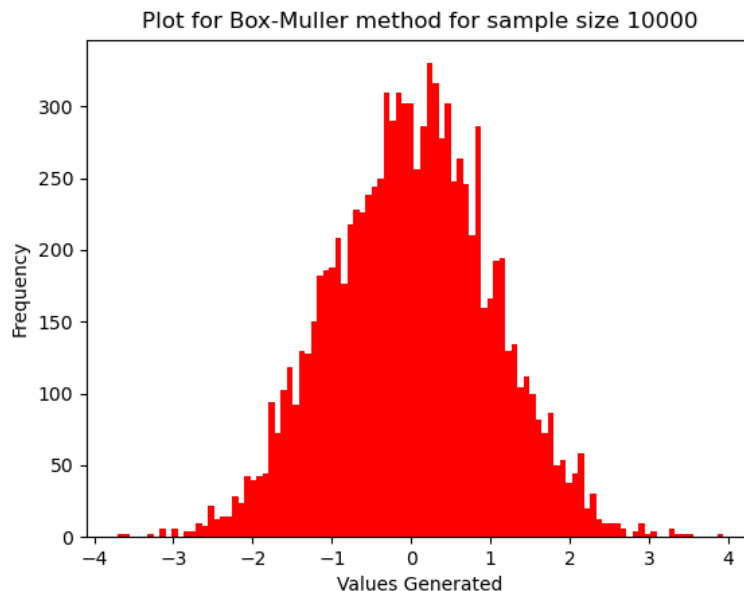   Sample Variance: 0.9918557202653139

  ➢ Size=10000
    Sample Mean: 0.011061055209812634
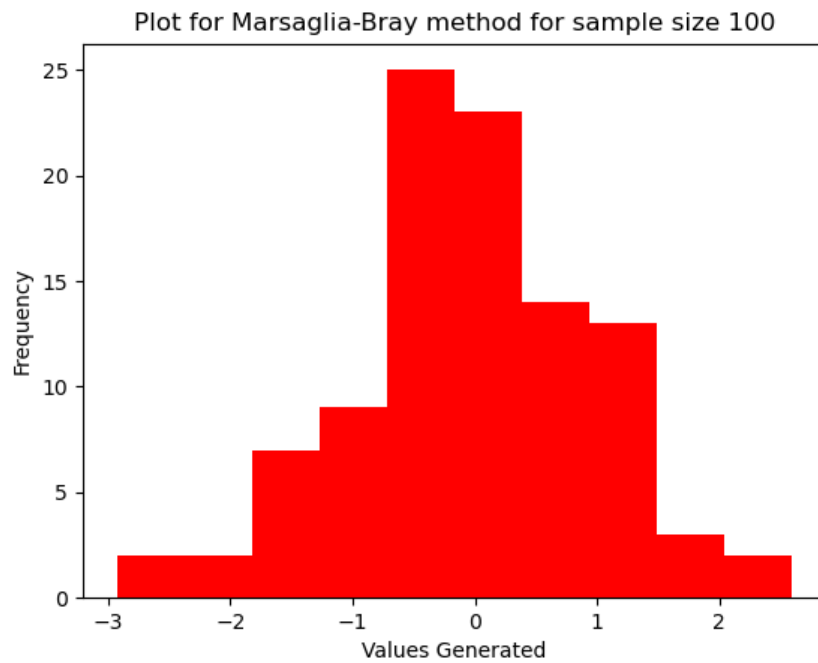   Sample Variance: 1.0195791641637724

2. Sample generated with Marsaglia-Bray method:

➢ Size=100
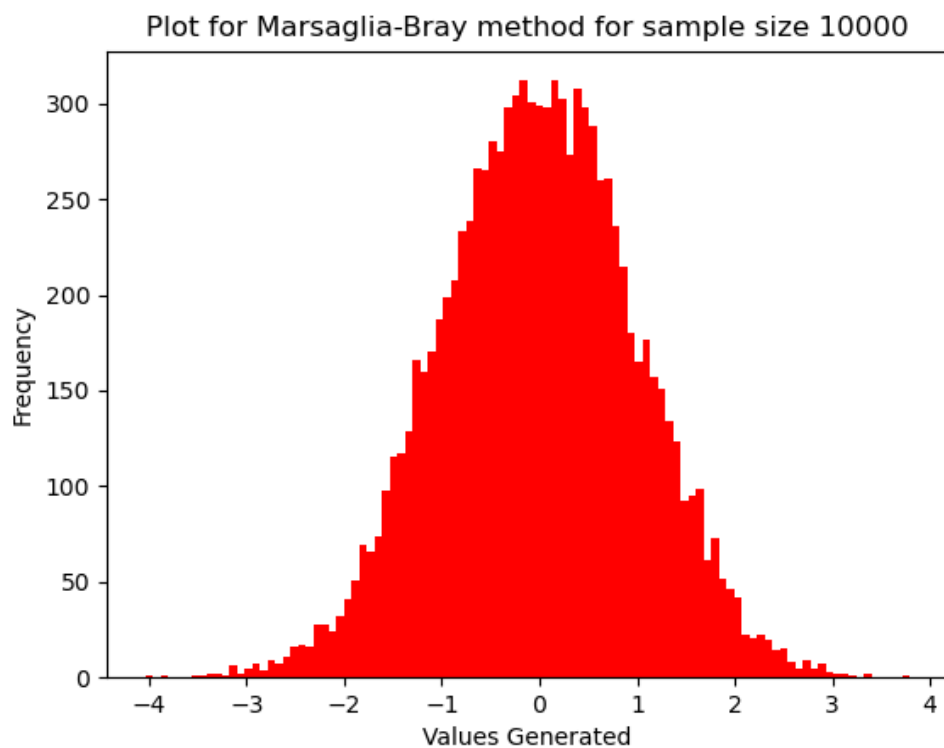Sample Mean: -0.007023253005896141
Sample Variance: 0.986746606935191
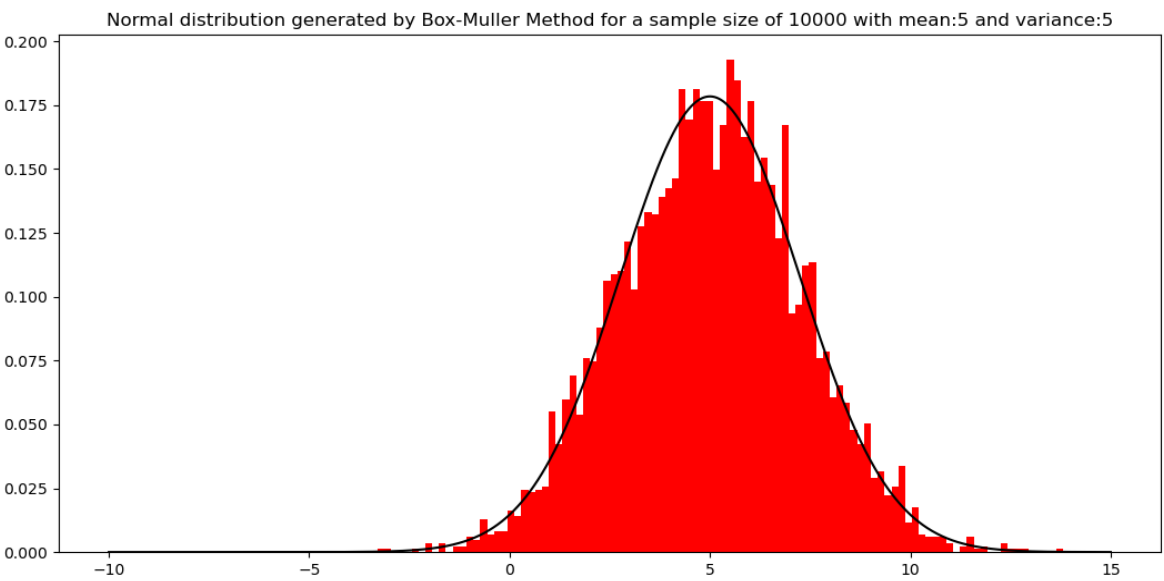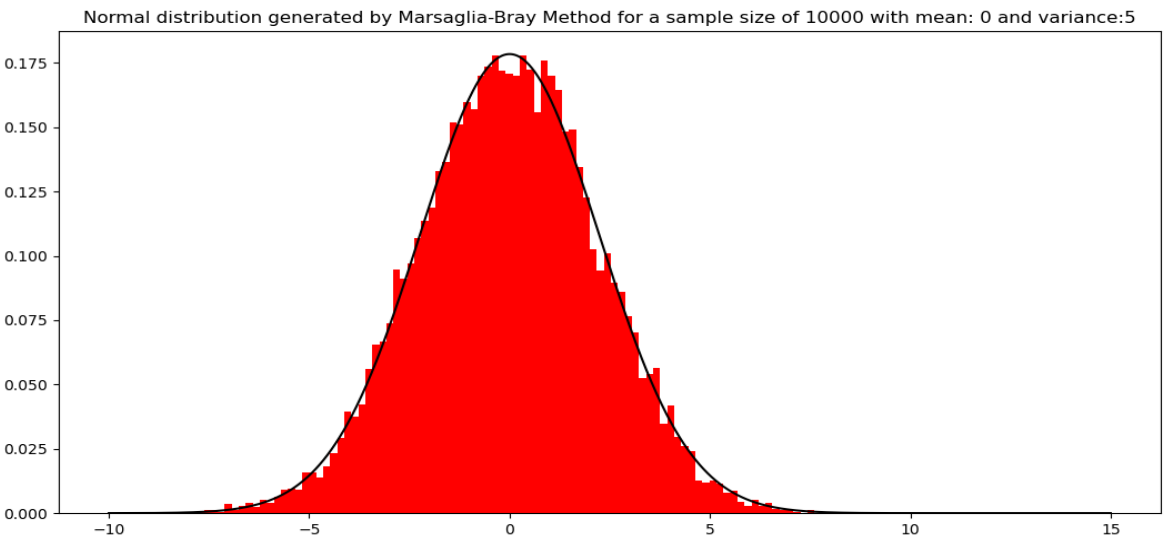

Plot for Marsaglia-Bray method for sample size 100

➢ Size=10000
Sample Mean: -0.00839004642666111
Sample Variance: 0.9940933766788598
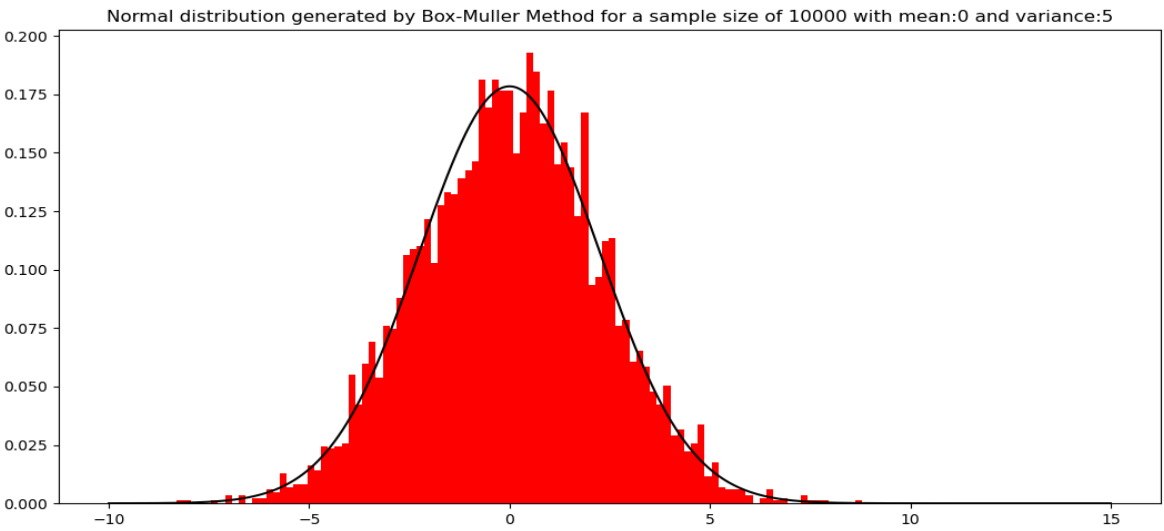
Plot for Marsaglia-Bray method for sample size 10000

Question 1(c):

Normal distribution generated by Box-Muller Method for a sample size of 10000 with mean:0 and variance:5

Normal distribution generated by Marsaglia-Bray Method for a sample size of 10000 with mean: 0 and variance:5

Normal distribution generated by Box-Muller Method for a sample size of 10000 with mean:5 and variance:5

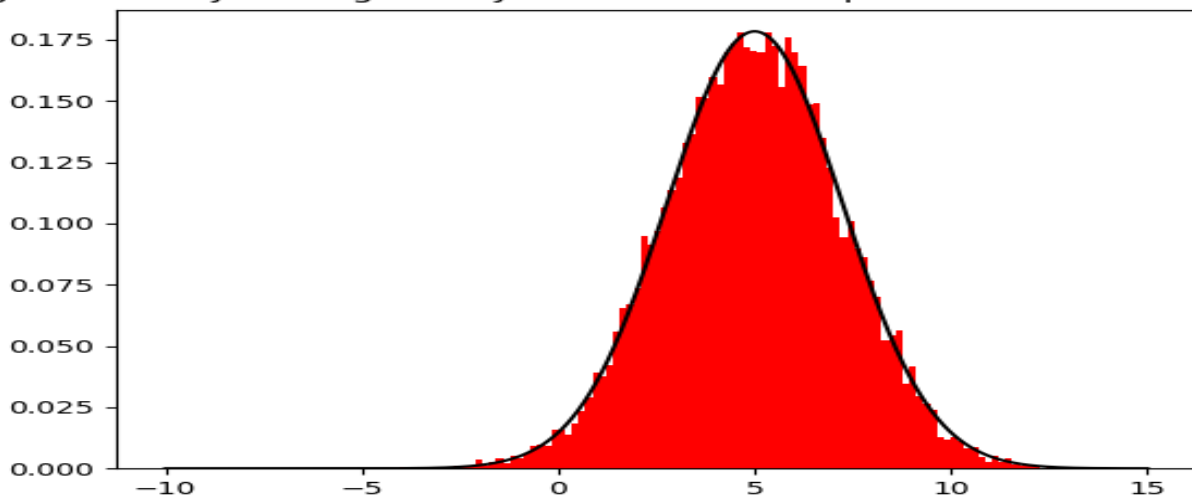➢ Normal distribution generated by Marsaglia-Bray Method for a sample size of 10000 with mean: 5 and variance: 5

➢ It can be observed that the plots are symmetrically distributed around the mean value and the pdf of the distribution is almost outlining the distribution shown with histograms.
➢ Accuracy is more when the variance is equal to 5.

Question 2:

Time taken for Box-Muller method for sample size 10000: 0.045439

Time taken for Marsaglia-Bray method for sample size 10000: 0.106714

By observing the above values, it is clearly visible that **Box-Muller** method for generating sample from Normal distribution is **faster**.

Question 3:

The proportion of values rejected while using Marsaglia and Bray Method:

When sample of 100 values were generated: 0.13793103448275862

When sample of 10000 values were generated: 0.21801689083515796

When sample of 100000 values were generated: 0.2143429550132776

When sample of 1000000 values were generated: 0.21511007296336762

The rejection proportion for large sample sizes is nearly equal to $1 - \pi/4$. This can be theoretically verified since the fraction of values rejected should be the one which lie outside the circle of radius 0.5 in the square of side 1 which is equal to $1 \times 1 - \pi(1/2)^2$ which is equal to $1 - \pi/4$.