$$X = AW + \mu$$

W is a Dx1 vector of Standard normal variables, as drawn by the randn function.

$$AA^T = C$$

Also, $C = Q \Lambda Q^T$ [Eigen decomposition]

Hence, $A = Q \Lambda^{0.5}$ [Λ is a diagonal matrix]

Hence, $X = (Q \Lambda^{0.5}) W + \mu$

Q & Λ are found by eig(C) in MATLAB.

Since $X = \mu + Aw$

$$E(X) = \mu + AE(w) = \mu$$

$$E((X-\mu)(X-\mu)^T) = E(Aww^TA^T) = AA^T = C$$

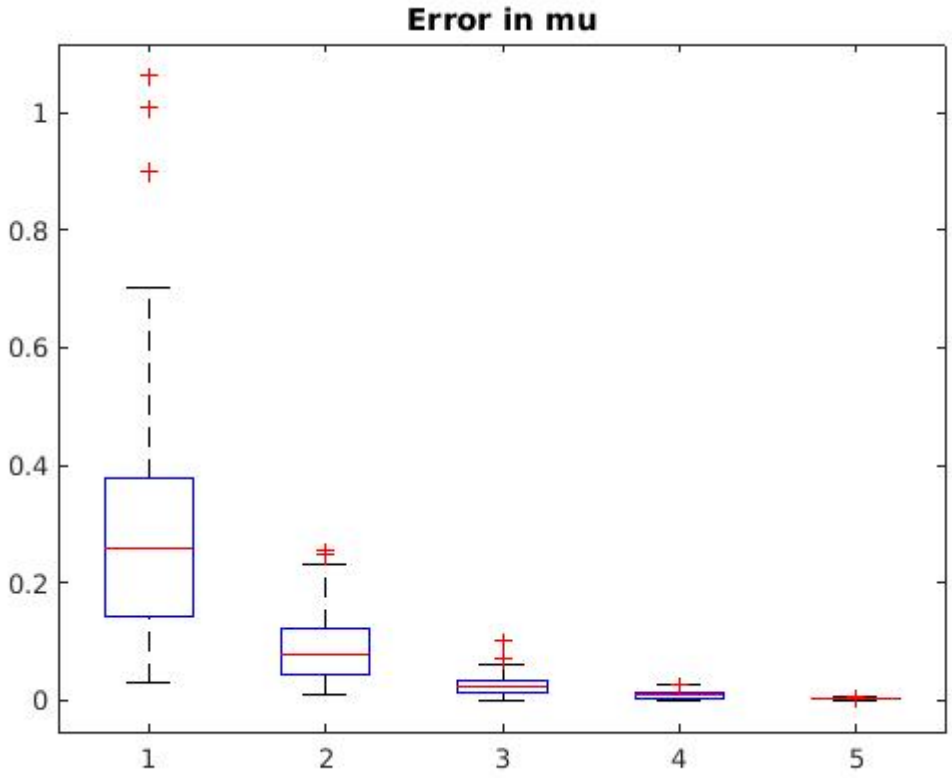
Thus we can calculate μ and C from the drawn sample points by

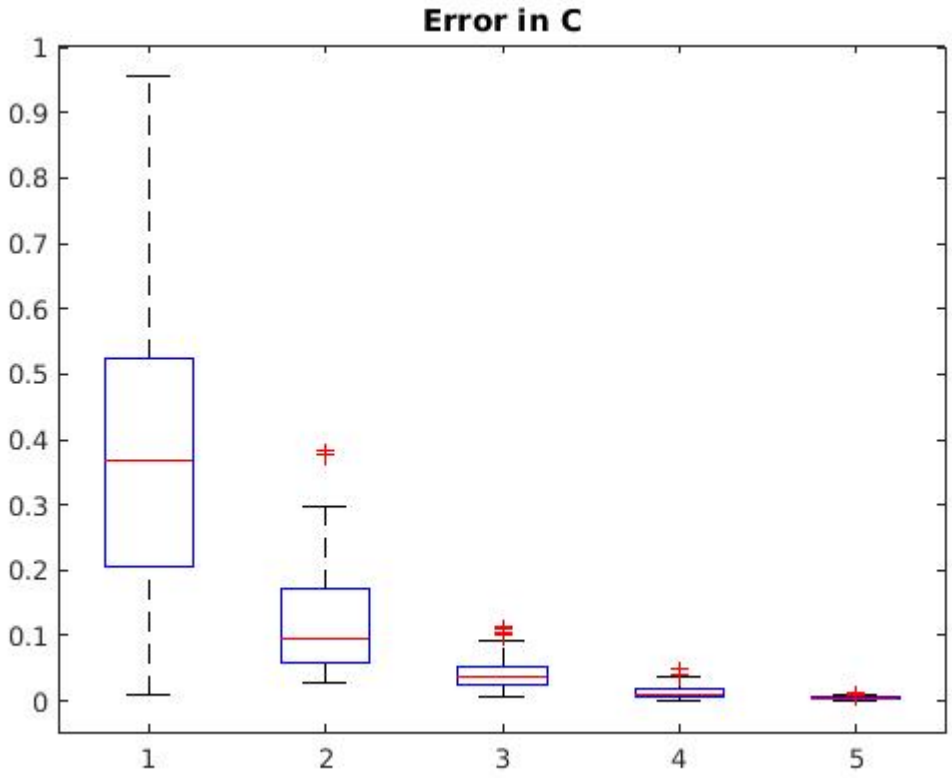
$$\mu = \frac{\Sigma X_i}{N}$$

$$C = \frac{\Sigma (X_i - \mu)(X_i - \mu)^T}{N}$$

Results-

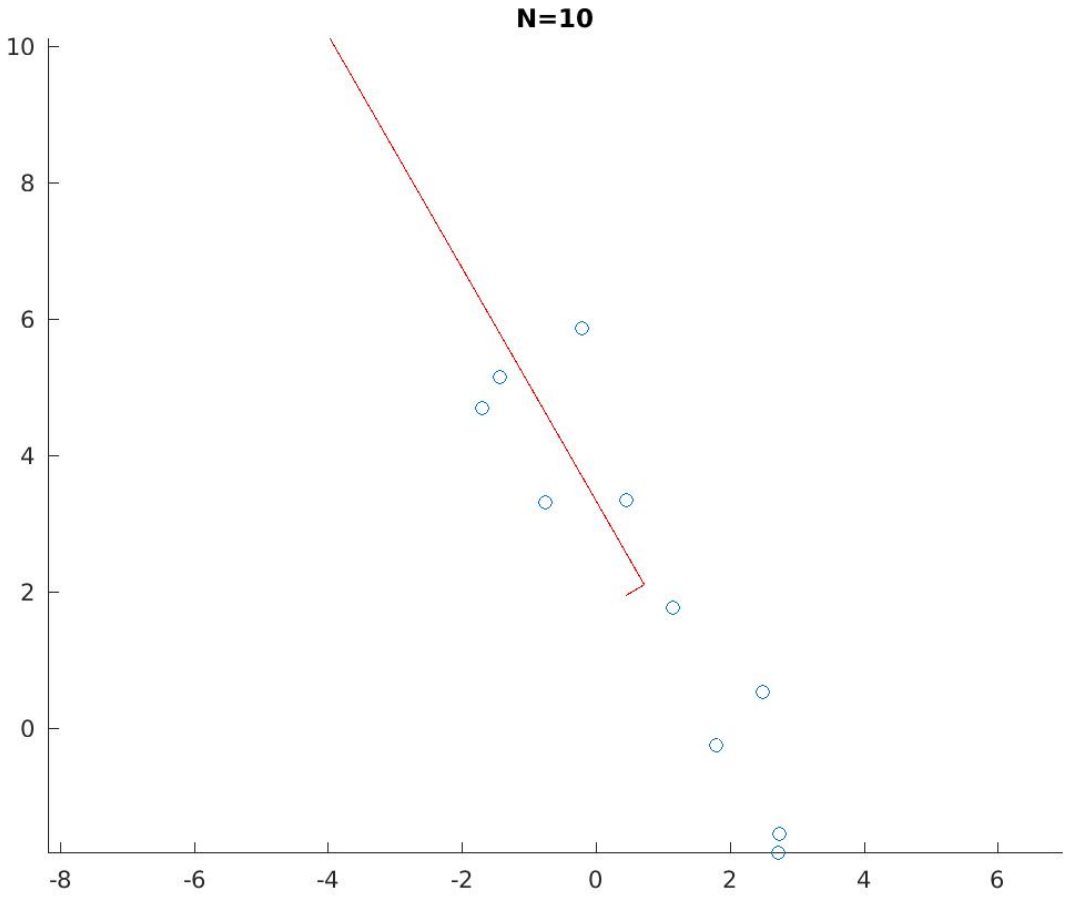
Errors-

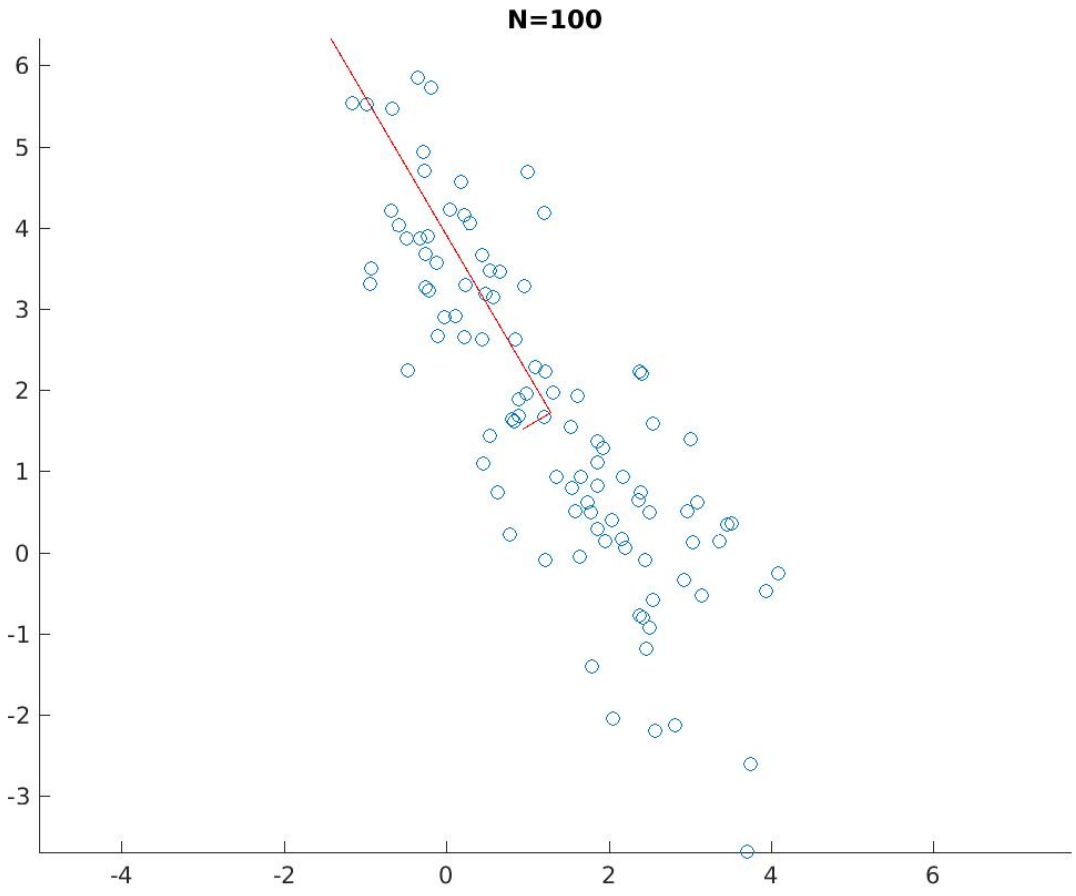


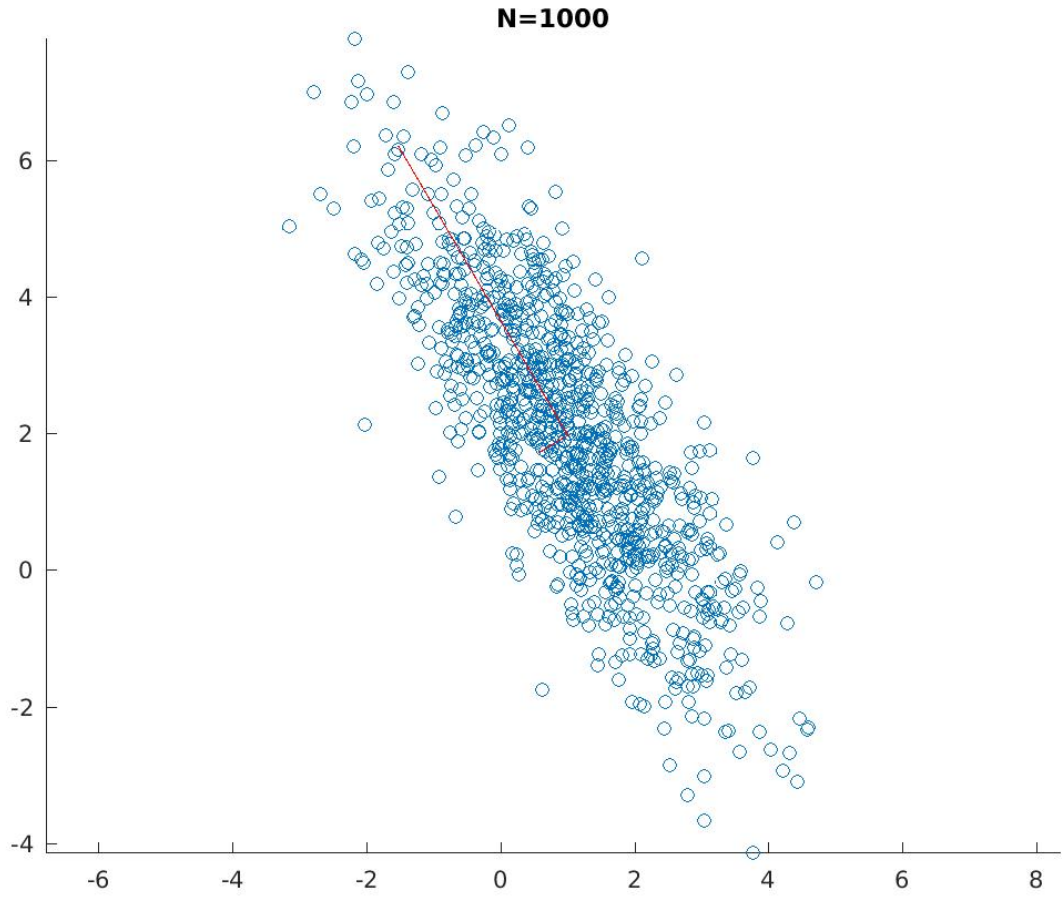


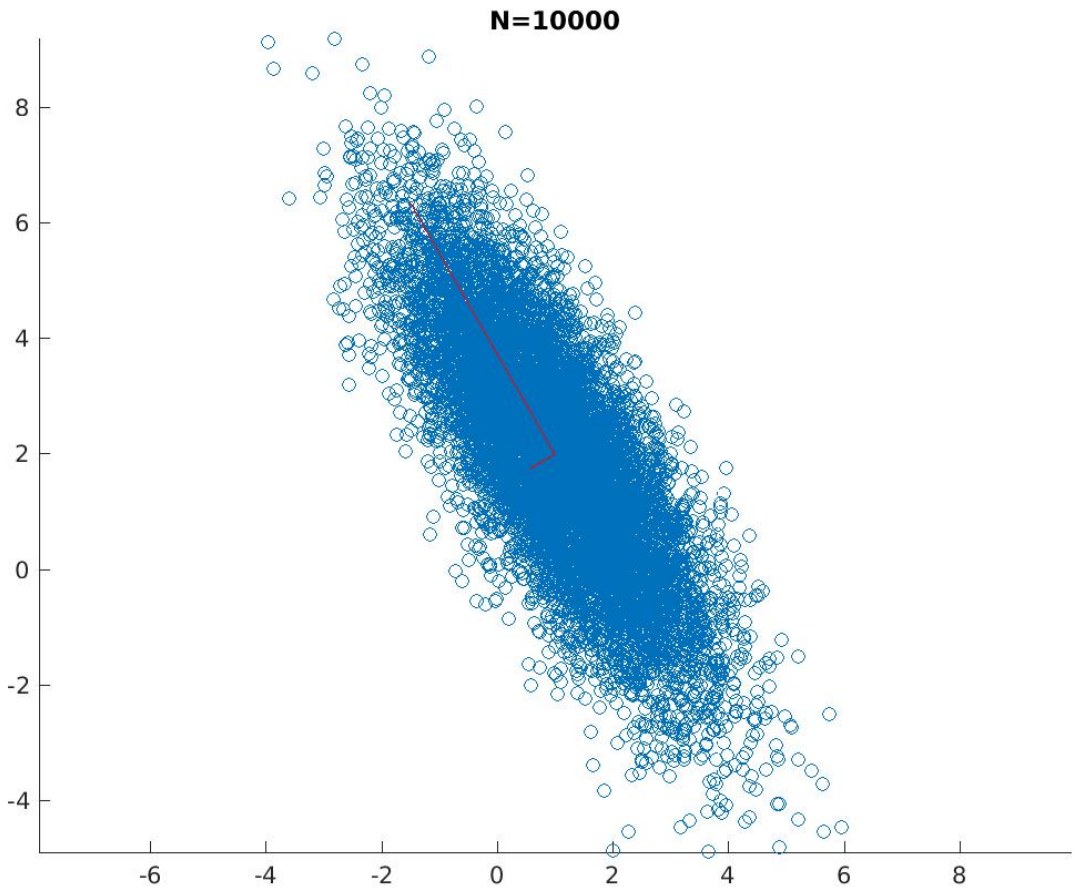
The X axis is log(N) in both the cases, while Y axis is relative error.

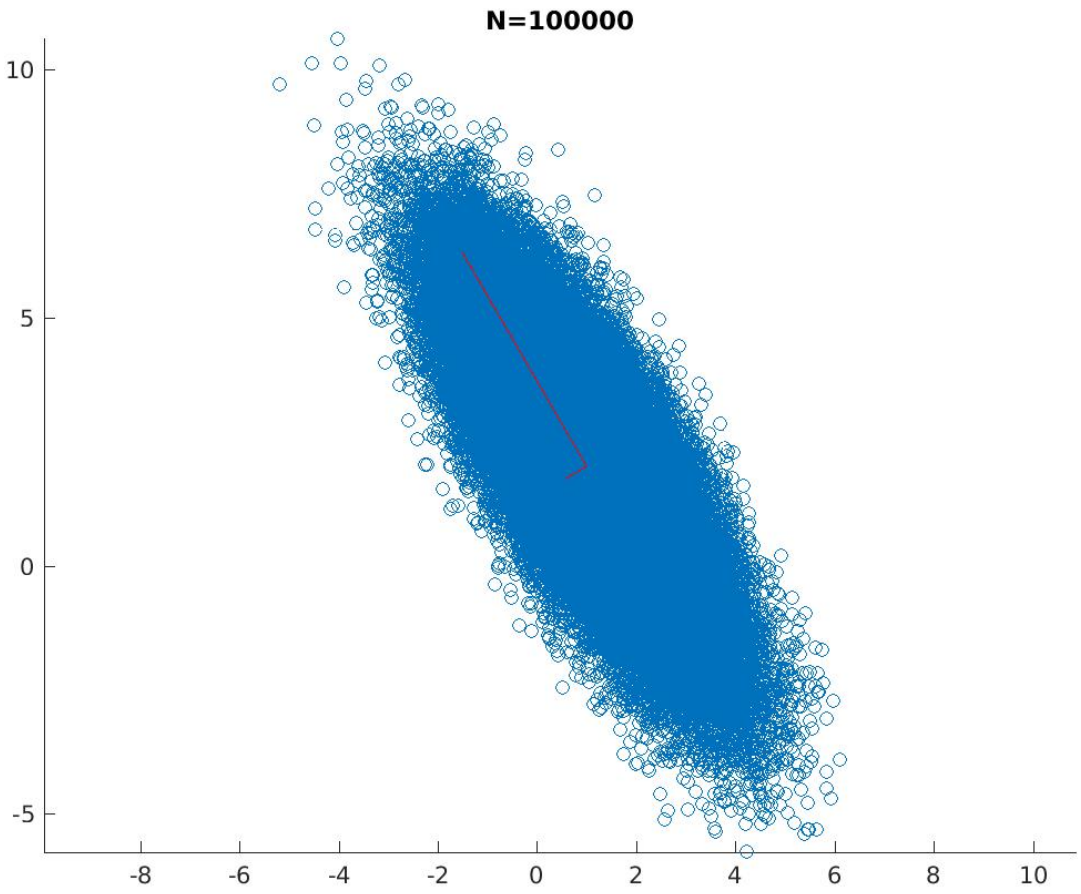
PTO for other plots-


N=10
10
8
6
4
2
0
-8
-6
-4
-2
0
2
4
6


N=100
6
5
4
3
2
1
0
-1
-2
-3
-4
-2
0
2
4
6


N=1000
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
6
8


N=10000
8
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
6
8



To run the script, run P2_driver.m, the above plots will be saved as jpg files.