

## Continuous Distributions

**Beta** Variable:  $0 < x < 1$  Shape parameters:  $a > 0, b > 0$

$$f = \frac{1}{\text{Beta}[a, b]} (x^{a-1} (1-x)^{b-1});$$

dom[f] =  $0 < x < 1$ ;  
param[f] = {a > 0, b > 0};

**Generalized Beta** Variable:  $\min < x < \max$  Shape parameters:  $a > 0, b > 0$

$$f = \frac{(\max - \min)^{1-a-b}}{\text{Beta}[a, b]} ((\max - x)^{b-1} (x - \min)^{a-1});$$

dom[f] =  $\min < x < \max$ ;  
param[f] = {a > 0, b > 0, max > min};

**Cauchy** Variable:  $-\infty < x < \infty$  Parameters: none

$$f = \frac{1}{\pi} \left( \frac{1}{(1+x^2)} \right);$$

domain[f] = {x, -∞, ∞};

**Standard Chi-squared** Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom)  
Gamma[ν/2, 2]

$$f = \frac{1}{2^{\nu/2} \text{Gamma}[\frac{\nu}{2}]} (\text{Exp}[-x/2] x^{\nu/2-1});$$

dom[f] =  $0 < x < \infty$ ;  
param[f] = {ν > 0};

**Chi - Squared** S x is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom) Scale Param  
Gamma[ν/2, 2/S]

$$f = \frac{S^{\nu/2}}{2^{\nu/2} \text{Gamma}[\frac{\nu}{2}]} (\text{Exp}[-\frac{Sx}{2}] x^{\nu/2-1});$$

dom[f] =  $0 < x < \infty$ ;  
param[f] = {ν > 0, S > 0};

**Chi-Squared** x/S is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom) Scal  
Gamma[ν/2, 2/S]

$$f = \frac{1}{2^{\nu/2} S^{\nu/2} \text{Gamma}\left[\frac{\nu}{2}\right]} \left( \text{Exp}\left[-\frac{x}{2S}\right] x^{\nu/2-1} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {ν > 0, S > 0};

**Standard Inverted Chi-Squared**  $1/x$  is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom)  
Inverted Gamma[ν/2, 2]

$$f = \frac{1}{2^{\nu/2} \text{Gamma}\left[\frac{\nu}{2}\right]} \left( \text{Exp}\left[-\frac{1}{2x}\right] x^{-1-\nu/2} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {ν > 0};

**Inverted Chi – Squared**  $S/x$  is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom) Scale Parameter:  $S > 0$   
Inverted Gamma[ν/2, 2/S]

$$f = \frac{S^{\nu/2}}{2^{\nu/2} \text{Gamma}\left[\frac{\nu}{2}\right]} \left( \text{Exp}\left[-\frac{S}{2x}\right] x^{-1-\nu/2} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {ν > 0, S > 0};

**Standard Inverted Chi**  $1/x^2$  is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom)  
Inverted Sqrt-Gamma[ν/2, 2]

$$f = \frac{1}{2^{\nu/2-1} \text{Gamma}\left[\frac{\nu}{2}\right]} \left( \text{Exp}\left[-\frac{1}{2x^2}\right] x^{-1-\nu} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {ν > 0};

**Inverted Chi**  $s/x^2$  is  $\chi^2(\nu)$  Variable:  $x > 0$  Shape parameter:  $\nu > 0$  (degrees of freedom) Scale Parameter:  $S > 0$   
Inverted Sqrt-Gamma[ν/2, 2/S]

$$f = \frac{S^{\nu/2}}{2^{\nu/2-1} \text{Gamma}\left[\frac{\nu}{2}\right]} \left( \text{Exp}\left[-\frac{S}{2x^2}\right] x^{-1-\nu} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {ν > 0, S > 0};

**Noncentral Chi-Squared** Variable:  $x > 0$  Shape parameters:  $\nu > 0$  (degrees of freedom),  $\lambda > 0$  (noncentrality parameter)

$$f = 2^{-\nu/2} \text{Hypergeometric0F1Regularized}\left[\frac{\nu}{2}, \frac{x\lambda}{4}\right] \left( \text{Exp}\left[-\frac{(x+\lambda)}{2}\right] x^{(\nu-2)/2} \right);$$

domain[f] = {x, 0, ∞} && {ν > 0, λ > 0};

**Gamma** Variable:  $x > 0$  Parameters:  $a > 0$  (shape),  $b > 0$  (scale)

$$f = \frac{1}{\text{Gamma}[a] b^a} \quad (\text{Exp}[-x/b] x^{a-1});$$

dom[f] = 0 < x < ∞;  
param[f] = {v > 0, a > 0, b > 0};

**Inverted Gamma** Variable:  $x > 0$  Parameters:  $a > 0$  (shape),  $b > 0$  (scale)

$$f = \frac{1}{\text{Gamma}[a] b^a} \quad \left( \text{Exp}\left[-\frac{1}{b x}\right] x^{-(a+1)} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {v > 0, a > 0, b > 0};

**Sqrt-Gamma** Variable:  $x > 0$  Parameters:  $a > 0$  (shape),  $b > 0$  (scale)

$$f = \frac{2 b^{-a}}{\text{Gamma}[a]} \quad \left( \text{Exp}\left[-\frac{x^2}{b}\right] x^{-1+2a} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {v > 0, a > 0, b > 0};

**Inverted Sqrt-Gamma** Variable:  $x > 0$  Parameters:  $a > 0$  (shape),  $b > 0$  (scale)

$$f = \frac{2 b^{-a}}{\text{Gamma}[a]} \quad \left( \text{Exp}\left[-\frac{1}{b x^2}\right] x^{-1-2a} \right);$$

dom[f] = 0 < x < ∞;  
param[f] = {v > 0, a > 0, b > 0};

**Exponential** Variable:  $x > 0$  Scale parameter:  $\lambda > 0$  (the mean)

$$f = \frac{1}{\lambda} \quad (\text{Exp}[-x/\lambda]);$$

dom[f] = 0 < x < ∞;  
param[f] = {λ > 0};

**Extreme Value (Gumbel; Type I)** Variable:  $-\infty < x < \infty$  (standard form)

$$f = \text{Exp}[-\text{Exp}[-x] - x];$$

domain[f] = {x, -∞, ∞};

**Fisher's F** Variable:  $x > 0$  Shape parameters:  $v_1$  and  $v_2$  (degrees of freedom)

$$f = \frac{\text{Gamma}\left[\frac{\nu_1 + \nu_2}{2}\right] \left(\frac{\nu_1}{\nu_2}\right)^{\nu_1/2}}{\text{Gamma}\left[\frac{\nu_1}{2}\right] \text{Gamma}\left[\frac{\nu_2}{2}\right]} \left( \frac{\mathbf{x}^{\nu_1/2 - 1}}{\left(1 + \frac{\nu_1}{\nu_2} \mathbf{x}\right)^{(\nu_1 + \nu_2)/2}} \right);$$

$$\text{dom}[f] = 0 < \mathbf{x} < \infty;$$

$$\text{param}[f] = \{\nu_1 > 0, \nu_2 > 0\};$$

$$f = \frac{\left(\frac{\nu_1}{\nu_2}\right)^{\nu_1/2}}{\text{Beta}\left[\frac{\nu_1}{2}, \frac{\nu_2}{2}\right]} \left( \frac{\mathbf{x}^{\nu_1/2 - 1}}{\left(1 + \frac{\nu_1}{\nu_2} \mathbf{x}\right)^{(\nu_1 + \nu_2)/2}} \right);$$

$$f = \frac{\nu_1^{\nu_1/2} \nu_2^{\nu_2/2}}{\text{Beta}\left[\frac{\nu_1}{2}, \frac{\nu_2}{2}\right]} \left( \frac{\mathbf{x}^{\nu_1/2 - 1}}{(\mathbf{x} \nu_1 + \nu_2)^{(\nu_1 + \nu_2)/2}} \right);$$

**Noncentral Fisher's F** Variable:  $x > 0$  Shape parameters:  $\nu_1$  and  $\nu_2$  (degrees of freedom),  $\lambda > 0$  (noncentrality)

$$f = \frac{1}{\text{Beta}\left[\frac{\nu_1}{2}, \frac{\nu_2}{2}\right]} \text{Hypergeometric1F1}\left[\frac{\nu_1 + \nu_2}{2}, \frac{\nu_1}{2}, \frac{\mathbf{x} \lambda \nu_1}{2(\mathbf{x} \nu_1 + \nu_2)}\right]$$

$$\left( e^{-\lambda/2} \mathbf{x}^{\frac{1}{2}(-2 + \nu_1)} \nu_1^{\nu_1/2} \nu_2^{\nu_2/2} (\mathbf{x} \nu_1 + \nu_2)^{-\frac{1}{2}(\nu_1 + \nu_2)} \right);$$

$$\text{domain}[f] = \{\mathbf{x}, 0, \infty\} \&\& \{\nu_1 > 0, \nu_2 > 0, \lambda > 0\};$$

**Logistic** Variable:  $-\infty < x < \infty$  Parameters:  $a, b > 0$   
mean =  $a$ , var =  $\pi^2 b^3 / 3$  EHP(p98)

$$f = \frac{1}{b} \left( \frac{\text{Exp}\left[-(\mathbf{x} - a) / b\right]}{\left(1 + \text{Exp}\left[-(\mathbf{x} - a) / b\right]\right)^2} \right);$$

$$\text{dom}[f] = -\infty < \mathbf{x} < \infty;$$

$$\text{param}[f] = \{a \in \text{Reals}, b > 0\};$$

$$f = \frac{1}{2b} \left( \frac{1}{\left(1 + \text{Cosh}\left[\frac{a - \mathbf{x}}{b}\right]\right)} \right);$$

**Inverse Gaussian (Wald)** Variable:  $x > 0$  Parameters:  $\mu > 0$  (location, mean),  $\lambda > 0$  (scale)

$$f = \sqrt{\frac{\lambda}{2\pi}} \left( \text{Exp}\left[-\lambda \frac{(\mathbf{x} - \mu)^2}{2\mu^2 \mathbf{x}}\right] \mathbf{x}^{-3/2} \right);$$

$$\text{domain}[f] = \{\mathbf{x}, 0, \infty\} \&\& \{\mu > 0, \lambda > 0\};$$

**Normal** Variable:  $-\infty < x < \infty$  Parameters:  $\mu$  (location, mean),  $\sigma > 0$  (scale, std dev)

$$f = \frac{1}{\sigma \sqrt{2\pi}} \left( \text{Exp}\left[-\frac{(\mathbf{x} - \mu)^2}{2\sigma^2}\right] \right);$$

$$\text{dom}[f] = -\infty < \mathbf{x} < \infty;$$

$$\text{param}[f] = \{\mu \in \text{Reals}, \sigma > 0\};$$

**Lognormal** Variable:  $x > 0$  Parameters:  $\mu$  (scale),  $\sigma > 0$  (shape)

$$f = \frac{1}{\sigma \sqrt{2\pi}} \left( \frac{1}{x} \text{Exp} \left[ -\frac{(\text{Log}[x] - \mu)^2}{2\sigma^2} \right] \right);$$

$\text{domain}[f] = \{x, 0, \infty\} \ \&\& \ \{\mu \in \text{Reals}, \sigma > 0\};$

**Standard Student's t** Variable:  $-\infty < x < \infty$  Shape parameter:  $\nu > 0$  (degrees of freedom)

$$f = \frac{\text{Gamma} \left[ \frac{\nu+1}{2} \right]}{\sqrt{\nu\pi} \text{Gamma} \left[ \frac{\nu}{2} \right]} \left( \left( 1 + \frac{x^2}{\nu} \right)^{-\frac{\nu+1}{2}} \right);$$

$\text{dom}[f] = -\infty < x < \infty;$   
 $\text{param}[f] = \{\nu > 0\};$

**t** Variable:  $-\infty < x < \infty$  Shape parameter:  $\nu > 0$  (degrees of freedom),  $a \in \text{Reals}, b > 0$   
 $\text{mean}=a, \text{var}=\frac{b^2\nu}{\nu-2}$

$$f = \frac{b^\nu \nu^{\nu/2} \text{Gamma} \left[ \frac{1+\nu}{2} \right]}{\sqrt{\pi} \text{Gamma} \left[ \frac{\nu}{2} \right]} \left( ((x-a)^2 + b^2 \nu)^{-\frac{1}{2}(1+\nu)} \right);$$

$\text{dom}[f] = -\infty < x < \infty;$   
 $\text{param}[f] = \{\nu > 0, a \in \text{Reals}, b > 0\};$

$$f = \frac{b^\nu \text{Gamma} \left[ \frac{1+\nu}{2} \right]}{\sqrt{\pi} \sqrt{\nu} \text{Gamma} \left[ \frac{\nu}{2} \right]} \left( \left( b^2 + \frac{(x-a)^2}{\nu} \right)^{-\frac{1}{2}(1+\nu)} \right);$$

**Noncentral Student's t** Variable:  $-\infty < x < \infty$  Shape parameter:  $\nu > 0$  (degrees of freedom),  $\lambda > 0$  (non

$$f = \frac{1}{\text{Gamma} \left[ \frac{\nu}{2} \right]} \left( 2^{-\nu} e^{-\frac{\lambda^2}{2}} \nu^{\nu/2} \nu! \right. \\ \left. \left( \frac{1}{\text{Gamma} \left[ \frac{1+\nu}{2} \right]} \left( \sqrt{2} x \lambda (x^2 + \nu)^{-1-\frac{\nu}{2}} \text{Hypergeometric1F1} \left[ 1 + \frac{\nu}{2}, \frac{3}{2}, \frac{x^2 \lambda^2}{2(x^2 + \nu)} \right] \right) + \right. \\ \left. \left. \frac{(x^2 + \nu)^{-\frac{1}{2}-\frac{\nu}{2}} \text{Hypergeometric1F1} \left[ \frac{1+\nu}{2}, \frac{1}{2}, \frac{x^2 \lambda^2}{2(x^2 + \nu)} \right]}{\text{Gamma} \left[ 1 + \frac{\nu}{2} \right]} \right) \right);$$

$\text{domain}[f] = \{x, -\infty, \infty\} \ \&\& \ \{\nu > 0, \lambda > 0\};$

**Triangular** Variable:  $0 < x < 1$  Shape parameter:  $0 < c < 1$  (mode)

$$f = \text{If} \left[ x < c, \frac{2x}{c}, \frac{2(1-x)}{1-c} \right];$$

$\text{domain}[f] = \{x, 0, 1\} \ \&\& \ \{0 < c < 1\};$

**Inverse Triangular** Variable:  $0 < x < 1$  Shape parameter:  $0 < c < 1$

$$f = \text{If}[x < c, 2 \frac{c-x}{c}, 2 \frac{x-c}{1-c}];$$

$$\text{domain}[f] = \{x, 0, 1\} \&\& \{0 < c < 1\};$$

**Weibull**Variable:  $x > 0$ Parameters:  $a > 0$  (shape),  $b > 0$  (scale)

$$f = \frac{a}{b^a} \left( \frac{x^{a-1}}{e^{(\frac{x}{b})^a}} \right);$$

$$\text{domain}[f] = \{x, 0, \infty\} \&\& \{a > 0, b > 0\};$$

**Uniform (Rectangular)**Variable:  $a < x < b$ Parameters:  $a < b$ 

$$f = \frac{1}{b-a};$$

$$\text{domain}[f] = \{x, a, b\} \&\& \{a < b\};$$

**Discrete Distributions****Bernoulli**Variable:  $x = 0, 1$ Parameter:  $0 < p < 1$  (probability of success)

$$f = p^x (1-p)^{1-x};$$

$$\text{dom}[f] = 0 \leq x \leq 1;$$

$$\text{param}[f] = \{0 < p < 1, x \in \text{Integers}\};$$

**Binomial**Variable:  $x = 0, 1, \dots, n$ Parameters:  $0 < p < 1$   
 $n > 0$ 

(probability of success)

(no. of trials: a positive integer)

$$f = \text{Binomial}[n, x] (p^x (1-p)^{n-x});$$

$$\text{dom}[f] = 0 \leq x \leq n;$$

$$\text{param}[f] = \{0 < p < 1, n > 0, n \in \text{Integers}, x \in \text{Integers}\};$$

**Negative Binomial**Variable:  $x = 0, 1, 2, \dots$ Parameters:  $0 < p < 1$  (probability of success),  $r > 0$ 

$$f = p^x (\text{Binomial}[r+x-1, r-1] (1-p)^x);$$

$$\text{dom}[f] = 0 \leq x < \infty;$$

$$\text{param}[f] = \{0 < p < 1, r > 0, x \in \text{Integers}\};$$

**Beta-Binomial**Variable:  $x = 0, 1, \dots, n$ Parameters:  $a, b > 0$  $n > 0$  (no. of trials: a positive integer)



**Matrix T** Variable:  $X$

```

MatrixTDensity[X_, M_, Σ_, Ω_, ν_, form_: 1] := Module[{den},
  If[form === 1, den = (
    
$$\frac{\text{MultivariateGamma}[\text{nr}[X], \nu / 2]}{\pi^{\text{nr}[X]} \text{nc}[X]^{1/2} \text{MultivariateGamma}[\text{nr}[X], (\nu - \text{nc}[X]) / 2]}$$

    1
    
$$\frac{\text{Det}[\Omega]^{(\nu - \text{nc}[X]) / 2} \text{Det}[\Sigma]^{\text{nr}[X] / 2}}{(\text{Det}[\text{Inverse}[\Omega] + (X - M) \cdot \text{Inverse}[\Sigma] \cdot \text{Transpose}[X - M]]^{-1/2 (\nu + \text{nr}[X] + \text{nc}[X] - 1)})}$$

    ,
    den = (
    
$$\frac{\text{MultivariateGamma}[\text{nc}[X], \nu / 2]}{\pi^{\text{nr}[X]} \text{nc}[X]^{1/2} \text{MultivariateGamma}[\text{nc}[X], (\nu - \text{nr}[X]) / 2]} (\text{Det}[\Sigma]^{(\nu - \text{nr}[X]) / 2} \text{Det}[\Omega]^{\text{nc}[X] / 2} (\text{Det}[\Sigma + \text{Transpose}[X - M] \cdot \Omega \cdot (X - M)]^{-1/2 (\nu + \text{nr}[X] + \text{nc}[X] - 1)})}$$

    );
  den = matSimplify1[den];
  den
];

dom[f] = -∞ < X < ∞;
param[f] = {-∞ < M < ∞, Σ > 0, Ω > 0};

```

**Matrix Normal** Variable:  $X$

```

MatrixNormalDensity[X_, M_, Σ_, Ω_, form_: 1] := Module[{den},
  Which[
    form === 1,
    den = ( (2 π)- $\frac{\text{nr}[X] \text{nc}[X]}{2}$  Det[Σ]-nr[X]/2 Det[Ω]-nc[X]/2
      ( Exp[- $\frac{1}{2}$  Tr[Inverse[Ω] \cdot (X - M) \cdot Inverse[Σ] \cdot Transpose[X - M]]] );
    , form === 2,
    den = ( (2 π)- $\frac{\text{nr}[X] \text{nc}[X]}{2}$  Det[Σ]-nr[X]/2 Det[Ω]-nc[X]/2
      ( Exp[- $\frac{1}{2}$  Tr[(X - M) \cdot Inverse[Σ] \cdot Transpose[X - M] \cdot Inverse[Ω]]] );
    , form === 3,
    den = ( (2 π)- $\frac{\text{nr}[X] \text{nc}[X]}{2}$  Det[Σ]-nr[X]/2 Det[Ω]-nc[X]/2
      ( Exp[- $\frac{1}{2}$  Tr[Inverse[Σ] \cdot Transpose[X - M] \cdot Inverse[Ω] \cdot (X - M)]] );
    , form === 4,
    den = ( (2 π)- $\frac{\text{nr}[X] \text{nc}[X]}{2}$  Det[Σ]-nr[X]/2 Det[Ω]-nc[X]/2
      ( Exp[- $\frac{1}{2}$  Tr[Transpose[X - M] \cdot Inverse[Ω] \cdot (X - M) \cdot Inverse[Σ]]] );
  ];
  den = matSimplify1[den];
  den
];

dom[f] = -∞ < X < ∞;
param[f] = {-∞ < M < ∞, Σ > 0, Ω > 0};

```



**Multivariate Normal Variable:  $x$** 

$$f = \frac{1}{(2\pi)^{\frac{nr[x]}{2}} \sqrt{\text{Det}[\Sigma]}} \left( \text{Exp}\left[-\frac{1}{2} \mathbf{t}[x - \mu] \cdot \Sigma^{-1} \cdot (x - \mu)\right] \right);$$

$\text{dom}[f] = -\infty < \mathbf{x} < \infty;$   
 $\text{param}[f] = \{-\infty < \mu < \infty, \Sigma > 0\};$

**Multivariate tVariable:  $x$       WRONG!!!!!!!!!!!!!!!!!!!!**

$$f = \frac{n^{n/2}}{\pi^{\frac{nr[x]}{2}} \sqrt{\text{Det}[\Sigma]} \text{Gamma}\left[\frac{n}{2}\right] \text{Gamma}\left[\frac{1}{2}(n + nr[x])\right]} \left( (n + \mathbf{t}[x - \mu] \cdot \Sigma^{-1} \cdot (x - \mu))^{-\frac{1}{2}(n + nr[x])} \right);$$

$\text{dom}[f] = -\infty < \mathbf{x} < \infty;$   
 $\text{param}[f] = \{-\infty < \mu < \infty, \Sigma > 0, \nu > 0\};$

**Multivariate tVariable:  $x$** 

$$f = \frac{n^{n/2} \text{Gamma}\left[\frac{1}{2}(n + nr[x])\right]}{\pi^{\frac{nr[x]}{2}} \sqrt{\text{Det}[\Sigma]} \text{Gamma}\left[\frac{n}{2}\right]} \left( (n + \mathbf{t}[x - \mu] \cdot \Sigma^{-1} \cdot (x - \mu))^{-\frac{1}{2}(n + nr[x])} \right);$$

$\text{dom}[f] = -\infty < \mathbf{x} < \infty;$   
 $\text{param}[f] = \{-\infty < \mu < \infty, \Sigma > 0, \nu > 0\};$

**Wishart      Variable:  $X$** 

$$f = \frac{2^{-\frac{1}{2}\nu nr[X]} \pi^{-\frac{1}{4}(-1 + nr[X]) nr[X]} \text{Det}[\Sigma]^{-\nu/2}}{\prod_{i=1}^{nr[X]} \text{Gamma}\left[\frac{1}{2}(1 - i + \nu)\right]} \left( \text{Det}[X]^{\frac{1}{2}(\nu - nr[X] - 1)} \text{Exp}\left[-\frac{1}{2} \text{Tr}[\Sigma^{-1} \cdot X]\right] \right);$$

$\text{dom}[f] = X > 0;$   
 $\text{param}[f] = \{\Sigma > 0, \nu > 0\};$

**Inverted Wishart      Variable:  $X$** 

$$f = \frac{2^{-\frac{1}{2}(-1 + \nu - nr[X]) nr[X]} \pi^{-\frac{1}{4}(-1 + nr[X]) nr[X]} \text{Det}[\Sigma]^{\frac{1}{2}(1 - \nu + nr[X])}}{\prod_{i=1}^{nr[X]} \text{Gamma}\left[\frac{1}{2}(-i + \nu - nr[X])\right]} \left( \text{Det}[X]^{-\nu/2} \text{Exp}\left[-\frac{1}{2} \text{Tr}[\Sigma^{-1} \cdot X^{-1}]\right] \right);$$

$\text{dom}[f] = X > 0;$   
 $\text{param}[f] = \{\Sigma > 0, \nu > 0\};$

**Dirichlet      Variable:  $x_i, i=1,2,\dots, nr[x] = nr[\alpha] - 1$**

```

SetAttributes[Subscript, HoldFirst];
Clear[i, j, x, α];
f = 
$$\frac{\text{Gamma}[\sum_{i=1}^{\text{nr}[x]+1} \alpha_i]}{\prod_{i=1}^{\text{nr}[x]+1} \text{Gamma}[\alpha_i]} \left( \prod_{i=1}^{\text{nr}[x]} x_i^{\alpha_i-1} \right) \left( 1 - \sum_{i=1}^{\text{nr}[x]} x_i \right)^{\alpha_{\text{nr}[x]+1}-1};$$

dom[f] = 0 < x_i < 1 && Sum[x_i, {i, 1, nr[x]}] < 1;
param[f] = {α_i > 0};

```

## Multivariate Gamma Function

```

(* Multivariate Gamma Function *)
MultivariateGamma[p_, λ_] := πp (p-1)/4 ∏i=1p Gamma[Simplify[λ +  $\frac{1}{2}$  (-i + 1)]];
MVGf = MultivariateGamma;
mvgcp[xx, matSet[a, 3, 1, , 0]]
-xx1 xx2 + 2 xx1 xx3 xx2 - xx3 xx2 - xx1 xx3 + 1

```