ProbOnto distribution list – version

Bernoulli

name	Bernoulli (ID: 0000000)
type	discrete
variate	k, scalar
support	$k \in \{0, 1\}$

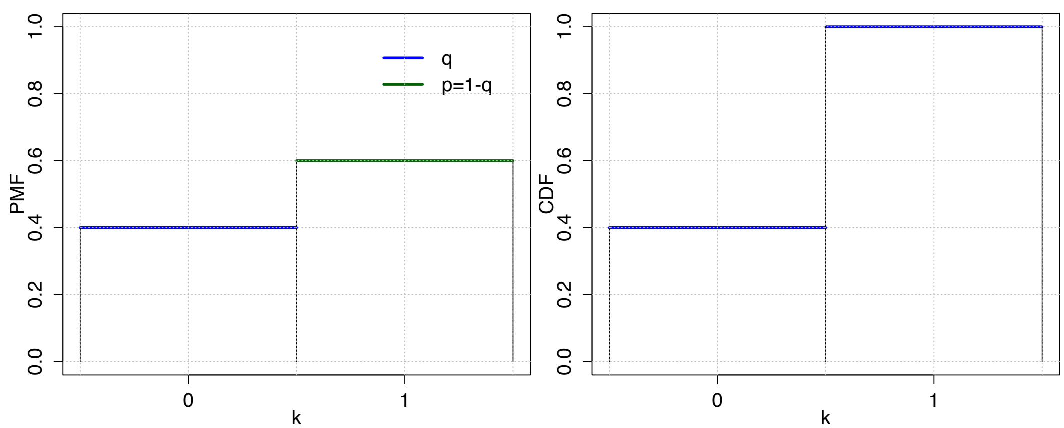

Figure 1: Bernoulli distribution plotted using the provided R code.

Parameter: probability

name	probability
type	scalar
symbol	p
definition	$0 < p < 1, p \in R$

Functions

PMF

$$\begin{cases} q = (1-p) & \text{for } k = 0 \\ p & \text{for } k = 1 \end{cases}$$

PMF in R

```
q=(1-p) for k=0 \\
p for k=1
```

CDF

$$\begin{cases} 0 & \text{for } k < 0 \\ q & \text{for } 0 \leq k < 1 \\ 1 & \text{for } k \geq 1 \end{cases}$$

Beta

name	Beta (ID: 0000012)
type	continuous
variate	x, scalar
support	$x \in (0, 1)$

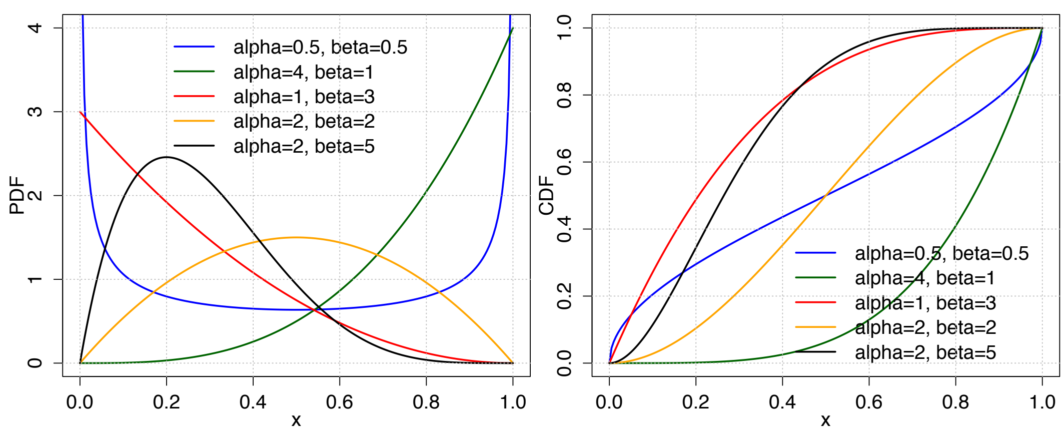

Figure 2: Beta distribution plotted using the provided R code.

Parameter: alpha

name	shape
type	scalar
symbol	α
definition	$\alpha > 0$

Parameter: beta

name	shape
type	scalar
symbol	β
definition	$\beta > 0$

Functions

PDF

$$\frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}$$

PDF in R

```
(x^(alpha-1)*(1-x)^(beta-1))/beta(alpha,beta)
```

CDF

$$I_x(\alpha,\beta)$$

CDF in R

```
Rbeta(x, a, b)
```

Binomial

name	Binomial (ID: 0000024)
type	discrete
variate	k, scalar
support	$k \in \{0, \ldots, n\}$

Parameter: numberOfFailures

name	number of trials
type	scalar
symbol	n
definition	$n \in N, n \geq 0$

Parameter: probability

name	success probability in each trial
type	scalar
symbol	p
definition	$p \in [0, 1]$

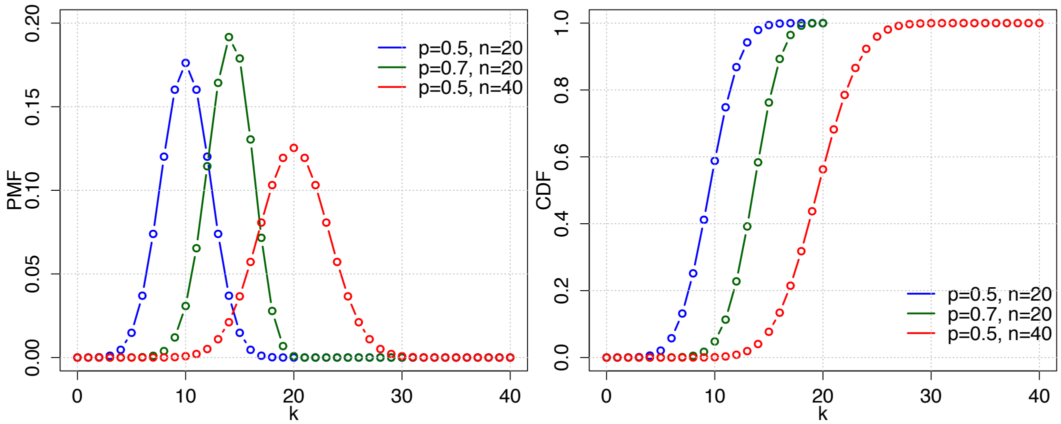

Figure 3: Binomial distribution plotted using the provided R code.

Functions

PMF

$$\binom{n}{k} p^k (1-p)^{n-k}$$

PMF in R

```
choose(n,k) * p^k*(1-p)^(n-k)
```

CDF

$$I_{1-p}(n-k, 1+k)$$

CDF in R

```
Rbeta(1-p, n-k, 1+k)
```

BirnbaumSaunders

name	Birnbaum-Saunders (ID: 0000034)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

Parameter: scale

name	scale
type	scalar
symbol	β
definition	$\beta > 0$

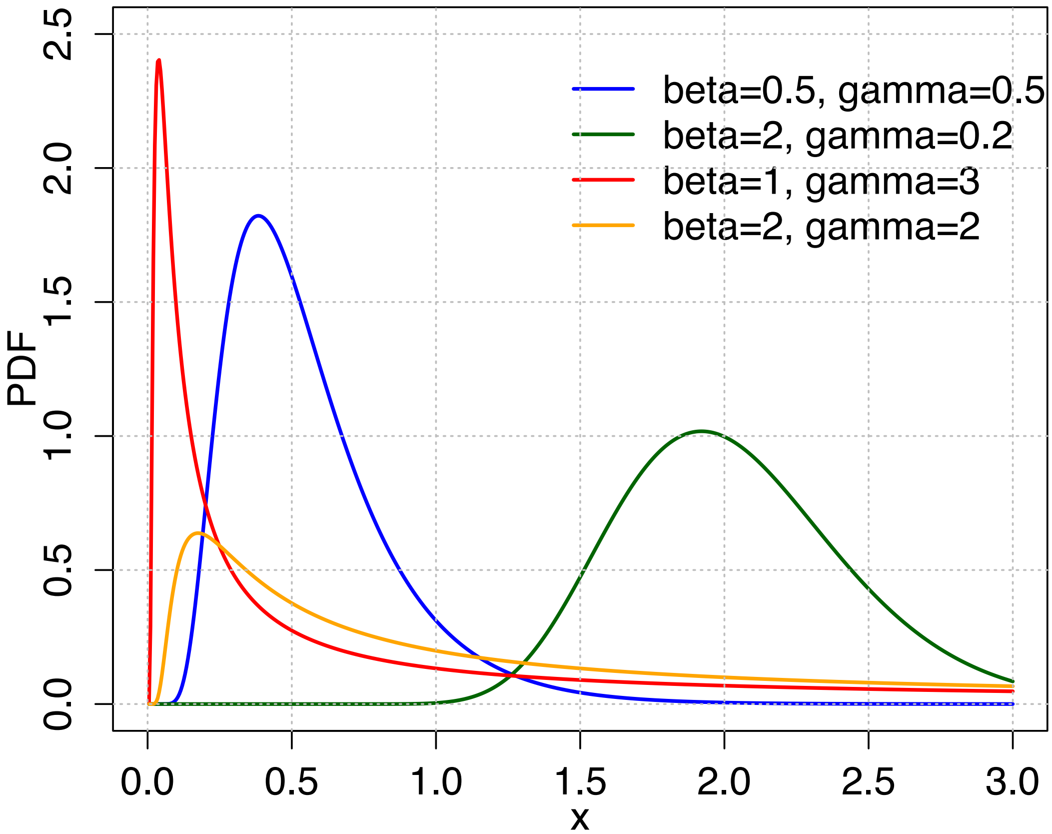

Figure 4: BirnbaumSaunders distribution plotted using the provided R code.

Parameter: shape

name	shape
type	scalar
symbol	γ
definition	$\gamma > 0$

Functions

PDF

$$\frac{1}{\sqrt{2\pi}} \exp\Big[-\frac{(\sqrt{x/\beta} - \sqrt{\beta/x})^2}{2\gamma^2} \Big] \Big[\frac{\sqrt{x/\beta} + \sqrt{\beta/x}}{2\gamma x} \Big]$$

PDF in R

```
1/(sqrt(2*pi))* exp( -(sqrt(x/beta) - sqrt(beta/x))^2 / (2*gamma^2) ) * ( sqrt(x/beta) + sqr
```

CDF

–

CategoricalNonordered

name	Categorical Nonordered (ID: 0000053)
type	discrete
variate	x, scalar
support	$x \in \{1, \ldots, k\}$

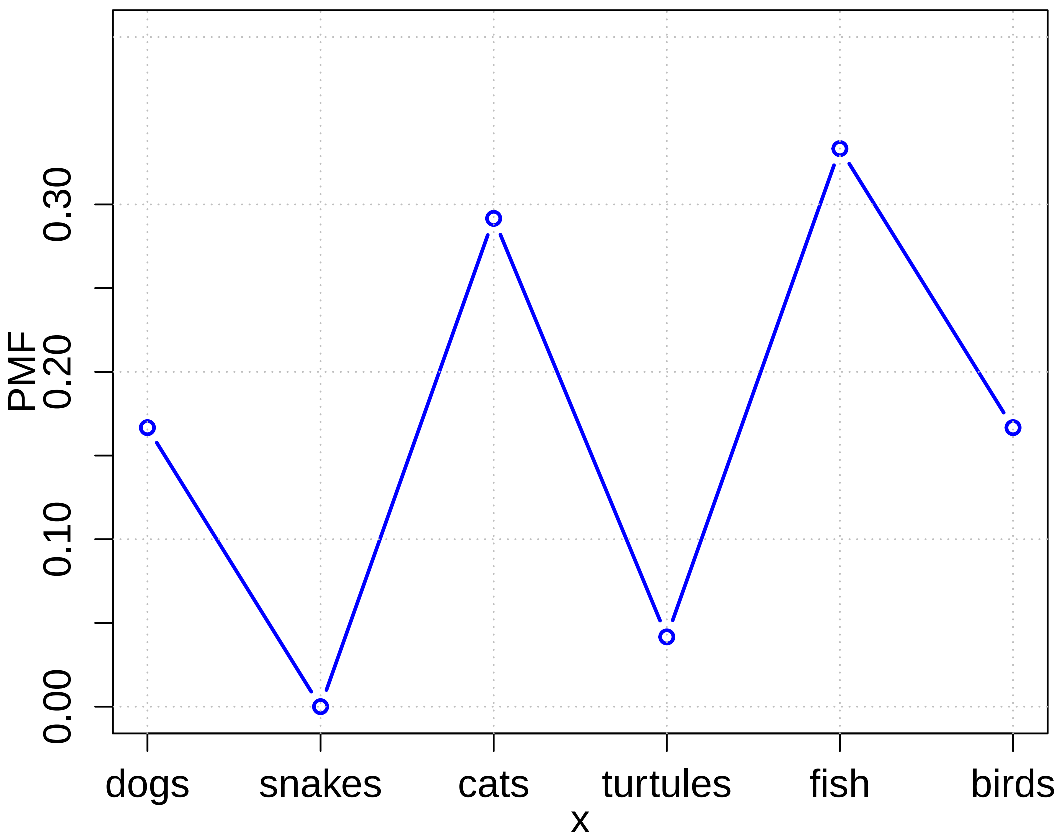

Figure 5: CategoricalNonordered distribution plotted using the provided R code.

Parameter: categoryProb

name	category probabilities
type	vector
symbol	$p_1, \ldots, p_k$
definition	$0 \leq p_i \leq 1, \Sigma p_i = 1$

Functions

PMF

$$p(x = i) = p_i$$

CDF

$$undefined$$

CategoricalOrdered

name	Categorical Ordered (ID: 0000044)
type	discrete
variate	x, scalar
support	$x \in \{1, \ldots, k\}$

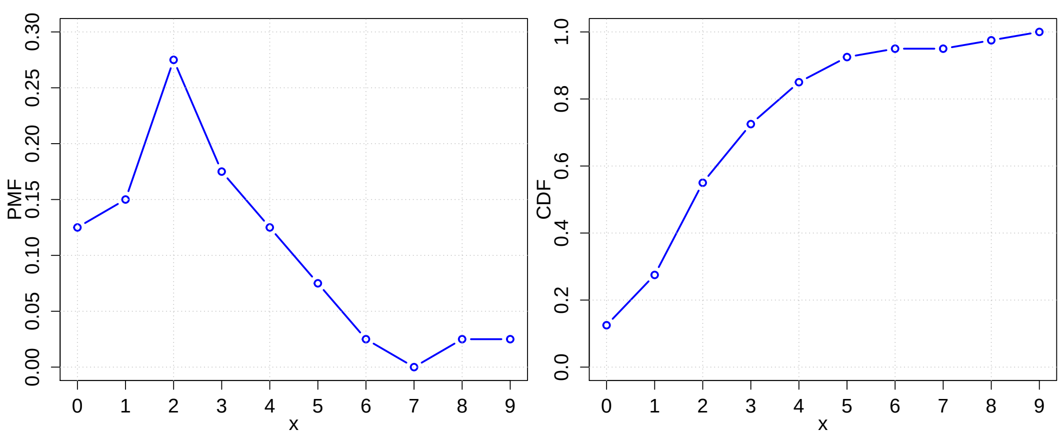

Figure 6: CategoricalOrdered distribution plotted using the provided R code.

Parameter: categoryProb

name	category probabilities
type	vector
symbol	$p_1, \ldots, p_k$
definition	$0 \leq p_i \leq 1, \Sigma p_i = 1$

Functions

PMF

$$p(x = i) = p_i$$

CDF

$$\begin{cases} 0 & \text{for } x < 1 \\ \sum_{j=1}^{i} p_j & \text{for } x \in [i, i+1) \\ 1 & \text{for } x \geq k \end{cases}$$

Cauchy

name	Cauchy (ID: 0000062)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

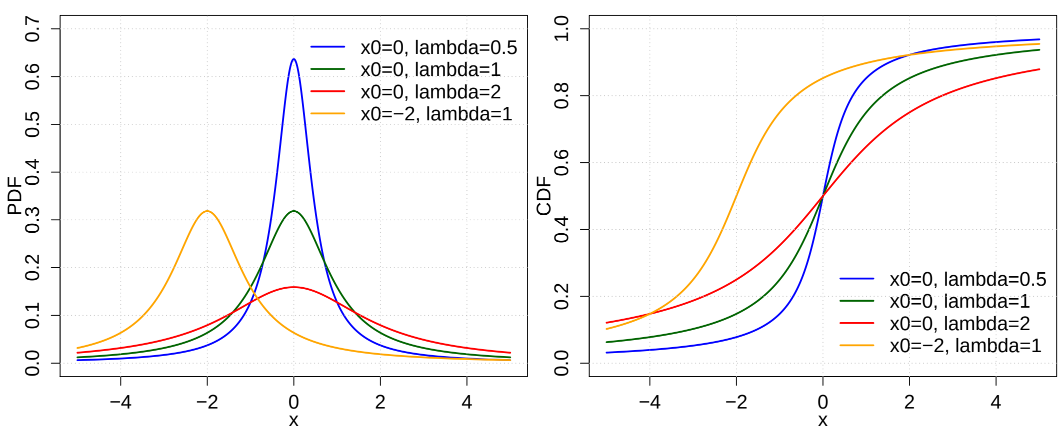

Figure 7: Cauchy distribution plotted using the provided R code.

Parameter: location

name	location
type	scalar
symbol	x_0
definition	$x_0 \in R$

Parameter: scale

name	scale
type	scalar
symbol	γ
definition	$\gamma \in R$

Functions

PDF

$$\frac{1}{\pi\gamma\left[1+\left(\frac{x-x_0}{\gamma}\right)^2\right]}$$

PDF in R

```
1 / (pi*gamma*(1 + ((x-x0)^2/gamma^2)))
```

CDF

$$\frac{1}{\pi}\arctan\left(\frac{x-x_0}{\gamma}\right)+\frac{1}{2}$$

CDF in R

```
1/pi * atan((x-x0)/gamma)+1/2
```

ChiSquared

name	Chi-squared (ID: 0000072)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	k
definition	$k \in N$

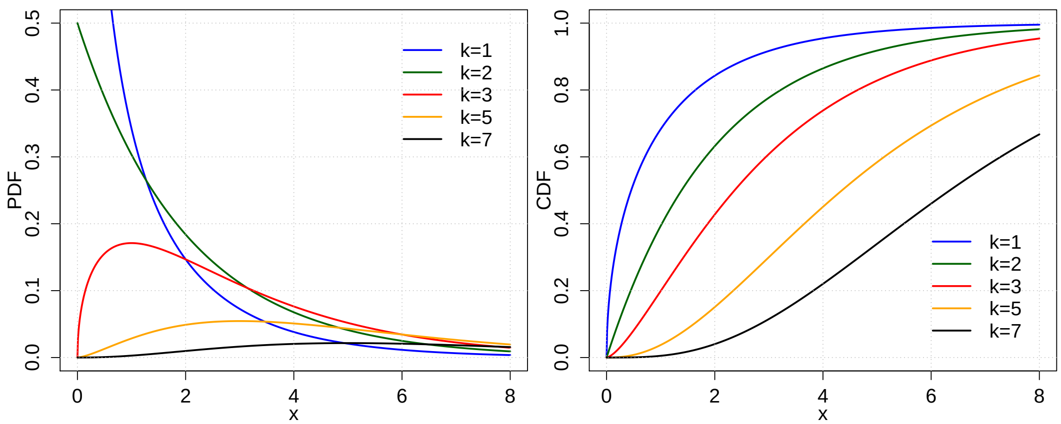

Figure 8: ChiSquared distribution plotted using the provided R code.

Functions

PDF

$$\frac{1}{2^{\frac{k}{2}}\Gamma\left(\frac{k}{2}\right)}\, x^{\frac{k}{2}-1}e^{-\frac{x}{2}}$$

PDF in R

```
1/( 2^k/2 * gamma(k/2) ) *  x^(k/2-1) * exp(-x/2)
```

CDF

$$\frac{1}{\Gamma\left(\frac{k}{2}\right)}\,\gamma\left(\frac{k}{2},\,\frac{x}{2}\right)$$

CDF in R

```
1/gamma(k/2) * Igamma(k/2,x/2)
```

Dirichlet

name	Dirichlet (ID: 0000090)
type	continuous
variate	x, vector
support	$x_1, \cdots, x_K \quad \text{where} \quad x_i \in [0,1] \quad \textit{and} \quad \sum_{i=1}^{K} x_i = 1$

Parameter: concentration

name	concentration
type	vector
symbol	$\alpha_1, \cdots, \alpha_K$
definition	$\alpha_1, \cdots, \alpha_K, \alpha_i > 0$

Functions

PDF

$$\frac{1}{B(\alpha)}\prod_{i=1}^{K} x_i^{\alpha_i - 1}\text{where}\quad B(\alpha) = \frac{\prod_{i=1}^{K}\Gamma(\alpha_i)}{\Gamma\left(\sum_{i=1}^{K}\alpha_i\right)}\text{where}\quad \alpha = (\alpha_1, \ldots, \alpha_K)$$

CDF

$$-$$

Exponential

name	Exponential (ID: 0000099)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

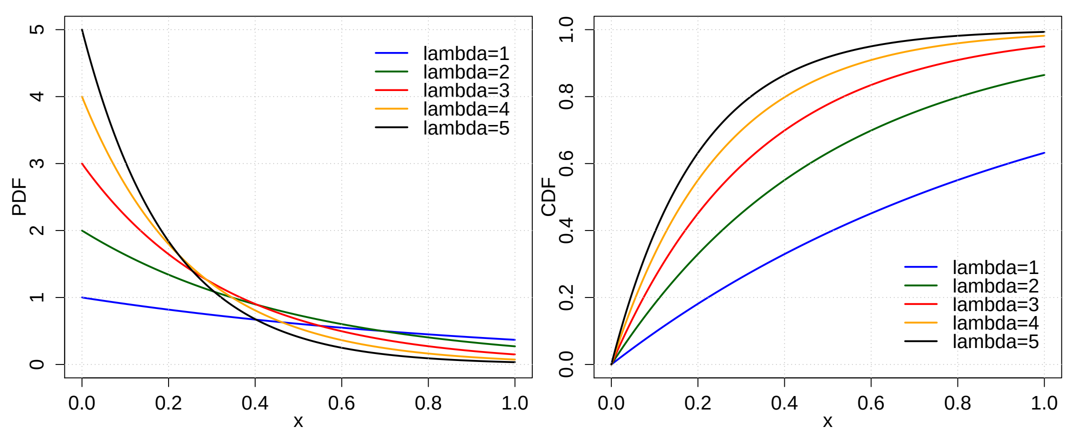

Figure 9: Exponential distribution plotted using the provided R code.

Parameter: rate

name	rate or inverse scale
type	scalar
symbol	λ
definition	$\lambda > 0$

Functions

PDF

$$\lambda e^{-\lambda x}$$

PDF in R

```
lambda*exp(-lambda*x)
```

CDF

$$1 - e^{-\lambda x}$$

CDF in R

```
1 - exp(-lambda*x)
```

F

name	F (ID: 0000108)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

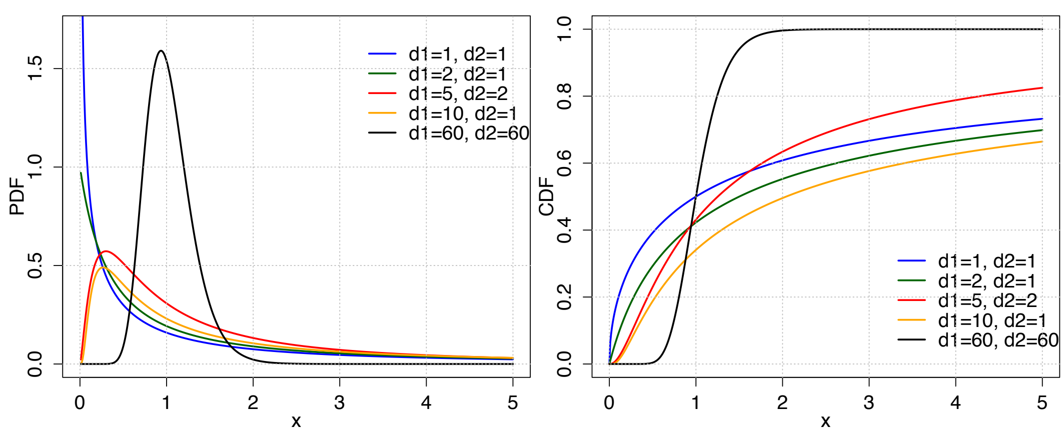

Figure 10: F distribution plotted using the provided R code.

Parameter: numerator

name	degree of freedom
type	scalar
symbol	d_1
definition	$d_1 > 0$

Parameter: denominator

name	degree of freedom
type	scalar
symbol	d_2
definition	$d_2 > 0$

Functions

PDF

$$\frac{\sqrt{\frac{(d_1 x)^{d_1} d_2^{d_2}}{(d_1 x + d_2)^{d_1 + d_2}}}}{x B\left(\frac{d_1}{2}, \frac{d_2}{2}\right)}$$

PDF in R

```
sqrt((d1*x)^d1*d2^(d2) / (d1*x+d2)^(d1+d2) ) / (x*beta(d1/2,d2/2))
```

CDF

$$I_{\frac{d_1 x}{d_1 x + d_2}}\left(\frac{d_1}{2}, \frac{d_2}{2}\right)$$

CDF in R

```
Rbeta(d1*x / (d1*x + d2), d1/2, d2/2)
```

Gamma

name	Gamma (ID: 0000118)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

Parameter: shape

name	shape
type	scalar
symbol	k
definition	$k > 0$

Parameter: scale

name	scale
type	scalar
symbol	θ
definition	$\theta > 0$

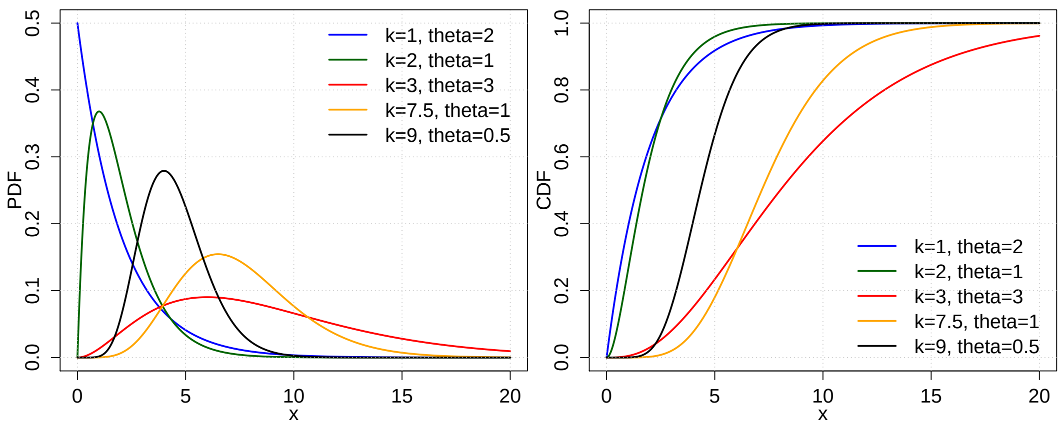

Figure 11: Gamma distribution plotted using the provided R code.

Functions

PDF

$$\frac{1}{\Gamma(k)\theta^k} x^{k-1} e^{-\frac{x}{\theta}}$$

PDF in R

```
1 / (gamma(k) * theta^k) * x^(k-1) * exp(-x/theta)
```

CDF

$$\frac{1}{\Gamma(k)} \gamma\left(k, \frac{x}{\theta}\right)$$

CDF in R

```
1/gamma(k) * Igamma(k,x/theta)
```

GeneralizedGamma1

name	Generalized Gamma 1 (ID: 0000137)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

Parameter: scale

name	scale
type	scalar
symbol	a
definition	$a > 0$

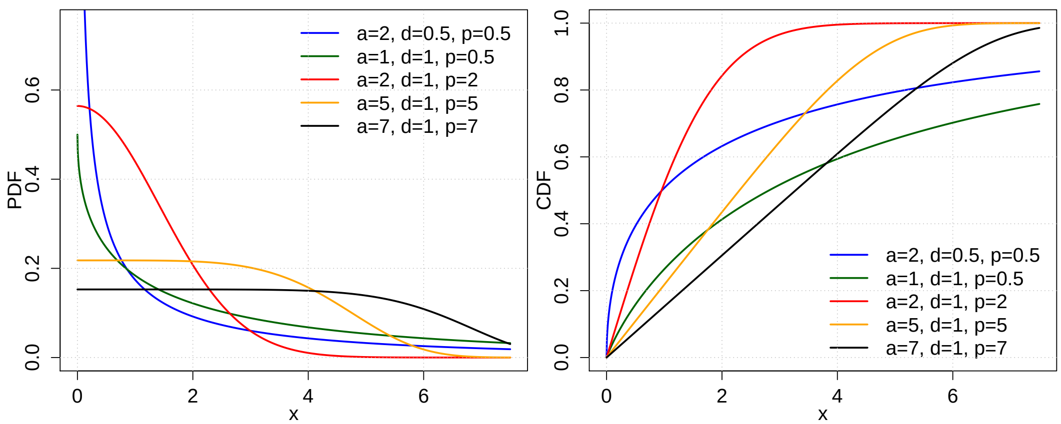

Figure 12: GeneralizedGamma1 distribution plotted using the provided R code.

Parameter: shape1

name	shape
type	scalar
symbol	d
definition	$d > 0$

Parameter: shape2

name	shape
type	-
symbol	p
definition	$p > 0$

Functions

PDF

$$\frac{p/a^d}{\Gamma(d/p)} x^{d-1} e^{-(x/a)^p}$$

PDF in R

```
p/a^d/gamma(d/p) * x^(d-1) * exp(-(x/a)^p)
```

CDF

$$\frac{\gamma(d/p, (x/a)^p)}{\Gamma(d/p)}$$

CDF in R

```
Igamma(d/p, (x/a)^p, lower=T) / gamma(d/p)
```

GeneralizedGamma2

name	Generalized Gamma 2 (ID: 0000148)
type	continuous
variate	x, scalar
support	$0 < a < x$

Parameter: location

name	location
type	scalar
symbol	a
definition	$a > 0$

Parameter: scale

name	b ¿ 0
type	scalar
symbol	b
definition	$scale$

Parameter: shape1

name	shape
type	scalar
symbol	c
definition	$c > 0$

Parameter: shape2

name	shape2
type	scalar
symbol	k
definition	$k > 0$

Functions

PDF

$$\frac{k(x-a)^{kc-1}}{b^{kc}\Gamma(c)} \exp\Big[-\Big(\frac{x-a}{b}\Big)^k\Big]$$

CDF

$$-$$

GeneralizedPoisson

name	Generalized Poisson (ID: 0000160)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

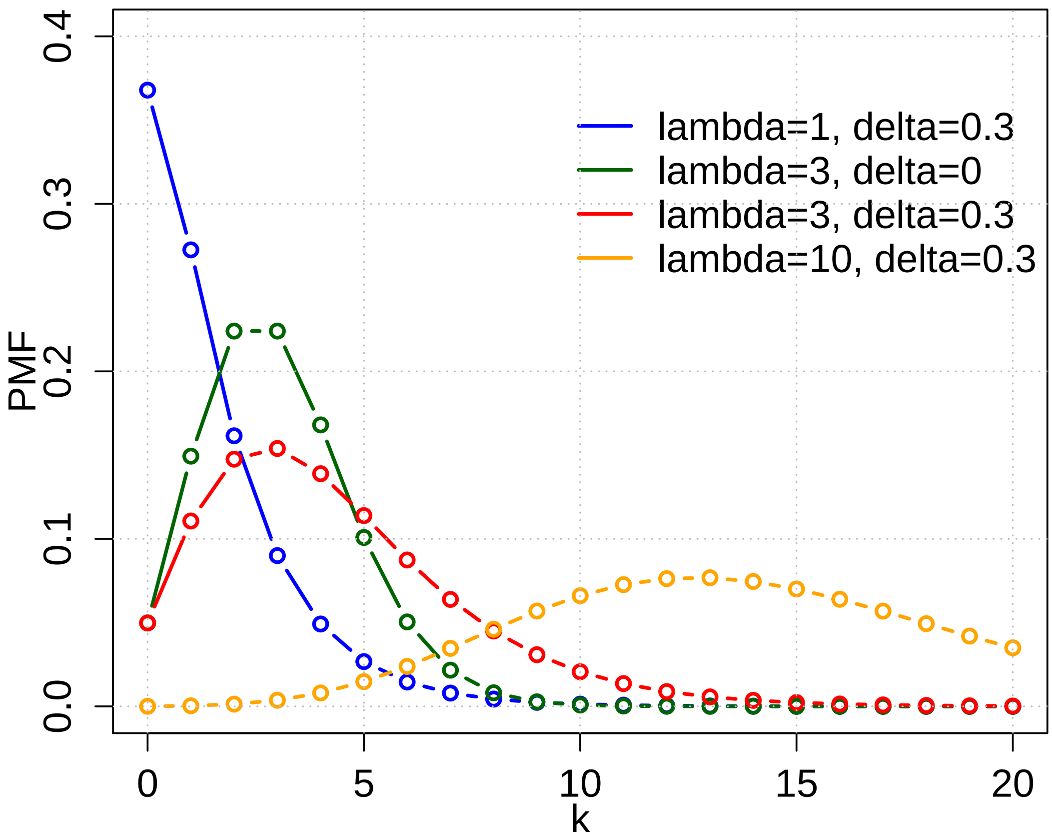

Figure 13: GeneralizedPoisson distribution plotted using the provided R code.

Parameter: rate

name	Poisson intensity
type	scalar
symbol	λ
definition	$\lambda \in R, \lambda > 0$

Parameter: dispersion

name	dispersion
type	scalar
symbol	δ
definition	$\max(-1, -\lambda/4) < \delta < 1$

Functions

PMF

$$\frac{\lambda(\lambda + k\delta)^{k-1} \times e^{-\lambda-k\delta}}{k!}$$

PMF in R

```
(lambda*(lambda+k*delta)^(k-1) * exp(-lambda-k*delta)) / factorial(k)
```

CDF

$$-$$

Geometric

name	Geometric (ID: 0000128)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

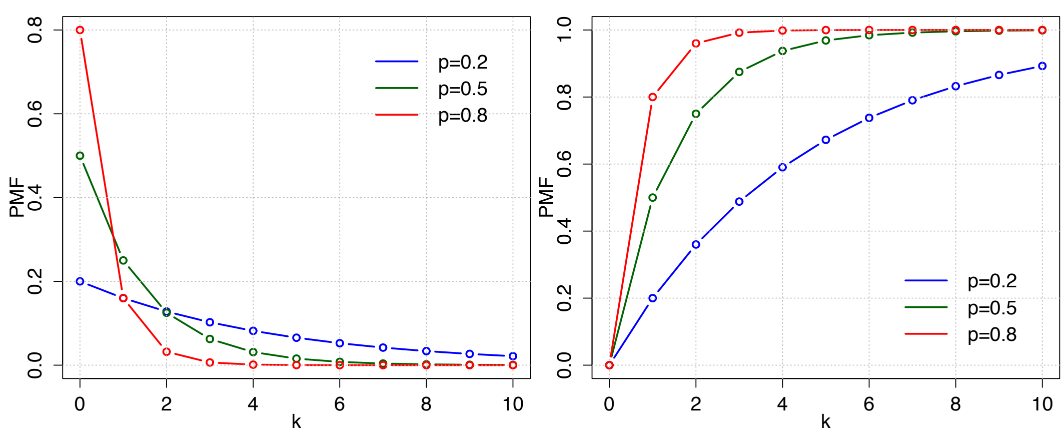

Figure 14: Geometric distribution plotted using the provided R code.

Parameter: probability

name	success probability
type	scalar
symbol	p
definition	$0 < p \leq 1$

Functions

PMF

$$(1-p)^k\, p$$

PMF in R

```
p*(1-p)^k
```

CDF

$$1-(1-p)^{k+1}$$

CDF in R

```
1-(1 - p)^(k+1)
```

Gompertz

name	Gompertz (ID: 0000172)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

Parameter: shape

name	shape
type	scalar
symbol	η
definition	$\eta > 0$

Parameter: scale

name	scale
type	scalar
symbol	b
definition	$b > 0$

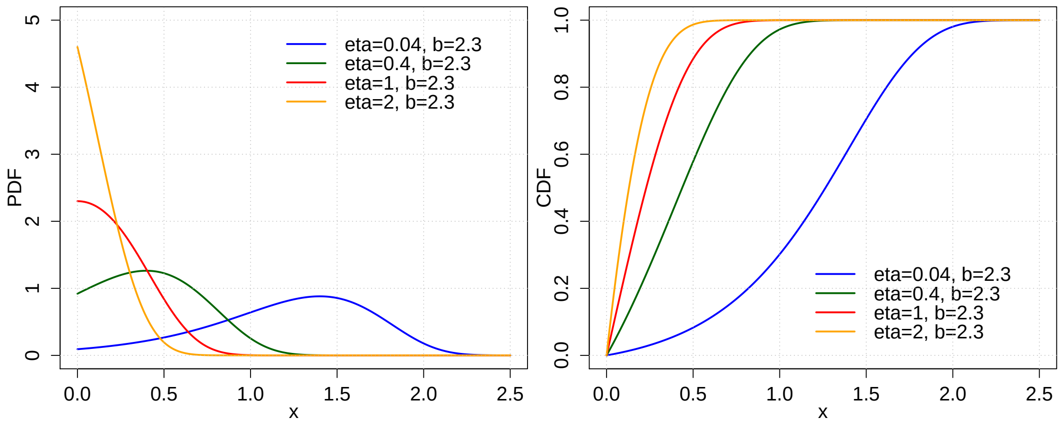

Figure 15: Gompertz distribution plotted using the provided R code.

Functions

PDF

$$b\eta e^{bx} e^{\eta} \exp\left(-\eta e^{bx}\right)$$

PDF in R

```
b*eta*exp(b*x)*exp(eta)*exp(-eta*exp(b*x))
```

CDF

$$1 - \exp\left(-\eta\left(e^{bx} - 1\right)\right)$$

CDF in R

```
1-exp(-eta*(exp(b*x)-1))
```

Gumbel

name	Gumbel (ID: 0000182)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

Parameter: location

name	location
type	scalar
symbol	μ
definition	$\mu \in R$

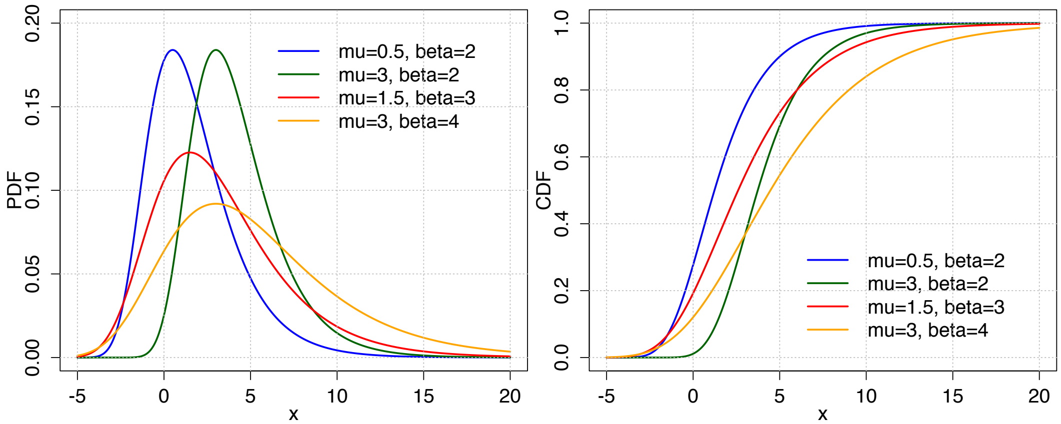

Figure 16: Gumbel distribution plotted using the provided R code.

Parameter: scale

name	scale
type	scalar
symbol	β
definition	$\beta > 0, \beta \in R$

Functions

PDF

$$\frac{e^{-e^{-\frac{x-\mu}{\beta}}} e^{-\frac{x-\mu}{\beta}}}{\beta}$$

CDF

$$e^{-e^{-(x-\mu)/\beta}}$$

Hypergeometric

name	Hypergeometric (ID: 0000191)
type	discrete
variate	k, scalar
support	$k \in \{\max(0,\, n+K-N),\, \ldots,\, \min(n,\, K)\}$

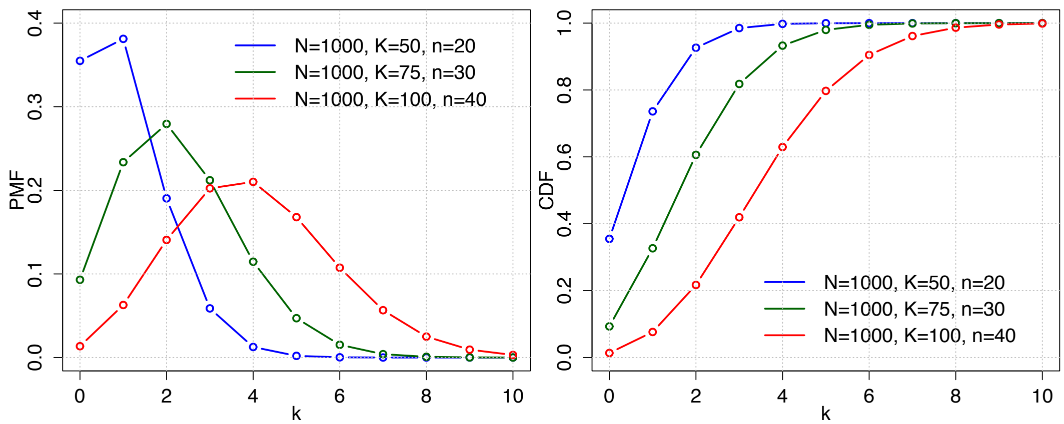

Figure 17: Hypergeometric distribution plotted using the provided R code.

Parameter: populationSize

name	population size
type	scalar
symbol	N
definition	$N \in \{0, 1, 2, \dots\}$

Parameter: numberOfTrials

name	number of trials
type	scalar
symbol	K
definition	$K \in \{0, 1, 2, \dots, N\}$

Parameter: numberOfSuccesses

name	number of successes
type	scalar
symbol	n
definition	$n \in \{0, 1, 2, \dots, N\}$

Functions

PMF

$$\frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$$

PMF in R

```
choose(K,k)*choose(M-K,n-k)/choose(M,n)
```

CDF

$$1 - \frac{\binom{n}{k+1}\binom{N-n}{K-k-1}}{\binom{N}{K}} \, {}_3F_2\left[\begin{matrix} 1, \; k+1-K, \; k+1-n \\ k+2, \; N+k+2-K-n \end{matrix} ; 1\right]$$

CDF in R

```
cumsum(PMF)
```

InverseGamma

name	Inverse-Gamma (ID: 0000201)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

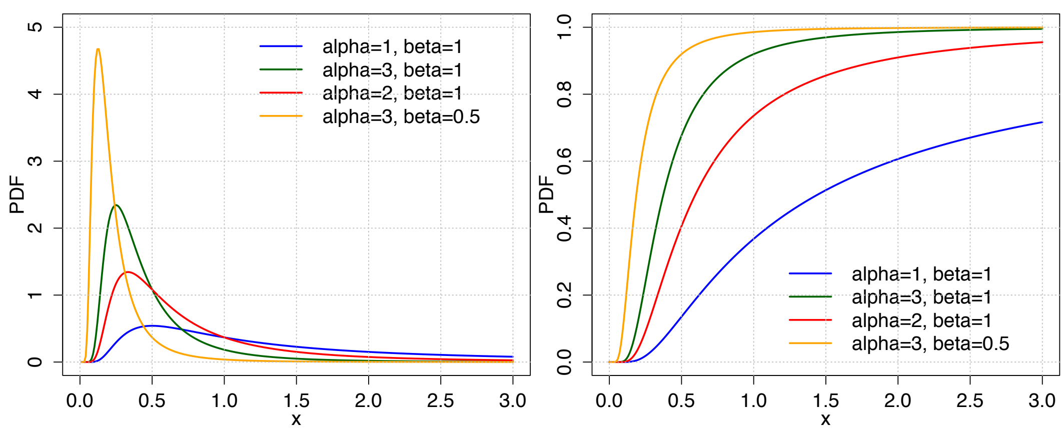

Figure 18: InverseGamma distribution plotted using the provided R code.

Parameter: shape

name	shape
type	scalar
symbol	α
definition	$\alpha > 0, \alpha \in R$

Parameter: scale

name	scale
type	scalar
symbol	β
definition	$\beta > 0, \beta \in R$

Functions

PDF

$$\frac{\beta^\alpha}{\Gamma(\alpha)} x^{-\alpha-1} \exp\left(\frac{-\beta}{x}\right)$$

CDF

$$\frac{\Gamma(\alpha, \beta/x)}{\Gamma(\alpha)}$$

InverseGaussian

name	Inverse Gaussian (ID: 0000211)
type	continuous
variate	,
support	

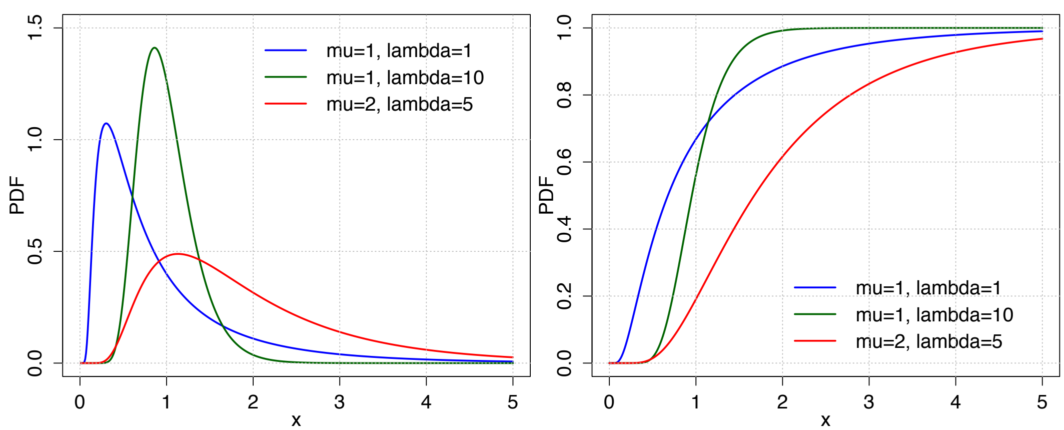

Figure 19: InverseGaussian distribution plotted using the provided R code.

Parameter: shape

name	shape
type	scalar
symbol	λ
definition	$\lambda > 0$

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu > 0$

Functions

PDF

$$\sqrt{\frac{\lambda}{2\pi x^3}}\exp\Big(-\frac{\lambda}{2\mu^2 x}(x-\mu)^2\Big)$$

PDF in R

```
sqrt(lambda/(2*pi*x^3) ) * exp(-lambda/(2*mu^2 x) * (x-mu)^2)
```

CDF

$$\Phi\left(\sqrt{\frac{\lambda}{x}}\left(\frac{x}{\mu}-1\right)\right)+\exp\left(\frac{2\lambda}{\mu}\right)\Phi\left(-\sqrt{\frac{\lambda}{x}}\left(\frac{x}{\mu}+1\right)\right)$$

CDF in R

```
pnorm(sqrt(lambda/x) * (x/mu-1)) + exp(2*lambda/mu) * pnorm(-sqrt(lambda/x) * (x/mu+1))
```

InverseWishart

name	Inverse-Wishart (ID: 0000220)
type	continuous
variate	X, matrix
support	$X(p \times p)$ – positive-definite matrix

Parameter: scaleMatrix

name	scale matrix
type	matrix
symbol	Ψ
definition	$\Psi > 0$, positive-definite matrix

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	ν
definition	$\nu > p-1, \nu \in R$

Functions

PDF

$$\frac{|\Psi|^{\frac{\nu}{2}}}{2^{\frac{\nu p}{2}}\Gamma_p(\frac{\nu}{2})}\,|X|^{-\frac{\nu+p+1}{2}}\,e^{-\frac{1}{2}\mathrm{tr}(\Psi X^{-1})}$$

CDF

$$-$$

Laplace1

name	Laplace 1 (ID: 0000230)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

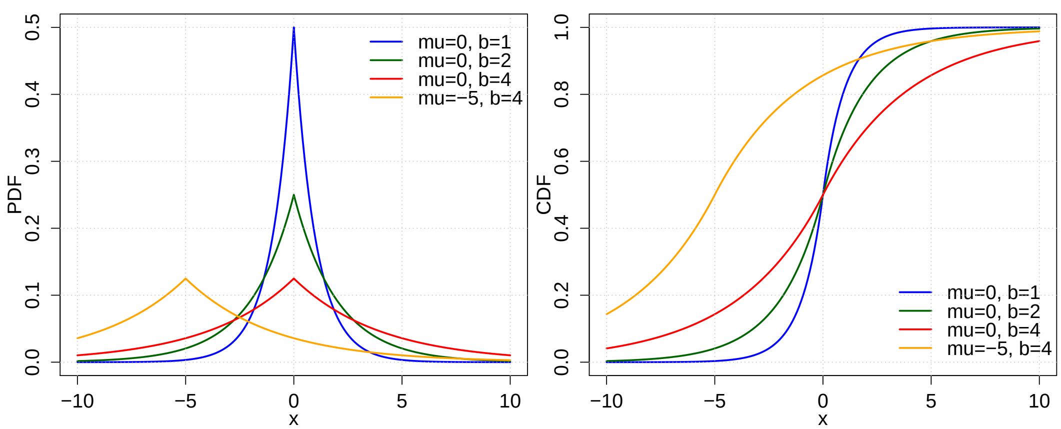

Figure 20: Laplace1 distribution plotted using the provided R code.

Parameter: location

name	location
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: scale

name	scale
type	scalar
symbol	b
definition	$b > 0, b \in R$

Functions

PDF

$$\frac{1}{2\,b} \exp\left(-\frac{|x-\mu|}{b}\right)$$

PDF in R

```
1/(2*b) * exp(- abs(x-mu)/b )
```

CDF

$$\begin{cases} \frac{1}{2}\exp\left(\frac{x-\mu}{b}\right) & \text{if } x < \mu \\ 1 - \frac{1}{2}\exp\left(-\frac{x-\mu}{b}\right) & \text{if } x \geq \mu \end{cases}$$

CDF in R

```
1/2 * exp( (x-mu)/b ) for x < mu
1- 1/2 * exp( -(x-mu)/b ) x >= mu
```

Laplace2

name	Laplace 2 (ID: 0000241)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

Parameter: location

name	-
type	scalar
symbol	μ
definition	$-$

Parameter: tau

name	-
type	scalar
symbol	τ
definition	$-$

Functions

PDF

$$\frac{\tau}{2} \exp\left(-\tau|x-\mu|\right)$$

CDF

$$-$$

LogLogistic

name	Log-Logistic (ID: 0000263)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

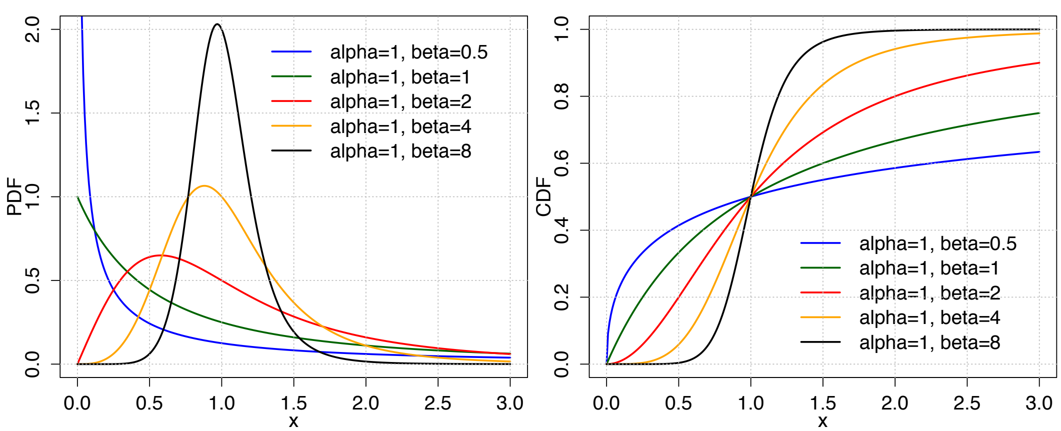

Figure 21: LogLogistic distribution plotted using the provided R code.

Parameter: scale

name	scale
type	scalar
symbol	α
definition	$\alpha > 0$

Parameter: shape

name	shape
type	scalar
symbol	β
definition	$\beta > 0$

Functions

PDF

$$\frac{(\beta/\alpha)(x/\alpha)^{\beta-1}}{(1+(x/\alpha)^{\beta})^2}$$

PDF in R

```
(beta/alpha)*(x/alpha)^(beta-1) / (1+(x/alpha)^beta)^2
```

CDF

$$\frac{1}{1+(x/\alpha)^{-\beta}}$$

CDF in R

```
1 / (1+(x/alpha)^(-beta))
```

LogNormal1

name	Log-Normal 1 (ID: 0000274)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

Parameter: meanLog

name	mean of log(x)
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: stdevLog

name	shape
type	scalar
symbol	σ
definition	$\sigma > 0$

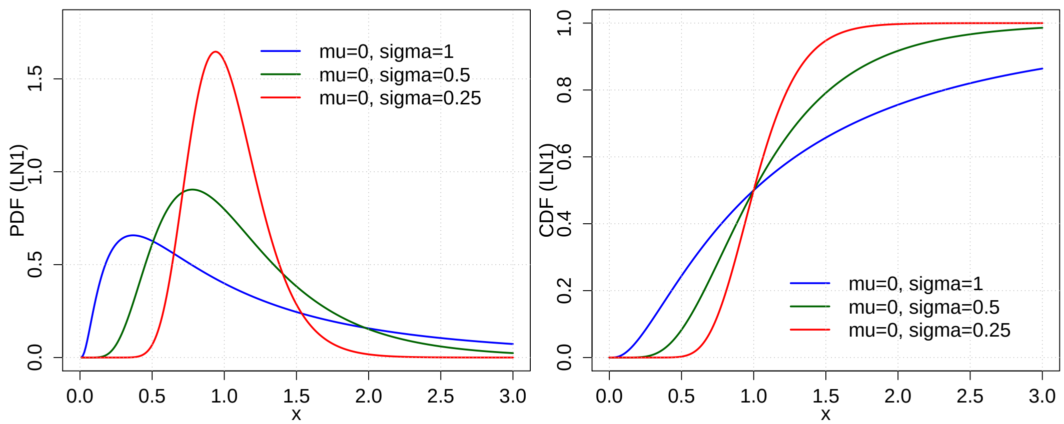

Figure 22: LogNormal1 distribution plotted using the provided R code.

Functions

PDF

$$\frac{1}{x\sigma\sqrt{2\pi}}\ e^{-\frac{(\ln x-\mu)^2}{2\sigma^2}}$$

PDF in R

```
1/(x*sigma*sqrt(2*pi)) * exp((-(log(x)-mu)^2)/(2*sigma^2))
```

CDF

$$\frac{1}{2}+\frac{1}{2}\,\mathrm{erf}\Big[\frac{\ln x-\mu}{\sqrt{2}\sigma}\Big]$$

CDF in R

```
1/2 + 1/2 *erf( (log(x)-mu)/(sqrt(2)*sigma) )
```

LogNormal2

name	Log-Normal 2 (ID: 0000284)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

Parameter: meanLog

name	mean of log(x)
type	scalar
symbol	μ
definition	$\mu \in R$

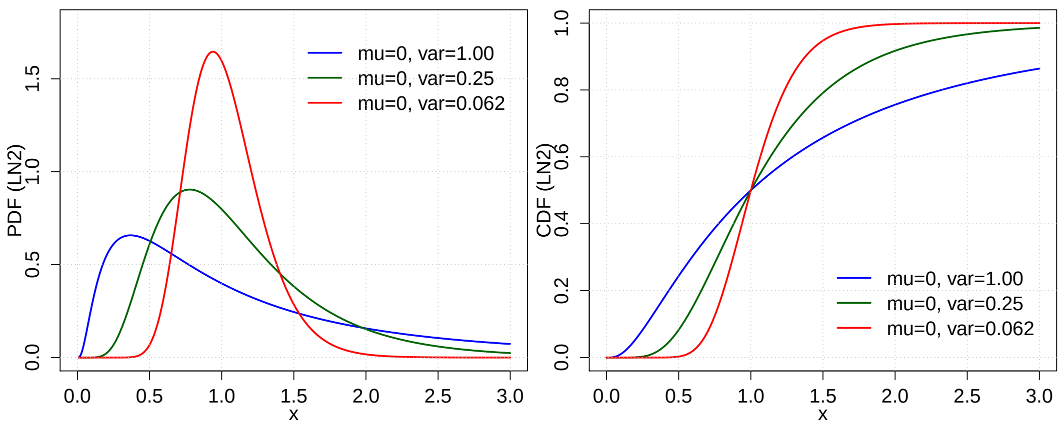

Figure 23: LogNormal2 distribution plotted using the provided R code.

Parameter: varLog

name	shape
type	scalar
symbol	v
definition	$v > 0$

Functions

PDF

$$\frac{1}{x\sqrt{v}\sqrt{2\pi}}\ e^{-\frac{(\ln x-\mu)^2}{2v}}$$

PDF in R

```
1/(x*sqrt(v)*sqrt(2*pi)) * exp(-(ln(x)-mu)^2/(2*v))
```

CDF

$$\frac{1}{2}+\frac{1}{2}\,\mathrm{erf}\Big[\frac{\ln x-\mu}{\sqrt{2}\sqrt{var}}\Big]$$

CDF in R

```
1/2 + 1/2 * erf( (log(x)-mu) / (sqrt(2)*sqrt(var)) )
```

LogNormal3

name	Log-Normal 3 (ID: 0000294)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

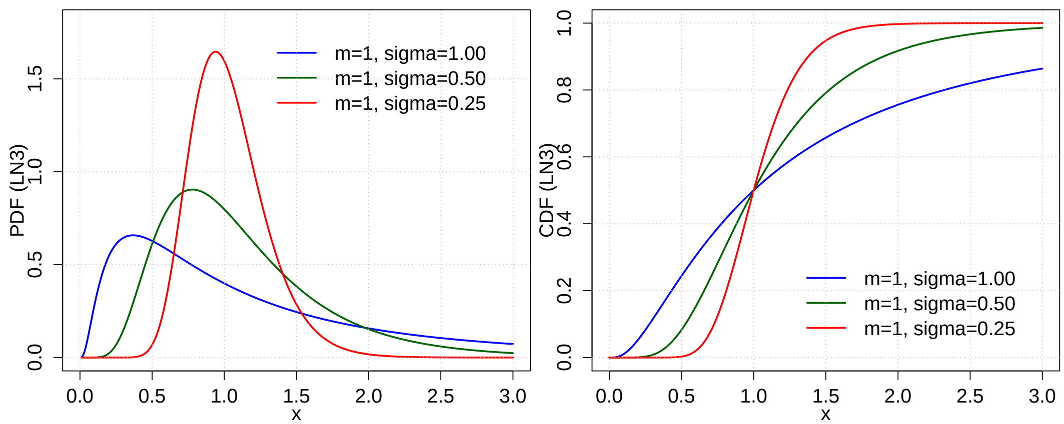

Figure 24: LogNormal3 distribution plotted using the provided R code.

Parameter: median

name	median / geometric mean
type	scalar
symbol	m
definition	$m > 0$

Parameter: stdevLog

name	shape
type	scalar
symbol	σ
definition	$\sigma > 0$

Functions

PDF

$$\frac{1}{x\sigma\sqrt{2\pi}}\, e^{-\frac{[\ln(x/m)]^2}{2\sigma^2}}$$

PDF in R

```
1/(x*sigma*sqrt(2*pi)) * exp(-(log(x/m))^2 / (2*sigma^2))
```

CDF

$$\frac{1}{2} + \frac{1}{2}\,\mathrm{erf}\Big[\frac{\ln x - \ln m}{\sqrt{2}\sigma}\Big]$$

CDF in R

```
1/2 + 1/2 * erf( (log(x)-log(m)) / (sqrt(2)*sigma) )
```

LogNormal4

name	Log-Normal 4 (ID: 0000304)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

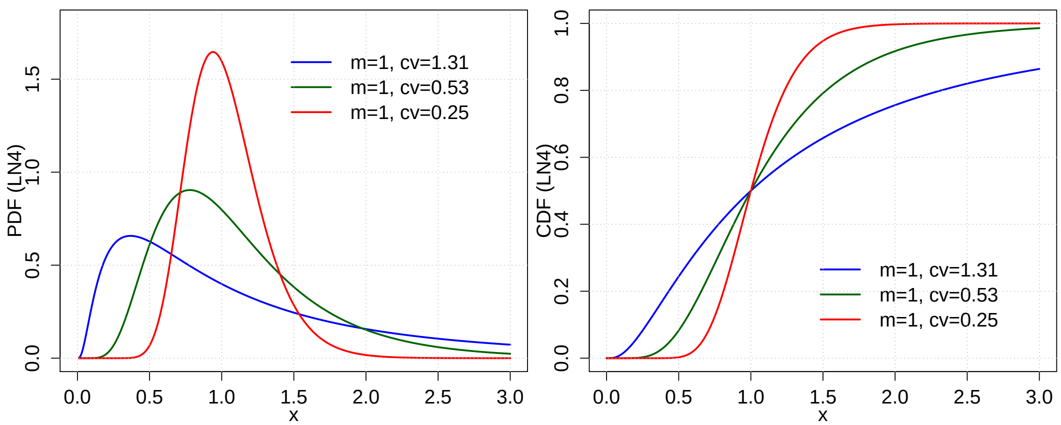

Figure 25: LogNormal4 distribution plotted using the provided R code.

Parameter: median

name	median / geometric mean
type	scalar
symbol	m
definition	$m > 0$

Parameter: coefVar

name	coefficient of variation
type	scalar
symbol	cv
definition	$cv > 0$

Functions

PDF

$$\frac{1}{x\sqrt{\ln(cv^2+1)}\sqrt{2\pi}}\, e^{-\frac{[\ln(x/m)]^2}{2\ln(cv^2+1)}}$$

PDF in R

```
1/(x*sqrt(log(cv^2+1))*sqrt(2*pi)) * exp( -(log(x/m))^2 / (2*log(cv^2+1)) )
```

CDF

$$\frac{1}{2}+\frac{1}{2}\,\mathrm{erf}\Big[\frac{\ln x-\ln m}{\sqrt{2}\sqrt{\log(cv^2+1)}}\Big]$$

CDF in R

```
1/2 + 1/2 * erf( (log(x)-log(m)) / (sqrt(2*log(cv^2+1))) )
```

LogNormal5

name	Log-Normal 5 (ID: 0000314)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

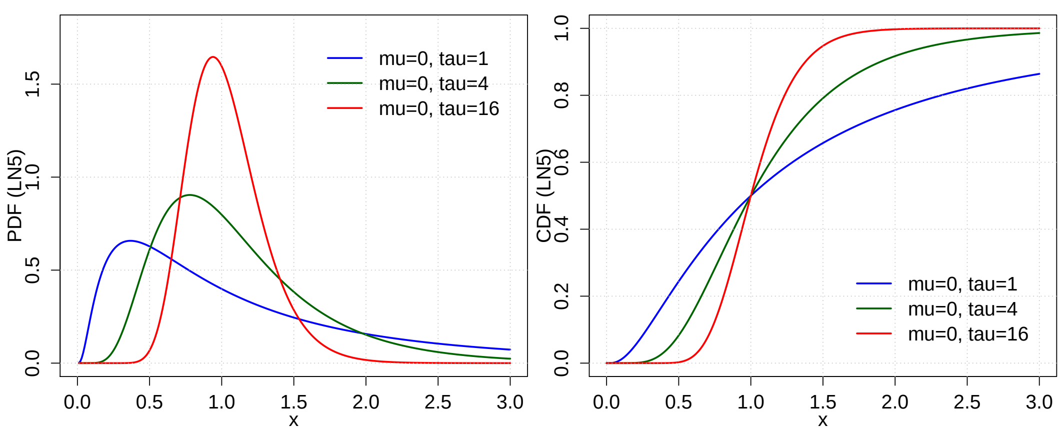

Figure 26: LogNormal5 distribution plotted using the provided R code.

Parameter: meanLog

name	mean of log(x)
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: precision

name	precision
type	scalar
symbol	τ
definition	$\tau > 0$

Functions

PDF

$$\sqrt{\frac{\tau}{2\pi}}\frac{1}{x}e^{-\frac{\tau}{2}(\log x-\mu)^2}$$

PDF in R

```
sqrt(tau / (2*pi)) * (1/x) * exp(- (tau/2)*(log(x)-mu)^2 )
```

CDF

$$\frac{1}{2}+\frac{1}{2}\operatorname{erf}\Big[\frac{\ln x-\mu}{\sqrt{2/\tau}}\Big]$$

CDF in R

```
1/2 + 1/2 * erf( (log(x)-mu) / sqrt(2/tau) )
```

LogNormal6

name	Log-Normal 6 (ID: 0000004)
type	
variate	,
support	

Functions

CDF

LogNormal7

name	Log-Normal 7 (ID: 0000017)
type	
variate	,
support	

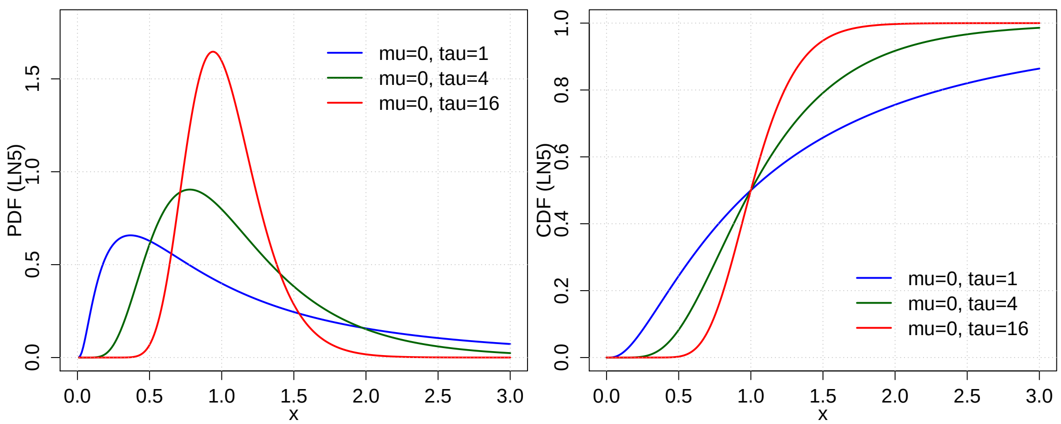

Figure 27: LogNormal6 distribution plotted using the provided R code.

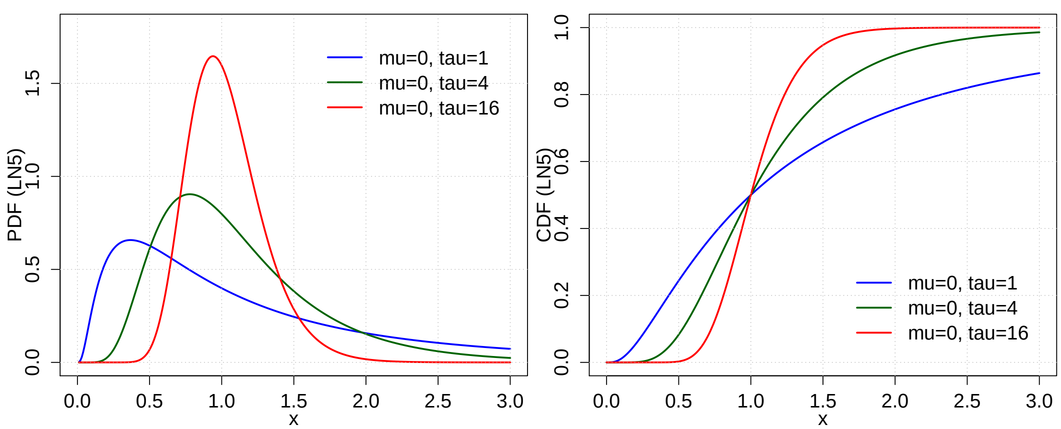

Figure 28: LogNormal7 distribution plotted using the provided R code.

Functions

CDF

LogUniform

name	Log-Uniform (ID: 0000029)
type	continuous
variate	x, scalar
support	$x \in (min, max)$

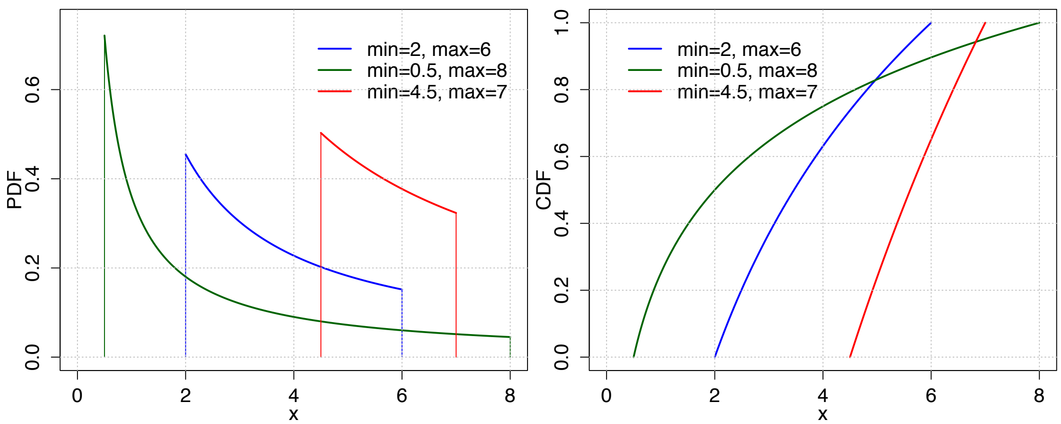

Figure 29: LogUniform distribution plotted using the provided R code.

Parameter: minimum

name	minimum
type	scalar
symbol	min
definition	$m > 0$

Parameter: maximum

name	maximum
type	scalar
symbol	max
definition	$max \geq min$

Functions

PDF

$$\frac{1}{x(\log(max) - \log(min))}$$

PDF in R

```
1/(x*(log(max) - log(min)))
```

CDF

$$\frac{\log(x) - \log(min)}{\log(max) - \log(min)}$$

CDF in R

```
(log(x) - log(min)) / (log(max) - log(min))
```

Logistic

name	Logistic (ID: 0000253)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

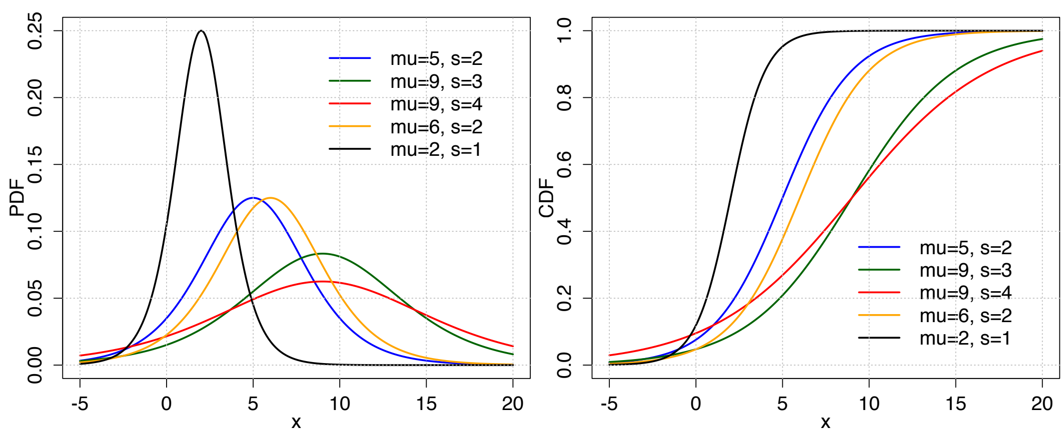

Figure 30: Logistic distribution plotted using the provided R code.

Parameter: location

name	location
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: scale

name	scale
type	scalar
symbol	s
definition	$s > 0, s \in R$

Functions

PDF

$$\frac{e^{-\frac{x-\mu}{s}}}{s\left(1+e^{-\frac{x-\mu}{s}}\right)^2}$$

PDF in R

```
exp(-(x-mu)/s) / (s*(1+exp(-(x-mu)/s))^2)
```

CDF

$$\frac{1}{1+e^{-\frac{x-\mu}{s}}}$$

CDF in R

```
1/(1+exp(-(x-mu)/s))
```

MixtureDistribution

name	Mixture Distribution (ID: 0000039)
type	continuous
variate	$-$, -
support	$-$

Parameter: weight

name	mixing coefficients
type	vector
symbol	$\pi_1, \ldots, \pi_k$
definition	$\Sigma_{i=1}^{K} \pi_i = 1; 0 \leq \pi_i \leq 1$

Functions

PDF

$f(x; \pi, \theta) = \sum_{i=1}^{K} \pi_i \; p_i(x; \theta_i)$ where $p_i(x; \theta_i)$the PDF of the i^{th} component with parameters θ_i

CDF

$$-$$

Multinomial

name	Multinomial (ID: 0000048)
type	discrete
variate	X, vector
support	$X_i \in \{0, \ldots, n\}, \Sigma X_i = n$

Parameter: numberOfTrials

name	number of trials
type	scalar
symbol	n
definition	$n > 0, n \in N$

Parameter: probabilityOfSuccess

name	event probabilities
type	vector
symbol	$p_1, \ldots, p_k$
definition	$p_1, \ldots, p_k, \Sigma p_i = 1$

Functions

PMF

$$\frac{n!}{x_1! \cdots x_k!} p_1^{x_1} \cdots p_k^{x_k}$$

CDF

$$-$$

MultivariateNormal1

name	Multivariate Normal 1 (ID: 0000057)
type	continuous
variate	x, vector
support	$x \in \mu + \text{span}(\Sigma) \subseteq R^k$

Parameter: mean

name	location
type	vector
symbol	μ
definition	$\mu \in R^k$

Parameter: covarianceMatrix

name	covariance matrix
type	matrix
symbol	Σ
definition	$\Sigma \in R^{k \times k}$

Functions

PDF

$$(2\pi)^{-\frac{k}{2}} |\Sigma|^{-\frac{1}{2}} \, e^{-\frac{1}{2}(x-\mu)'\Sigma^{-1}(x-\mu)}$$

CDF

no analytic expression

MultivariateNormal2

name	Multivariate Normal 2 (ID: 0000067)
type	continuous
variate	x, vector
support	$x \in \mu + \mathrm{span}(\Sigma) \subseteq R^k$

Parameter: mean

name	location
type	vector
symbol	μ
definition	$\mu \in R^k$

Parameter: precisionMatrix

name	precision matrix
type	matrix
symbol	T
definition	$-$

Functions

PDF

$$(2\pi)^{-d/2} |T|^{\frac{1}{2}} \, \exp\big(-\frac{1}{2}(x-\mu)'T(x-\mu)\big)$$

CDF

no analytic expression

MultivariateStudentT1

name	Multivariate (Student) T 1 (ID: 0000076)
type	continuous
variate	x, vector
support	$x \in R^p$

Parameter: mean

name	location
type	vector
symbol	μ
definition	$\mu = [\mu_1, \ldots, \mu_p]^T, \mu_i \in R$

Parameter: covarianceMatrix

name	covariance matrix
type	matrix
symbol	Σ
definition	Σ, positive-definite real $p \times p$ matrix

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	ν
definition	ν

Functions

PDF

$$\frac{\Gamma\left[(\nu+p)/2\right]}{\Gamma(\nu/2)\nu^{p/2}\pi^{p/2}\left|\Sigma\right|^{1/2}\left[1+\frac{1}{\nu}(x-\mu)^{\mathrm{T}}\Sigma^{-1}(x-\mu)\right]^{(\nu+p)/2}}$$

CDF

no analytic expression

MultivariateStudentT2

name	Multivariate (Student) T 2 (ID: 0000084)
type	continuous
variate	x, vector
support	$x \in R^p, k \geq 2$

Parameter: mean

name	location
type	vector
symbol	μ
definition	$\mu = [\mu_1, \ldots, \mu_p]^T, \mu_i \in R$

Parameter: precisionMatrix

name	precision matrix
type	matrix
symbol	T
definition	$-$

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	k
definition	$-$

Functions

PDF

$$\frac{\Gamma((k+d)/2)}{\Gamma(k/2)k^{d/2}\pi^{d/2}}|T|^{1/2}\left[1+\frac{1}{k}(x-\mu)'T(x-\mu)\right]^{-(k+d)/2}$$

CDF

$$-$$

Nakagami

name	Nakagami (ID: 0000094)
type	continuous
variate	x, scalar
support	$x \in (0, +\infty)$

Parameter: shape

name	shape
type	scalar
symbol	m
definition	$m > 0$

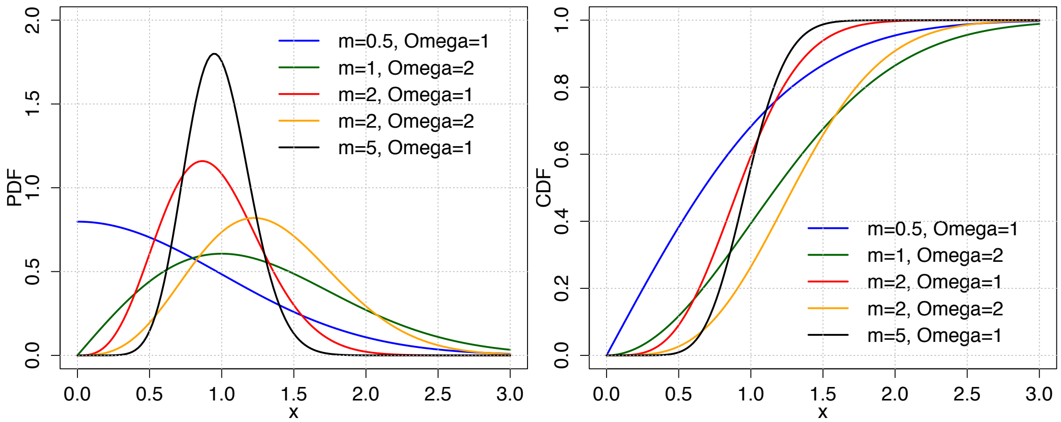

Figure 31: Nakagami distribution plotted using the provided R code.

Parameter: spread

name	spread
type	scalar
symbol	Ω
definition	$\Omega > 0$

Functions

PDF

$$\frac{2m^m}{\Gamma(m)\Omega^m} x^{2m-1} \exp(-\frac{m}{\omega} x^2)$$

PDF in R

```
2*m^m / (gamma(m)*Omega^m)*x^(2*m-1)*exp(-m/Omega*x^2)
```

CDF

$$\frac{\gamma(m, \frac{m}{\Omega} x^2)}{\Gamma(m)}$$

CDF in R

```
Igamma(m,m/Omega*x^2,lower=T)/gamma(m)
```

NegativeBinomial1

name	Negative Binomial 1 (ID: 0000103)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

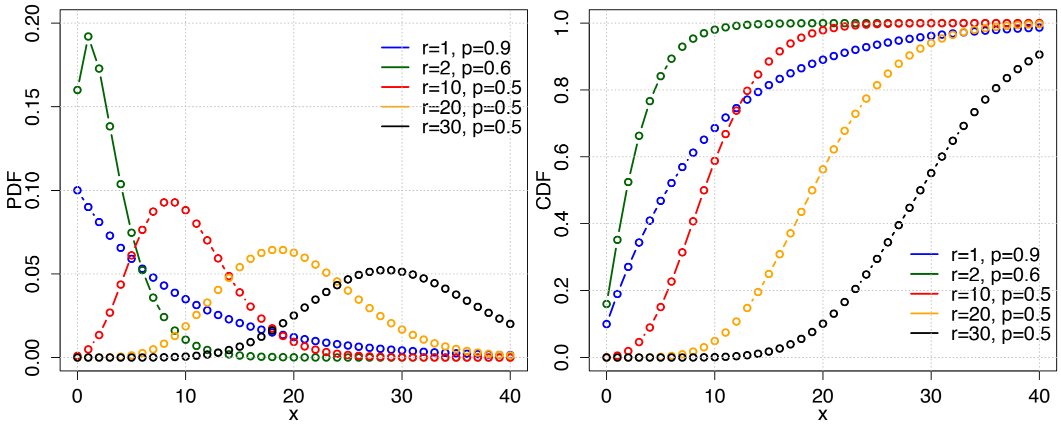

Figure 32: NegativeBinomial1 distribution plotted using the provided R code.

Parameter: numberOfFailures

name	number of failures
type	scalar
symbol	r
definition	$r > 0, r \in N$

Parameter: probability

name	success probability
type	scalar
symbol	p
definition	$p \in [0, 1]$

Functions

PMF

$$\binom{k+r-1}{k}(1-p)^r p^k$$

PMF in R

```
choose(k+r-1,k)*(1-p)^r*p^k
```

CDF

$$1 - I_p(k+1, r)$$

CDF in R

```
1 - Rbeta(p, k+1, r)
```

NegativeBinomial2

name	Negative Binomial 2 (ID: 0000113)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

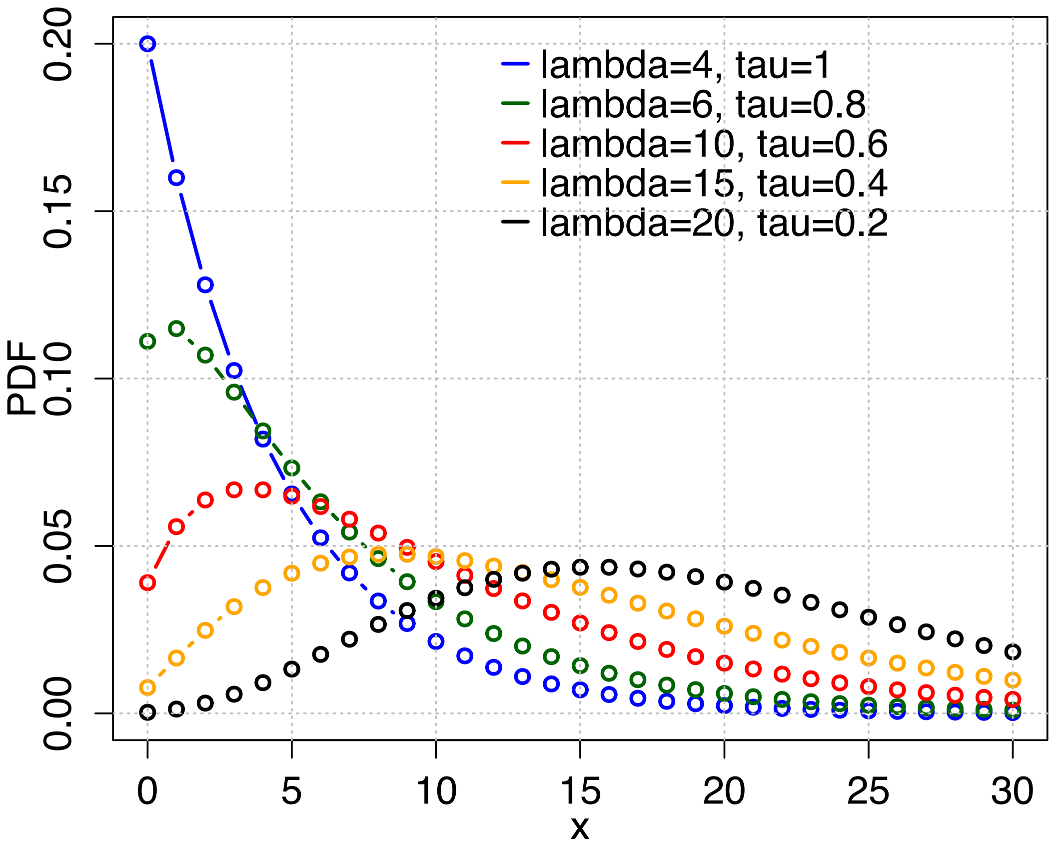

Figure 33: NegativeBinomial2 distribution plotted using the provided R code.

Parameter: rate

name	Poisson intensity
type	scalar
symbol	λ
definition	$\lambda \in R, \lambda > 0$

Parameter: overdispersion

name	overdispersion
type	scalar
symbol	τ
definition	$\tau \in R$

Functions

PMF

$$\frac{\Gamma(k+\frac{1}{\tau})}{k!\,\Gamma(\frac{1}{\tau})}\Big(\frac{1}{1+\tau\lambda}\Big)^{\frac{1}{\tau}}\Big(\frac{\lambda}{\frac{1}{\tau}+\lambda}\Big)^{k}$$

PMF in R

```
gamma(k + 1/tau)/(factorial(k) * gamma(1/tau)) * 1/(1+tau*lambda)^(1/tau) * (lambda/(1/tau -
```

CDF

$$-$$

NegativeBinomial3

name	Negative Binomial 3 (ID: 0000123)
type	discrete
variate	y, scalar
support	$y \in \{0, 1, 2, 3, \dots\}$

Parameter:

name	mean
type	scalar
symbol	μ
definition	$-$

Parameter: -

name	size parameter
type	scalar
symbol	θ
definition	$-$

Functions

PMF

$$\frac{\Gamma(\theta + y)}{\Gamma(a)\Gamma(y+1)}\Big(\frac{\theta}{\theta+\mu}\Big)^{\theta}\Big(\frac{\mu}{\theta+\mu}\Big)^{y}$$

CDF

$$-$$

Normal1

name	Normal 1 (ID: 0000132)
type	continuous
variate	x, scalar
support	$x \in R$

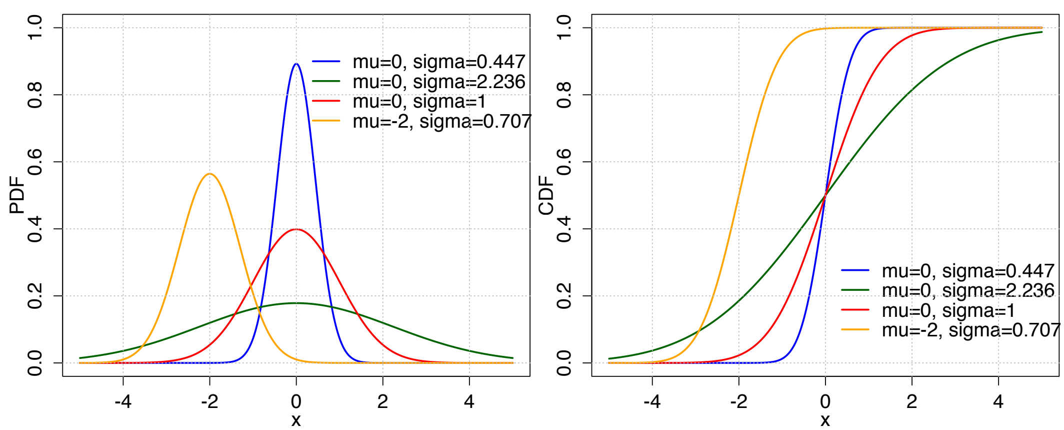

Figure 34: Normal1 distribution plotted using the provided R code.

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: stdev

name	standard deviation
type	scalar
symbol	σ
definition	$\sigma > 0$

Functions

PDF

$$\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

PDF in R

```
1/(sigma*sqrt(2*pi))*exp(-(x-mu)^2/(2*sigma^2))
```

CDF

$$\frac{1}{2}\left[1+\operatorname{erf}\left(\frac{x-\mu}{\sigma\sqrt{2}}\right)\right]$$

CDF in R

```
1/2 * (1 + erf((x-mu)/(sigma*sqrt(2))))
```

Normal2

name	Normal 2 (ID: 0000143)
type	continuous
variate	x, scalar
support	$x \in R$

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: var

name	variance
type	scalar
symbol	v
definition	$v > 0$

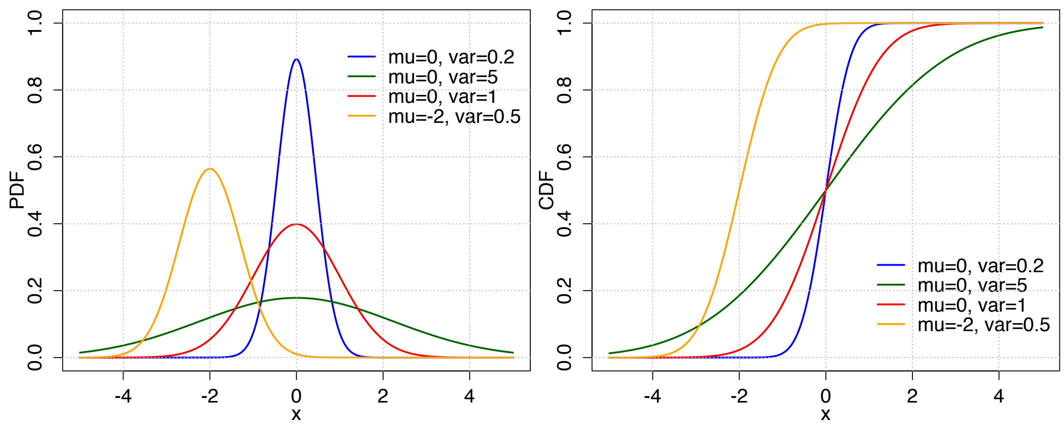

Figure 35: Normal2 distribution plotted using the provided R code.

Functions

PDF

$$\frac{1}{\sqrt{v}\sqrt{2\pi}}e^{-\frac{(x-\mu)^2}{2*v}}$$

PDF in R

```
1/(sqrt(var)*sqrt(2*pi))*exp(-(x-mu)^2/(2*var))
```

CDF

$$\frac{1}{2}\left[1+\operatorname{erf}\left(\frac{x-\mu}{\sqrt{v}\sqrt{2}}\right)\right]$$

CDF in R

```
1/2 * (1 + erf((x-mu)/(sqrt(var)*sqrt(2))))
```

Normal3

name	Normal 3 (ID: 0000155)
type	continuous
variate	x, scalar
support	$x \in R$

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu \in R$

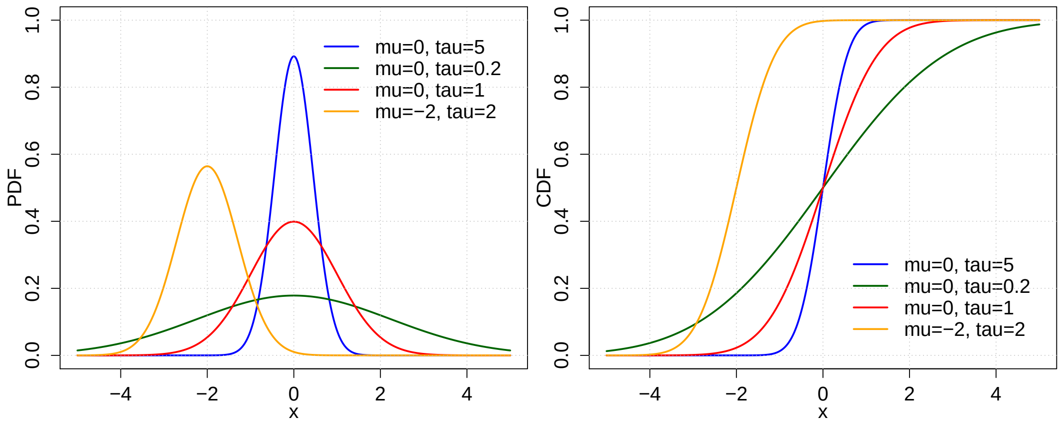

Figure 36: Normal3 distribution plotted using the provided R code.

Parameter: precision

name	precision
type	scalar
symbol	τ
definition	$\tau > 0$

Functions

PDF

$$\sqrt{\frac{\tau}{2\pi}} e^{-\frac{\tau}{2}(x-\mu)^2}$$

PDF in R

```
sqrt(tau/(2*pi))*exp(-tau/2*(x-mu)^2)
```

CDF

$$\frac{1}{2}\left[1 + \mathrm{erf}\left(\frac{x-\mu}{\sqrt{1/\tau}\sqrt{2}}\right)\right]$$

CDF in R

```
1/2*(1+erf((x-mu)/(sqrt(1/tau)*sqrt(2))))
```

NormalInverseGamma

name	Normal- inverse-gamma (ID: 0000165)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty), \sigma^2 \in (0, +\infty)$

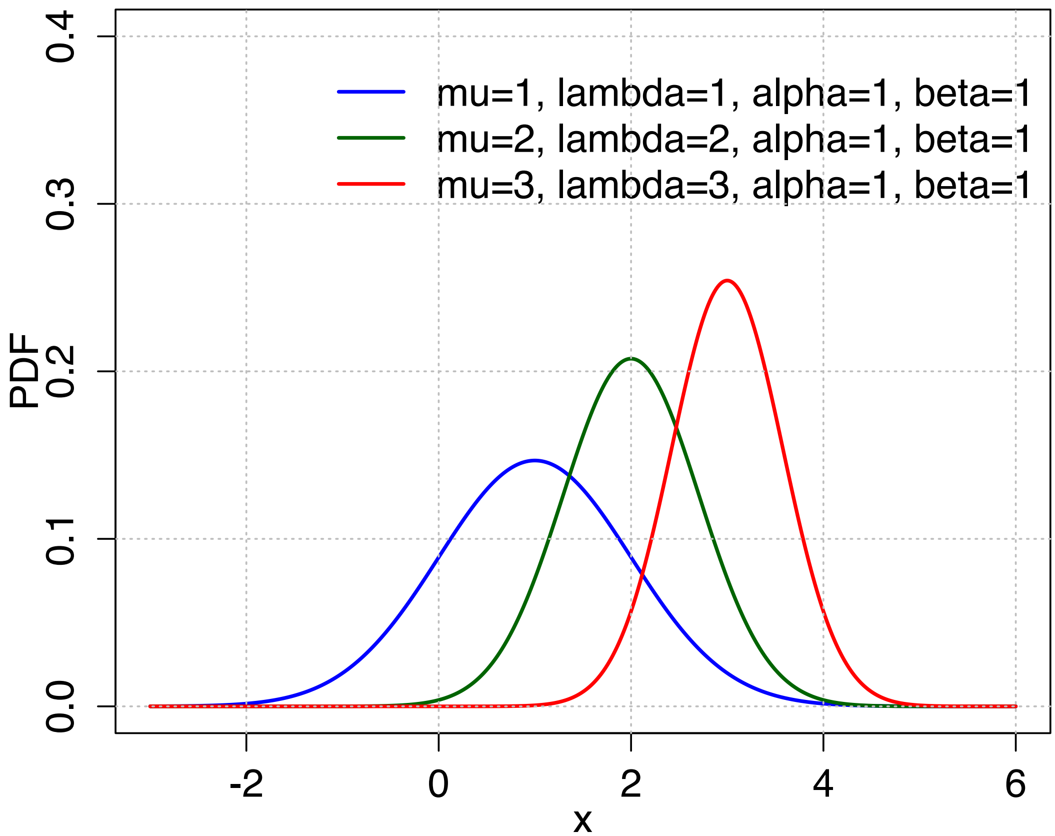

Figure 37: NormalInverseGamma distribution plotted using the provided R code.

Parameter: mean

name	location
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: lambda

name	-
type	scalar
symbol	λ
definition	$\lambda > 0, \lambda \in R$

Parameter: alpha

name	shape
type	scalar
symbol	α
definition	$\alpha > 0, \alpha \in R$

Parameter: beta

name	scale
type	scalar
symbol	β
definition	$\beta > 0, \beta \in R$

Functions

PDF

$$\frac{\sqrt{\lambda}}{\sigma\sqrt{2\pi}} \frac{\beta^{\alpha}}{\Gamma(\alpha)} \left(\frac{1}{\sigma^2}\right)^{\alpha+1} e^{-\frac{2\beta+\lambda(x-\mu)^2}{2\sigma^2}}$$

PDF in R

```
sqrt(lambda)/(sigma*sqrt(2*pi)) * beta^alpha/gamma(alpha) * (1/sigma^2)^(alpha + 1) * exp(-
```

CDF

$$-$$

Pareto

name	Pareto (ID: 0000177)
type	continuous
variate	x, scalar
support	$x \in [x_m, +\infty)$

Parameter: scale

name	scale
type	scalar
symbol	x_m
definition	$x_m > 0, x_m \in R$

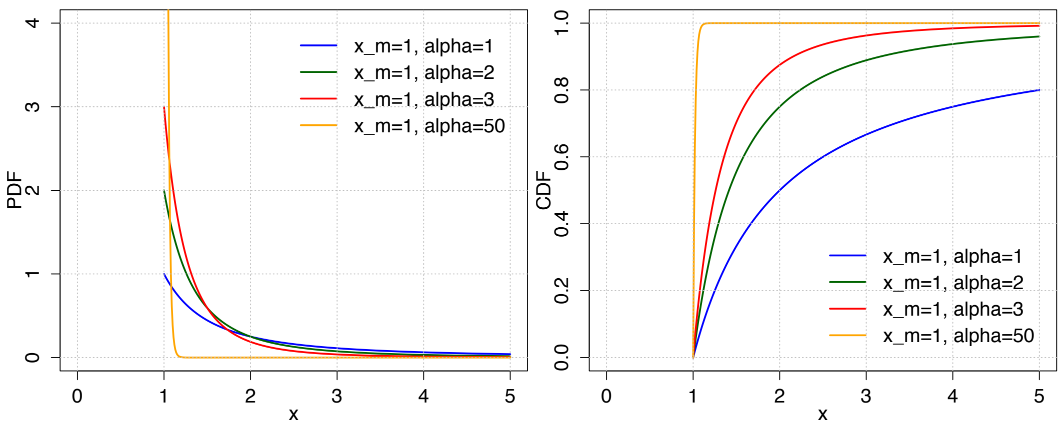

Figure 38: Pareto distribution plotted using the provided R code.

Parameter: shape

name	shape
type	scalar
symbol	α
definition	$\alpha > 0, \alpha \in R$

Functions

PDF

$$\frac{\alpha\, x_m^\alpha}{x^{\alpha+1}} \text{ for } x \geq x_m$$

CDF

$$1 - \left(\frac{x_m}{x}\right)^\alpha \text{ for } x \geq x_m$$

Poisson

name	Poisson (ID: 0000187)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

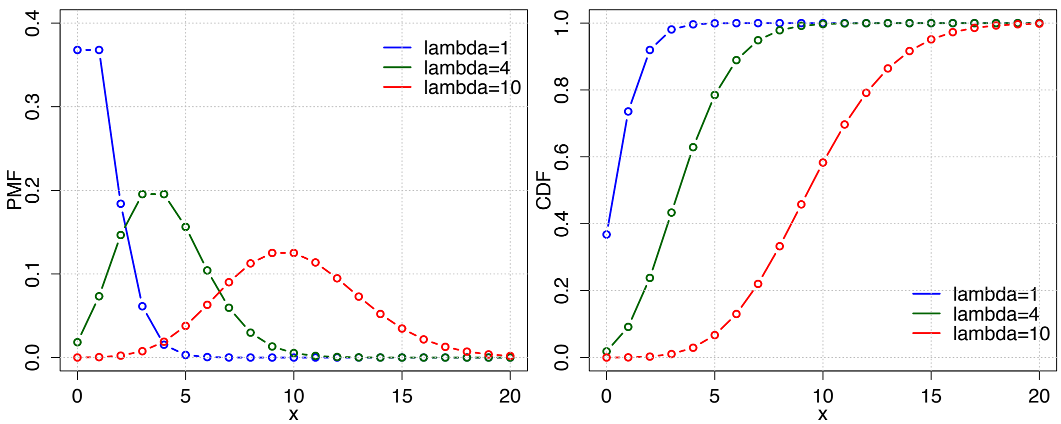

Figure 39: Poisson distribution plotted using the provided R code.

Parameter: rate

name	Poisson intensity
type	scalar
symbol	λ
definition	$\lambda \in R, \lambda > 0$

Functions

PMF

$$\frac{\lambda^k}{k!}e^{-\lambda}$$

PMF in R

```
lambda^k/factorial(k) * exp(-lambda)
```

CDF

$$\frac{\gamma(\lfloor k+1 \rfloor, \lambda)}{\lfloor k \rfloor !}$$

CDF in R

```
Igamma(floor(k+1), lambda, lower=F) / factorial(floor(k))
```

Rayleigh

name	Rayleigh (ID: 0000197)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

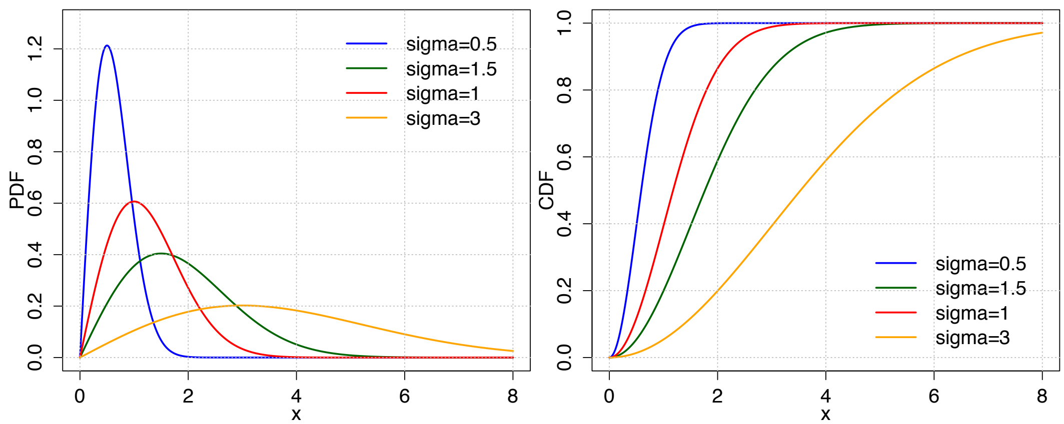

Figure 40: Rayleigh distribution plotted using the provided R code.

Parameter: scale

name	scale
type	scalar
symbol	σ
definition	$\sigma > 0$

Functions

PDF

$$\frac{x}{\sigma^2} e^{-x^2/2\sigma^2}$$

CDF

$$1 - e^{-x^2/2\sigma^2}$$

StandardNormal

name	Standard Normal (ID: 0000206)
type	continuous
variate	x, scalar
support	$x \in R$

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu = 0$

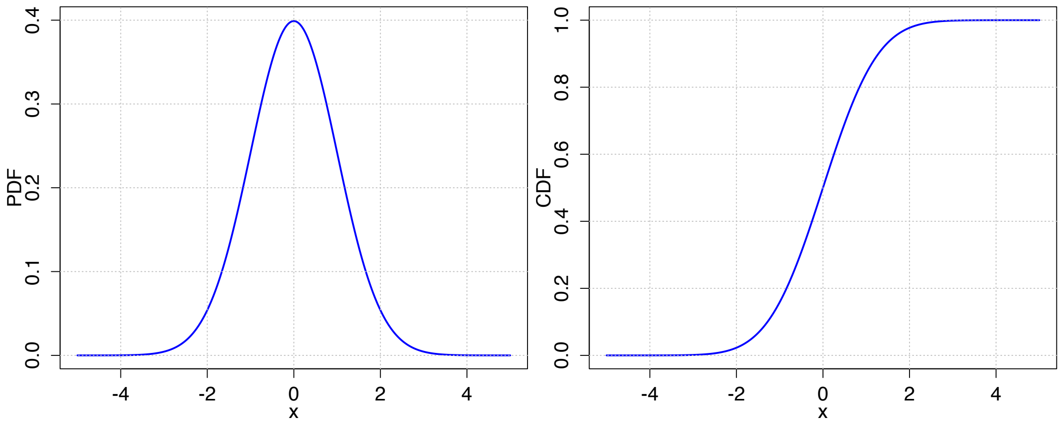

Figure 41: StandardNormal distribution plotted using the provided R code.

Parameter: stdev

name	standard deviation
type	scalar
symbol	σ
definition	$\sigma = 1$

Functions

PDF

$$\frac{e^{-\frac{1}{2}x^2}}{\sqrt{2\pi}}$$

PDF in R

```
1/(sqrt(2*pi))*exp(-x^2/2)
```

CDF

$$\frac{1}{2}\left[1 + \operatorname{erf}\left(\frac{x}{\sqrt{2}}\right)\right]$$

CDF in R

```
1/2 * (1 + erf(x/(sqrt(2))))
```

StandardUniform

name	Standard Uniform (ID: 0000225)
type	continuous
variate	x, scalar
support	$x \in [0, 1]$

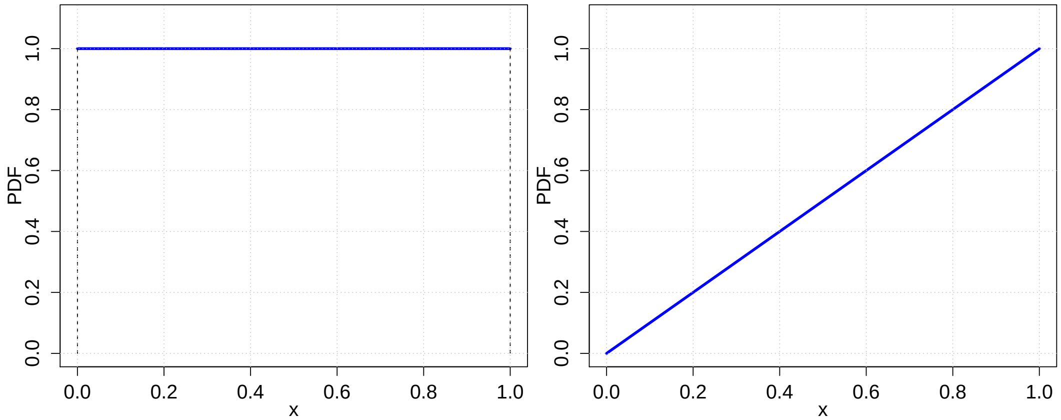

Figure 42: StandardUniform distribution plotted using the provided R code.

Parameter: minimum

name	minimum
type	scalar
symbol	a
definition	$a = 0$

Parameter: maximum

name	maximum
type	scalar
symbol	b
definition	$b = 1$

Functions

PDF

$$1$$

PDF in R

```
1
```

CDF

$$x$$

CDF in R

```
x
```

StudentT

name	Student's t-distribution (ID: 0000216)
type	continuous
variate	x, scalar
support	$x \in (-\infty, +\infty)$

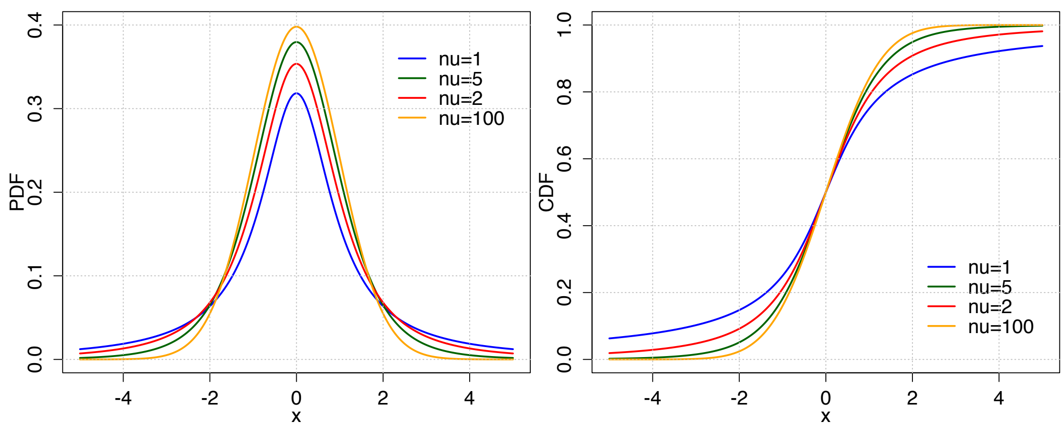

Figure 43: StudentT distribution plotted using the provided R code.

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	ν
definition	$\nu > 0, \nu \in R$

Functions

PDF

$$\frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\pi}\,\Gamma\left(\frac{\nu}{2}\right)}\left(1+\frac{x^2}{\nu}\right)^{-\frac{\nu+1}{2}}$$

PDF in R

```
gamma((nu+1)/2)/(sqrt(nu*pi)*gamma(nu/2))*(1+x^2/nu)^(-(nu+1)/2)
```

CDF

$$\frac{1}{2}+x\Gamma\left(\frac{\nu+1}{2}\right)\times\frac{{}_2F_1\left(\frac{1}{2},\frac{\nu+1}{2};\frac{3}{2};-\frac{x^2}{\nu}\right)}{\sqrt{\pi\nu}\,\Gamma\left(\frac{\nu}{2}\right)}$$

CDF in R

```
1/2+x*gamma((nu+1)/2)*hypergeo(1/2,(nu+1)/2,3/2,-x^2/nu)/( sqrt(pi*nu) *gamma(nu/2))
```

Triangular

name	Triangular (ID: 0000235)
type	continuous
variate	x, scalar
support	$a \leq x \leq b$

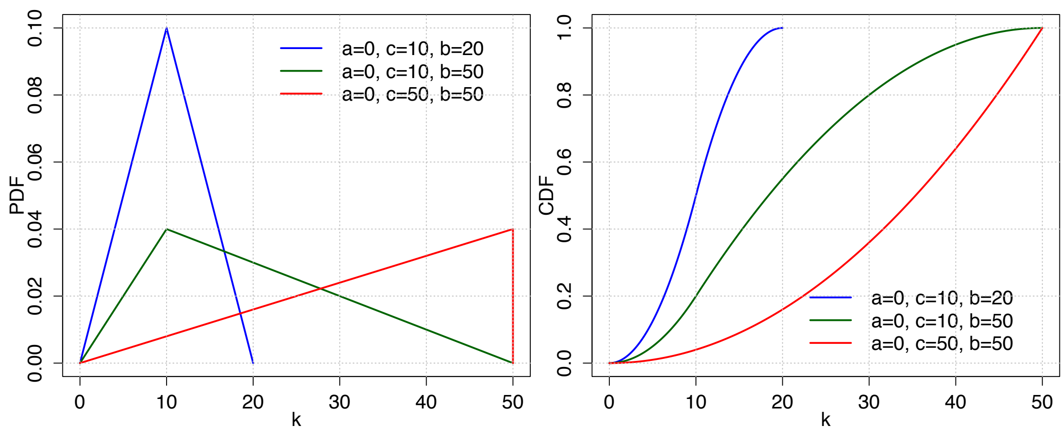

Figure 44: Triangular distribution plotted using the provided R code.

Parameter: lowerLimit

name	lower limit
type	scalar
symbol	a
definition	$a \in R$

Parameter: upperLimit

name	upper limit
type	scalar
symbol	b
definition	$b \in R, a < b$

Parameter: shape

name	shape (mode)
type	scalar
symbol	c
definition	$c \in R$

Functions

PDF

$$\begin{cases} 2(x-a)/[(b-a)(c-a)] & \text{for } a \le x \le c \\ 2(b-x)/[(b-a)(b-c)] & \text{for } c \le x \le b \end{cases}$$

PDF in R

```
2*(x-a) / ((b-a)*(c-a)) for a <= x <= c \\
2*(b-x) / ((b-a)*(b-c)) for c <= x <= b
```

CDF

$$\begin{cases} (x-a)^2/[(b-a)(c-a)] & \text{for } a \le x \le c \\ 1-(b-x)^2/[(b-a)(b-c)] & \text{for } c \le x \le b \end{cases}$$

CDF in R

```
(x-a)^2 / ((b-a)*(c-a)) for a <= x <= c \\
1 - (b-x)^2 / ((b-a)*(b-c)) for c <= x <= b
```

TruncatedNormal

name	Truncated Normal (ID: 0000246)
type	continuous
variate	x, scalar
support	$x \in [a, b]$

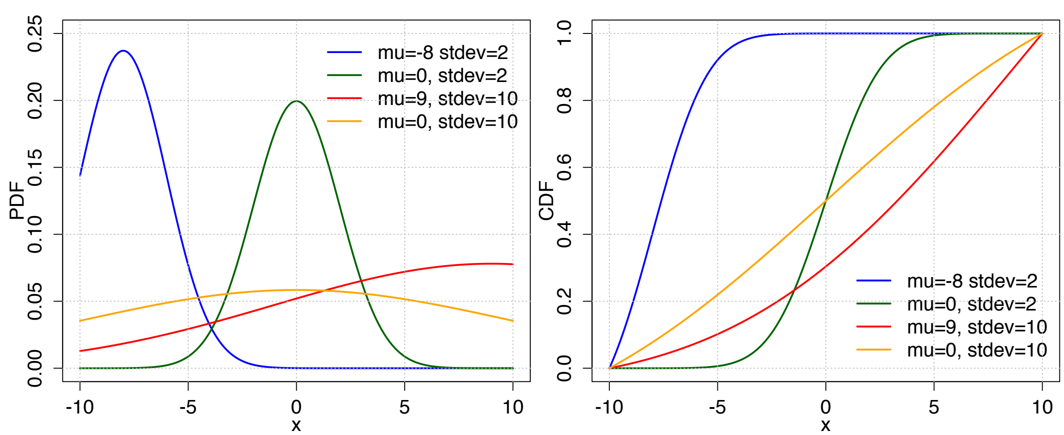

Figure 45: TruncatedNormal distribution plotted using the provided R code.

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu \in R$

Parameter: stdev

name	standard deviation
type	scalar
symbol	σ
definition	$\sigma > 0$

Parameter: lowerBound

name	lower bound
type	scalar
symbol	a
definition	$a \in R$

Parameter: upperBound

name	upper bound
type	scalar
symbol	b
definition	$b \in R, b > a$

Functions

PDF

$$\frac{\frac{1}{\sigma}\phi(\frac{x-\mu}{\sigma})}{\Phi(\frac{b-\mu}{\sigma}) - \Phi(\frac{a-\mu}{\sigma})}$$

PDF in R

```
( 1/sigma * phi((x-mu)/sigma) ) / ( Phi((b-mu)/sigma)-Phi((a-mu)/sigma) )
```

CDF

$$\frac{\Phi(\frac{x-\mu}{\sigma}) - \Phi(\frac{a-\mu}{\sigma})}{\Phi(\frac{b-\mu}{\sigma}) - \Phi(\frac{a-\mu}{\sigma})}$$

CDF in R

```
( Phi((x-mu)/sigma)-Phi((a-mu)/sigma) ) / ( Phi((b-mu)/sigma)-Phi((a-mu)/sigma) )
```

Uniform

name	Uniform (ID: 0000258)
type	continuous
variate	x, scalar
support	$x \in [a, b]$

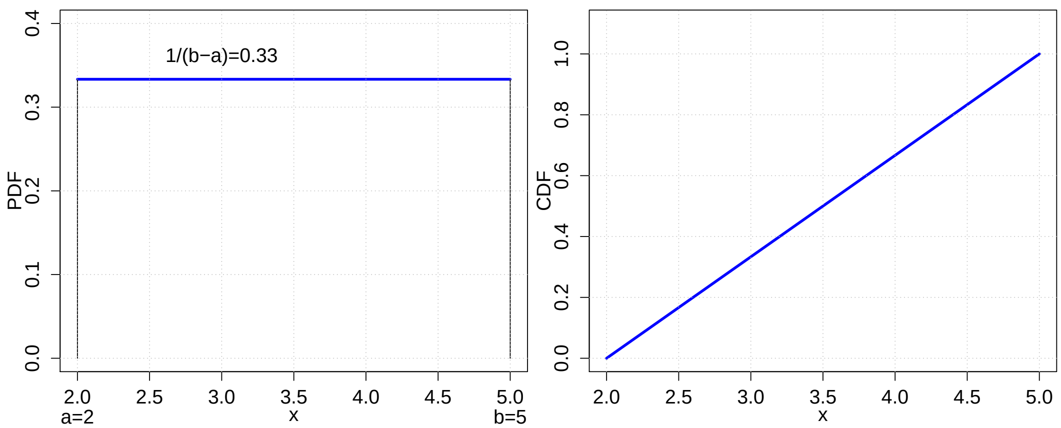

Figure 46: Uniform distribution plotted using the provided R code.

Parameter: minimum

name	minimum
type	scalar
symbol	a
definition	$a \in R$

Parameter: maximum

name	maximum
type	scalar
symbol	b
definition	$b \in R, a < b$

Functions

PDF

$$\begin{cases} \frac{1}{b-a} & \text{for } x \in [a, b] \\ 0 & \text{otherwise} \end{cases}$$

PDF in R

```
1/(b-a)
```

CDF

$$\begin{cases} 0 & \text{for } x < a \\ \frac{x-a}{b-a} & \text{for } x \in [a, b) \\ 1 & \text{for } x \geq b \end{cases}$$

CDF in R

```
(x-a)/(b-a)
```

UniformDiscrete1

name	Uniform Discrete 1 (ID: 0000268)
type	discrete
variate	x, scalar
support	$a, b \in \{\dots, -2, -1, 0, 1, 2, 3, \dots\}$

Parameter: minimum

name	minimum
type	scalar
symbol	a
definition	$a \in \{\dots, -2, -1, 0, 1, 2, 3, \dots\}$

Parameter: maximum

name	maximum
type	scalar
symbol	b
definition	$b \in \{\dots, -2, -1, 0, 1, 2, 3, \dots\}, b \geq a$

Parameter: numberOfValues

name	number of values
type	scalar
symbol	n
definition	$n = b - a + 1$

Functions

PMF

$$1/n$$

CDF

$$\frac{\lfloor k \rfloor - a + 1}{n}$$

UniformDiscrete2

name	Uniform Discrete 2 (ID: 0000279)
type	discrete
variate	x, scalar
support	$x \in \{0, 1, 2, \ldots, n\}$

Parameter: minimum

name	minimum
type	scalar
symbol	a
definition	$a = 0$

Parameter: numberOfValues

name	number of values
type	scalar
symbol	n
definition	$n \in N$

Functions

PMF

$$1/(n+1)$$

CDF

$$\frac{x+1}{n+1}$$

Weibull1

name	Weibull 1 (ID: 0000289)
type	continuous
variate	x, scalar
support	$x \in [0, +\infty)$

Parameter: scale

name	scale
type	scalar
symbol	λ
definition	$\lambda \in (0, +\infty)$

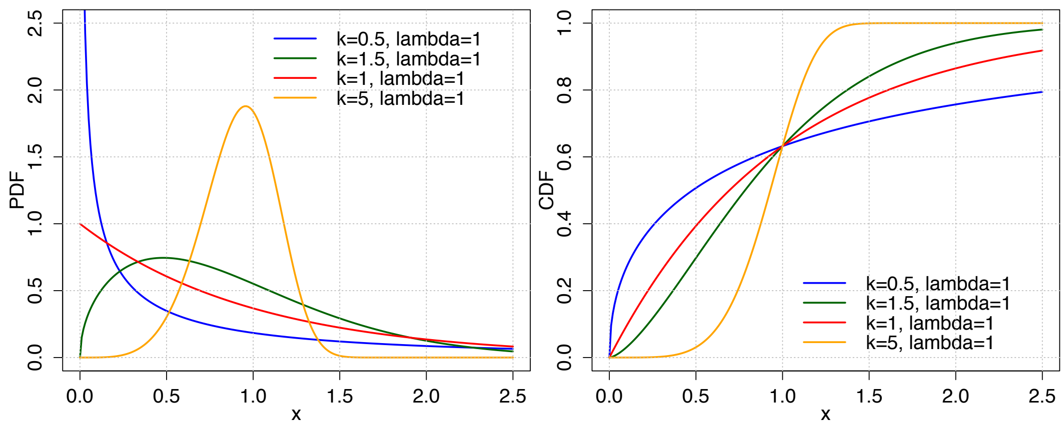

Figure 47: Weibull1 distribution plotted using the provided R code.

Parameter: shape

name	shape
type	scalar
symbol	k
definition	$k \in (0, +\infty)$

Functions

PDF

$$\begin{cases} \frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

PDF in R

```
k/lambda * (x/lambda)^(k-1) * exp(-(x/lambda)^k)
```

CDF

$$\begin{cases} 1 - e^{-(x/\lambda)^k} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

CDF in R

```
1- exp(-(x/lambda)^k)
```

Weibull2

name	Weibull 2 (ID: 0000299)
type	continuous
variate	x, scalar
support	$x > 0$

Parameter: lambda

name	lambda
type	scalar
symbol	λ
definition	$-$

Parameter: shape

name	shape
type	scalar
symbol	v
definition	$-$

Functions

PDF

$$v\lambda\, x^{v-1} e^{-\lambda x^{v}}$$

CDF

$$-$$

Wishart1

name	Wishart 1 (ID: 0000309)
type	continuous
variate	X, matrix
support	$X(p \times p) -$ positive definite matrix

Parameter: scaleMatrix

name	scale matrix
type	matrix
symbol	V
definition	$V > 0, p \times p -$ positive definite matrix

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	n
definition	$n > p - 1$

Functions

PDF

$$\frac{|X|^{\frac{n-p-1}{2}} e^{-\frac{\mathrm{tr}(V^{-1}X)}{2}}}{2^{\frac{np}{2}} |V|^{\frac{n}{2}} \Gamma_p(\frac{n}{2})}$$

CDF

$$-$$

Wishart2

name	Wishart 2 (ID: 0000319)
type	continuous
variate	X, matrix
support	$X(p \times p) -$ symmetric, positive definite matrix

Parameter: inverseScaleMatrix

name	inverse scale matrix
type	matrix
symbol	R
definition	$p \times p - symmetric, positive definite matrix$

Parameter: degreesOfFreedom

name	degrees of freedom
type	scalar
symbol	k
definition	$-$

Functions

PDF

$$|R|^{k/2}|x|^{(k-p-1)/2}e^{-\frac{1}{2}\,tr(Rx)}$$

CDF

$$-$$

ZeroInflatedNegativeBinomial

name	Zero-Inflated Negative Binomial (ID: 0000006)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

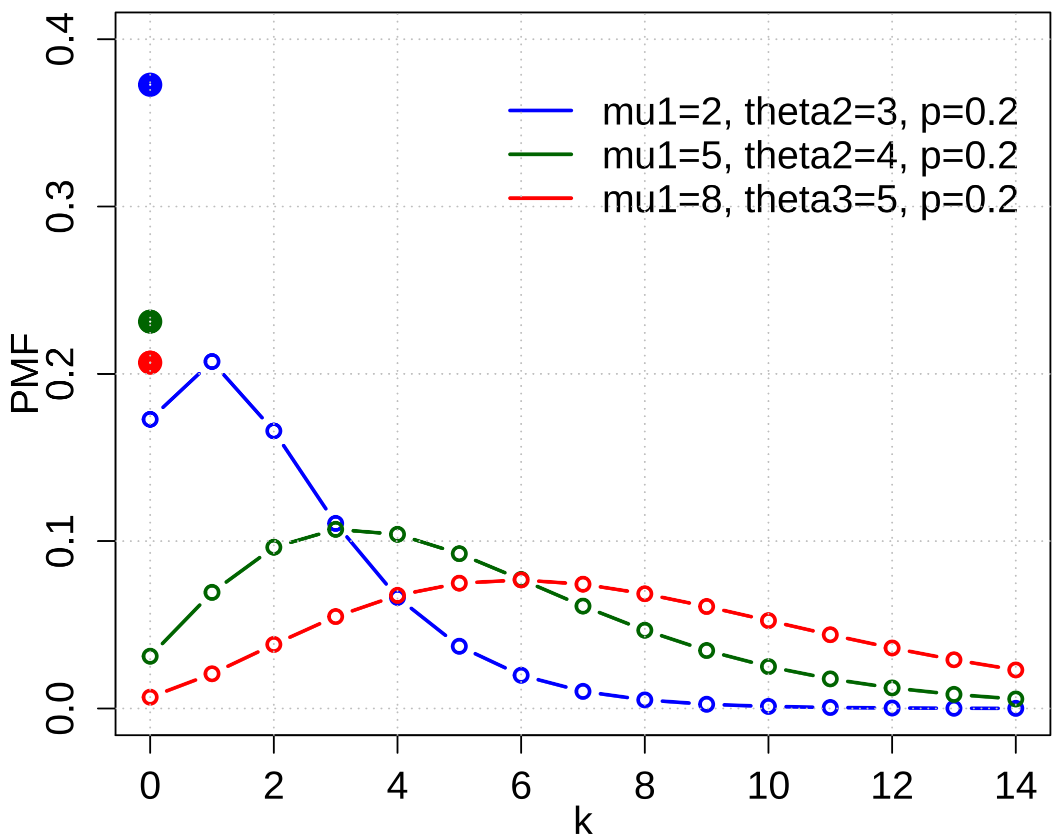

Figure 48: ZeroInflatedNegativeBinomial distribution plotted using the provided R code.

Parameter: mean

name	mean
type	scalar
symbol	μ
definition	$\mu > 0$

Parameter: sizeParameter

name	size parameter
type	scalar
symbol	θ
definition	$-$

Parameter: probabilityOfZero

name	probability of zero
type	scalar
symbol	p
definition	$0 < p < 1, p \in R$

Functions

PMF

$$\begin{cases} p + (1-p)\left(\frac{\theta}{\theta+\mu}\right)^{\theta} & \text{for } y = 0 \\ (1-p)\frac{\Gamma(\theta+y)}{\Gamma(a)\Gamma(y+1)}\left(\frac{\theta}{\theta+\mu}\right)^{\theta}\left(\frac{\mu}{\theta+\mu}\right)^{y} & \text{for } y > 0 \end{cases}$$

PMF in R

```
p + (1-p) * (theta/(theta + mu))^theta * (mu/(theta+mu))^y  for y=0
(1-p)*gamma(theta+y)/gamma(a)/gamma(y+1)*(theta/(theta+mu))^theta*(mu/(theta+mu))^y for y>0
```

CDF

$$-$$

ZeroInflatedPoisson

name	Zero-inflated Poisson (ID: 0000019)
type	discrete
variate	k, scalar
support	$k \in \{0, 1, 2, 3, \dots\}$

Parameter: rate

name	Poisson intensity
type	scalar
symbol	λ
definition	$\lambda \in R, \lambda > 0$

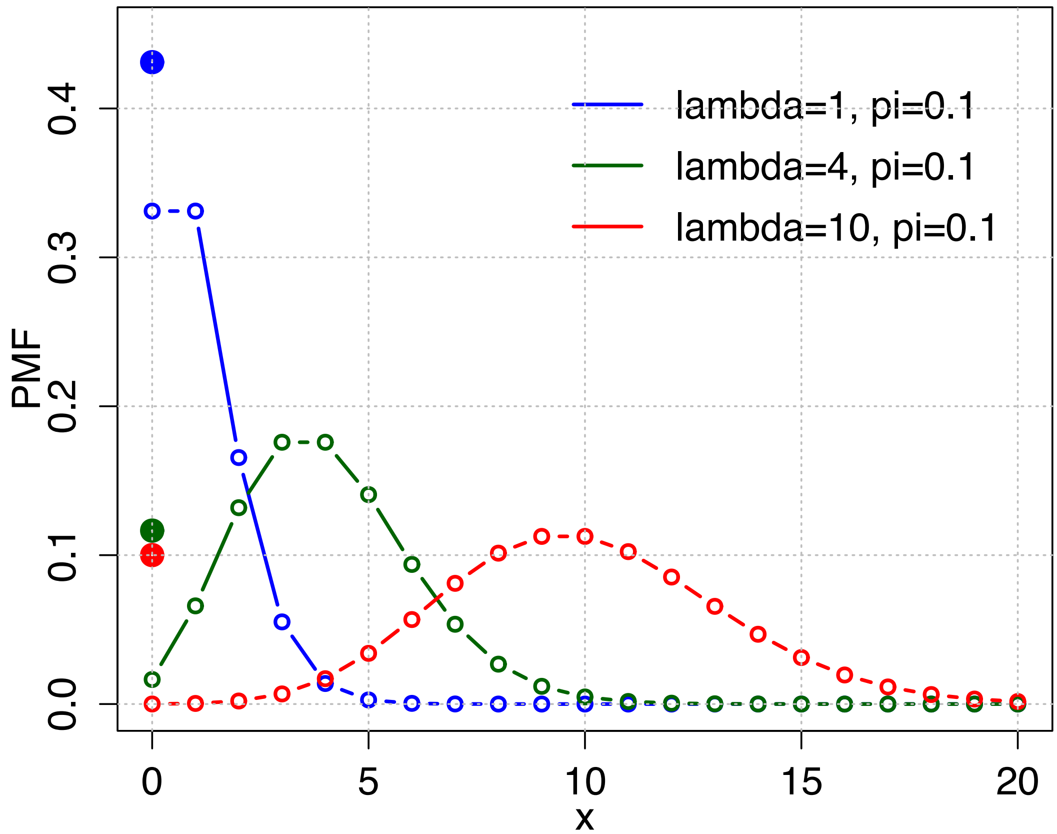

Figure 49: ZeroInflatedPoisson distribution plotted using the provided R code.

Parameter: probabilityOfZero

name	probability of extra zeros
type	scalar
symbol	π
definition	$0 < \pi < 1, \pi \in R$

Functions

PMF

$$\begin{cases} \pi + (1-\pi)e^{-\lambda} & \text{for } k = 0 \\ (1-\pi)e^{-\lambda}\frac{\lambda^k}{k!} & \text{for } k > 0 \end{cases}$$

PMF in R

```
pi + (1-pi)*exp(-lambda) if k=0\\
```

```
(1-pi)*exp(-lambda) * lambda^k/factorial(k)  if k>0
```

CDF

—