Some Common Probability Distributions

Distribution of X	Probability mass/density function	$\mathrm{E}(X)$	$\mathrm{Var}(X)$	Moment generating function $M_X(t)$
Bernoulli $\mathrm{Ber}(p)$ where $0 < p < 1$	$p^x(1-p)^{1-x}$ for $x = 0, 1$	p	$p(1-p)$	$pe^t + 1 - p$ for $t \in \mathbb{R}$
Binomial $\mathrm{B}(n, p)$ where $n \in \mathbb{N}$, $0 < p < 1$	$\binom{n}{x} p^x (1-p)^{n-x}$ for $x = 0, 1, 2, \ldots, n$	np	$np(1-p)$	$(pe^t + 1 - p)^n$ for $t \in \mathbb{R}$
Geometric $\mathrm{Geo}(p)$ where $0 < p < 1$	$(1-p)^{x-1}p$ for $x = 1, 2, 3, \ldots$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{pe^t}{1-(1-p)e^t}$ for $t < -\ln(1-p)$
Negative binomial $\mathrm{NB}(r, p)$ where $r \in \mathbb{N}$, $0 < p < 1$	$\binom{x-1}{r-1}(1-p)^{x-r}p^r$ for $x = r, r+1, r+2, \ldots$	$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	$\left[\frac{pe^t}{1-(1-p)e^t}\right]^r$ for $t < -\ln(1-p)$
Hypergeometric $\mathrm{Hyp}(N, m, n)$ where $N \in \mathbb{N}$, $m, n \in \{0, \ldots, N\}$	$\frac{\binom{m}{x}\binom{N-m}{n-x}}{\binom{N}{n}}$ for $x \in \{\max(0, n+m-N), \ldots, \min(n, m)\}$	$\frac{nm}{N}$	$\left(\frac{N-n}{N-1}\right) n \left(\frac{m}{N}\right)\left(1 - \frac{m}{N}\right)$	
Poisson $\mathrm{Po}(\lambda)$ where $\lambda > 0$	$\frac{e^{-\lambda}\lambda^x}{x!}$ for $x = 0, 1, 2, \ldots$	λ	λ	$e^{\lambda(e^t - 1)}$ for $t \in \mathbb{R}$
Uniform $\mathrm{U}(a, b)$ where $a, b \in \mathbb{R}$, $a < b$	$\frac{1}{b-a}$ for $a < x < b$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	
Exponential $\mathrm{Exp}(\lambda)$ where $\lambda > 0$	$\lambda e^{-\lambda x}$ for $x > 0$	$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\frac{\lambda}{\lambda - t}$ for $t < \lambda$
Gamma $\Gamma(\alpha, \lambda)$ where $\alpha, \lambda > 0$	$\frac{\lambda^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\lambda x}$ for $x > 0$	$\frac{\alpha}{\lambda}$	$\frac{\alpha}{\lambda^2}$	$\left(\frac{\lambda}{\lambda - t}\right)^\alpha$ for $t < \lambda$
Normal $\mathrm{N}(\mu, \sigma^2)$ where $\mu \in \mathbb{R}$, $\sigma > 0$	$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ for $x \in \mathbb{R}$	μ	σ^2	$e^{\mu t + \frac{1}{2}\sigma^2 t^2}$ for $t \in \mathbb{R}$
Chi-squared $\chi^2(r)$ where $r \in \mathbb{N}$	$\frac{1}{\Gamma\left(\frac{r}{2}\right) 2^{\frac{r}{2}}} x^{\frac{r}{2}-1} e^{-\frac{x}{2}}$ for $x > 0$	r	$2r$	$\frac{1}{(1-2t)^{\frac{r}{2}}}$ for $t < \frac{1}{2}$
Student's t $t(r)$ where $r \in \mathbb{N}$	$\frac{\Gamma\left(\frac{r+1}{2}\right)}{\sqrt{r\pi}\,\Gamma\left(\frac{r}{2}\right)} \left(1 + \frac{x^2}{r}\right)^{-\frac{r+1}{2}}$ for $x \in \mathbb{R}$	0 for $r > 1$	$\frac{r}{r-2}$ for $r > 2$	
Snedecor's F $F(m, n)$ where $m, n \in \mathbb{N}$	$\frac{\Gamma\left(\frac{m+n}{2}\right)}{\Gamma\left(\frac{m}{2}\right)\Gamma\left(\frac{n}{2}\right)} \left(\frac{m}{n}\right)^{\frac{m}{2}} x^{\frac{m}{2}-1} \left(1 + \frac{m}{n}x\right)^{-\frac{m+n}{2}}$ for $x > 0$	$\frac{n}{n-2}$ for $n > 2$	$\frac{2n^2(m+n-2)}{m(n-2)^2(n-4)}$ for $n > 4$	
Beta $\mathrm{Beta}(\alpha, \beta)$ where $\alpha, \beta > 0$	$\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1}$ for $0 < x < 1$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$	

Notes: $\Gamma(\alpha) = \int_0^\infty x^{\alpha-1}e^{-x}\mathrm{d}x$ for $\alpha > 0$; $\Gamma(\alpha) = (\alpha-1)\Gamma(\alpha-1)$, $\Gamma(1) = 1$, $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.