Package: argus (via r-universe)

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Type Package

Title Random Variate Generator for the Argus Distribution

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Imports Runuran

Description Random variate generation, density, CDF and quantile function for the Argus distribution. Especially, it includes for random variate generation a flexible inversion method that is also fast in the varying parameter case. A Ratio-of-Uniforms method is provided as second alternative.

License GPL (>= 2)

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`argus-package` *Generator and density for the Argus distribution*

Description

Random variate generation, density, CDF and quantile function for the Argus distribution. Especially, it includes for random variate generation a flexible inversion method that is also fast in the varying parameter case. A Ratio-of-Uniforms method is provided as second alternative.

Details

The Argus distribution has the density (pdf) which is proportional to

$$f(x) = x\sqrt{1-x^2}\exp(-0.5\chi^2(1-x^2)), \text{for} 0 \leq x \leq 1 \text{and} \chi > 0$$

Package:	argus
License:	GPL 2 or later

Package **argus** provides the routines:

`rargus` generates argus distributed random variates.

`dargus` computes the density of the argus distribution.

`pargus` computes the CDF of the argus distribution.

`qargus` computes the quantile function (ie. the inverse CDF)of the argus distribution.

Author(s)

Wolfgang Hörmann & Christoph Baumgarten

References

Christoph Baumgarten: Random Variate Generation by Fast Numerical Inversion in the Varying Parameter Case.

Examples

```
## Evaluate the pdf (density)
dargus(c(0.1,0.5,0.9), chi=0.3)
## Evaluate the CDF for different chi values
pargus(c(0.1,0.5,0.9), chi=c(0.3,1.3,2.3))
## Evaluate the quantile function
pargus(c(0.1,0.5,0.9), chi=4.5)
## Draw a random sample
rargus(n=10, chi=0.3)
## compare histogram and density
system.time(y<-rargus(1.e5,chi=2.5))
hist(y,breaks=100,freq=FALSE)
lines(x<-seq(0,1,1.e-3),dargus(x,2.5),col=2,lwd=2)
```

rargus *The Argus distribution*

Description

Density, distribution function, quantile function and random generation for the Argus distribution with parameter chi. rargus() uses very efficient random variate generation methods. Inversion or the Ratio of Uniforms method can be selected.

Usage

```
rargus(n=length(chi) , chi, method = c("inversion","RoU") )
dargus(x, chi, log = FALSE)
pargus(x, chi, lower = TRUE, log.p = FALSE)
qargus(p, chi, lower = TRUE, log.p = FALSE)
```

Arguments

n	Number of observations
chi	parameter vector chi>0
method	random variate generation method to be used (details are below)
x	x-value for the density or CDF
log	If TRUE the logarithm of the density is returned.
lower	If FALSE 1-CDF or its inverse is returned
log.p	log(p) the logarithm of the probability is used or returned
p	probability of the quantile

Details

The Argus distribution has the density (pdf) which is proportional to

$$f(x) = x\sqrt{1-x^2}\exp(-0.5\chi^2(1-x^2)), \text{for} 0 \leq x \leq 1 \text{and} \chi > 0$$

The generators used for rargus() are very efficient also for the varying parameter case, i.e. when the vector chi has length n.

method = "inversion": transforms the uniform variate into an argus variate using a close to exact approximation of the inverse CDF. It is also well suited for the varying parameter case as the theorem that an argus variate can be represented as a transformed truncated Gamma(1.5) variate allows to express the inverse CDF of the argus distribution as a simple transform of the inverse CDF of the Gamma(1.5) distribution. The use of the pinv.new() function of the Runuran package makes that evaluation very fast. When loading the argus-package pinv.new() calculates and stores the required tables.

method = "RoU": uses the Ratio of Uniforms method which requires 2 or more uniform variates to generate one argus variate. It is also a bit slower than the inversion method and is added here mainly for the case that the Runuran-package is not available.

Value

`rargus` creates a random sample of size `n`.

`dargus` gives the density, `dargus` give the CDF and `qargus` gives the quantile function. The length of the result for these 3 functions is the maximum of the lengths of the numerical arguments that are recycled to the length of the result. Only the first elements of the logical arguments are used.

Author(s)

Wolfgang Hörmann and Christoph Baumgarten

References

Christoph Baumgarten: Random Variate Generation by Fast Numerical Inversion in the Varying Parameter Case.

Examples

```
library(argus)
# pdf, cdf and quantile function
dargus((0:10)/10,.6)
qargus(0.9,2)
pargus(qargus(0.9,2),2)

y<-rargus(n=1.e5,chi=0.3,method="inversion")
hist(y,breaks=100,main="Argus pdf with chi=0.3",freq=FALSE)
lines(xv<-seq(0,1,0.001),dargus(xv,chi=0.3),lwd=0.2,col=2)

n=1.e5
chiv <- 1. +runif(n)*5 # chi-values in (1,5)
system.time({set.seed(123);y<-rargus(chi=chiv)})
set.seed(123);u<- runif(n)
mean(abs(pargus(y,chiv)-u))

# random variate generation with the inversion method
y<-rargus(n=1.e5,chi=0.3,method="inversion")
hist(y,breaks=100,main="Argus pdf with chi=0.3",freq=FALSE)
lines(xv<-seq(0,1,0.001),dargus(xv,chi=0.3),lwd=0.2,col=2)
# using Ratio of Uniforms
y<-rargus(n=1.e5,chi=3,method="RoU")
hist(y,breaks=100,main="Argus pdf with chi=3",freq=FALSE)
lines(xv<-seq(0,1,0.001),dargus(xv,chi=3),lwd=2,col=2)
# generating for different chi values
y<-rargus(n=100,chi=runif(100)*2,method="RoU")
```

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