Package ‘dng’

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Description Provides density, distribution function, quantile function and random
generation for the split normal and split-t distributions, and computes their
mean, variance, skewness and kurtosis for the two distributions (Li, F,
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Description

Density distribution function, quantile function and random generation function for the split normal distribution.

Usage

dsplitn(x, mu, sigma, lmd, logarithm)
psplitn(q, mu, sigma, lmd)
qsplitn(p, mu, sigma, lmd)
rsplitn(n, mu, sigma, lmd)

Arguments

x vector of quantiles.
mu vector of location parameter. (The mode of the density)
sigma vector of standard deviations.
lmd vector of skewness parameters (>0). If is 1, reduced to symmetric normal distribution.
logarithm logical; if TRUE, probabilities p are given as log(p).
q vector of quantiles.
p vector of probability.
n number of observations. If length(n) > 1, the length is taken to be the number required.

Details

The random variable y follows a split-normal distribution, y~N(μ, σ, λ), which has density:

\[
1/(1 + \lambda)\sigma' \sqrt{(2/\pi)}exp(-(y - \mu)^2/2\sigma^2)\text{, if } y \leq \mu
\]

\[
1/(1 + \lambda)\sigma' \sqrt{(2/\pi)}exp(-(y - \mu)^2/2\sigma^2\lambda^2)\text{, if } y > \mu
\]

where σ > 0 and λ > 0. The Split-normal distribution reduce to normal distribution when λ = 1.
**Value**

dsplitn gives the density; psplitn gives the percentile; qsplitn gives the quantile; and rsplitn gives the random variables. Invalid arguments will result in return value NaN, with a warning.

The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

**Functions**

- psplitn: Percentile for the split-normal distribution.
- qsplitn: Quantile for the split-normal distribution.
- rsplitn: Random variables from the split-normal distribution.

**Author(s)**

Feng Li, Jiayue Zeng

**References**


**See Also**

`splitn_mean()`, `splitn_var()`, `splitn_skewness()` and `splitn_kurtosis()` for numerical characteristics of the split-normal distribution.

**Examples**

```r
n <- 3
mu <- c(0,1,2)
sigma <- c(1,2,3)
lmd <- c(1,2,3)

q0 <- rsplitn(n, mu, sigma, lmd)
d0 <- dsplitn(q0, mu, sigma, lmd, logarithm = FALSE)
p0 <- psplitn(q0, mu, sigma, lmd)
q1 <- qsplitn(p0, mu, sigma, lmd)
all.equal(q0, q1)
```
Moments of the split normal distribution

Description

Computing the mean, variance, skewness and kurtosis for the split-normal distribution.

Usage

\begin{align*}
\text{splitn_kurtosis}(lmd) \\
\text{splitn_mean}(\mu, \sigma, lmd) \\
\text{splitn_skewness}(\sigma, lmd) \\
\text{splitn_var}(\sigma, lmd)
\end{align*}

Arguments

\begin{itemize}
  \item \text{lmd} \quad \text{vector of skewness parameters (>0). If is 1, reduce to normal distribution.}
  \item \text{mu} \quad \text{vector of location parameter. (The mode of the density)}
  \item \text{sigma} \quad \text{vector of standard deviations.}
\end{itemize}

Value

\text{splitn_mean} \text{ gives the mean. splitn_var} \text{ gives the variance. splitn_skewness} \text{ gives the skewness. splitn_kurtosis} \text{ gives the kurtosis. (splitn_mean, splitn_var,splitn_skewness and splitn_kurtosis} \text{ are all vectors.}

Functions

\begin{itemize}
  \item \text{splitn_kurtosis}: Kurtosis for the split-normal distribution.
  \item \text{splitn_skewness}: Skewness for the split-normal distribution.
  \item \text{splitn_var}: Variance for the split-normal distribution.
\end{itemize}

Author(s)

Feng Li, Jiayue Zeng

References


See Also

\text{psplitn(), dsplitn(), qsplitn() and rsplitn()} \text{ for the split-normal distribution.}
**Examples**

```r
mu <- c(0L,1L,2L)
sigma <- c(0.5L,1L,2L)
lmd <- c(1L,2L,3L)

mean0 <- splitn_mean(mu, sigma, lmd)
var0 <- splitn_var(sigma, lmd)
skewness0 <- splitn_skewness(sigma, lmd)
kurtosis0 <- splitn_kurtosis(lmd)
```

**Description**

Density, distribution function, quantile function and random generation for the normal distribution for the split student-t distribution.

**Usage**

```r
dsplitt(x, mu, df, phi, lmd, logarithm)
psplitt(q, mu, df, phi, lmd)
qsplitt(p, mu, df, phi, lmd)
rsplitt(n, mu, df, phi, lmd)
```

**Arguments**

- `x`: vector of quantiles.
- `mu`: vector of location parameter. (The mode of the density)
- `df`: degrees of freedom (> 0, can be non-integer). df = Inf is also allowed.
- `phi`: vector of scale parameters (>0).
- `lmd`: vector of skewness parameters (>0). If is 1, reduced to the symmetric student t distribution.
- `logarithm`: logical; if TRUE, probabilities p are given as log(p).
- `q`: vector of quantiles.
- `p`: vector of probability.
- `n`: number of observations. If length(n) > 1, the length is taken to be the number required.
Details

The random variable $y$ follows a split-t distribution with $\nu>0$ degrees of freedom, $y \sim t(\mu, \phi, \lambda, \nu)$, if its density function is of the form

$$CK(\mu, \phi, \nu)I(y \leq \mu) + CK(\mu, \lambda \phi, \nu)I(y > \mu),$$

where,

$$K(\mu, \phi, \nu) = \left[\nu/\left(\nu + (y - \mu)^2/\phi^2\right)\right]^{(\nu+1)/2}$$

is the kernel of a student $t$ density with variance $\phi^2\nu/\left(\nu - 2\right)$ and

$$c = 2\left(1 + \lambda\phi(\sqrt{\nu})\text{Beta}(\nu/2, 1/2)\right)^{-1}$$

is the normalization constant.

Value

dsplitt gives the density; psplitt gives the percentile; qsplitt gives the quantile; and rsplitt gives the random variables. Invalid arguments will result in return value NaN, with a warning.

The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Functions

- psplitt: Percentile for the split-t distribution.
- qsplitt: Quantile for the split-t distribution.
- rsplitt: Random variables from the split-t distribution.

Author(s)

Feng Li, Jiayue Zeng

References


See Also

splitt_mean(), splitt_var(), splitt_skewness() and splitt_kurtosis() for numerical characteristics of the Split-t distribution.
splitt_kurtosis

Examples

n <- 3
mu <- c(0,1,2)
df <- rep(10,3)
phi <- c(0.5,1,2)
lmd <- c(1,2,3)

q0 <- rsplitt(n, mu, df, phi, lmd)
d0 <- dsplitt(q0, mu, df, phi, lmd, logarithm = FALSE)
p0 <- psplitt(q0, mu, df, phi, lmd)
q1 <- qsplitt(p0, mu, df, phi, lmd)
all.equal(q0, q1)

splitt_kurtosis  Moments of the split-t distribution

Description

Computing the mean, variance, skewness and kurtosis for the split student-t distribution.

Usage

splitt_kurtosis(df, phi, lmd)
splitt_mean(mu, df, phi, lmd)
splitt_skewness(df, phi, lmd)
splitt_var(df, phi, lmd)

Arguments

df  degrees of freedom (> 0, can be non-integer). df = Inf is allowed.
phi  vector of scale parameters (> 0).
lmd  vector of skewness parameters (> 0). If is 1, reduced to symmetric student t distribution.
mu  vector of location parameter. (The mode of the density)

Value

splitt_mean gives the mean. splitt_var gives the variance. splitt_skewness gives the skewness. splitt_kurtosis gives the kurtosis. (splitt_mean, splitt_var, splitt_skewness and splitt_kurtosis are all vectors.)

Invalid arguments will result in return value NaN, with a warning.
Functions

- `splitt_kurtosis`: Kurtosis for the split-t distribution.
- `splitt_skewness`: Skewness for the split-t distribution.
- `splitt_var`: Variance for the split-t distribution.

Author(s)

Feng Li, Jiayue Zeng

References


See Also

`dsplitt()`, `psplitt()`, `qsplitt()` and `rsplitt()` for the split-t distribution.

Examples

```r
mu <- c(0,1,2)
df <- rep(10,3)
phi <- c(0.5,1,2)
lmd <- c(1,2,3)

mean0 <- splitt_mean(mu, df, phi, lmd)
var0 <- splitt_var(df, phi, lmd)
skewness0 <- splitt_skewness(df, phi, lmd)
kurtosis0 <- splitt_kurtosis(df, phi, lmd)
```
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