

Continuous Probability Densities

Uniform

$$X \sim \text{Unif}(a, b)$$

Situation: X is a random real number in the interval $x \in [a, b]$.

$$f_X(x) = \frac{1}{b-a} \text{ when } x \in [a, b]$$

$$F_X(x) = \frac{x-a}{b-a} \text{ when } x \in [a, b]$$

$$E(X) = \frac{1}{2}(a + b)$$

$$\text{Var}(X) = \frac{1}{12}(b - a)^2$$

Exponential

$$X \sim \text{Exp}(\lambda)$$

Situation: X is the amount of time until a Poisson event occurs.

$$f_X(x) = \lambda e^{-\lambda x} \text{ when } x \geq 0$$

$$F_X(x) = 1 - e^{-\lambda x} \text{ when } x \geq 0$$

$$E(X) = 1/\lambda$$

$$\text{Var}(X) = 1/\lambda^2$$

Normal

$$X \sim \text{Norm}(\mu, \sigma)$$

Situation: X is normal with mean μ and standard deviation σ .

$$f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-\mu)^2/2\sigma^2}$$

$$F_X(x) = \Phi(x)$$

$$E(X) = \mu$$

$$\text{Var}(X) = \sigma^2$$

Gamma

$$X \sim \text{Gamma}(n, \lambda)$$

Situation: X is the amount of time until n Poisson events occur.

$$f_X(x) = \frac{\lambda^n x^{n-1}}{(n-1)!} e^{-\lambda x} \text{ when } x \geq 0$$

$$F_X(x) = 1 - e^{-\lambda x} \left(\sum_{k=0}^{n-1} \frac{(\lambda x)^k}{k!} \right), x \geq 0$$

$$E(X) = n/\lambda$$

$$\text{Var}(X) = n/\lambda^2$$