# Package 'FAdist'

October 12, 2022

Type Package	
Title Distributions that are Sometimes Used in Hydrology	
Version 2.4	
Imports stats	
<b>Date</b> 2022-03-02	
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<b>Description</b> Probability distributions that are sometimes useful in hydrology.	
License GPL-2	
<pre>URL https://github.com/tpetzoldt/FAdist</pre>	
Repository CRAN	
NeedsCompilation no	
Date/Publication 2022-03-03 22:10:02 UTC	
Duty1 ubilitation 2022 03 03 22.10.02 01C	
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FAdist-package Distributions that are sometimes used in hydrology
-------------------------------------------------------------------

# **Description**

This package contains several distributions that are sometimes useful in hydrology

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GAMMA3 Three-Parameter Gamma Distribution (also known as Pearson type III distribution)

# Description

Density, distribution function, quantile function and random generation for the 3-parameter gamma distribution with shape, scale, and threshold (or shift) parameters equal to shape, scale, and thres, respectively.

# Usage

```
dgamma3(x,shape=1,scale=1,thres=0,log=FALSE)
pgamma3(q,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
qgamma3(p,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
rgamma3(n,shape=1,scale=1,thres=0)
```

# Arguments

x,q	vector of quantiles.
p	vector of probabilities.
n	number of observations.
shape	shape parameter.
scale	scale parameter.
thres	threshold or shift parameter.
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, $P[X > x]$ .

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#### **Details**

If Y is a random variable distributed according to a gamma distribution (with shape and scale parameters), then X = Y + m has a 3-parameter gamma distribution with the same shape and scale parameters, and with threshold (or shift) parameter m.

#### Value

dgamma3 gives the density, pgamma3 gives the distribution function, qgamma3 gives the quantile function, and rgamma3 generates random deviates.

#### References

Bobee, B. and F. Ashkar (1991). The Gamma Family and Derived Distributions Applied in Hydrology. Water Resources Publications, Littleton, Colo., 217 p.

#### See Also

```
dgamma, pgamma, qgamma, rgamma
```

# **Examples**

```
thres <- 10
x <- rgamma3(n=10,shape=2,scale=11,thres=thres)
dgamma3(x,2,11,thres)
dgamma(x-thres,2,1/11)</pre>
```

**GenPARETO** 

Generalized Pareto Distribution

# **Description**

Density, distribution function, quantile function and random generation for the generalized Pareto distribution with shape and scale parameters equal to shape and scale, respectively.

#### **Usage**

```
dgp(x,shape=1,scale=1,log=FALSE)
pgp(q,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
qgp(p,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
rgp(n,shape=1,scale=1)
```

# **Arguments**

```
x,qvector of quantiles.pvector of probabilities.nnumber of observations.shapeshape parameter.
```

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```
scale scale parameter.

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**

If *X* is a random variable distributed according to a generalized Pareto distribution, it has density  $f(x) = 1/\text{scale}*(1-\text{shape}*x/\text{scale})^{((1-\text{shape})/\text{shape})}$ 

#### Value

dgp gives the density, pgp gives the distribution function, qgp gives the quantile function, and rgp generates random deviates.

#### References

Coles, S. (2001) An introduction to statistical modeling of extreme values. Springer

## **Examples**

```
x <- rgp(1000,-.2,10)
hist(x,freq=FALSE,col='gray',border='white')
curve(dgp(x,-.2,10),add=TRUE,col='red4',lwd=2)</pre>
```

**GEV** 

Generalized Extreme Value Distribution (for maxima)

#### **Description**

Density, distribution function, quantile function and random generation for the generalized extreme value distribution (for maxima) with shape, scale, and location parameters equal to shape, scale, and location, respectively.

# Usage

```
dgev(x,shape=1,scale=1,location=0,log=FALSE)
pgev(q,shape=1,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
qgev(p,shape=1,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
rgev(n,shape=1,scale=1,location=0)
```

# **Arguments**

```
x,q vector of quantiles.
p vector of probabilities.
n number of observations.
shape shape parameter.
```

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```
scale scale parameter.

location location parameter.

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**

If X is a random variable distributed according to a generalized extreme value distribution, it has density

#### Value

dgev gives the density, pgev gives the distribution function, qgev gives the quantile function, and rgev generates random deviates.

#### References

Coles, S. (2001) An introduction to statistical modeling of extreme values. Springer

## **Examples**

```
x <- rgev(1000,-.1,3,100)
hist(x,freq=FALSE,col='gray',border='white')
curve(dgev(x,-.1,3,100),add=TRUE,col='red4',lwd=2)</pre>
```

**GUMBEL** 

Gumbel Distribution (for maxima)

# Description

Density, distribution function, quantile function and random generation for the Gumbel distribution (for maxima) with scale and location parameters equal to scale and location, respectively.

```
dgumbel(x,scale=1,location=0,log=FALSE)
pgumbel(q,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
qgumbel(p,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
rgumbel(n,scale=1,location=0)
```

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## **Arguments**

x,q	vector of quantiles.
р	vector of probabilities.
n	number of observations.
scale	scale parameter.
location	location parameter.
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**

```
If X is a random variable distributed according to a Gumbel distribution, it has density f(x) = 1/\text{scale*exp(-(x-location)/scale-exp(-(x-location)/scale))}
```

#### Value

dgumbel gives the density, pgumbel gives the distribution function, qgumbel gives the quantile function, and rgumbel generates random deviates.

#### References

Coles, S. (2001) An introduction to statistical modeling of extreme values. Springer

# Examples

```
x <- rgumbel(1000,3,100)
hist(x,freq=FALSE,col='gray',border='white')
curve(dgumbel(x,3,100),add=TRUE,col='red4',lwd=2)</pre>
```

KAPPA

Kappa Distribution

# Description

Density, distribution function, quantile function and random generation for the kappa distribution with shape and scale parameters equal to shape and scale, respectively.

```
dkappa(x,shape=1,scale=1,log=FALSE)
pkappa(q,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
qkappa(p,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
rkappa(n,shape=1,scale=1)
```

KAPPA4

# Arguments

x,q	vector of quantiles.
р	vector of probabilities.
n	number of observations.
shape	shape parameter.
scale	scale parameter.
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**

```
If X is a random variable distributed according to a kappa distribution, it has density f(x) = \frac{(-(\sinh e^{-1}))^{n}}{(-(\sinh e^{-1}))^{n}}
```

#### Value

dkappa gives the density, pkappa gives the distribution function, qkappa gives the quantile function, and rkappa generates random deviates.

#### **Examples**

```
x <- rkappa(1000,12,10)
hist(x,freq=FALSE,col='gray',border='white')
curve(dkappa(x,12,10),add=TRUE,col='red4',lwd=2)</pre>
```

KAPPA4

Four-Parameter Kappa Distribution

# **Description**

Density, distribution function, quantile function and random generation for the four-parameter kappa distribution with shape1, shape2, scale, and location parameters equal to shape1, shape2, scale, and location, respectively.

```
dkappa4(x,shape1,shape2,scale=1,location=0,log=FALSE)
pkappa4(q,shape1,shape2,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
qkappa4(p,shape1,shape2,scale=1,location=0,lower.tail=TRUE,log.p=FALSE)
rkappa4(n,shape1,shape2,scale=1,location=0)
```

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## **Arguments**

x,q	vector of quantiles.
р	vector of probabilities.
n	number of observations.
shape1	shape parameter.
shape2	shape parameter.
scale	scale parameter.
location	location parameter.
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**

See References

#### Value

dkappa4 gives the density, pkappa4 gives the distribution function, qkappa4 gives the quantile function, and rkappa4 generates random deviates.

#### References

Hosking, J.R.M. (1994). The four-parameter kappa distribution. IBM Journal of Research and Development, 38(3), 251-258.

# **Examples**

```
x <- rkappa4(1000,.1,.2,12,110)
hist(x,freq=FALSE,col='gray',border='white')
curve(dkappa4(x,.1,.2,12,110),add=TRUE,col='red4',lwd=2)</pre>
```

LGAMMA3

Log-Pearson Type III Distribution

### **Description**

Density, distribution function, quantile function and random generation for the log-Pearson type III distribution with shape1, shape2, and scale parameters equal to shape, scale, and thres, respectively.

```
dlgamma3(x,shape=1,scale=1,thres=1,log=FALSE)
plgamma3(q,shape=1,scale=1,thres=1,lower.tail=TRUE,log.p=FALSE)
qlgamma3(p,shape=1,scale=1,thres=1,lower.tail=TRUE,log.p=FALSE)
rlgamma3(n,shape=1,scale=1,thres=1)
```

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## **Arguments**

x,q	vector of quantiles.
р	vector of probabilities.
n	number of observations.
shape	shape1 parameter.
scale	shape2 parameter.
thres	scale parameter.
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**

If Y is a random variable distributed according to a gamma distribution (with shape and scale parameters), then X = exp(Y+m) has a log-Pearson type III distribution with shape 1 and shape 2 parameters corresponding to the shape and 1/scale parameteres of Y, and with scale parameter m.

#### Value

dlgamma3 gives the density, plgamma3 gives the distribution function, qlgamma3 gives the quantile function, and rlgamma3 generates random deviates.

## References

BOBEE, B. and F. ASHKAR (1991). The Gamma Family and Derived Distributions Applied in Hydrology. Water Resources Publications, Littleton, Colo., 217 p.

#### See Also

```
dgamma, pgamma, qgamma, rgamma, dgamma3, pgamma3, qgamma3, rgamma3
```

#### **Examples**

```
thres <- 10 x <- rlgamma3(n=10, shape=2, scale=11, thres=thres) dlgamma3(x,2,11,thres) dgamma3(log(x),2,1/11,thres)/x dgamma(log(x)-thres,2,11)/x
```

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	$\sim$	~	$\Gamma \cap$	

Log-Logistic Distribution

## **Description**

Density, distribution function, quantile function and random generation for the log-logistic distribution with shape and scale parameters equal to shape and scale, respectively.

## Usage

```
dllog(x,shape=1,scale=1,log=FALSE)
pllog(q,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
qllog(p,shape=1,scale=1,lower.tail=TRUE,log.p=FALSE)
rllog(n,shape=1,scale=1)
```

#### **Arguments**

x,q		vector of quantiles.
р		vector of probabilities.
n		number of observations.
shape		shape parameter.
scale		scale parameter.
log,lo	g.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**

If Y is a random variable distributed according to a logistic distribution (with location and scale parameters), then X = exp(Y) has a log-logistic distribution with shape and scale parameters corresponding to the scale and location parameteres of Y, respectively.

# Value

dllog gives the density, pllog gives the distribution function, qllog gives the quantile function, and rllog generates random deviates.

#### See Also

```
dlogis, plogis, qlogis, rlogis
```

# Examples

```
x <- rllog(10,1,0)
dllog(x,1,0)
dlogis(log(x),0,1)/x</pre>
```

LLOGIS3

LLOGIS3	Three-Parameter Log-Logistic Distribution

## **Description**

Density, distribution function, quantile function and random generation for the 3-parameter log-logistic distribution with shape, scale, and threshold (or shift) parameters equal to shape, scale, and three, respectively.

# Usage

```
dllog3(x,shape=1,scale=1,thres=0,log=FALSE)
pllog3(q,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
qllog3(p,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
rllog3(n,shape=1,scale=1,thres=0)
```

## Arguments

x,q	vector of quantiles.
р	vector of probabilities.
n	number of observations.
shape	shape parameter.
scale	scale parameter.
thres	threshold (or shift) parameter.
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**

If Y is a random variable distributed according to a logistic distribution (with location and scale parameters), then X = exp(Y) + m has a 3-parameter log-logistic distribution with shape and scale parameters corresponding to the scale and location parameters of Y, respectively; and threshold parameter m.

#### Value

dllog3 gives the density, pllog3 gives the distribution function, qllog3 gives the quantile function, and rllog3 generates random deviates.

#### See Also

```
dlogis, plogis, qlogis, rlogis, dllog, pllog, qllog, rllog
```

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## **Examples**

```
m <- 100
x <- rllog3(10,1,0,m)
dllog3(x,1,0,m)
dllog(x-m,1,0)
dlogis(log(x-m),0,1)/(x-m)</pre>
```

LNORM3

Three-Parameter Lognormal Distribution

# **Description**

Density, distribution function, quantile function and random generation for the 3-parameter lognormal distribution with shape, scale, and threshold (or shift) parameters equal to shape, scale, and thres, respectively.

# Usage

```
dlnorm3(x,shape=1,scale=1,thres=0,log=FALSE)
plnorm3(q,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
qlnorm3(p,shape=1,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
rlnorm3(n,shape=1,scale=1,thres=0)
```

# **Arguments**

x,q vector of quantiles.
p vector of probabilities.
n number of observations.
shape shape parameter.
scale scale parameter.
thres threshold (or shift) parameter.
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**

If Y is a random variable distributed according to a normal distribution (with location(mean) and scale(standard deviation) parameters), then X = exp(Y) + m has a 3-parameter lognormal distribution with shape and scale parameters corresponding to the scale and location parameters of Y, respectively; and threshold parameter m.

#### Value

dlnorm3 gives the density, plnorm3 gives the distribution function, qlnorm3 gives the quantile function, and rlnorm3 generates random deviates.

WEIBULL3

## See Also

dnorm, pnorm, qnorm, rnorm, dlnorm, plnorm, qlnorm, rlnorm

#### **Examples**

```
m <- 100
x <- rlnorm3(10,1,0,m)
dlnorm3(x,1,0,m)
dlnorm(x-m,0,1)
dnorm(log(x-m),0,1)/(x-m)</pre>
```

WEIBULL3

Three-Parameter Weibull Distribution

# **Description**

Density, distribution function, quantile function and random generation for the 3-parameter Weibull distribution with shape, scale, and threshold (or shift) parameters equal to shape, scale, and thres, respectively.

## Usage

```
dweibull3(x,shape,scale=1,thres=0,log=FALSE)
pweibull3(q,shape,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
qweibull3(p,shape,scale=1,thres=0,lower.tail=TRUE,log.p=FALSE)
rweibull3(n,shape,scale=1,thres=0)
```

# Arguments

```
x,q vector of quantiles.
p vector of probabilities.
n number of observations.
shape shape parameter.
scale scale parameter.
thres threshold (or shift) parameter.
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**

If Y is a random variable distributed according to a Weibull distribution (with shape and scale parameters), then X = Y + m has a 3-parameter Weibull distribution with shape and scale parameters corresponding to the shape and scale parameteres of Y, respectively; and threshold parameter m.

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# Value

dweibull3 gives the density, pweibull3 gives the distribution function, qweibull3 gives the quantile function, and rweibull3 generates random deviates.

# See Also

```
dweibull, pweibull, qweibull, rweibull
```

# **Examples**

```
m <- 100
x <- rweibull3(10,3,1,m)
dweibull3(x,3,1,m)
dweibull(x-m,3,1)</pre>
```

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