Package 'triangulr'

September 28, 2020

Title High-Performance Triangular Distribution Functions

Version 1.0.0

Description A collection of high-performance functions for the triangular distribution that consists of the probability density function, cumulative distribution function, quantile function, random variate generator, moment generating function, characteristic function, and expected shortfall function. References: Samuel Kotz, Johan Ren Van Dorp (2004) <doi:10.1142/5720> and Acerbi, Carlo & Tasche, Dirk. (2002) <doi:10.1111/1468-0300.00091>.

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URL https://github.com/irkaal/triangulr/
https://irkaal.github.io/triangulr/

BugReports https://github.com/irkaal/triangulr/issues

Depends R (>= 3.1)

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LinkingTo Rcpp

Imports Rcpp (>= 1.0.5), rlang (>= 0.4.7), vctrs (>= 0.3.4)

Suggests testthat (>= 2.3.2)

NeedsCompilation yes

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R topics documented:

`Triangular` *The Triangular Distribution*

Description

These functions provide information about the triangular distribution on the interval from `min` to `max` with mode equal to `mode`. `ctri` gives the characteristic function, `dtri` gives the density function, `estri` gives the expected shortfall, `mgtri` gives the moment generating function, `ptri` gives the distribution function, `qtri` gives the quantile function, and `rtri` gives the random variate generator.

Usage

```
ctri(t, min = 0, max = 1, mode = 0.5)

dtri(x, min = 0, max = 1, mode = 0.5, log = FALSE)

estri(p, min = 0, max = 1, mode = 0.5, lower_tail = TRUE, log_p = FALSE)

mgtri(t, min = 0, max = 1, mode = 0.5)

ptri(q, min = 0, max = 1, mode = 0.5, lower_tail = TRUE, log_p = FALSE)

qtri(p, min = 0, max = 1, mode = 0.5, lower_tail = TRUE, log_p = FALSE)

rtri(n, min = 0, max = 1, mode = 0.5)
```

Arguments

`t`	Vector of dummy variables.
`min`	Lower limit of the distribution. Must have `min` $<$ `max`.
`max`	Upper limit of the distribution. Must have `max` $>$ `min`.
`mode`	The mode of the distribution. Must have `mode` $\geq$ `min` and `mode` $\leq$ `max`.
`x, q`	Vector of quantiles.
`log, log_p`	Logical; if `TRUE`, probabilities `p` are given as `log(p)`.
`p`	Vector of probabilities.
`lower_tail`	Logical; if `TRUE` (default), probabilities `p` are $P[X \leq x]$, otherwise, $P[X > x]$.
`n`	Number of observations. Must have length of one.

Details

If min, max, or mode are not specified they assume the default values of 0, 1, and 0.5 respectively.

The triangular distribution has density

$$0$$

for $x < min$ or $x > max$

$$f(x) = \frac{2(x - min)}{(max - min)(mode - min)}$$

for $min \leq x < mode$, and

$$f(x) = \frac{2(max - x)}{(max - min)(max - mode)}$$

for $mode < x \leq max$.

rtri will not generate either of the extreme values unless max -min is small compared to min, and in particular not for the default arguments.

Value

ctri gives the characteristic function, dtri gives the density function, estri gives the expected shortfall, mgtri gives the moment generating function, ptri gives the distribution function, qtri gives the quantile function, and rtri gives the random variate generator.

The numerical arguments other than n with values of size one are recycled to the length of t for ctri and mgtri, the length of x for dtri, the length of p for estri and qtri, the length of q for ptri, and n for rtri. This determines the length of the result.

The logical arguments log, lower_tail, and log_p must be of length one each.

Note

The characteristics of output from pseudo-random number generators (such as precision and periodicity) vary widely. See .Random.seed for more information on R's random number generation algorithms.

See Also

RNG about random number generation in R.

Distributions for other standard distributions.

Examples

```
# min, max, and mode with lengths equal to the length of x
x <- c(0, 0.5, 1)
d <- dtri(x, min = c(0, 0, 0), max = c(1, 1, 1), mode = c(0.5, 0.5, 0.5))
# min and max will be recycled to the length of x
rec_d <- dtri(x, min = 0, max = 1, mode = c(0.5, 0.5, 0.5))
all.equal(d, rec_d)
```

```
# min, max, and mode with lengths equal to the length of x
n <- 3
set.seed(1)
r <- rtri(n, min = c(0, 0, 0), max = c(1, 1, 1), mode = c(0.5, 0.5, 0.5))
# min and max will be recycled to the length of n
set.seed(1)
rec_r <- rtri(n, min = 0, max = 1, mode = c(0.5, 0.5, 0.5))
all.equal(r, rec_r)

# Log quantiles
x <- c(0, 0.5, 1)
log_d <- dtri(x, log = TRUE)
d <- dtri(x, log = FALSE)
all.equal(log(d), log_d)

# Upper tail probabilities
q <- c(0, 0.5, 1)
upper_p <- ptri(q, lower_tail = FALSE)
p <- ptri(q, lower_tail = TRUE)
all.equal(upper_p, 1 - p)

# Log probabilities
q <- c(0, 0.5, 1)
log_p <- ptri(q, log_p = TRUE)
p <- ptri(q, log_p = FALSE)
all.equal(upper_p, 1 - p)

# The quantile function
p <- c(0, 0.5, 1)
upper_q <- ptri(1 - p, lower_tail = FALSE)
q <- ptri(p, lower_tail = TRUE)
all.equal(upper_q, q)

p <- c(0, 0.5, 1)
log_q <- qtri(log(p), log_p = TRUE)
q <- qtri(p, log_p = FALSE)
all.equal(log_q, q)

# Moment generating function
t <- c(1, 2, 3)
mgtri(t)

# Characteristic function
t <- c(1, 2, 3)
ctri(t)

# Expected Shortfall
p <- c(0.1, 0.5, 1)
estri(p)
```

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