distribution	pmf and domain	$E(X)$	$Var(X)$	mgf $M(\theta)$
$Bernoulli(p)$	$p(x) = p^x(1-p)^{1-x},\ x = 0,1$	p	$p(1-p)$	$1 - p + pe^{\theta}$
$Binomial(n,p)$	$p(x) = \binom{n}{x}p^x(1-p)^{n-x},\ x = 0,1,\ldots,n$	np	$np(1-p)$	$(1-p+pe^{\theta})^n$
$Poisson(\lambda)$	$p(x) = \frac{e^{-\lambda}\lambda^x}{x!},\ x = 0,1,2,\ldots$	λ	λ	$e^{\lambda(e^{\theta}-1)}$
$Geometric(p)$	$p(x) = p(1-p)^{x-1},\ x = 1,2,3,\ldots$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{pe^{\theta}}{1-(1-p)e^{\theta}}$ $\theta < -\ln(1-p)$
$Neg.bin(r,p)$	$p(x) = \binom{x-1}{r-1}p^r(1-p)^{x-r}$, $x = r, r+1, r+2, \ldots$	$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	$\left(\frac{pe^{\theta}}{1-(1-p)e^{\theta}}\right)^r$ $\theta < -\ln(1-p)$
$Hyp.geom(n,M,N)$	$p(x) = \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}},\ x = 0,1,\ldots,n$ $x \le M,\ n-x \le N-M$	$\frac{nM}{N}$	$\frac{nM}{N}(1-\frac{M}{N})(\frac{N-n}{N-1})$	
$Discrete\ uniform$	$p(x) = \frac{1}{n}\ ,\ x \in \{x_1, x_2, \ldots, x_n\}$	$\frac{\sum_{i=1}^n x_i}{n}$	$\frac{\sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n}}{n}$	$\frac{1}{n}\sum_{i=1}^n e^{\theta x_i}$
$logarithmic(p)$	$p(k) = -\frac{p^k}{k\ln(1-p)}\ ,\ k = 1,2,3,\ldots$	$-\frac{p}{(1-p)\ln(1-p)}$	$-\frac{p^2+p\ln(p)}{(1-p)^2(\ln(1-p))^2}$	$\frac{\ln(1-pe^{\theta})}{\ln(1-p)}$ $\theta < -\ln(p)$
$multinomial$	$p(x_1,x_2,\ldots,x_r) = \frac{n!}{x_1!x_2!\cdots x_r!}p_1^{x_1}p_2^{x_2}\cdots p_r^{x_r}$	$E(X_i) = np_i$	$\sigma_i^2 = np_i(1-p_i)$ $\sigma_{i,j} = -np_ip_j$ for $i \neq j$	

Euler Gamma function: for $\alpha > 0$, $\Gamma(\alpha) = \displaystyle\int_0^{\infty} u^{\alpha-1}e^{-u}\,du$.

Some properties of the Euler Gamma function:
1. If $n > 0$ is an integer, then $\Gamma(n) = (n-1)!$, **2.** $\Gamma(\frac{1}{2}) = \sqrt{\pi}$, **3.** If $x > 1$, then $\Gamma(x) = (x-1)\Gamma(x-1)$

Binomial theorem: $(a+b)^n = \displaystyle\sum_{j=1}^{n}\binom{n}{j}a^jb^{n-j}$. Geometric series: $\displaystyle\sum_{j=m}^{\infty} r^j = \frac{r^m}{1-r}$.

Liebniz rule: $\displaystyle\frac{d}{dx}\int_{a(x)}^{b(x)} g(x,y)\,dy = g(x,b(x))b'(x) - g(x,a(x))a'(x) + \int_{a(x)}^{b(x)} \frac{\partial}{\partial x}f(x,y)\,dy$.

distribution	pdf and domain	$E(X)$	$Var(X)$	mgf $M(\theta)$
$uniform(a,b)$	$f(x) = \frac{1}{b-a},\ a < x < b$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	$\frac{e^{\theta b}-e^{\theta a}}{(b-a)\theta}$
$Exp(\lambda)$	$f(x) = \lambda e^{-\lambda x},\ x > 0$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$(1-\frac{\theta}{\lambda})^{-1}$ $\theta < \lambda$
$Gamma(\alpha,\beta)$	$f(x) = \frac{x^{\alpha-1}e^{-x/\beta}}{\beta^\alpha\Gamma(\alpha)},\ x > 0$	$\alpha\beta$	$\alpha\beta^2$	$(1-\beta\theta)^{-\alpha}$ $\theta < 1/\beta$
$Normal(\mu,\sigma^2)$	$f(x) = \frac{e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}}{\sqrt{2\pi\sigma^2}},\ -\infty < x < \infty$	μ	σ^2	$e^{\mu\theta+\frac{\sigma^2\theta^2}{2}}$
$log-normal(\mu,\sigma^2)$	$f(x) = \frac{e^{-\frac{(\ln(x)-\mu)^2}{2\sigma^2}}}{x\sqrt{2\pi\sigma^2}},\ 0 < x < \infty$	$e^{\mu+\frac{\sigma^2}{2}}$	$[e^{\sigma^2}-1]e^{2\mu+\sigma^2}$	
$chi-square\ with$ $\nu\ d.f.\ \ \chi^2_\nu$	$f(x) = \frac{x^{\frac{\nu}{2}-1}e^{-x/2}}{2^{\frac{\nu}{2}}\Gamma(\frac{\nu}{2})},\ x > 0$	ν	2ν	$(1-2\theta)^{-\frac{\nu}{2}}$ $\theta < \frac{1}{2}$
$Beta(\alpha,\beta)$ $\alpha > 0,\ \beta > 0$	$f(x) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}\, x^{\alpha-1}(1-x)^{\beta-1},\ 0 < x < 1$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$	
$F_{n,m}-distribution$ $n\ numer, m\ denom\ df$	$f(x) = \frac{\Gamma(\frac{n+m}{2})}{\Gamma(\frac{n}{2})\Gamma(\frac{m}{2})}(\frac{n}{m})^{\frac{n}{2}}\, x^{\frac{n}{2}-1}(1+\frac{nx}{m})^{-\frac{n+m}{2}}$ $for\ x > 0$	$\frac{m}{m-2}$ $m > 2$	$\frac{2m^2(n+m-2)}{n(m-2)^2(m-4)}$ $m > 4$	
$t_m-distribution$ $m\ df$	$f(x) = \frac{\Gamma(\frac{m+1}{2})}{\sqrt{\pi m}\Gamma(\frac{m}{2})}(1+\frac{t^2}{m})^{-(\frac{m+1}{2})}$ $for\ -\infty < x < \infty$	0 $m > 1$	$\frac{m}{m-2}$ $m > 2$	
$Laplace\ dist./double$ $exp.\ \lambda > 0, c \in \mathbb{R}$	$f(x) = \frac{\lambda}{2}e^{-\lambda\lvert x-c\rvert},\ x \in \mathbb{R}$	c	$\frac{2}{\lambda^2}$	$\frac{e^{c\theta}}{1-\frac{\theta^2}{\lambda^2}}$ $-\lambda < \theta < \lambda$
$bivariate$ $normal$	$f(x,y) = \frac{e^{-\frac{Q(x,y)}{2(1-\rho^2)}}}{2\pi\sigma_x\sigma_y\sqrt{1-\rho^2}},\ (x,y) \in \mathbb{R}^2$ $Q(x,y) = (\frac{x-\mu_x}{\sigma_x})^2 - 2\rho(\frac{x-\mu_x}{\sigma_x})(\frac{y-\mu_y}{\sigma_y}) + (\frac{y-\mu_y}{\sigma_y})^2$	$E(X) = \mu_x$ $E(Y) = \mu_y$	$Var(X) = \sigma_x^2$ $Var(Y) = \sigma_y^2$ $corr(X,Y) = \rho$	
$Pareto$ $\alpha > 0,\ \lambda > 0$	$f(x) = \frac{\alpha\lambda^\alpha}{x^{\alpha+1}},\ x > \lambda$	$\frac{\alpha\lambda}{\alpha-1}$ $\alpha > 1$	$\frac{\alpha\lambda^2}{(\alpha-1)^2(\alpha-2)}$ $\alpha > 2$	