# Package 'powdist'

October 14, 2022

Type Package
Title Power and Reversal Power Distributions
Version 0.1.4
Author Susan Anyosa [aut, cre], Jorge Luis Bazán Guzmán [aut], Artur Lemonte [aut]
Maintainer Susan Anyosa <susanaliciach@gmail.com></susanaliciach@gmail.com>
Imports stats, rmutil, gamlss.dist, normalp
<b>Depends</b> R (>= 3.1.0)
<b>Description</b> Density, distribution function, quantile function and random generation for the family of power and reversal power distributions.
License GPL-3
Encoding UTF-8
RoxygenNote 6.0.1
NeedsCompilation no
Repository CRAN
<b>Date/Publication</b> 2017-11-23 11:41:38 UTC
R topics documented:
powdist-package       2         ExponentialPower       2         Gumbel       3         PowerCauchy       4         PowerExponentialPower       5         PowerLaplace       7         PowerLogistic       8         PowerNormal       9         PowerReversalGumbel       10         PowerT       12         ReversalGumbel       13

2 ExponentialPower

	ReversalPowerCauchy
	ReversalPowerExponentialPower
	ReversalPowerLaplace
	ReversalPowerLogistic
	ReversalPowerNormal
	ReversalPowerReversalGumbel
	ReversalPowerT
Index	23

powdist-package

Power and reversal power distributions

## Description

The **powdist** package enables to compute the probability density function, cumulative distribution function, quantile function and generate random numbers for the following distributions: power Logistic (plogis), reversal power Logistic (rplogis), power Normal (pnorm), reversal power Normal (rpnorm), power Cauchy (pcauchy), reversal power Cauchy (rpcauchy), power reversal-Gumbel (prgumbel), power Student T (pt), reversal power Student T (rpt), power Laplace (plaplace), reversal power Laplace (rplaplace), power exponential power (pexpow) and reversal power exponential power (rpexpow).

ExponentialPower

The Exponential Power Distribution

#### **Description**

Density, distribution function, quantile function and random generation for the exponential power distribution with parameters mu, sigma and k.

```
dexpow(x, mu = 0, sigma = 1, k = 0, log = FALSE)

pexpow(q, mu = 0, sigma = 1, k = 0, lower.tail = TRUE, log.p = FALSE)

qexpow(p, mu = 0, sigma = 1, k = 0, lower.tail = TRUE, log.p = FALSE)

rexpow(n, mu = 0, sigma = 1, k = 0)
```

Gumbel 3

## **Arguments**

x, q	vector of quantiles.
mu, sigma	location and scale parameters.
k	shape parameter.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

#### **Details**

The Exponential distribution has density

$$f(x) = \left[\frac{e^{-\left(\frac{x-\mu}{\sigma}\right)}}{\left(1+e^{-\left(\frac{x-\mu}{\sigma}\right)}\right)^2}\right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and k the shape parameter.

## References

Lemonte A. and Bazán J.L.

## **Examples**

```
dexpow(1, 3, 4, 1)
pexpow(1, 3, 4, 1)
qexpow(0.2, 3, 4, 1)
rexpow(5, 3, 4, 1)
```

Gumbel

The Gumbel Distribution

## **Description**

Density, distribution function, quantile function and random generation for the Gumbel distribution with parameters mu and sigma.

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

4 PowerCauchy

## **Arguments**

x, q	vector of quantiles.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

## **Details**

The Gumbel distribution has density

$$f(x) = \left[\frac{1}{\sigma}e^{\left(-\frac{x-\mu}{\sigma}\right)-e^{\left(-\frac{x-\mu}{\sigma}\right)}}\right],$$

where  $-\infty < \mu < \infty$  is the location paramether and  $\sigma^2 > 0$  is the scale parameter.

# **Examples**

```
dgumbel(1, 3, 4)
pgumbel(1, 3, 4)
qgumbel(0.2, 3, 4)
rgumbel(5, 3, 4)
```

PowerCauchy

The Power Cauchy Distribution

## **Description**

Density, distribution function, quantile function and random generation for the power Cauchy distribution with parameters mu, sigma and lambda.

```
dpcauchy(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)

ppcauchy(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
   log.p = FALSE)

qpcauchy(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
   log.p = FALSE)

rpcauchy(n, lambda = 1, mu = 0, sigma = 1)
```

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

#### **Details**

The power Cauchy distribution has density

$$f(x) = \lambda \left[ \frac{1}{\pi} \arctan\left(\frac{x-\mu}{\sigma}\right) + \frac{1}{2} \right]^{\lambda-1} \left[ \frac{1}{\pi\sigma\left(1 + \left(\frac{x-\mu}{\sigma}\right)^2\right)} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

## **Examples**

```
dpcauchy(1, 1, 3, 4)
ppcauchy(1, 1, 3, 4)
qpcauchy(0.2, 1, 3, 4)
rpcauchy(5, 2, 3, 4)
```

PowerExponentialPower The Power Exponential Power Distribution

# **Description**

Density, distribution function, quantile function and random generation for the power exponential power distribution with parameters mu, sigma, lambda and k.

## Usage

```
dpexpow(x, lambda = 1, mu = 0, sigma = 1, k = 0, log = FALSE)

ppexpow(q, lambda = 1, mu = 0, sigma = 1, k = 0, lower.tail = TRUE,
    log.p = FALSE)

qpexpow(p, lambda = 1, mu = 0, sigma = 1, k = 0, lower.tail = TRUE,
    log.p = FALSE)

rpexpow(n, lambda = 1, mu = 0, sigma = 1, k = 0)
```

## **Arguments**

x, q	vector of quantiles.
mu, sigma	location and scale parameters.
k, lambda	shape parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

## **Details**

The power exponential power distribution has density

$$f(x) = \frac{\lambda}{\sigma} \left[ \frac{e^{-\left(\frac{x-\mu}{\sigma}\right)}}{\left(1 + e^{-\left(\frac{x-\mu}{\sigma}\right)}\right)^2} \right] \left[ \frac{e^{\left(\frac{x-\mu}{\sigma}\right)}}{1 + e^{\left(\frac{x-\mu}{\sigma}\right)}} \right]^{\lambda - 1},$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  and k the shape parameters.

#### References

Lemonte A. and Bazán J.L.

```
dpexpow(1, 1, 3, 4, 1)
ppexpow(1, 1, 3, 4, 1)
qpexpow(0.2, 1, 3, 4, 1)
rpexpow(5, 2, 3, 4, 1)
```

PowerLaplace 7

PowerLaplace

The Power Laplace Distribution

## **Description**

Density, distribution function, quantile function and random generation for the power Laplace distribution with parameters mu, sigma and lambda.

#### Usage

```
dplaplace(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)

pplaplace(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qplaplace(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rplaplace(n, lambda = 1, mu = 0, sigma = 1)
```

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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].
p	vector of probabilities.
n	number of observations.

## **Details**

The power Laplace distribution has density

```
f(x) = \lambda \left[\frac{1}{2} + \frac{\left(1 - e^{-\frac{|x-\mu|}{\sigma}}\right)}{2} \mathrm{sign}\left(\frac{x-\mu}{\sigma}\right)\right]^{\lambda-1} \left[\frac{e^{-\frac{|x-\mu|}{\sigma}}}{2\sigma}\right], \text{ where } -\infty < \mu < \infty \text{ is the location paramether, } \sigma^2 > 0 \text{ the scale parameter and } \lambda > 0 \text{ the shape parameter.}
```

```
dplaplace(1, 1, 3, 4)
pplaplace(1, 1, 3, 4)
qplaplace(0.2, 1, 3, 4)
rplaplace(5, 2, 3, 4)
```

8 PowerLogistic

PowerLogistic

The Power Logistic Distribution

## **Description**

Density, distribution function, quantile function and random generation for the power logistic distribution with parameters mu, sigma and lambda.

## Usage

```
dplogis(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)

pplogis(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qplogis(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rplogis(n, lambda = 1, mu = 0, sigma = 1)
```

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

## **Details**

The power Logistic distribution has density

$$f(x) = \lambda \left[ \frac{1}{1 + e^{-\left(\frac{x - \mu}{\sigma}\right)}} \right]^{\lambda - 1} \left[ \frac{e^{-\left(\frac{x - \mu}{\sigma}\right)}}{\sigma\left(1 + e^{-\left(\frac{x - \mu}{\sigma}\right)}\right)^2} \right], \text{ where } -\infty < \mu < \infty \text{ is the location paramether,}$$
 
$$\sigma^2 > 0 \text{ the scale parameter and } \lambda > 0 \text{ the shape parameter.}$$

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

PowerNormal 9

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

Johnson, N. L., Kotz, S. and Balakrishnan, N. (1995) Continuous Univariate Distributions, volume 1, chapter 16. Wiley, New York.

Lemonte, A. J. and Bazán, J. L. (2017) New links for binary regression: an application to coca cultivation in Peru. *TEST*.

Nadarajah, S. (2009) The skew logistic distribution. AStA Advances in Statistical Analysis, 93, 187-203.

Prentice, R. L. (1976) A Generalization of the probit and logit methods for dose-response curves. *Biometrika*, **32**, 761-768.

## **Examples**

```
dplogis(1, 1, 3, 4)
pplogis(1, 1, 3, 4)
qplogis(0.2, 1, 3, 4)
rplogis(5, 2, 3, 4)
```

PowerNormal

The Power Normal Distribution

## Description

Density, distribution function, quantile function and random generation for the power normal distribution with parameters mu, sigma and lambda.

## Usage

```
dpnorm(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)

ppnorm(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qpnorm(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rpnorm(n, lambda = 1, mu = 0, sigma = 1)
```

## **Arguments**

```
x, q vector of quantiles.
lambda shape parameter.
mu, sigma location and scale parameters.
log, log.p logical; if TRUE, probabilities p are given as log(p).
```

10 PowerReversalGumbel

lower.tail logical; if TRUE (default), probabilities are  $P[X \le x]$ , otherwise, P[X > x].

p vector of probabilities.

n number of observations.

## **Details**

The power Normal distribution has density

$$f(x) = \lambda \left[ \Phi\left(\frac{x-\mu}{\sigma}\right) \right]^{\lambda-1} \left[ \frac{e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}}{\sigma\sqrt{2\pi}} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

Bazán, J. L., Romeo, J. S. and Rodrigues, J. (2014) Bayesian skew-probit regression for binary response data. *Brazilian Journal of Probability and Statistics*. **28**(4), 467–482.

Gupta, R. D. and Gupta, R. C. (2008) Analyzing skewed data by power normal model. *Test* 17, 197–210.

Kundu, D. and Gupta, R. D. (2013) Power-normal distribution. Statistics 47, 110–125.

## **Examples**

```
dpnorm(1, 1, 3, 4)
ppnorm(1, 1, 3, 4)
qpnorm(0.2, 1, 3, 4)
rpnorm(5, 2, 3, 4)
```

PowerReversalGumbel

The Power Reversal-Gumbel Distribution

# Description

Density, distribution function, quantile function and random generation for the power Reversal-Gumbel distribution with parameters mu, sigma and lambda.

PowerReversalGumbel 11

## Usage

```
dprgumbel(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)

pprgumbel(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qprgumbel(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rprgumbel(n, lambda = 1, mu = 0, sigma = 1)
```

#### **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
p	vector of probabilities.
n	number of observations.

## **Details**

The power reverlsa-Gumbel distribution has density

$$f(x) = \lambda \left[ 1 - e^{-e^{\left(\frac{x-\mu}{\sigma}\right)}} \right]^{\lambda - 1} \left[ \frac{1}{\sigma} e^{\left(\frac{x-\mu}{\sigma}\right) - e^{\left(\frac{x-\mu}{\sigma}\right)}} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

## References

Abanto -Valle, C. A., Bazán, J. L. and Smith, A. C. (2014) *State space mixed models for binary responses with skewed inverse links using JAGS*. Rio de Janeiro, Brazil.

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

```
dprgumbel(1, 1, 3, 4)
pprgumbel(1, 1, 3, 4)
qprgumbel(0.2, 1, 3, 4)
rprgumbel(5, 2, 3, 4)
```

PowerT

PowerT

The Power Student t Distribution

## **Description**

Density, distribution function, quantile function and random generation for the power Student t distribution with parameters mu, sigma, lambda and df.

## Usage

```
dpt(x, lambda = 1, mu = 0, sigma = 1, df, log = FALSE)

ppt(q, lambda = 1, mu = 0, sigma = 1, df, lower.tail = TRUE, log.p = FALSE)

qpt(p, lambda = 1, mu = 0, sigma = 1, df, lower.tail = TRUE, log.p = FALSE)

rpt(n, lambda = 1, mu = 0, sigma = 1, df)
```

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
df	degrees of freedom ( $> 0$ , maybe non-integer). df = Inf is allowed.
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, $P[X > x]$ .
p	vector of probabilities.
n	number of observations.

# **Details**

The power Student t distribution has density

$$f(x) = [\lambda/\sigma][f((x-\mu)/\sigma)][F((x-\mu)/\sigma)](\lambda - 1),$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Lemonte A. and Bazán J.L.

ReversalGumbel 13

# Examples

```
dpt(1, 1, 3, 4, 1)
ppt(1, 1, 3, 4, 1)
qpt(0.2, 1, 3, 4, 1)
rpt(5, 2, 3, 4, 1)
```

ReversalGumbel

The Reversal-Gumbel Distribution

## **Description**

Density, distribution function, quantile function and random generation for the Reversal-Gumbel distribution with parameters mu and sigma.

## Usage

```
drgumbel(x, mu = 0, sigma = 1, log = FALSE)
prgumbel(q, mu = 0, sigma = 1, lower.tail = TRUE, log.p = FALSE)
qrgumbel(p, mu = 0, sigma = 1, lower.tail = TRUE, log.p = FALSE)
rrgumbel(n, mu = 0, sigma = 1)
```

## **Arguments**

x, q	vector of quantiles.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
p	vector of probabilities.
n	number of observations.

#### **Details**

The reversal-Gumbel distribution has density

$$f(x) = \left[\frac{1}{\sigma}e^{\left(\frac{x-\mu}{\sigma}\right) - e^{\left(\frac{x-\mu}{\sigma}\right)}}\right],$$

where  $-\infty < \mu < \infty$  is the location parameter and  $\sigma^2 > 0$  is the scale parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

## **Examples**

```
drgumbel(1, 3, 4)
prgumbel(1, 3, 4)
qrgumbel(0.2, 3, 4)
rprgumbel(5, 3, 4)
```

ReversalPowerCauchy

The Reversal Power Cauchy Distribution

## **Description**

Density, distribution function, quantile function and random generation for the reversal power Cauchy distribution with parameters mu, sigma and lambda.

#### Usage

```
drpcauchy(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)
prpcauchy(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qrpcauchy(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rrpcauchy(n, lambda = 1, mu = 0, sigma = 1)
```

#### **Arguments**

```
x, q vector of quantiles.

lambda shape parameter.

mu, sigma location and scale parameters.

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].

p vector of probabilities.

n number of observations.
```

## **Details**

The reversal power Cauchy distribution has density

$$f(x) = \lambda \left[ \frac{1}{\pi} \arctan\left(-\frac{x-\mu}{\sigma}\right) + \frac{1}{2} \right]^{\lambda - 1} \left[ \frac{1}{\pi \sigma \left(1 + \left(\frac{x-\mu}{\sigma}\right)^2\right)} \right]$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

#### **Examples**

```
drpcauchy(1, 1, 3, 4)
prpcauchy(1, 1, 3, 4)
qrpcauchy(0.2, 1, 3, 4)
rrpcauchy(5, 2, 3, 4)
```

ReversalPowerExponentialPower

The Reversal Power Exponential Power Distribution

#### **Description**

Density, distribution function, quantile function and random generation for the reversal power exponential power distribution with parameters mu, sigma, lambda and k.

```
drpexpow(x, lambda = 1, mu = 0, sigma = 1, k = 0, log = FALSE)
prpexpow(q, lambda = 1, mu = 0, sigma = 1, k = 0, lower.tail = TRUE,
    log.p = FALSE)

qrpexpow(p, lambda = 1, mu = 0, sigma = 1, k = 0, lower.tail = TRUE,
    log.p = FALSE)

rrpexpow(n, lambda = 1, mu = 0, sigma = 1, k = 0)
```

## **Arguments**

x, q	vector of quantiles.
mu, sigma	location and scale parameters.
k, lambda	shape parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

## **Details**

The reversal power exponential power distribution has density

```
f(x) = [\lambda/\sigma][f((x-\mu)/\sigma)][F((x-\mu)/\sigma)](\lambda - 1),
```

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  and k the shape parameters.

# **Examples**

```
drpexpow(1, 1, 3, 4, 1)
prpexpow(1, 1, 3, 4, 1)
qrpexpow(0.2, 1, 3, 4, 1)
rrpexpow(5, 2, 3, 4, 1)
```

ReversalPowerLaplace The Power Reversal Laplace Distribution

## Description

Density, distribution function, quantile function and random generation for the power reversal Laplace distribution with parameters mu, sigma and lambda.

```
drplaplace(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)
prplaplace(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qrplaplace(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rrplaplace(n, lambda = 1, mu = 0, sigma = 1)
```

ReversalPowerLogistic 17

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
p	vector of probabilities.
n	number of observations.

## **Details**

The reversal power Laplace distribution has density

$$f(x) = \lambda \left[ \frac{1}{2} + \frac{\left(1 - e^{\frac{|x - \mu|}{\sigma}}\right)}{2} \operatorname{sign}\left(-\frac{x - \mu}{\sigma}\right) \right]^{\lambda - 1} \left[ \frac{e^{-\frac{|x - \mu|}{\sigma}}}{2\sigma} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

## **Examples**

```
drplaplace(1, 1, 3, 4)
prplaplace(1, 1, 3, 4)
qrplaplace(0.2, 1, 3, 4)
rrplaplace(5, 2, 3, 4)
```

ReversalPowerLogistic The Reversal Power Logistic Distribution

## **Description**

Density, distribution function, quantile function and random generation for the reversal power logistic distribution with parameters mu, sigma and lambda.

```
drplogis(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)
prplogis(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qrplogis(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rrplogis(n, lambda = 1, mu = 0, sigma = 1)
```

#### **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

#### **Details**

The reversal power Logistic distribution has density

$$f(x) = \lambda \left[ \frac{1}{1 + e^{\left(\frac{x - \mu}{\sigma}\right)}} \right]^{\lambda - 1} \left[ \frac{e^{-\left(\frac{x - \mu}{\sigma}\right)}}{\sigma\left(1 + e^{-\left(\frac{x - \mu}{\sigma}\right)}\right)^2} \right], \text{ where } -\infty < \mu < \infty \text{ is the location paramether,}$$
 
$$\sigma^2 > 0 \text{ the scale parameter and } \lambda > 0 \text{ the shape parameter.}$$

## References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

Johnson, N. L., Kotz, S. and Balakrishnan, N. (1995) Continuous Univariate Distributions, volume 1, chapter 16. Wiley, New York.

Nagler J. (1994) Scobit: an alternative estimator to logit and probit. *American Journal Political Science*, **38**(1), 230-255.

Prentice, R. L. (1976) A Generalization of the probit and logit methods for dose-response curves. *Biometrika*, **32**, 761-768.

```
drplogis(1, 1, 3, 4)
prplogis(1, 1, 3, 4)
qrplogis(0.2, 1, 3, 4)
rrplogis(5, 2, 3, 4)
```

ReversalPowerNormal 19

ReversalPowerNormal

The Reversal Power Normal Distribution

## **Description**

Density, distribution function, quantile function and random generation for the reversal power normal distribution with parameters mu, sigma and lambda.

## Usage

```
drpnorm(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)
prpnorm(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qrpnorm(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rrpnorm(n, lambda = 1, mu = 0, sigma = 1)
```

## **Arguments**

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
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, $P[X > x]$ .
p	vector of probabilities.
n	number of observations.

## **Details**

The reversal power Normal distribution has density

$$f(x) = \lambda \left[ \Phi \left( -\frac{x-\mu}{\sigma} \right) \right]^{\lambda - 1} \left[ \frac{e^{-\frac{1}{2} \left( \frac{x-\mu}{\sigma} \right)^2}}{\sigma \sqrt{2\pi}} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

Bazán, J. L., Romeo, J. S. and Rodrigues, J. (2014) Bayesian skew-probit regression for binary response data. *Brazilian Journal of Probability and Statistics*. **28**(4), 467–482.

## **Examples**

```
drpnorm(1, 1, 3, 4)
prpnorm(1, 1, 3, 4)
qrpnorm(0.2, 1, 3, 4)
rrpnorm(5, 2, 3, 4)
```

ReversalPowerReversalGumbel

The Reversal Power Reversal-Gumbel Distribution

## **Description**

Density, distribution function, quantile function and random generation for the reversal power reversal-Gumbel distribution with parameters mu, sigma and lambda.

## Usage

```
drprgumbel(x, lambda = 1, mu = 0, sigma = 1, log = FALSE)
prprgumbel(q, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

qrprgumbel(p, lambda = 1, mu = 0, sigma = 1, lower.tail = TRUE,
    log.p = FALSE)

rrprgumbel(n, lambda = 1, mu = 0, sigma = 1)
```

# **Arguments**

```
x, q vector of quantiles.  
lambda shape parameter.  
mu, sigma location and scale parameters.  
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].  
p vector of probabilities.  
n number of observations.
```

ReversalPowerT 21

## **Details**

The reversal power reversal-Gumbel distribution has density

$$f(x) = \lambda \left[ 1 - e^{-e^{\left(-\frac{x-\mu}{\sigma}\right)}} \right]^{\lambda-1} \left[ \frac{1}{\sigma} e^{\left(\frac{x-\mu}{\sigma}\right) - e^{\left(\frac{x-\mu}{\sigma}\right)}} \right],$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

#### References

Anyosa, S. A. C. (2017) *Binary regression using power and reversal power links*. Master's thesis in Portuguese. Interinstitutional Graduate Program in Statistics. Universidade de São Paulo - Universidade Federal de São Carlos. Available in https://repositorio.ufscar.br/handle/ufscar/9016.

Bazán, J. L., Torres -Avilés, F., Suzuki, A. K. and Louzada, F. (2017) Power and reversal power links for binary regressions: An application for motor insurance policyholders. *Applied Stochastic Models in Business and Industry*, **33**(1), 22-34.

## **Examples**

```
drprgumbel(1, 1, 3, 4)
prprgumbel(1, 1, 3, 4)
qrprgumbel(0.2, 1, 3, 4)
rrprgumbel(5, 2, 3, 4)
```

ReversalPowerT

The Power Reversal Student t Distribution

#### Description

Density, distribution function, quantile function and random generation for the power reversal Student t distribution with parameters mu, sigma, lambda and df.

```
drpt(x, lambda = 1, mu = 0, sigma = 1, df, log = FALSE)
prpt(q, lambda = 1, mu = 0, sigma = 1, df, lower.tail = TRUE,
    log.p = FALSE)

qrpt(p, lambda = 1, mu = 0, sigma = 1, df, lower.tail = TRUE,
    log.p = FALSE)

rrpt(n, lambda = 1, mu = 0, sigma = 1, df)
```

22 ReversalPowerT

# Arguments

x, q	vector of quantiles.
lambda	shape parameter.
mu, sigma	location and scale parameters.
df	degrees of freedom ( $> 0$ , maybe non-integer). df = Inf is allowed.
log, log	p logical; if TRUE, probabilities p are given as log(p).
lower.ta	logical; if TRUE (default), probabilities are $P[X \le x]$ , otherwise, $P[X > x]$ .
р	vector of probabilities.
n	number of observations.

## **Details**

The reversal power Student t distribution has density

$$f(x) = [\lambda/\sigma][f((x-\mu)/\sigma)][F((x-\mu)/\sigma)](\lambda - 1),$$

where  $-\infty < \mu < \infty$  is the location paramether,  $\sigma^2 > 0$  the scale parameter and  $\lambda > 0$  the shape parameter.

```
drpt(1, 1, 3, 4, 1)
prpt(1, 1, 3, 4, 1)
qrpt(0.2, 1, 3, 4, 1)
rrpt(5, 2, 3, 4, 1)
```

# **Index**

dexpow(ExponentialPower), 2	pplogis(PowerLogistic),8
dgumbel (Gumbel), 3	ppnorm (PowerNormal), 9
dpcauchy (PowerCauchy), 4	pprgumbel (PowerReversalGumbel), 10
<pre>dpexpow (PowerExponentialPower), 5</pre>	ppt (PowerT), 12
dplaplace (PowerLaplace), 7	prgumbel (ReversalGumbel), 13
dplogis (PowerLogistic), 8	prpcauchy (ReversalPowerCauchy), 14
dpnorm (PowerNormal), 9	prpexpow
dprgumbel (PowerReversalGumbel), 10	(ReversalPowerExponentialPower),
dpt (PowerT), 12	15
drgumbel (ReversalGumbel), 13	prplaplace (ReversalPowerLaplace), 16
drpcauchy (ReversalPowerCauchy), 14	prplogis (ReversalPowerLogistic), 17
drpexpow	prpnorm (ReversalPowerNormal), 19
(ReversalPowerExponentialPower),	prprgumbel
15	(ReversalPowerReversalGumbel),
drplaplace (ReversalPowerLaplace), 16	20
drplogis (ReversalPowerLogistic), 17	<pre>prpt (ReversalPowerT), 21</pre>
drpnorm (ReversalPowerNormal), 19	
drprgumbel	qexpow (ExponentialPower), 2
(ReversalPowerReversalGumbel),	qgumbel (Gumbel), 3
20	qpcauchy (PowerCauchy), 4
drpt (ReversalPowerT), 21	<pre>qpexpow (PowerExponentialPower), 5</pre>
, ,	qplaplace (PowerLaplace), 7
ExponentialPower, 2	qplogis(PowerLogistic),8
	qpnorm (PowerNormal), 9
Gumbel, 3	<pre>qprgumbel (PowerReversalGumbel), 10</pre>
	qpt (PowerT), 12
pexpow(ExponentialPower), 2	qrgumbel (ReversalGumbel), 13
pgumbel (Gumbel), 3	qrpcauchy (ReversalPowerCauchy), 14
<pre>powdist (powdist-package), 2</pre>	qrpexpow
powdist-package, 2	(ReversalPowerExponentialPower),
PowerCauchy, 4	15
PowerExponentialPower, 5	qrplaplace (ReversalPowerLaplace), 16
PowerLaplace, 7	qrplogis(ReversalPowerLogistic), 17
PowerLogistic, 8	qrpnorm(ReversalPowerNormal), 19
PowerNormal, 9	qrprgumbel
PowerReversalGumbel, 10	(ReversalPowerReversalGumbel),
PowerT, 12	20
ppcauchy (PowerCauchy), 4	qrpt (ReversalPowerT), 21
<pre>ppexpow (PowerExponentialPower), 5</pre>	
pplaplace (PowerLaplace), 7	ReversalGumbel. 13

24 INDEX

```
ReversalPowerCauchy, 14
ReversalPowerExponentialPower, 15
ReversalPowerLaplace, 16
ReversalPowerLogistic, 17
ReversalPowerNormal, 19
ReversalPowerReversalGumbel, 20
ReversalPowerT, 21
rexpow (ExponentialPower), 2
rgumbel (Gumbel), 3
rpcauchy (PowerCauchy), 4
rpexpow (PowerExponentialPower), 5
rplaplace (PowerLaplace), 7
rplogis (PowerLogistic), 8
rpnorm (PowerNormal), 9
rprgumbel (PowerReversalGumbel), 10
rpt (PowerT), 12
rrgumbel (ReversalGumbel), 13
rrpcauchy (ReversalPowerCauchy), 14
rrpexpow
        (ReversalPowerExponentialPower),
        15
rrplaplace (ReversalPowerLaplace), 16
rrplogis(ReversalPowerLogistic), 17
rrpnorm (ReversalPowerNormal), 19
rrprgumbel
        (ReversalPowerReversalGumbel),
        20
rrpt (ReversalPowerT), 21
```