Package ‘skewunit’

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Title Estimation and Other Tools for Skew-Unit Models

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Description Provide estimation and data generation tools for the skew-unit family discussed based on Mukhopadhyay and Brani (1995) <doi:10.2307/2348710>. The family contains extensions for popular distributions such as the ArcSin discussed in Arnold and Groeneveld (1980) <doi:10.1080/01621459.1980.10477449>, triangular, U-quadratic and Johnson-SB proposed in Cortina-Borja (2006) <doi:10.1111/j.1467-985X.2006.00446_12.x> distributions, among others.

Depends R (>= 4.0.0), stats

Imports pracma

License GPL (>= 2)

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Contents

`asin` *The ArcSin distribution.*

Description

Density, distribution function and random generation for the ArcSin distribution.

Usage

```
dasin(x, log=FALSE)
pasin(q, lower.tail=TRUE, log.p=FALSE)
rasin(n)
```

Arguments

`x, q`	vector of quantiles.
`n`	number of observations. If length(n) > 1, the length is taken to be the number required.
`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

The ArcSin distribution has density

$$f(x) = \frac{1}{\pi\sqrt{x(1-x)}}, \quad x \in (0,1),$$

and cumulative distribution function

$$F(x) = \frac{2}{\pi} Arcsin(\sqrt{x}), \quad x \in (0,1).$$

Value

dasin gives the density, pasin gives the distribution function, and rasin generates random deviates. The length of the result is determined by n for rasin, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo

References

Arnold, B.C. and Groeneveld, R.A. (1980). Some Properties of the Arcsine Distribution. Journal of the Ammerican Statistical Association, 75, 173-175.

Examples

```
dasin(0.5)
pasin(0.5)
rasin(5)
```

---

choose.skewunit — *Choose a Distribution in a Family of Skew Distributions with Bounded Support*

Description

choose.skewunit select a combination of f and G in a Family of Skew Distributions with Bounded Support based on the Akaike information criteria (AIC) or Bayesian information criteria (BIC).

Usage

```
choose.skewunit(x, criteria="AIC")
```

Arguments

`x`	data in $(0,1)$ interval.
`criteria`	criteria to choose a model: AIC (default) or BIC.

Details

The Family of Skew Distributions with Bounded Support is defined by its density function given by

$$f(x) = 2G(\lambda(y - 0.5) + 0.5), \quad x \in (0,1), \lambda \in (-1,1),$$

where f is symmetric around 0.5, i.e., $f(x-0.5) = f(x+0.5)$. The avaliable options for family1 and family2 are asin, Uquad, triang, JSB and sbeta.

Value

an object of class "skewunit" is returned. The object returned for this functions is a list containing the following components:

`x`	x

Author(s)

Diego Gallardo, Emilio Gomez-Deniz, Osvaldo Venegas and Hector W. Gomez

Examples

```
set.seed(2100)
x=rskewunit(100, lambda=-0.5, delta=1.2, family1="asin", family2="triang")
aux=choose.skewunit(x, criteria="AIC")
aux
aux$summary
```

---

cuberoot *Calculates the cubic root*

Description

cuberoot(x) computes the cubic root of x, $\sqrt[3]{x}$.

Usage

```
cuberoot(x)
```

Arguments

`x`	a numeric or complex vector or array.

Value

the cube root of a number.

Author(s)

Diego Gallardo

Examples

```
cuberoot(-27)
cuberoot(0)
cuberoot(64)
```

estimate.skewunit *Estimation for a Family of Skew Distributions with Bounded Support*

Description

Perform parameter estimation for a family of skew distributions with bounded support.

Usage

```
estimate.skewunit(x, family1 = "asin", family2 = "asin", est.var = TRUE)
```

Arguments

`x`	data in $(0, 1)$ interval.
`family1`	first family of distributions related to f (asin by default). See details Section.
`family2`	first family of distributions related to G (asin by default). See details Section.
`est.var`	logical; if TRUE, estimate the standard errors of the estimators.

Details

The Family of Skew Distributions with Bounded Support is defined by its density function given by

$$f(x) = 2G(\lambda(y - 0.5) + 0.5), \quad x \in (0, 1), \lambda \in (-1, 1),$$

where f is symmetric around 0.5, i.e., $f(x - 0.5) = f(x + 0.5)$. The avaliable options for family1 and family2 are asin, Uquad, triang, JSB and sbeta.

Value

an object of class "skewunit" is returned. The object returned for this functions is a list containing the following components:

`x`	x

Author(s)

Diego Gallardo, Emilio Gomez-Deniz, Osvaldo Venegas and Hector W. Gomez

Examples

```
set.seed(2100)
x=rskewunit(100, lambda=-0.5, delta=1.2, family1="asin", family2="JSB")
estimate.skewunit(x, family1="asin", family2="JSB")
```

JSB *The Johnson S_B distribution.*

Description

Density, distribution function and random generation for the Johnson S_B distribution.

Usage

```
dJSB(x, delta=1, log=FALSE)
pJSB(q, delta=1, lower.tail=TRUE, log.p=FALSE)
rJSB(n, delta=1)
```

Arguments

x, q	vector of quantiles.
n	number of observations. If length(n) > 1, the length is taken to be the number required.
delta	shape parameter (by default is 1).
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$.

Details

The Johnson S_B distribution has density

$$f(x) = \frac{\delta}{x(1-x)} \phi\left(\delta \eta(x)\right), \quad x \in (0,1),$$

where $\eta(x) = \log(\frac{x}{1-x})$, $\phi(\cdot)$ denotes the density of the standard normal distribution and $\delta > 0$. Its cumulative distribution function is

$$F(x) = \Phi\left(\delta \eta(x)\right), \quad x \in (0,1),$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution.

Value

dJSB gives the density, pJSB gives the distribution function, and rJSB generates random deviates. The length of the result is determined by n for rasin, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo

References

Kotz, S., van Dorp, J.R. (2004). Beyond Beta. Other Continuous Families of Distributions with Bounded Support and Applications. World Scientific.

Examples

```
dJSB(0.5, 1.2)
pJSB(0.5, 0.5)
rJSB(5, 1.5)
```

---

sbeta — *The symmetrical beta distribution.*

Description

Density, distribution function and random generation for the symmetrical beta distribution.

Usage

```
dsbeta(x, delta=1, log=FALSE)
psbeta(q, delta=1, lower.tail=TRUE, log.p=FALSE)
rsbeta(n, delta=1)
```

Arguments

`x, q`	vector of quantiles.
`n`	number of observations. If length(n) > 1, the length is taken to be the number required.
`delta`	shape parameter (by default is 1).
`log, log.p`	logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$.

Details

The symmetrical beta distribution has density

$$f(x) = \frac{1}{B(\delta,\delta)} x^{\delta-1}(1-x)^{\delta-1}, \quad x \in (0,1), \delta > 0,$$

where $B(a, b)$ denotes the beta function. Its cumulative distribution function is

$$F(x) = I_x(\delta,\delta), \quad x \in (0,1).$$

Value

dsbeta gives the density, psbeta gives the distribution function, and rsbeta generates random deviates. The length of the result is determined by n for rasin, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo

Examples

```
dsbeta(0.5, 1.2)
psbeta(0.5, 0.5)
rsbeta(5, 1.5)
```

---

skewunit *A Family of Skew Distributions with Bounded Support*

Description

Density and random generation for a family of skew distributions with bounded support.

Usage

```
dskewunit(x, lambda = 0, delta = 1, delta2 = 1, family1 = "asin", family2 = "asin",
          log = FALSE)
rskewunit(n, lambda = 0, delta = 1, delta2 = 1, family1 = "asin", family2 = "asin")
```

Arguments

x	vector of quantiles.
n	number of observations. If length(n) > 1, the length is taken to be the number required.
lambda	skewness parameter such as $-1 \leq \lambda \leq 1$.
delta, delta2	shape parameters.
family1	first family of distributions related to f (asin by default). See details Section.
family2	second family of distributions related to G (asin by default). See details Section.
log	logical; if TRUE, probabilities p are given as log(p).

Details

The Family of Skew Distributions with Bounded Support is defined by its density function given by

$$f(x) = 2G(\lambda(x - 0.5) + 0.5), \quad x \in (0, 1), \lambda \in (-1, 1),$$

where f is symmetric around 0.5, i.e., $f(x - 0.5) = f(x + 0.5)$. The avaliable options for family1 and family2 are asin, Uquad, triang, JSB and sbeta.

Value

dskewunit gives the density, and rskewunit generates random deviates. The length of the result is determined by n for rnorm, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo, Emilio Gomez-Deniz, Osvaldo Venegas and Hector W. Gomez

Examples

```
dskewunit(c(0.2,0.8), lambda = 0.5, family1 = "asin", family2 = "asin")
rskewunit(100, lambda = -0.4, delta = 1, family1 = "triang", family2 = "JSB")
```

`triang` *The triangular distribution*

Description

Density, distribution function and random generation for the triangular distribution.

Usage

```
dtriang(x, log=FALSE)
ptriang(q, lower.tail=TRUE, log.p=FALSE)
rtriang(n)
```

Arguments

`x, q`	vector of quantiles.
`n`	number of observations. If length(n) > 1, the length is taken to be the number required.
`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

The triangular distribution has density

$$f(x) = \begin{cases} 4x, & 0 \le x \le 1/2, \\ 4(1-x), & 1/2 < x \le 1, \end{cases}$$

and cumulative distribution function

$$F(x) = \begin{cases} 2x^2, & 0 \le x \le 1/2, \\ 2x^2 - (2x-1)^2, & 1/2 < x \le 1, \end{cases}$$

Value

dtriang gives the density, ptriang gives the distribution function, and rtriang generates random deviates. The length of the result is determined by n for rasin, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo

Examples

```
dtriang(0.5)
ptriang(0.5)
rtriang(5)
```

`Uquad` *The U-quadratic distribution*

Description

Density, distribution function and random generation for the U-quadratic distribution.

Usage

```
dUquad(x, a=0, b=1, log=FALSE)
pUquad(q, a=0, b=1, lower.tail=TRUE, log.p=FALSE)
rUquad(n, a=0, b=1)
```

Arguments

`x, q`	vector of quantiles.
`n`	number of observations. If length(n) > 1, the length is taken to be the number required.
`a, b`	range of variable x. ($a < b$).
`log, log.p`	logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$.

Details

The U-quadratic distribution has density

$$f(x) = \alpha(x-\beta)^2, \quad x \in (a,b), a \leq x \leq b,$$

where $\alpha = 12/(b-a)^3$ and $\beta = (a+b)/2$. Its cumulative distribution function is

$$F(x) = \frac{\alpha}{3}[(x-\beta)^3 + (\beta-a)^3], \quad x \in (a,b).$$

Value

dUquad gives the density, pUquad gives the distribution function, and rUquad generates random deviates. The length of the result is determined by n for rasin, and is the maximum of the lengths of the numerical arguments for the other functions. The numerical arguments other than n are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Diego Gallardo

Examples

```
dUquad(0.5)
pUquad(0.5)
rUquad(5)
```

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