

DISTRIBUTIONS

| | Density/Probabilities | Mean | Variance | MGF |
|-------------|---|---------------------------------|--|--------------------------------------|
| Normal | $\frac{1}{\sigma\sqrt{2\pi}}e^{-(x-\mu)^2/2\sigma^2}$ | μ | σ^2 | $e^{\mu t + \frac{\sigma^2 t^2}{2}}$ |
| Gamma | $\frac{1}{\beta^\alpha \Gamma(\alpha)}x^{\alpha-1}e^{-x/\beta}$ | $\alpha\beta$ | $\alpha\beta^2$ | $(1 - \beta t)^{-\alpha}$ |
| Exponential | $\frac{1}{\theta}e^{-x/\theta}$ | θ | θ^2 | $(1 - \theta t)^{-1}$ |
| Chi square | $\frac{1}{2^{\nu/2}\Gamma(\nu/2)}x^{(\nu-2)/2}e^{-x/2}$ | ν | 2ν | $(1 - 2t)^{-\nu/2}$ |
| Beta | $\frac{\Gamma(\alpha + \beta)}{\Gamma(\alpha)\Gamma(\beta)}x^{\alpha-1}(1-x)^{\beta-1}$ | $\frac{\alpha}{\alpha + \beta}$ | $\frac{\alpha\beta}{(\alpha + \beta)^2(\alpha + \beta + 1)}$ | |
| Uniform | $\frac{1}{\beta - \alpha}$ | $\frac{\alpha + \beta}{2}$ | $\frac{(\beta - \alpha)^2}{12}$ | |
| Student's-t | $\frac{\Gamma((\nu + 1)/2)}{\sqrt{\pi\nu}\Gamma(\nu/2)}\left(1 + \frac{t^2}{\nu}\right)^{-(\nu+1)/2}$ | 0 | $\frac{\nu}{\nu - 2}$ | |
| Binomial | $P(X = k) = \binom{n}{k}\theta^k(1 - \theta)^{n-k},$ $k = 0, 1, \dots, n$ | $n\theta$ | $n\theta(1 - \theta)$ | |

$$f_{Y_r}(y) = \frac{n!}{(r-1)!(n-r)!} \cdot \left(\int_{-\infty}^y f(x)dx\right)^{r-1} \cdot f(y) \cdot \left(\int_y^{\infty} f(x)dx\right)^{n-r}$$

$$\sum_{i=1}^n (X_i - \mu)^2 = \sum_{i=1}^n (X_i - \bar{X})^2 + n(\bar{X} - \mu)^2$$

$$M_{\frac{X+a}{b}}(t) = e^{at/b} M_X\left(\frac{t}{b}\right)$$