

DISCRETE DISTRIBUTIONS

	RANGE \mathbb{X}	PARAMETERS	MASS FUNCTION f_X	CDF F_X	$E_{f_X} [X]$	$\text{Var}_{f_X} [X]$	MGF M_X
<i>Bernoulli</i> (θ)	$\{0, 1\}$	$\theta \in (0, 1)$	$\theta^x(1 - \theta)^{1-x}$		θ	$\theta(1 - \theta)$	$1 - \theta + \theta e^t$
<i>Binomial</i> (n, θ)	$\{0, 1, \dots, n\}$	$n \in \mathbb{Z}^+, \theta \in (0, 1)$	$\binom{n}{x} \theta^x(1 - \theta)^{n-x}$		$n\theta$	$n\theta(1 - \theta)$	$(1 - \theta + \theta e^t)^n$
<i>Poisson</i> (λ)	$\{0, 1, 2, \dots\}$	$\lambda \in \mathbb{R}^+$	$\frac{e^{-\lambda} \lambda^x}{x!}$		λ	λ	$\exp \{ \lambda (e^t - 1) \}$
<i>Geometric</i> (θ)	$\{1, 2, \dots\}$	$\theta \in (0, 1)$	$(1 - \theta)^{x-1} \theta$	$1 - (1 - \theta)^x$	$\frac{1}{\theta}$	$\frac{(1 - \theta)}{\theta^2}$	$\frac{\theta e^t}{1 - e^t(1 - \theta)}$
<i>NegBinomial</i> (n, θ)	$\{n, n + 1, \dots\}$	$n \in \mathbb{Z}^+, \theta \in (0, 1)$	$\binom{x-1}{n-1} \theta^n (1 - \theta)^{x-n}$		$\frac{n}{\theta}$	$\frac{n(1 - \theta)}{\theta^2}$	$\left(\frac{\theta e^t}{1 - e^t(1 - \theta)} \right)^n$
or	$\{0, 1, 2, \dots\}$	$n \in \mathbb{Z}^+, \theta \in (0, 1)$	$\binom{n+x-1}{x} \theta^n (1 - \theta)^x$		$\frac{n(1 - \theta)}{\theta}$	$\frac{n(1 - \theta)}{\theta^2}$	$\left(\frac{\theta}{1 - e^t(1 - \theta)} \right)^n$

For **CONTINUOUS** distributions (see over), define the **GAMMA FUNCTION**

$$\Gamma(\alpha) = \int_0^{\infty} x^{\alpha-1} e^{-x} dx$$

and the LOCATION/SCALE transformation $Y = \mu + \sigma X$ gives

$$f_Y(y) = f_X \left(\frac{y - \mu}{\sigma} \right) \frac{1}{\sigma} \quad F_Y(y) = F_X \left(\frac{y - \mu}{\sigma} \right) \quad M_Y(t) = e^{\mu t} M_X(\sigma t) \quad E_{f_Y} [Y] = \mu + \sigma E_{f_X} [X] \quad \text{Var}_{f_Y} [Y] = \sigma^2 \text{Var}_{f_X} [X]$$

CONTINUOUS DISTRIBUTIONS

	RANGE	PARAMETERS	PDF	CDF	$E_{f_X} [X]$	$\text{Var}_{f_X} [X]$	MGF
	\mathbb{X}		f_X	F_X			M_X
<i>Uniform</i> (α, β) (standard model $\alpha = 0, \beta = 1$)	(α, β)	$\alpha < \beta \in \mathbb{R}$	$\frac{1}{\beta - \alpha}$	$\frac{x - \alpha}{\beta - \alpha}$	$\frac{(\alpha + \beta)}{2}$	$\frac{(\beta - \alpha)^2}{12}$	$\frac{e^{\beta t} - e^{\alpha t}}{t(\beta - \alpha)}$
<i>Exponential</i> (λ) (standard model $\lambda = 1$)	\mathbb{R}^+	$\lambda \in \mathbb{R}^+$	$\lambda e^{-\lambda x}$	$1 - e^{-\lambda x}$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\left(\frac{\lambda}{\lambda - t}\right)$
<i>Gamma</i> (α, β) (standard model $\beta = 1$)	\mathbb{R}^+	$\alpha, \beta \in \mathbb{R}^+$	$\frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x}$		$\frac{\alpha}{\beta}$	$\frac{\alpha}{\beta^2}$	$\left(\frac{\beta}{\beta - t}\right)^\alpha$
<i>Weibull</i> (α, β) (standard model $\beta = 1$)	\mathbb{R}^+	$\alpha, \beta \in \mathbb{R}^+$	$\alpha \beta x^{\alpha-1} e^{-\beta x^\alpha}$	$1 - e^{-\beta x^\alpha}$	$\frac{\Gamma(1 + \alpha^{-1})}{\beta^{1/\alpha}}$	$\frac{\Gamma(1 + 2\alpha^{-1}) - \Gamma(1 + \alpha^{-1})^2}{\beta^{2/\alpha}}$	
<i>Normal</i> (μ, σ^2) (standard model $\mu = 0, \sigma = 1$)	\mathbb{R}	$\mu \in \mathbb{R}, \sigma \in \mathbb{R}^+$	$\frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{-\frac{(x - \mu)^2}{2\sigma^2}\right\}$		μ	σ^2	$\exp\left\{\mu t + \frac{\sigma^2 t^2}{2}\right\}$
<i>Student</i> (ν)	\mathbb{R}	$\nu \in \mathbb{R}^+$	$\frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\Gamma\left(\frac{\nu}{2}\right) \sqrt{\pi\nu} \left\{1 + \frac{x^2}{\nu}\right\}^{(\nu+1)/2}}$		0 (if $\nu > 1$)	$\frac{\nu}{\nu - 2}$ (if $\nu > 2$)	
<i>Pareto</i> (θ, α)	\mathbb{R}^+	$\theta, \alpha \in \mathbb{R}^+$	$\frac{\alpha \theta^\alpha}{(\theta + x)^{\alpha+1}}$	$1 - \left(\frac{\theta}{\theta + x}\right)^\alpha$	$\frac{\theta}{\alpha - 1}$ (if $\alpha > 1$)	$\frac{\alpha \theta^2}{(\alpha - 1)(\alpha - 2)}$ (if $\alpha > 2$)	
<i>Beta</i> (α, β)	$(0, 1)$	$\alpha, \beta \in \mathbb{R}^+$	$\frac{\Gamma(\alpha + \beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1} (1 - x)^{\beta-1}$		$\frac{\alpha}{\alpha + \beta}$	$\frac{\alpha\beta}{(\alpha + \beta)^2(\alpha + \beta + 1)}$	