

# Probability Distributions

## Discrete Distributions

	PMF: $f(k)$	MGF: $m_X(t)$	Mean	Variance
Binom( $n, p$ )	$\binom{n}{k} p^k (1-p)^{n-k}$	$(pe^t + 1 - p)^n$	$np$	$np(1-p)$
Pois( $\lambda$ )	$e^{-\lambda} \lambda^k / k!$	$\exp(\lambda(e^t - 1))$	$\lambda$	$\lambda$
Geom( $p$ )	$p(1-p)^k$	$\frac{pe^t}{1 - (1-p)e^t}$	$1/p$	$(1-p)/p^2$
Negbinom( $r, p$ )	$\binom{k-1}{r-1} p^r (1-p)^{k-r}$	$\left(\frac{pe^t}{1 - (1-p)e^t}\right)^r$	$r/p$	$r(1-p)/p^2$

## Continuous Distributions

	PDF: $f(x)$	MGF: $m_X(t)$	Mean	Variance
Unif( $a, b$ )	$\frac{1}{b-a}$ on $[a, b]$	$\frac{e^{tb} - e^{ta}}{t(b-a)}$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Exp( $\lambda$ )	$\lambda e^{-\lambda x}$ on $[0, \infty)$	$\frac{\lambda}{\lambda - t}$ on $(-\infty, \lambda)$	$1/\lambda$	$1/\lambda^2$
Norm( $\mu, \sigma^2$ )	$\frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$	$\exp\left(\mu t + \frac{\sigma^2 t^2}{2}\right)$	$\mu$	$\sigma^2$
Gamma( $\alpha, \lambda$ )	$\frac{\lambda^\alpha x^{\alpha-1}}{\Gamma(\alpha)} e^{-\lambda x}$ on $[0, \infty)$	$\left(\frac{\lambda}{\lambda - t}\right)^\alpha$ on $(-\infty, \lambda)$	$\alpha/\lambda$	$\alpha/\lambda^2$
Chisq( $n$ )	$\frac{x^{n/2-1}}{2^{n/2}\Gamma(n/2)} e^{-x/2}$ on $[0, \infty)$	$\left(\frac{1}{1-2t}\right)^{n/2}$ on $(-\infty, \lambda)$	$n$	$2n$