Statistics – Common Distributions

Discrete Distributions

Distribution	Density	Range of Variates	Mean	Variance
Uniform	$\frac{1}{N}$	$N = 1, 2, \ldots$ $x = 1, 2, \ldots, N$	$\frac{N+1}{2}$	$\frac{N^2-1}{12}$
Bernoulli	$p^x(1-p)^{1-x}$	$0 \leq p \leq 1, x = 0, 1$	p	$p(1-p)$
Binomial	$\binom{n}{x} p^x(1-p)^{n-x}$	$0 \leq p \leq 1, n = 1, 2, \ldots$ $x = 0, 1, \ldots n$	np	$np(1-p)$
Poisson	$\frac{e^{-\lambda}\lambda^x}{x!}$	$\lambda > 0, x = 0, 1, 2, \ldots$	λ	λ
Geometric	$p(1-p)^x$	$0 < p \leq 1, x = 0, 1, 2, \ldots$	$\frac{(1-p)}{p}$	$\frac{(1-p)}{p^2}$

Continuous Distributions

Distribution	Density	Range of Variates	Mean	Variance
Uniform	$\frac{1}{b-a}$	$-\infty < a < b < \infty$ $a < x < b$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Normal $N(\mu, \sigma^2)$	$\frac{1}{\sqrt{2\pi\sigma^2}} \exp[\frac{-(x-\mu)^2}{2\sigma^2}]$	$-\infty < \mu < \infty$ $\sigma > 0, -\infty < x < \infty$	μ	σ^2
Lognormal (μ, σ^2)	$\frac{1}{x\sqrt{2\pi\sigma^2}} \exp[\frac{-(logx-\mu)^2}{2\sigma^2}]$	$-\infty < \mu < \infty$ $\sigma > 0, -\infty < x < \infty$	$e^{(\mu+\frac{1}{2}\sigma^2)}$	$e^{(2\mu+\sigma^2)}(e^{\sigma^2}-1)$
Exponential	$\lambda e^{-\lambda x}$	$\lambda > 0, x \geq 0$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
Gamma (α, λ)	$\frac{\lambda^\alpha x^{\alpha-1} e^{-\lambda x}}{\Gamma(\alpha)}$	$\lambda > 0, \alpha > 0, x > 0$	$\frac{\alpha}{\lambda}$	$\frac{\alpha}{\lambda^2}$
Weibull (c, γ)	$c\gamma x^{\gamma-1} e^{-cx^\gamma}$	$c > 0, \gamma > 0, x > 0$	$c^{-\frac{1}{\gamma}}\Gamma(1+\gamma^{-1})$	$c^{-\frac{2}{\gamma}}[\Gamma(1+2\frac{1}{\gamma})$ $-\Gamma^2(1+\frac{1}{\gamma})]$
Pareto(α, λ)	$\frac{\alpha\lambda^\alpha}{(\lambda+x)^{\alpha+1}}$	$\alpha > 0, \lambda > 0, x > 0$	$\frac{\lambda}{(\alpha-1)}$	$\frac{\lambda^2\alpha}{(\alpha-1)^2(\alpha-2)}$
Burr$(\alpha, \lambda, \gamma)$	$\frac{\alpha\gamma\lambda^\alpha x^{\gamma-1}}{(\lambda+x^\gamma)^{\alpha+1}}$	$\alpha > 0, \lambda > 0, \gamma > 0, x > 0$	Not required	Not required