Table of Selected Discrete and Continuous Distributions and Some of Their Characteristics

Distribution	Probability density function	Mean	Variance
Binomial, $B(n, p)$	$f(x)=\binom{n}{x}p^x q^{n-x}$, $x=0, 1, \ldots, n$; $0<p<1$, $q=1-p$	np	npq
(Bernoulli, $B(1, p)$	$f(x)=p^x q^{1-x}$, $x=0, 1$	p	pq)
Poisson $P(\lambda)$	$f(x)=e^{-\lambda}\frac{\lambda^x}{x!}$, $x=0, 1, \ldots$; $\lambda>0$	λ	λ
Hypergeometric	$f(x)=\frac{\binom{m}{x}\binom{n}{r-x}}{\binom{m+n}{r}}$, where $x=0, 1, \ldots, \min(r, m)$	$\frac{mr}{m+n}$	$\frac{mnr(m+n-r)}{(m+n)^2(m+n-1)}$
Negative Binomial	$f(x)=p^r\binom{r+x-1}{x}q^x$, $x=0, 1, \ldots$; $0<p<1$, $q=1-p$	$\frac{rq}{p}$	$\frac{rq}{p^2}$
(Geometric	$f(x)=pq^x$, $x=0, 1, \ldots$	$\frac{q}{p}$	$\frac{q}{p^2}$)
Multinomial	$f(x_1, \ldots, x_k)=\frac{n!}{x_1!\,x_2!\cdots x_k!}\times$ $p_1^{x_1}p_2^{x_2}\cdots p_k^{x_k}$, $x_j\geq 0$ integers, $x_1+\cdots+x_k=n$; $p_j>0$, $j=1, 2, \ldots, k$, $p_1+p_2+\cdots+p_k=1$	vector of expectations: $(np_1, \ldots, np_k)'$	vector of variances: $(np_1q_1, \ldots, np_kq_k)'$ $q_j=1-p_j$, $j=1, \ldots, k$
Normal, $N(\mu, \sigma^2)$	$f(x)=\frac{1}{\sqrt{2\pi}\sigma}\exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right]$, $x\in\mathbb{R}$; $\mu\in\mathbb{R}$, $\sigma>0$	μ	σ^2
(Standard Normal, $N(0, 1)$	$f(x)=\frac{1}{\sqrt{2\pi}}\exp\left(-\frac{x^2}{2}\right)$, $x\in\mathbb{R}$	0	1)
Gamma	$f(x)=\frac{1}{\Gamma(\alpha)\beta^\alpha}x^{\alpha-1}\exp\left(-\frac{x}{\beta}\right)$, $x>0$; $\alpha, \beta>0$	$\alpha\beta$	$\alpha\beta^2$
Chi-square	$f(x)=\frac{1}{\Gamma\left(\frac{r}{2}\right)2^{r/2}}x^{\frac{r}{2}-1}\exp\left(-\frac{x}{2}\right)$, $x>0$; $r>0$ integer	r	$2r$

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Distribution	Probability density function	Mean	Variance
Negative Exponential	$f(x)=\lambda\exp(-\lambda x)$, $x>0$; $\lambda>0$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$
Uniform, $U(\alpha, \beta)$	$f(x)=\frac{1}{\beta-\alpha}$, $\alpha\leq x\leq\beta$; $-\infty<\alpha<\beta<\infty$	$\frac{\alpha+\beta}{2}$	$\frac{(\alpha-\beta)^2}{12}$
Beta	$f(x)=\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}x^{\alpha-1}(1-x)^{\beta-1}$, $0<x<1$; $\alpha, \beta>0$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$
Cauchy	$f(x)=\frac{\sigma}{\pi}\cdot\frac{1}{\sigma^2+(x-\mu)^2}$, $x\in\mathbb{R}$; $\mu\in\mathbb{R}$, $\sigma>0$	Does not exist	Does not exist
Bivariate Normal	$f(x_1, x_2)=\frac{1}{2\pi\sigma_1\sigma_2\sqrt{1-\rho^2}}\exp\left(-\frac{q}{2}\right)$, $q=\frac{1}{1-\rho^2}\left[\left(\frac{x_1-\mu_1}{\sigma_1}\right)^2-2\rho\left(\frac{x_1-\mu_1}{\sigma_1}\right)\times\left(\frac{x_2-\mu_2}{\sigma_2}\right)+\left(\frac{x_2-\mu_2}{\sigma_2}\right)^2\right]$, $x_1, x_2, \in\mathbb{R}$; $\mu_1, \mu_2\in\mathbb{R}$, $\sigma_1, \sigma_2>0$, $-1\leq\rho\leq 1$	vector of expectations: $(\mu_1, \mu_2)'$	vector of variances $(\sigma_1^2, \sigma_2^2)'$.
k-Variate Normal, $N(\boldsymbol{\mu}, \boldsymbol{\Sigma})$	$f(\mathbf{x})=(2\pi)^{-k/2}\lvert\boldsymbol{\Sigma}\rvert^{-1/2}\times$ $\exp\left[-\frac{1}{2}(\mathbf{x}-\boldsymbol{\mu})'\boldsymbol{\Sigma}^{-1}(\mathbf{x}-\boldsymbol{\mu})\right]$, $\mathbf{x}\in\mathbb{R}^k$; $\boldsymbol{\mu}\in\mathbb{R}$, $\boldsymbol{\Sigma}$: $k\times k$ non-singular symmetric matrix	mean vector: $\boldsymbol{\mu}$	covariance matrix: $\boldsymbol{\Sigma}$

$\Gamma(\alpha+1)=\alpha\Gamma(\alpha)$, $\forall\ \alpha>0$

$\Gamma(1)=1$.

$\Gamma(n+1)=n!$ $\quad\forall\, n$: positive integer