DISCRETE DISTRIBUTIONS

	range $\mathbb{X}$	*parameters*	*pmf* f_X	*cdf* F_X	$\mathrm{E}[X]$	$\mathrm{Var}[X]$	*mgf* M_X
$Bernoulli(\theta)$	$\{0,1\}$	$\theta \in (0,1)$	$\theta^x(1-\theta)^{1-x}$		θ	$\theta(1-\theta)$	$1-\theta+\theta e^t$
$Binomial(n,\theta)$	$\{0,1,...,n\}$	$n \in \mathbb{Z}^+, \theta \in (0,1)$	$\binom{n}{x}\theta^x(1-\theta)^{n-x}$		$n\theta$	$n\theta(1-\theta)$	$(1-\theta+\theta e^t)^n$
$Poisson(\lambda)$	$\{0,1,2,...\}$	$\lambda \in \mathbb{R}^+$	$\dfrac{e^{-\lambda}\lambda^x}{x!}$		λ	λ	$\exp\{\lambda(e^t-1)\}$
$Geometric(\theta)$	$\{1,2,...\}$	$\theta \in (0,1)$	$(1-\theta)^{x-1}\theta$	$1-(1-\theta)^x$	$\dfrac{1}{\theta}$	$\dfrac{(1-\theta)}{\theta^2}$	$\dfrac{\theta e^t}{1-e^t(1-\theta)}$
$NegBinomial(n,\theta)$	$\{n,n+1,...\}$	$n \in \mathbb{Z}^+, \theta \in (0,1)$	$\binom{x-1}{n-1}\theta^n(1-\theta)^{x-n}$		$\dfrac{n}{\theta}$	$\dfrac{n(1-\theta)}{\theta^2}$	$\left(\dfrac{\theta e^t}{1-e^t(1-\theta)}\right)^n$
or	$\{0,1,2,...\}$	$n \in \mathbb{Z}^+, \theta \in (0,1)$	$\binom{n+x-1}{x}\theta^n(1-\theta)^x$		$\dfrac{n(1-\theta)}{\theta}$	$\dfrac{n(1-\theta)}{\theta^2}$	$\left(\dfrac{\theta}{1-e^t(1-\theta)}\right)^n$

The PDF of the *multivariate normal distribution* is

$$f_{\boldsymbol{X}}(\boldsymbol{x}) = \frac{1}{(2\pi)^{K/2}|\boldsymbol{\Sigma}|^{1/2}} \exp\Big\{-\frac{1}{2}(\boldsymbol{x}-\boldsymbol{\mu})^T\boldsymbol{\Sigma}^{-1}(\boldsymbol{x}-\boldsymbol{\mu})\Big\},$$

for $\boldsymbol{x} \in \mathbb{R}^K$ with $\boldsymbol{\Sigma}$ a $(K \times K)$ variance-covariance matrix and $\boldsymbol{\mu}$ a $(K \times 1)$ mean vector.

The location/scale transformation $Y = \mu + \sigma X$ gives

$$f_Y(y) = \frac{1}{\sigma} f_X\left(\frac{y-\mu}{\sigma}\right) \qquad F_Y(y) = F_X\left(\frac{y-\mu}{\sigma}\right)$$

$$M_Y(t) = e^{\mu t} M_X(\sigma t) \qquad \mathrm{E}[Y] = \mu + \sigma \mathrm{E}[X] \qquad \mathrm{Var}[Y] = \sigma^2 \mathrm{Var}[X]$$

The *gamma function* is given by $\Gamma(\alpha) = \int_0^\infty x^{\alpha-1}e^{-x}\,dx$.