Package 'trapezoid'

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Title The Trapezoidal Distribution

Depends R (>= 2.12.0)

Suggests ggplot2, plyr

Description The trapezoid package provides 'dtrapezoid', 'ptrapezoid', 'qtrapezoid', and 'rtrapezoid' functions for the trapezoidal distribution.

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Collate 'dtrapezoid.R' 'ptrapezoid.R' 'qtrapezoid.R' 'rtrapezoid.R'

NeedsCompilation yes

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R topics documented:

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trapezoid	*The Trapezoidal Distribution*

Description

Density function, distribution function, quantile function, and random generation for the trapezoidal distribution with minimum equal to 'min', lower mode equal to 'mode1', upper mode equal to 'mode2', and maximum equal to 'max'. For the generalized trapezoidal distribution, 'n1', 'n3', and 'alpha' may optionally be specified.

Usage

```
dtrapezoid(x, min = 0, mode1 = 1/3, mode2 = 2/3, max = 1, n1 = 2, n3 = 2,
  alpha = 1, log = FALSE)
ptrapezoid(q, min = 0, mode1 = 1/3, mode2 = 2/3, max = 1, n1 = 2, n3 = 2,
  alpha = 1, lower.tail = TRUE, log.p = FALSE)
qtrapezoid(p, min = 0, mode1 = 1/3, mode2 = 2/3, max = 1, n1 = 2, n3 = 2,
  alpha = 1, lower.tail = TRUE, log.p = FALSE)
rtrapezoid(n, min = 0, mode1 = 1/3, mode2 = 2/3, max = 1, n1 = 2, n3 = 2,
  alpha = 1)
```

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.
min	vector of minima.
mode1	vector of lower modes.
mode2	vector of upper modes.
max	vector of maxima.
n1	vector of growth parameters.
n3	vector of decay parameters.
alpha	vector of boundary ratio parameters.
log, log.p	logical; if 'TRUE', probabilities 'p' are given as 'log(p)'.
lower.tail	logical; if 'TRUE' (default), probabilities are 'P[X <= x]', otherwise, 'P[X > x]'.

Details

The generalized trapezoidal distribution is described by van Dorp and Kotz (2003) and van Dorp and colleagues (2007). With 'n1', 'n3', and 'alpha' equal to the default values of 2, 2, and 1, respectively, the distribution shape is of a quadrilateral trapezoid. Altering 'n1', 'n3', or 'alpha' changes the growth rate, decay rate, and boundary ratio parameters, respectively, as demonstrated in the examples below.

Value

'dtrapezoid' gives the density function, 'ptrapezoid' gives the distribution function, 'qtrapezoid' gives the quantile function, and 'rtrapezoid' generates random deviates.

Author(s)

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References

van Dorp, J. R. and Kotz, S. (2003) Generalized trapezoidal distributions. *Metrika*. **58**(1):85–97. Preprint available: http://www.seas.gwu.edu/~dorpjr/Publications/JournalPapers/Metrika2003VanDorp.pdf

van Dorp, J. R., Rambaud, S.C., Perez, J. G., and Pleguezuelo, R. H. (2007) An elicitation procedure for the generalized trapezoidal distribution with a uniform central stage. *Decision Analysis Journal*. **4**:156–166. Preprint available: http://www.seas.gwu.edu/~dorpjr/Publications/JournalPapers/DA2007.pdf

See Also

Distributions for standard distributions.

Examples

```
## Plot default trapezoid distribution
curve(dtrapezoid(x, min = 0, mode1 = 1/3, mode2 = 2/3, max = 1,
  n1 = 2, n3 = 2, alpha = 1), from = 0, to = 1)


## Plot triangular trapezoid distribution
curve(dtrapezoid(x, min = 0, mode1 = 1/2, mode2 = 1/2, max = 1,
  n1 = 2, n3 = 2, alpha = 1), from = 0, to = 1)


## Explore effects of n1, n3, and alpha parameters
# plyr and ggplot2 are required for this example
require(plyr)
require(ggplot2)

x <- seq(from = 0, to = 1, by = 0.01)

# Create a list of arguments, varying n1, n3, and alpha
arguments <- list()
arguments[['A']] <- list(x = x, n1 = 2, n3 = 2, alpha = 0.8)
arguments[['B']] <- list(x = x, n1 = 1.5, n3 = 1.5, alpha = 1)
arguments[['C']] <- list(x = x, n1 = 2.5, n3 = 2.5, alpha = 1.5)
arguments[['D']] <- list(x = x, n1 = 1.5, n3 = 2.5, alpha = 0.5)
arguments[['E']] <- list(x = x, n1 = 2.5, n3 = 1.5, alpha = 1)
arguments[['F']] <- list(x = x, n1 = 0.5, n3 = 0.5, alpha = 1.5)
arguments[['G']] <- list(x = x, n1 = 1.5, n3 = 0.5, alpha = 0.5)
arguments[['H']] <- list(x = x, n1 = 2.5, n3 = 0.5, alpha = 1)
arguments[['I']] <- list(x = x, n1 = 0.5, n3 = 1.5, alpha = 1.5)
arguments[['J']] <- list(x = x, n1 = 0.5, n3 = 2.5, alpha = 0.5)

# Calculate the distributions
plot.data <- ldply(arguments, function(z)
{
  x <- z$x
  density <- dtrapezoid(x = z$x, min = 0, mode1 = 0.2, mode2 = 0.8,
    max = 1, n1 = z$n1, n3 = z$n3, alpha = z$alpha)
```

```
  args <- paste("n1 = ", z$n1, ", n3 = ", z$n3, ", alpha = ", z$alpha,
    sep="", collapse="")
  out <- data.frame(x, density, args)
})

# Create labels for later use in displaying the arguments on the plots
plot.data$label <- paste(plot.data$.id, ": ", plot.data$args, sep="")

# Create plots
generalizedTrapezoids <- ggplot(data = plot.data, aes(x = x, y = density)) +
  geom_line() + theme_bw() +
  facet_wrap(~label, ncol = 2, scales = "free_y")
print(generalizedTrapezoids)
```

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