Homework 6

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November 27, 2021

1. Exercise 6.3: Central Limit Theorem

Knowing that the program's random generator gives a uniform distribution to us, we used this property to sum specific number of random numbers for 10000 samples.

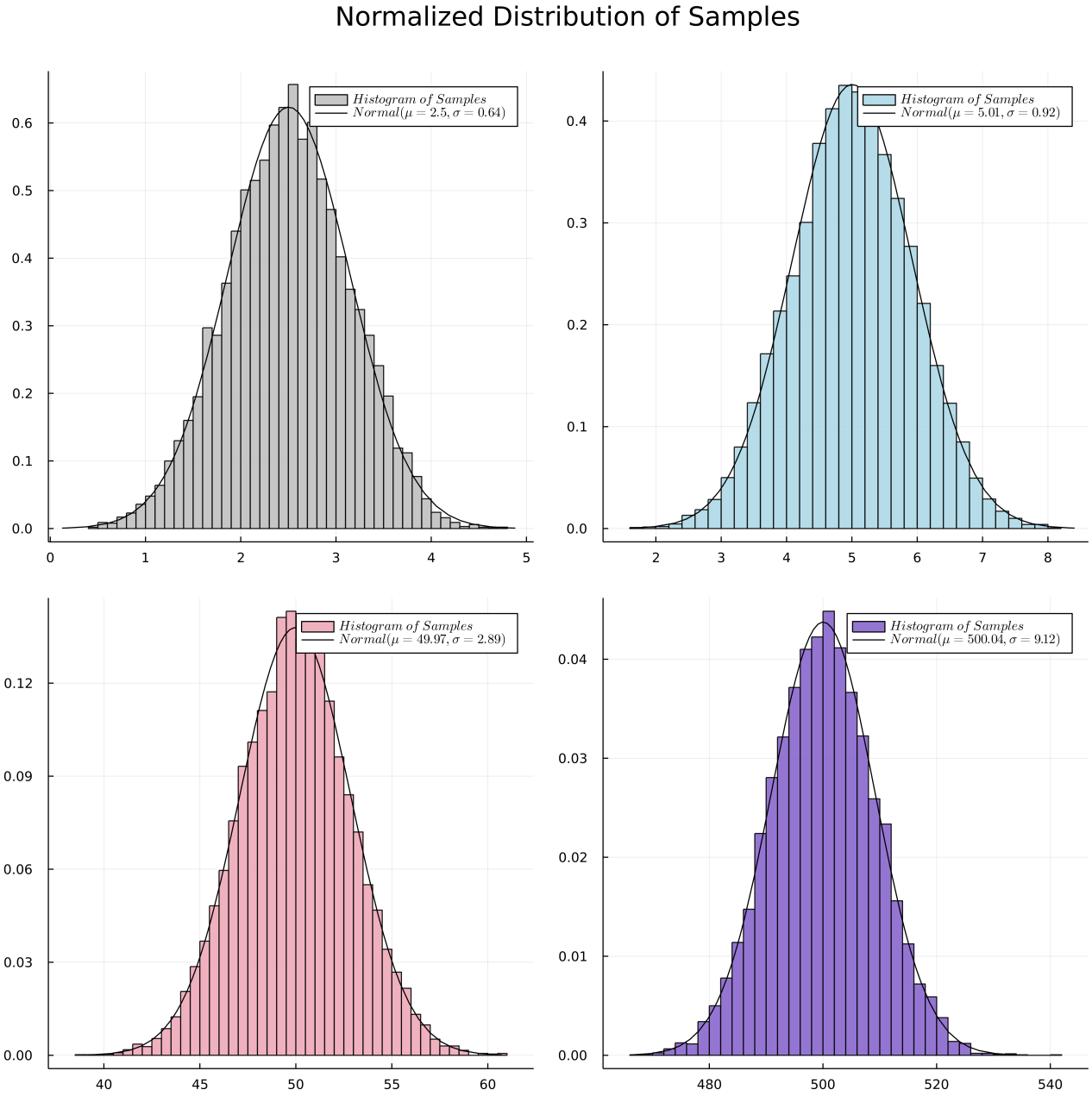

Figure 1: Central Limit Theorem for lengths: 5, 10, 100, 1000 for 10000 samples each.

2. Exercise 6.4: Transformation Matrix

$$\int_a^b \frac{1}{2\pi\sigma^2}\rho \exp\left(-\frac{\rho^2}{2\sigma^2}\right) d\rho d\theta$$

$$f(\rho) = \int_0^\rho \frac{1}{\sigma^2} \exp\left(-\frac{\rho'^2}{2\sigma^2}\right) d\rho' = x = 1 - \exp\left(-\frac{\rho^2}{2\sigma^2}\right)$$

$$\rho = \sqrt{-2\sigma^2 \ln(1-x)}$$

$$f(\theta) = \int_0^\theta \frac{1}{2\pi} d\theta' = x' = \frac{\theta}{2\pi}$$

$$\theta = 2\pi x'$$

$$y1 = \rho\cos\theta \quad , \quad y2 = \rho\sin\theta$$

With these results, I used an array of randomly generated numbers from the program's uniform distribution algorithm as input and considered N/2 of these elements as x1 and others as x2, and put into these equations.

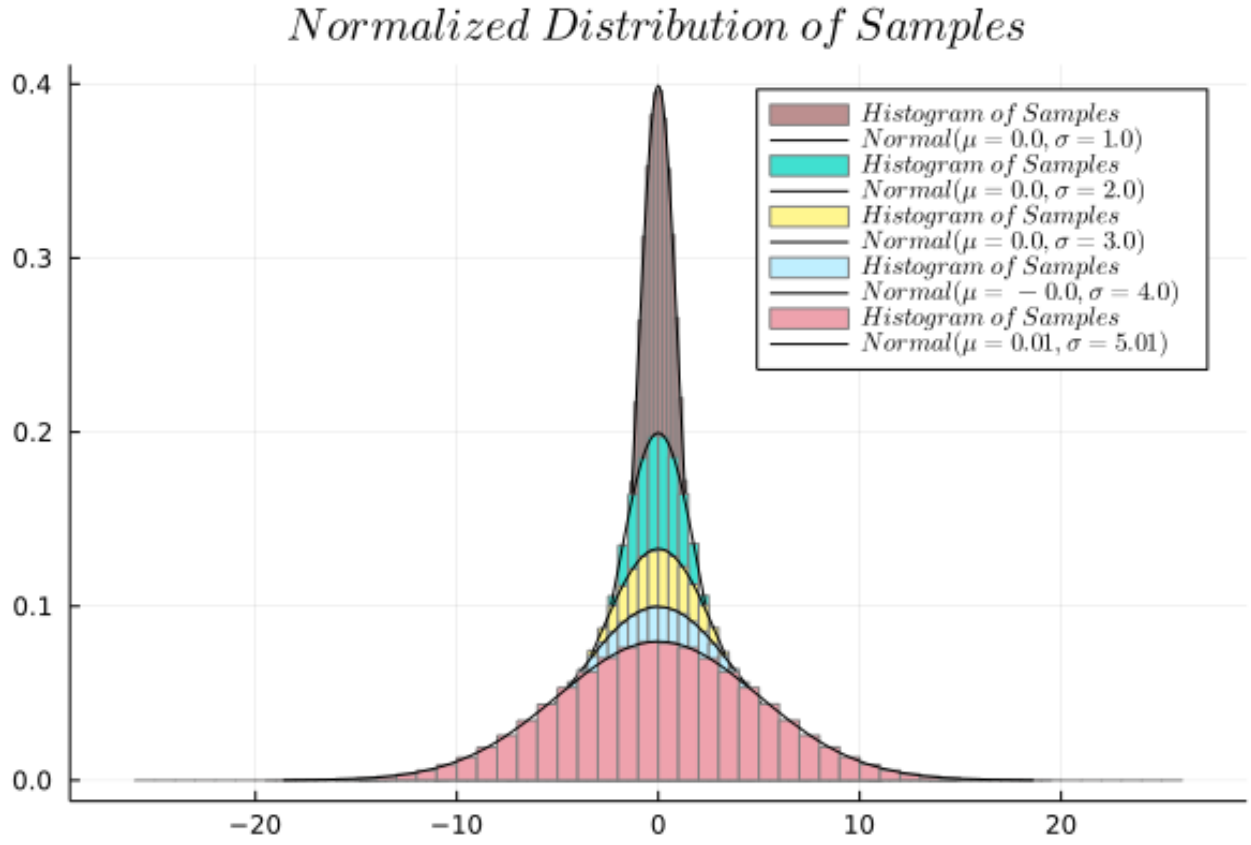

Figure 2: Random numbers' distribution using the Box–Muller transform getting use of the program's own uniform distribution random generator. σ=[1, 2, 3, 4, 5] , Sample Number=1000000

use this link to check the saved data.