R documentation

of ‘GenGamma.Rd’

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GenGamma *Generalized gamma distribution*

Description

Density, distribution function, hazards, quantile function and random generation for the generalized gamma distribution, using the parameterisation originating from Prentice (1974). Also known as the (generalized) log-gamma distribution.

Usage

```
dgengamma(x, mu=0, sigma=1, Q, log = FALSE)
pgengamma(q, mu=0, sigma=1, Q, lower.tail = TRUE, log.p = FALSE)
qgengamma(p, mu=0, sigma=1, Q, lower.tail = TRUE, log.p = FALSE)
rgengamma(n, mu=0, sigma=1, Q)
Hgengamma(x, mu=0, sigma=1, Q)
hgengamma(x, mu=0, sigma=1, Q)
```

Arguments

`x,q`	vector of quantiles.
`p`	vector of probabilities.
`n`	number of observations. If `length(n) > 1`, the length is taken to be the number required.
`mu`	Vector of “location” parameters.
`sigma`	Vector of “scale” parameters. Note the inconsistent meanings of the term “scale” - this parameter is analogous to the (log-scale) standard deviation of the log-normal distribution, “sdlog” in `dlnorm`, rather than the “scale” parameter of the gamma distribution `dgamma`. Constrained to be positive.
`Q`	Vector of shape parameters.
`log, log.p`	logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	logical; if TRUE (default), probabilities are $P(X \le x)$, otherwise, $P(X > x)$.

Details

If $\gamma \sim Gamma(Q^{-2}, 1)$, and $w = log(Q^2\gamma)/Q$, then $x = \exp(\mu + \sigma w)$ follows the generalized gamma distribution with probability density function

$$f(x|\mu, \sigma, Q) = \frac{|Q|(Q^{-2})^{Q^{-2}}}{\sigma x \Gamma(Q^{-2})} \exp(Q^{-2}(Qw - \exp(Qw)))$$

This parameterisation is preferred to the original parameterisation of the generalized gamma by Stacy (1962) since it is more numerically stable near to $Q = 0$ (the log-normal distribution), and allows $Q <= 0$. The original is available in this package as `dgengamma.orig`, for the sake of completion and compatibility with other software - this is implicitly restricted to `Q`>0 (or `k`>0 in the original notation). The parameters of `dgengamma` and `dgengamma.orig` are related as follows.

`dgengamma.orig(x, shape=shape, scale=scale, k=k) =`

`dgengamma(x, mu=log(scale) + log(k)/shape, sigma=1/(shape*sqrt(k)), Q=1/sqrt(k))`

The generalized gamma distribution simplifies to the gamma, log-normal and Weibull distributions with the following parameterisations:

```
dgengamma(x, mu, sigma, Q=0)       =   dlnorm(x, mu, sigma)
 dgengamma(x, mu, sigma, Q=1)      =   dweibull(x, shape=1/sigma, scale=exp(mu))
 dgengamma(x, mu, sigma, Q=sigma)  =   dgamma(x, shape=1/sigma^2, rate=exp(-mu) / sigma^2)
```

The properties of the generalized gamma and its applications to survival analysis are discussed in detail by Cox (2007).

The generalized F distribution `GenF` extends the generalized gamma to four parameters.

Value

`dgengamma` gives the density, `pgengamma` gives the distribution function, `qgengamma` gives the quantile function, `rgengamma` generates random deviates, `Hgengamma` retuns the cumulative hazard and `hgengamma` the hazard.

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References

Prentice, R. L. (1974). A log gamma model and its maximum likelihood estimation. Biometrika 61(3):539-544.

Farewell, V. T. and Prentice, R. L. (1977). A study of distributional shape in life testing. Technometrics 19(1):69-75.

Lawless, J. F. (1980). Inference in the generalized gamma and log gamma distributions. Technometrics 22(3):409-419.

Cox, C., Chu, H., Schneider, M. F. and Muñoz, A. (2007). Parametric survival analysis and taxonomy of hazard functions for the generalized gamma distribution. Statistics in Medicine 26:4252-4374

Stacy, E. W. (1962). A generalization of the gamma distribution. Annals of Mathematical Statistics 33:1187-92

See Also

`GenGamma.orig`, `GenF`, `Lognormal`, `GammaDist`, `Weibull`.

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