

**DISCRETE DISTRIBUTIONS**

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

For **CONTINUOUS** distributions (see over), define the **GAMMA FUNCTION** for  $\alpha > 0$

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

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

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

**CONTINUOUS DISTRIBUTIONS**

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