DISTRIBUTION X	DENSITY FUNCTION $f_X(x)$	EX	$Var(X)$	PROBABILITY GENERATING FUNCTION $G_X(t)$ MOMENT GENERATING FUNCTION $M_X(t)$
uniform on $\{1, ..., n\}$	$f(x) = \frac{1}{n}$ for $x = 1, 2, ..., n$	$\frac{n+1}{2}$	$\frac{n^2-1}{12}$	$G_X(t) = \frac{t(t^n-1)}{n(t-1)}$ $M_X(t) = \frac{e^t(e^{nt}-1)}{n(e^t-1)}$
binomial $b(n, p)$	$f(x) = \binom{n}{x} p^x(1-p)^{n-x}$ for $x = 0, 1, ..., n$	np	$np(1-p)$	$G_X(t) = (1-p+pt)^n$ $M_X(t) = (1-p+pe^t)^n$
$Geom(p)$ $0 < p < 1$	$f(x) = p(1-p)^x$ for $x = 0, 1, 2, ...$	$\frac{1-p}{p}$	$\frac{1-p}{p^2}$	$G_X(t) = \frac{p}{1-(1-p)t}$ $M_X(t) = \frac{p}{1-(1-p)e^t}$
negative binomial $NB(r, p)$	$f(x) = \binom{r+x-1}{x} p^r(1-p)^x$ for $x = 0, 1, 2, ...$	$r\frac{1-p}{p}$	$r\frac{1-p}{p^2}$	$G_X(t) = \left(\frac{p}{1-(1-p)t}\right)^r$ $M_X(t) = \left(\frac{p}{1-(1-p)e^t}\right)^r$
$Pois(\lambda)$	$f(x) = \frac{\lambda^x e^{-\lambda}}{x!}$ for $x = 0, 1, 2, ...$	λ	λ	$G_X(t) = e^{\lambda(t-1)}$ $M_X(t) = e^{\lambda(e^t-1)}$
hypergeometric $Hyp(n, r, k)$	$f(x) = \frac{\binom{r}{x}\binom{n-r}{k-x}}{\binom{n}{k}}$ for $x = 0, 1, ..., k$	$\frac{kr}{n}$	$\frac{kr}{n}\left(\frac{n-r}{n}\right)\frac{n-k}{n-1}$	not given here
$d-$dimensional hypergeometric with parameters $n, (n_1, ..., n_d), k$	$f(x_1, ..., x_d) = \frac{\binom{n_1}{x_1}\binom{n_2}{x_2}\cdots\binom{n_d}{x_d}}{\binom{n}{k}}$ for $x_1 + x_2 + ... + x_d = k$	N/A	N/A	N/A
multinomial $n, (p_1, ..., p_d)$	$f(x_1, ..., x_d) = \frac{n!}{x_1!x_2!\cdots x_d!}p_1^{x_1}p_2^{x_2}\cdots p_d^{x_d}$ for $x_1 + x_2 + ... + x_d = n$	N/A	N/A	N/A

DISTRIBUTION X	DENSITY FUNCTION $f_X(x)$ DISTRIBUTION FUNCTION $F_X(x)$	EXPECTED VALUE EX VARIANCE $Var(X)$	MGF $M_X(t)$
uniform on (a,b)	$f(x) = \begin{cases} \frac{1}{b-a} & x \in (a,b) \\ 0 & \text{else} \end{cases}$ $F(x) = \begin{cases} 0 & x < a \\ \frac{x-a}{b-a} & x \in [a,b) \\ 1 & x \geq b \end{cases}$	$EX = \frac{a+b}{2}$ $Var(X) = \frac{(b-a)^2}{12}$	$M_X(t) = \frac{e^{tb}-e^{ta}}{t(b-a)}$
exponential $Exp(\lambda)$	$f(x) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$ $F(x) = \begin{cases} 1 - e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$	$EX = \frac{1}{\lambda}$ $Var(X) = \frac{1}{\lambda^2}$	$M_X(t) = \frac{\lambda}{\lambda - t}$ for $t < \lambda$
Cauchy	$f(x) = \frac{1}{\pi(1+x^2)}$ $F(x) = \frac{1}{2} + \frac{1}{\pi}\arctan x$	$EX = \infty$ $Var(X)$ DNE	$M_X(t)$ DNE
std. normal $n(0,1)$	$f(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$ $F(x) = G(x)$	$EX = 0$ $Var(X) = 1$	$M_X(t) = e^{t^2/2}$
normal $n(\mu, \sigma^2)$	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(\frac{-(x-\mu)^2}{2\sigma^2}\right)$ $F(x) = G(\frac{x-\mu}{\sigma})$	$EX = \mu$ $Var(X) = \sigma^2$	$M_X(t) = \exp\left(\mu t + \frac{\sigma^2 t^2}{2}\right)$
gamma $\Gamma(r, \lambda)$	$f(x) = \begin{cases} \frac{\lambda^r}{\Gamma(r)} x^{r-1} e^{-\lambda x} & x > 0 \\ 0 & x \leq 0 \end{cases}$ F_X not given here	$EX = \frac{r}{\lambda}$ $Var(X) = \frac{r}{\lambda^2}$	$M_X(t) = \left(\frac{\lambda}{\lambda - t}\right)^r$ for $t < \lambda$
joint normal with mean vector $\vec{\mu}$ and covariance matrix Σ	$f(\vec{x}) = \frac{1}{(2\pi)^{d/2}\sqrt{\det \Sigma}} \exp\left[\frac{-1}{2}(\vec{x} - \vec{\mu})^T \Sigma^{-1} (\vec{x} - \vec{\mu})\right]$	N/A	not given here