Monte Carlo Simulation

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Lab No: **05**

Ques.1) (a)

-> Samples are being generated for N(0,1) using Box-Muller and Marsgalia-Bray methods for 100 and 10000 values. The mean and variance observed :
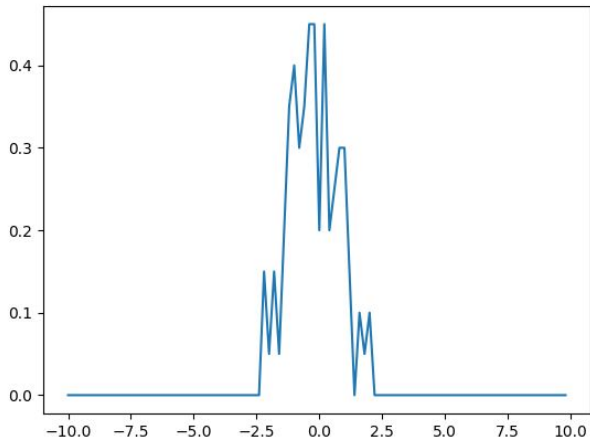
Mean:

Method	100 values	10000 values
Box-Muller	-0.128	-0.013
Marsgalia-Bray	-0.036	-0.005

Variance:

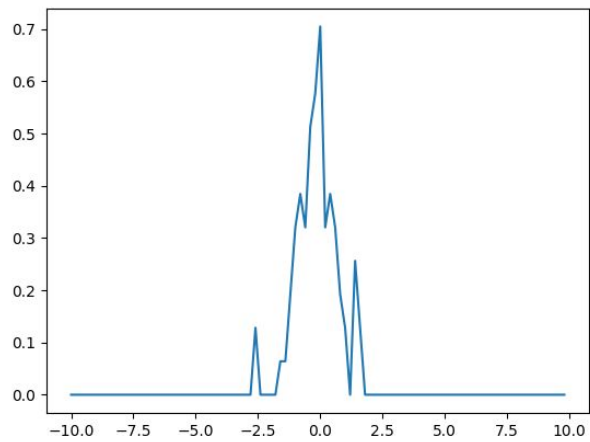| Method	100 values	10000 values
Box-Muller	0.94	1.007
Marsgalia-Bray	0.98	1.0129

Ques.1) (b)
-> For **Box-Muller:**

No of iterations = 100
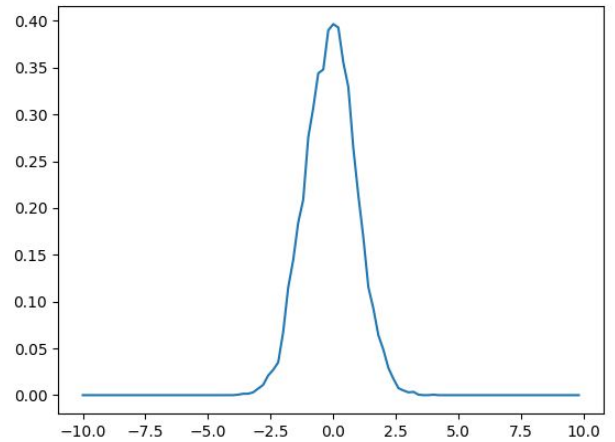
No of iterations = 10000

-> For **Marsgalia-Bray**:

No of iterations = 100
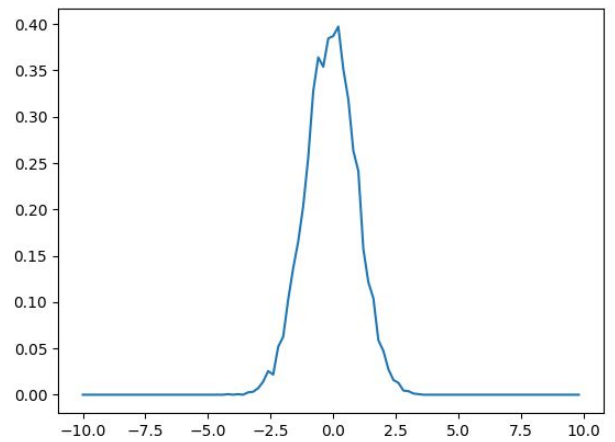
No of iterations = 10000
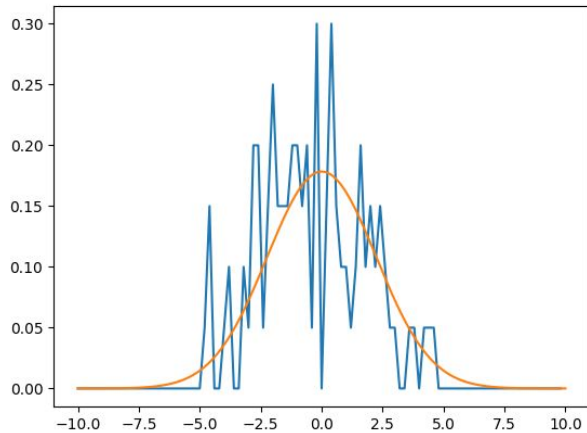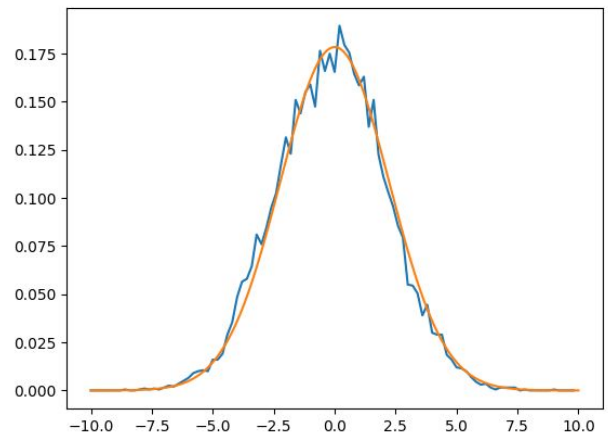
Ques.1) (c)
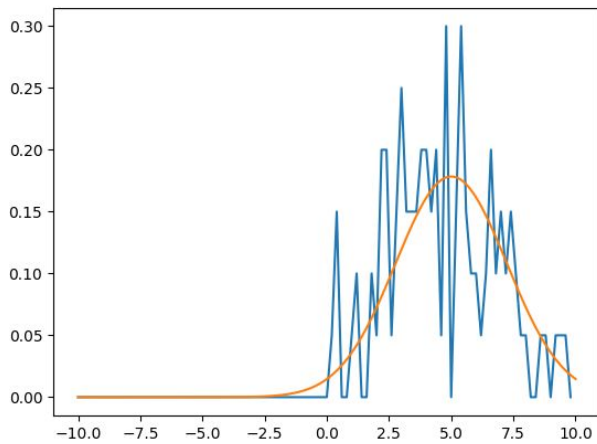**-> Box-Muller for N(0,5)** :

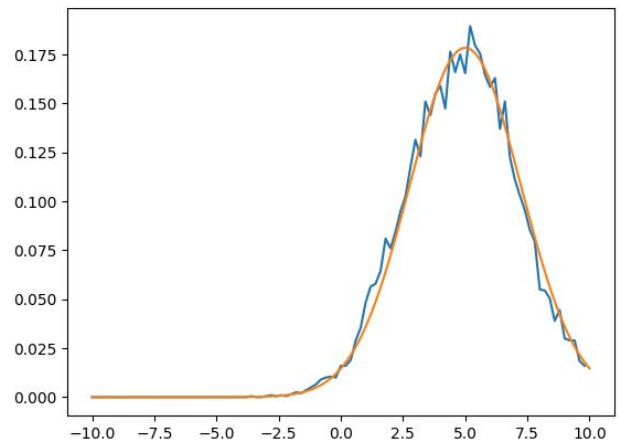**No of iterations = 100**

No of iterations = 10000

-> Box-Muller for N(5,5) :

No of iterations = 100

No of iterations = 10000

-> The orange lines represent the actual distribution curve according to the formula of Normal distribution and the blue lines represent the observed one.

-> Marsgalia-Bray for N(0,5) :

No of iterations = 100

No of iterations = 10000
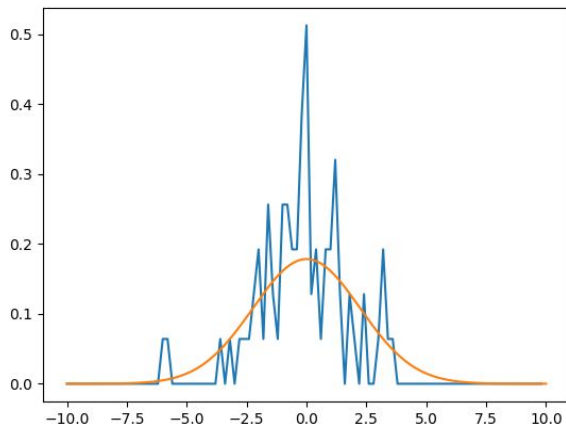
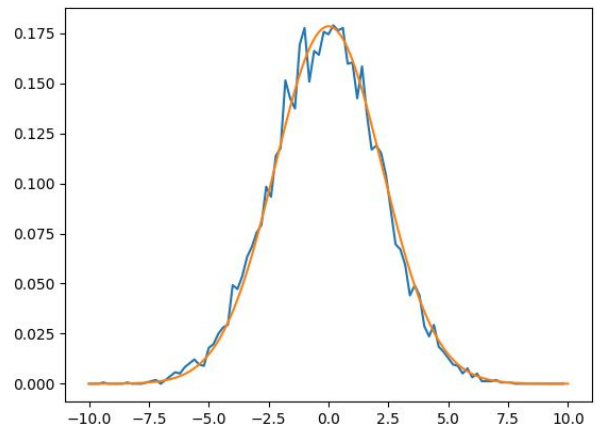**-> Marsgalia-Bray for N(5,5) :**

No of iterations = 100
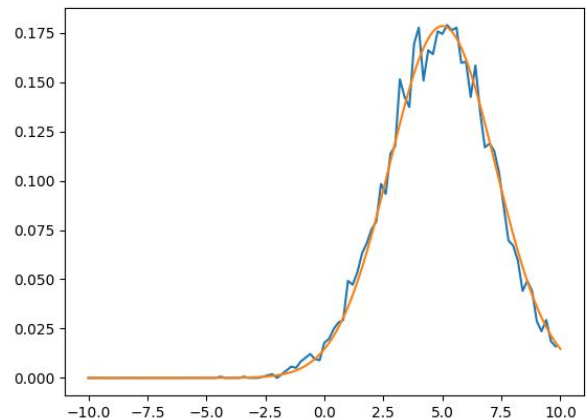
No of iterations = 10000

-> The orange lines represent the actual distribution curve according to the formula of Normal distribution and the blue lines represent the observed one.
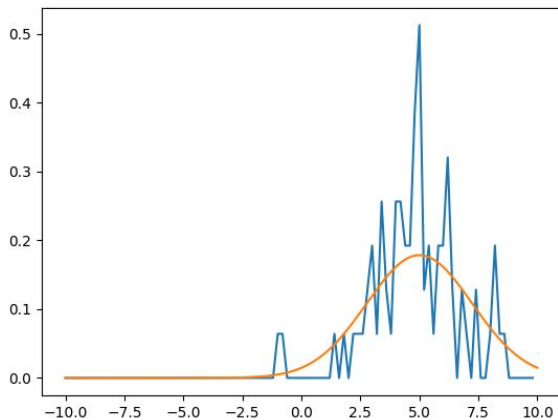**->** It can be concluded from both the above methods that generated distribution converges to the actual distribution according to the formula on increasing the number of iterations in the process.

Ques.2)

-> The time of executions in the above methods are:

Method	100 values	10000 values
Box-Muller	0.000177	0.018710
Marsgalia-Bray	0.0001467	0.019892

```
naman-ubuntu@naman:~/Desktop/Monte_Lab5$ python3 180123029_NamanGoyal_a.py
Mean generated for 100 values is  -0.12843280738574303
Variance generated for 100 values is  0.9363486343921261
Time of execution for 100 values is  0.0001766681671142578
Mean generated for 10000 values is  -0.012292695595812704
Variance generated for 10000 values is  1.007429959144274
The time of execution for 10000 values is  0.01871013641357422
naman-ubuntu@naman:~/Desktop/Monte_Lab5$
```

```
naman-ubuntu@naman:~/Desktop/Monte_Lab5$ python3 180123029_NamanGoyal_b.py
Mean generated for 100 values is  -0.03635027010377276
Variance generated for 100 values is  0.6845029390132865
Time of execution for 100 values is  0.00014662742614746094
Proportion of Values Rejected for 100 samples =  0.22
Mean generated for 10000 values is  -0.005834580943937106
Variance generated for 10000 values is  1.0129621631803947
The time of execution for 10000 values is  0.01989269256591797
Proportion of Values Rejected for 10000 samples =  0.2174
naman-ubuntu@naman:~/Desktop/Monte_Lab5$
```

Ques.3)
-> From the above 2 figs., we can see that the **Proportion of Values Rejected for Marsgalia-Bray** for the 2 samples :
   1.) For 100 values **:: 0.22**
   2.) For 10000 values **:: 0.2174**

-> The values are **very close to 1-**$\pi/4 = 0.214601.$
-> So they observed are values are **comparable** to the above-given value.