Package ‘triangulr’

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Title High-Performance Triangular Distribution Functions

Version 1.2.1


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

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

Depends R (>= 3.3)

Encoding UTF-8

ByteCompile true

RoxygenNote 7.1.1

Collate 'check.R' 'cpp11.R' 'error.R' 'Triangular.R'

LinkingTo cpp11

SystemRequirements C++11

Imports rlang (>= 0.4.11), vctrs (>= 0.3.8)

Suggests testthat (>= 3.0.2)

NeedsCompilation yes

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The Triangular Distribution

Description

These functions provide information about the triangular distribution on the interval from min to max with mode equal to mode. 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

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

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)

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

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

Arguments

x, q Vector of quantiles.
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 ≥ min and mode ≤ max.
log, log_p Logical; if TRUE, probabilities p are given as log(p).
lower_tail Logical; if TRUE (default), probabilities p are P[X ≤ x], otherwise, P[X > x].
p Vector of probabilities.
n Number of observations. Must have length of one.
t Vector of dummy variables.
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

\[ f(x) = \begin{cases} 
 0 & \text{for } x < \text{min} \text{ or } x > \text{max} \\
 2(x - \text{min}) & \text{for } \text{min} \leq x < \text{mode}, \text{ and} \\
 2(\text{max} - x) & \text{for } \text{mode} < x \leq \text{max}.
\end{cases} \]

\[ f(x) = \frac{2(x - \text{min})}{(\text{max} - \text{min})(\text{mode} - \text{min})} \]

for \( \text{min} \leq x < \text{mode} \), and

\[ f(x) = \frac{2(\text{max} - x)}{(\text{max} - \text{min})(\text{max} - \text{mode})} \]

for \( \text{mode} < x \leq \text{max} \).

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

Value

d\text{tri} \text{ gives the density function, e\text{stri} \text{ gives the expected shortfall, m\text{gtri} \text{ gives the moment generating function, p\text{tri} \text{ gives the distribution function, q\text{tri} \text{ gives the quantile function, and r\text{tri} \text{ gives the random variate generator.}}}

The numerical arguments other than \text{n} with values of size one are recycled to the length of \text{t} for m\text{gtri}, the length of \text{x} for d\text{tri}, the length of \text{p} for e\text{stri} and q\text{tri}, the length of \text{q} for p\text{tri}, and \text{n} for r\text{tri}. 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 .\text{Random.seed} for more information on R’s random number generation algorithms.

See Also

\text{RNG} about random number generation in R.
\text{Distributions} for other standard distributions.

Examples

```r
# min, max, and mode with lengths equal to the length of x
x <- c(0, 0.5, 1)
d <- d\text{tri}(x,
  \text{min} = c(0, 0, 0),
  \text{max} = c(1, 1, 1),
  \text{mode} = c(0.5, 0.5, 0.5))

# min and max will be recycled to the length of x
```
Triangular

```r
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)
```
Triangular

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

.Random.seed, 3

Distributions, 3
dtri (Triangular), 2
estri (Triangular), 2
mgtri (Triangular), 2
ptri (Triangular), 2
qtri (Triangular), 2
RNG, 3
rtri (Triangular), 2
Triangular, 2