

3. Random Variables and Probability Distributions - Expectation and Variance

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Part 1: Uniform Distribution $X \sim U[a, b]$

Let X be a random variable uniformly distributed on the interval $[a, b]$.

1. Computing $\mathbb{E}(X)$

The expectation of X for a uniform distribution $U[a, b]$ is given by:

$$\mathbb{E}(X) = \frac{a + b}{2}.$$

2. Computing $\mathbb{V}(X)$

The variance of X for a uniform distribution $U[a, b]$ is given by:

$$\mathbb{V}(X) = \frac{(b - a)^2}{12}.$$

Part 2: Normal Distribution $X \sim \mathcal{N}(\mu, \sigma^2)$

Let X be a random variable with a normal distribution, where $X \sim \mathcal{N}(\mu, \sigma^2)$.

1. Computing $\mathbb{E}(X)$

The expectation of X for a normal distribution with mean μ and variance σ^2 is:

$$\mathbb{E}(X) = \mu.$$

2. Computing $\mathbb{V}(X)$

The variance of X for a normal distribution with mean μ and variance σ^2 is:

$$\mathbb{V}(X) = \sigma^2.$$