Distributions

Distribution	Probability Density Function	$\mathbb{E}(X)$	**Var**(X)
$X \overset{d}{=} \mathrm{Bi}(n,p)$	$p_X(x) = \binom{n}{x} p^x (1-p)^{n-x}$	np	$np(1-p)$
$N \overset{d}{=} \mathrm{G}(p)$	$p_N(n) = (1-p)^n p$	$\frac{1-p}{p}$	$\frac{1-p}{p^2}$
$Z \overset{d}{=} \mathrm{Nb}(r,p)$	$p_Z(z) = \binom{-r}{z} p^r (p-1)^z$		
$X \overset{d}{=} \mathrm{Hg}(n,D,N)$	$p_X(x) = \frac{\binom{D}{x}\binom{N-D}{n-x}}{\binom{N}{n}}$	$\frac{nD}{N}$	$\frac{nD(N-D)}{N^2} \cdot (1 - \frac{n-1}{N-1})$
$X \overset{d}{=} \mathrm{Pn}(\alpha t)$	$p_X(x) = \frac{e^{-\alpha}(\alpha)^x}{x!}$	α	α
$X \overset{d}{=} \mathrm{U}(m,n)$	$p_X(x) = \frac{1}{n-m+1}$	$\frac{m+n}{2}$	$\frac{1}{12}((n-m+1)^2 - 1)$
$X \overset{d}{=} \mathrm{R}(a,b)$	$f_X(x) = \frac{1}{b-a}$	$\frac{a+b}{2}$	$\frac{1}{12}(b-a)^2$
$T \overset{d}{=} \exp(\alpha)$	$f_T(t) = \begin{cases} \alpha e^{-\alpha t}, & t \geq 0 \\ 0, & t < 0 \end{cases}$	$\frac{1}{\alpha}$	$\frac{1}{\alpha^2}$
$T \overset{d}{=} \gamma(r,\alpha)$	$f_T(t) = \frac{\alpha^r t^{r-1} e^{-\alpha t}}{\Gamma(r)},\ t > 0$	$\frac{r}{\alpha}$	$\frac{r}{\alpha^2}$
$X \overset{d}{=} \mathrm{Beta}(\alpha,\beta)$	$f_X(x) = \begin{cases} \frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}, & 0 \leq x \leq 1 \\ 0, & \text{elsewhere} \end{cases}$	$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$
$X \overset{d}{=} \mathrm{Pareto}(\alpha,\gamma)$	$f_X(x) = \frac{\gamma\alpha^\gamma}{x^{\gamma+1}},\ \text{for } \alpha \leq x < \infty$	$\frac{\gamma\alpha}{\gamma-1},\ \text{for } \gamma > 1$	$\frac{\gamma\alpha^2}{(\gamma-1)^2(\gamma-2)},\ \text{for } \gamma > 2$
$X \overset{d}{=} \mathrm{N}(\mu,\sigma^2)$	$f_X(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2\sigma^2}(x-\mu)^2},\ \text{for } x \in \mathbb{R}$	μ	σ^2
$X \overset{d}{=} \mathrm{Weibull}(\beta,\gamma)$	$f_X(x) = \frac{\gamma x^{\gamma-1}}{\beta^\gamma} e^{-(\frac{x}{\beta})^\gamma},\ \text{for } 0 \leq x < \infty$	$\beta\Gamma\left(\frac{\gamma+1}{\gamma}\right)$	$\beta^2\left[\Gamma\left(\frac{\gamma+2}{\gamma}\right) - \Gamma\left(\frac{\gamma+1}{\gamma}\right)^2\right]$
$X \overset{d}{=} \mathrm{C}(m,a)$	$f_X(x) = \frac{1}{\pi}\frac{a}{a^2+(x-m)^2},\ \text{for } -\infty < x < \infty$	Undefined	Undefined
$Y \overset{d}{=} \mathrm{LN}(\mu,\sigma^2)$	$f_Y(y) = \frac{1}{\sqrt{2\pi}\sigma y} e^{-\frac{(\ln y - \mu)^2}{2\sigma^2}},\ \text{for } y > 0$	$e^{r\mu + \frac{1}{2}r^2\sigma^2},\ r \geq 0$	$e^{2\mu+\sigma^2}(e^{\sigma^2} - 1)$
$Y \overset{d}{=} \mathrm{LN}(\mu,\sigma^2)$	$f_Y(y) = \frac{1}{\sqrt{2\pi}\sigma y} e^{-\frac{(\ln y - \mu)^2}{2\sigma^2}},\ \text{for } y > 0$	$e^{r\mu + \frac{1}{2}r^2\sigma^2},\ r \geq 0$	$e^{2\mu+\sigma^2}(e^{\sigma^2} - 1)$

Other Formulae

Sample Variance

$s^2 = \frac{1}{n-1}\sum_{i=1}^n (x_i - \bar{x})^2 = \frac{1}{n-1}\left(\left(\sum_{i=1}^n x_i^2\right) - n\bar{x}^2\right)$