Monte Carlo Simulations (MA323) Lab 5

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Question 1 (a)

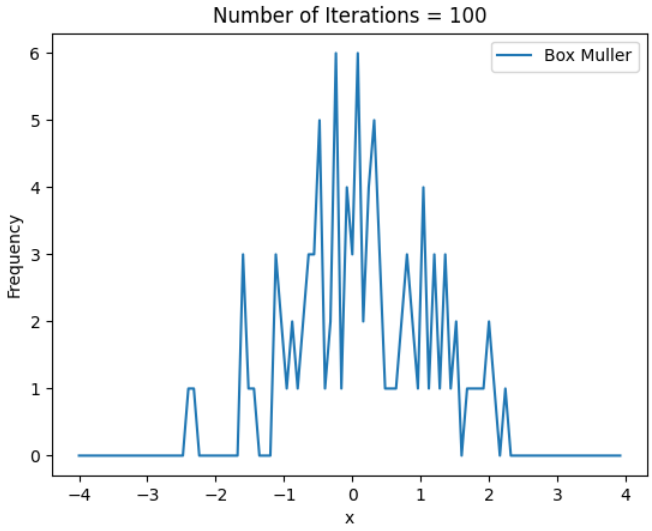
Samples from N(0,1) are generated using the Box-Muller method and the Marsgalia-Bray method, taking 100 and 10000 values. The values of mean and variance for the generated distribution are -

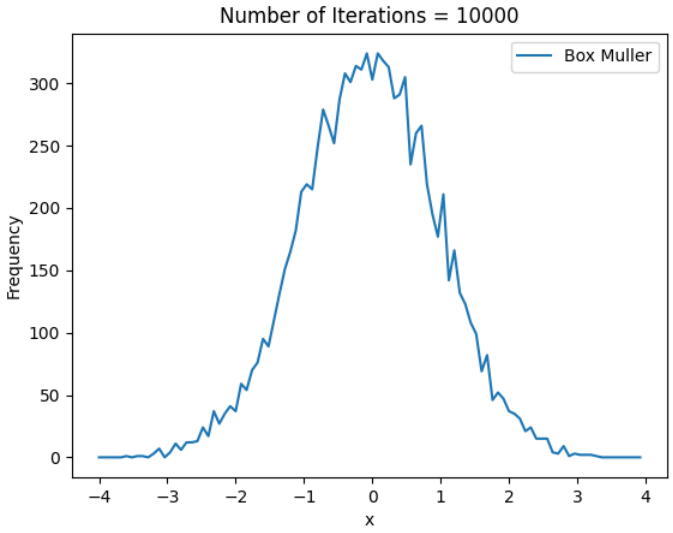
1) Box Muller (100 iterations)
    a) Mean = 0.19122
    b) Variance = 1
2) Box Muller (10000 iteartions)
    a) Mean = -0.00507
    b) Variance = 1
3) Marsgalia Bray (100 iterations)
    a) Mean = -0.05561
    b) Variance = 1
4) Marsgalia Bray (10000 iterations)
    a) Mean = 0.00270
    b) Variance = 1

Question 1 (b)

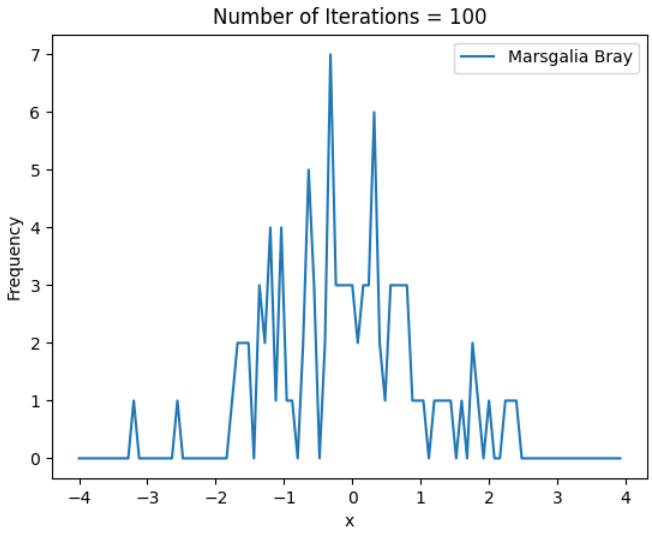
The graphs plotted are -

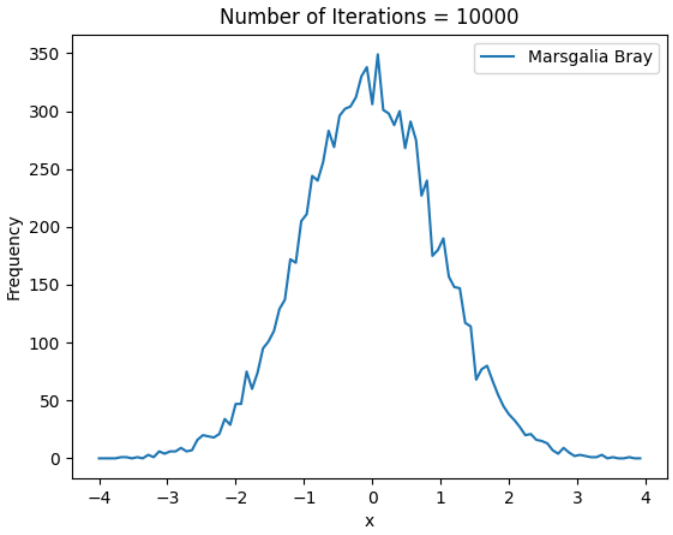
1) Box Muller





2) Marsgalia Bray

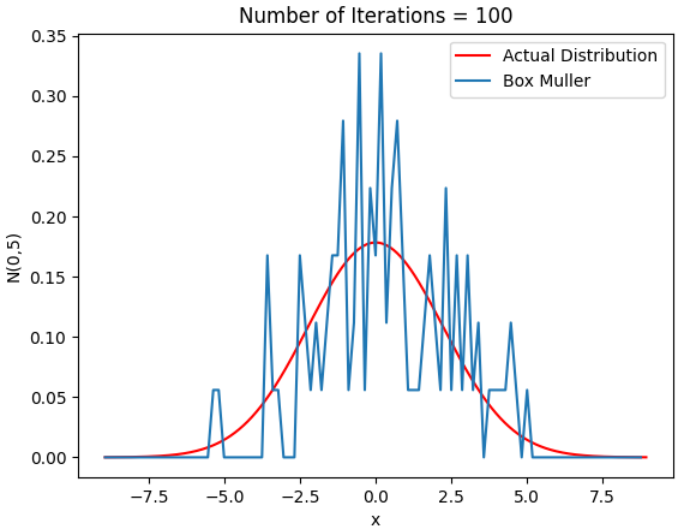


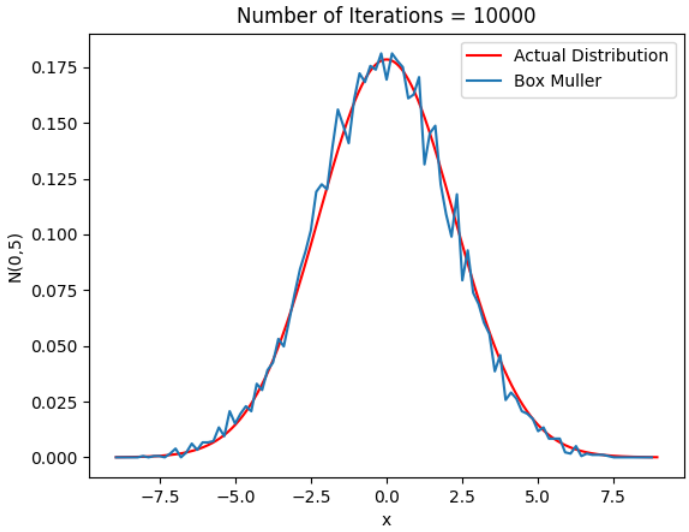


Question 1 (c)

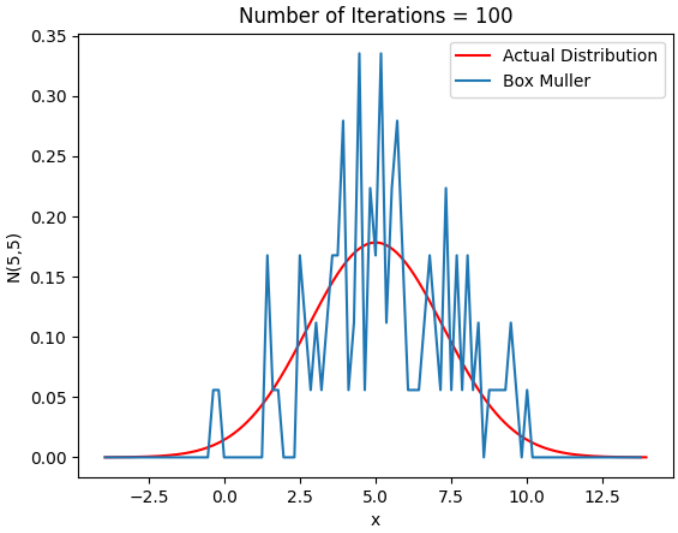
The graphs plotted are -

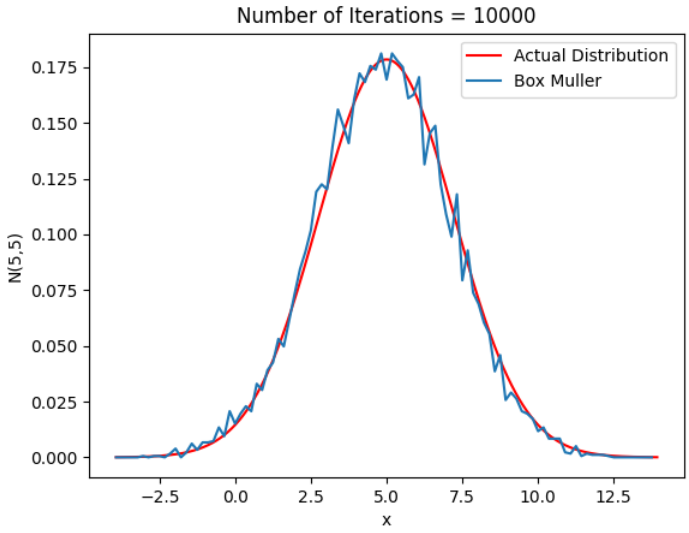
1) Box Muller for N(0,5)



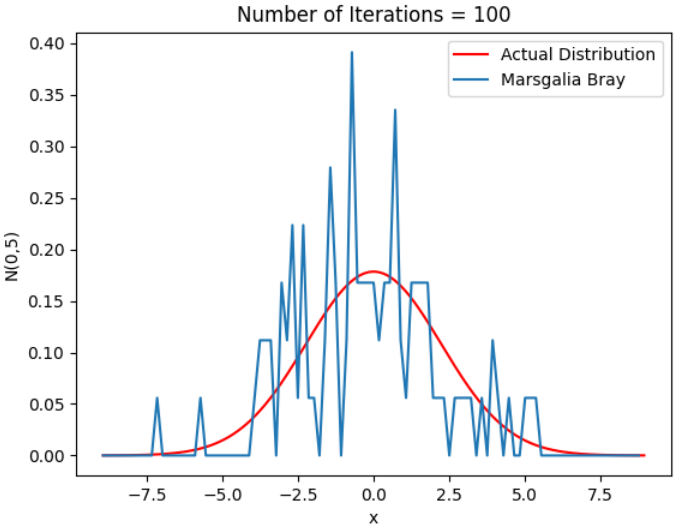


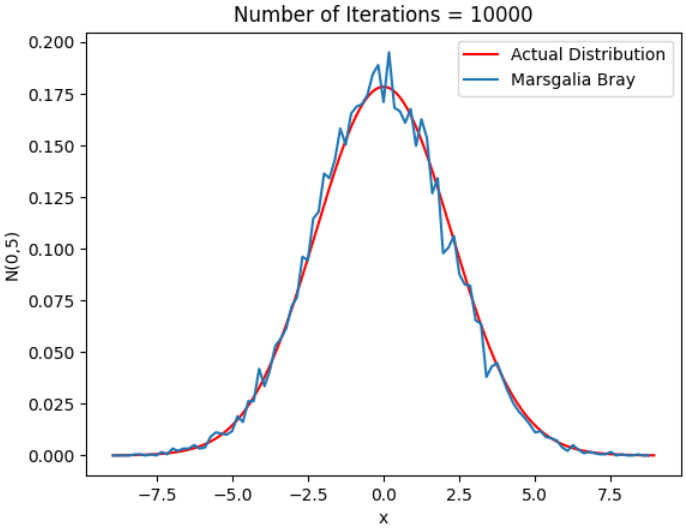
2) Box Muller for N(5,5)



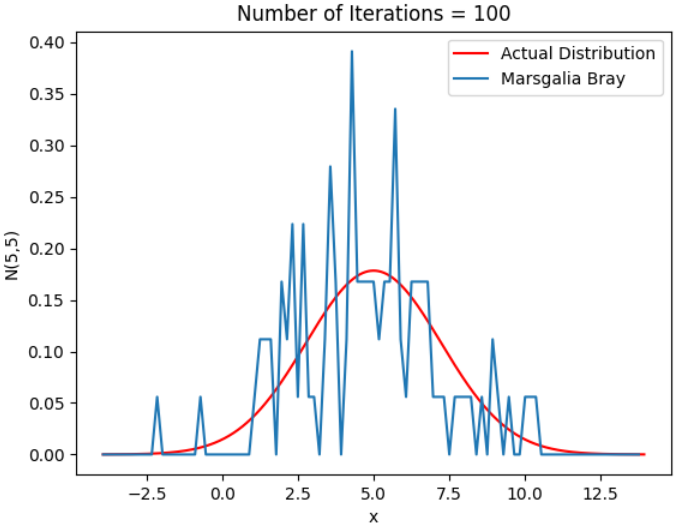


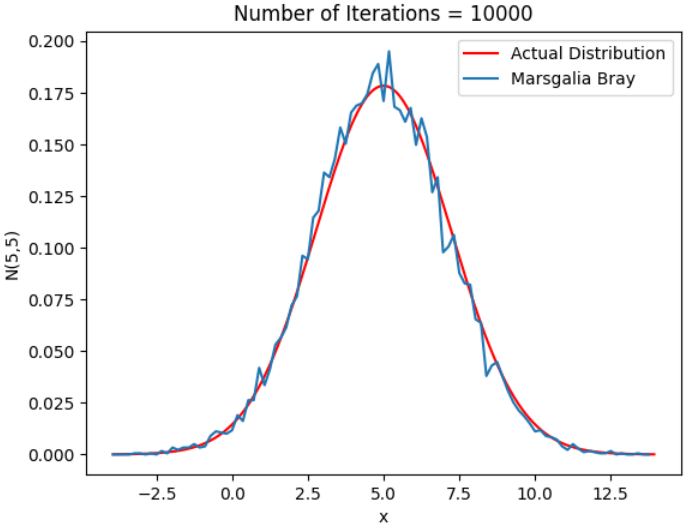
3) Marsgalia Bray for N(0,5)





4) Marsgalia Bray for N(5,5)





It can be observed that the generated distributions converge to the actual distribution on increasing the number of iterations for the experiment.

Question 2

The computation times are given by -

1) Box Muller
    a) 100 iterations : 0.00041 seconds
    b) 10000 iterations : 0.04379 seconds
2) Marsgalia Bray
    a) 100 iterations : 0.00029 seconds
    b) 10000 iterations : 0.02701 seconds

It can be observed that the time taken for Marsgalia Bray method is lower than the Box Muller method, as there are additional overheads in calculating sin and cos in the Box Muller method.

Question 3

The proportion of values which are rejected by the Marsgalia Bray method is **0.206349** for 100 iterations and **0.217404** for 10000 iterations which are very close to $1 - \pi/4$ (0.2146018).