

# Random Number Generator

February 17, 2026

## 1 Uniform Samples Generation

To replicate the functionality of a uniform random number generator, a pseudo LCG generator was employed. With appropriate seed, the distribution of samples thus obtained will approximate

$$f_X(x) = \begin{cases} 1 & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

The plot of histogram comparing with true *PDF* of uniform random variable is in plot 1 given below.

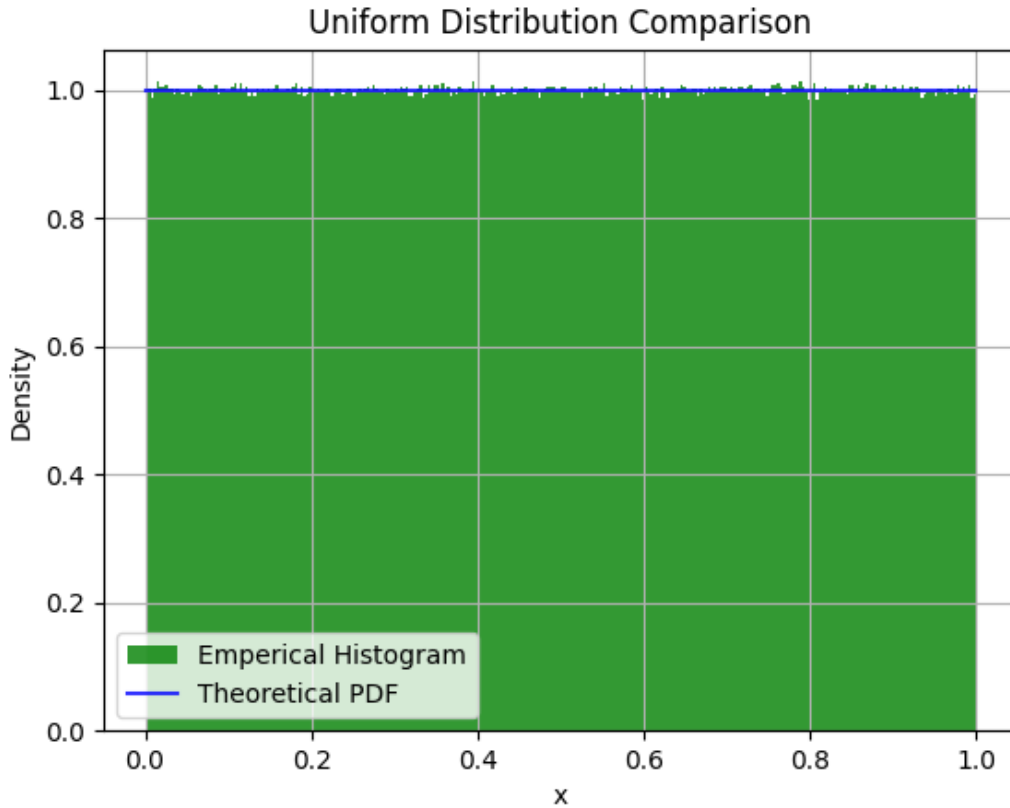


Figure 1: Uniform Distribution and Histogram.

Normal distributions ( $\mathcal{N}(0,1)$ ) can be generated using 2 uniform distributions by the means of box-muller transform. The corresponding transform formulae are given below.

$$X_1 = \sqrt{-2 \ln U_1} \cos(2\pi U_2)$$

$$X_2 = \sqrt{-2 \ln U_1} \sin(2\pi U_2)$$

where,  $U_1, U_2$  are 2 *iid* uniform distributions in interval  $(0,1)$  and  $X_1, X_2$  are 2 normal distributions ( $\mathcal{N}(0,1)$ ) The density of normal distribution with 0 mean and unit variance is given by

$$f_X(x) = \frac{1}{\sqrt{2\pi}} \exp \frac{-x^2}{2}$$

The plot of histogram compared with *PDF* of  $\mathcal{N}(0,1)$  distribution is in plot 2 given below.

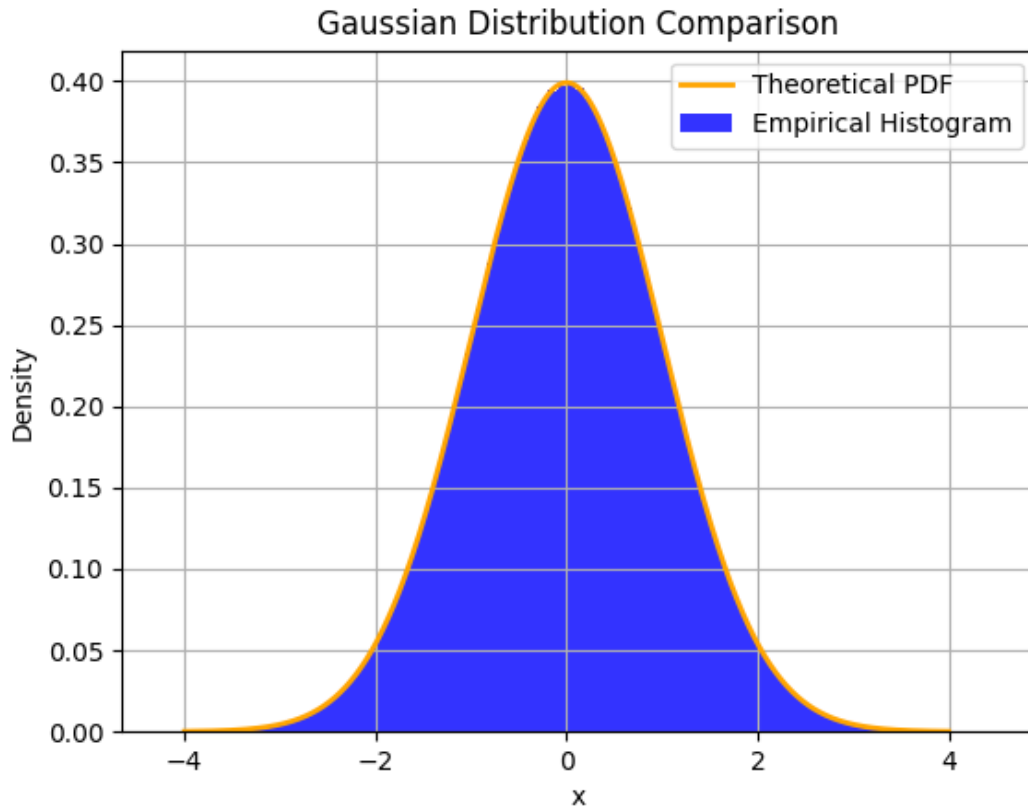


Figure 2: Gaussian Distribution and Histogram.