Package 'extras'

August 27, 2024

Title Helper Functions for Bayesian Analyses

Version 0.7.3

Description Functions to 'numericise' 'R' objects (coerce to numeric objects), summarise 'MCMC' (Monte Carlo Markov Chain) samples and calculate deviance residuals as well as 'R' translations of some 'BUGS' (Bayesian Using Gibbs Sampling), 'JAGS' (Just Another Gibbs Sampler), 'STAN' and 'TMB' (Template Model Builder) functions.

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URL https://poissonconsulting.github.io/extras/, https://github.com/poissonconsulting/extras

BugReports https://github.com/poissonconsulting/extras/issues

Depends R (>= 4.3.0)

Imports chk, lifecycle, stats

Suggests covr, hms, ggplot2, knitr, MASS, rlang, rmarkdown, scales, sn, testthat (>= 3.0.0), tibble, tidyr, viridis, withr

Config/testthat/edition 3

Encoding UTF-8

Language en-US

RoxygenNote 7.3.2

VignetteBuilder knitr

NeedsCompilation no

Author Nicole Hill [aut, cre] (<https://orcid.org/0000-0002-7623-2153>), Joe Thorley [aut] (<https://orcid.org/0000-0002-7683-4592>), Kirill Müller [ctb] (<https://orcid.org/0000-0002-1416-3412>), Nadine Hussein [ctb] (<https://orcid.org/0000-0003-4470-8361>), Poisson Consulting [cph, fnd]

Maintainer Nicole Hill <nicole@poissonconsulting.ca>

Repository CRAN

Date/Publication 2024-08-27 10:10:03 UTC

Contents

`as_list` *As List*

Description

Coerces an object to an list. All attributes are removed except any names.

Usage

```
as_list(x, ...)

## Default S3 method:
as_list(x, ...)
```

Arguments

`x`	An object.
`...`	Other arguments passed to methods.

Value

A list.

Examples

```
as_list(1:3)
as_list(c(x = 1, y = 2))
```

`as_list_unnamed` *As List*

Description

Coerces an object to an list. All attributes are removed except any names.

Usage

```
as_list_unnamed(x, ...)

## Default S3 method:
as_list_unnamed(x, ...)
```

Arguments

`x`	An object.
`...`	Other arguments passed to methods.

Value

A list.

Examples

```
as_list_unnamed(1:3)
as_list_unnamed(c(x = 1, y = 2))
```

chk_index *Check Index*

Description

Checks if an object is a vector of one or more positive integer values.

Usage

```
chk_index(x, x_name = NULL)

vld_index(x)
```

Arguments

x	An object.
x_name	A string of the name of object x or NULL.

Value

The chk_ function throws an informative error if the test fails.

The vld_ function returns a flag indicating whether the test was met.

Functions

- vld_index(): Validate Index

Examples

```
x <- c(2L, 1L)
chk_index(x)
y <- c(2L, -1L)
try(chk_index(y))
vld_index(c(-1))
vld_index(c(3L, 1L))
```

chk_indices *Check Indices*

Description

Checks if an object is a list of indices ie vectors of one or more positive integer values.

Usage

```
chk_indices(x, x_name = NULL)

vld_indices(x)
```

Arguments

x	An object.
x_name	A string of the name of object x or NULL.

Value

The chk_ function throws an informative error if the test fails.

The vld_ function returns a flag indicating whether the test was met.

Functions

- vld_indices(): Validate Indices

Examples

```
x <- list(c(2L, 1L))
chk_indices(x)
y <- c(2L, 1L)
try(chk_indices(y))
vld_indices(c(3L, 1L))
vld_indices(list(c(3L, 1L)))
```

---

chk_pars *Check Parameter Names*

Description

Checks if valid parameter names.

Usage

```
chk_pars(x, x_name = NULL)

vld_pars(x)
```

Arguments

x	An object.
x_name	A string of the name of object x or NULL.

Details

The character vector must consist of values that start with an alpha and only include alphanumeric characters and '_' or '.'.

Missing values and duplicates are permitted.

Value

The chk_ function throws an informative error if the test fails.

The vld_ function returns a flag indicating whether the test was met.

Functions

- vld_pars(): Validate Parameter Names

Examples

```
x <- c("x", "a1._", "X")
chk_pars(x)
y <- c("x[1]", "a1", "a1", "._0")
try(chk_pars(y))
vld_pars(c("x", "a1._", "X"))
vld_pars(c("x[1]", "a1", "a1", "._0"))
```

---

dbern *Bernoulli Distribution*

Description

Bernoulli Distribution

Usage

```
dbern(x, prob, log = FALSE)

pbern(q, prob, lower.tail = TRUE, log = FALSE)

qbern(p, prob, lower.tail = TRUE, log = FALSE)

rbern(n, prob)
```

Arguments

x	A vector of 0s and 1s.
prob	A numeric vector of values between 0 and 1 of the probability of success.
log	A flag specifying whether to return the log-transformed value.
q	A vector of quantiles.

lower.tail	A flag specifying whether to return the lower or upper tail of the distribution.
p	A vector of probabilities.
n	A non-negative whole number of the number of random samples to generate.

Value

An numeric vector of the random samples.

Examples

```
dbern(1, 0.5)
pbern(0.75, 0.5)
qbern(0.1, 0.5)
rbern(1, 0.5)
```

---

dev_bern *Bernoulli Deviances*

Description

Bernoulli Deviances

Usage

```
dev_bern(x, prob = 0.5, res = FALSE)
```

Arguments

x	A vector of 0s and 1s.
prob	A numeric vector of values between 0 and 1 of the probability of success.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_bern(c(TRUE, FALSE), 0.7)
```

dev_beta_binom *Beta-Binomial Deviances*

Description

This parameterization of the beta-binomial distribution uses an expected probability parameter, `prob`, and a dispersion parameter, `theta`. The parameters of the underlying beta mixture are `alpha = (2 * prob) / theta` and `beta = (2 * (1 - prob)) / theta`. This parameterization of `theta` is unconventional, but has useful properties when modelling. When `theta = 0`, the beta-binomial reverts to the binomial distribution. When `theta = 1` and `prob = 0.5`, the parameters of the beta distribution become `alpha = 1` and `beta = 1`, which correspond to a uniform distribution for the beta-binomial probability parameter.

Usage

```
dev_beta_binom(x, size = 1, prob = 0.5, theta = 0, res = FALSE)
```

Arguments

`x`	A non-negative whole numeric vector of values.
`size`	A non-negative whole numeric vector of the number of trials.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
`res`	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: `dev_bern()`, `dev_binom()`, `dev_gamma()`, `dev_gamma_pois()`, `dev_lnorm()`, `dev_neg_binom()`, `dev_norm()`, `dev_pois()`, `dev_pois_zi()`, `dev_skewnorm()`, `dev_student()`

Examples

```
dev_beta_binom(c(0, 1, 2), 10, 0.5, 0.1)
```

dev_binom *Binomial Deviances*

Description

Binomial Deviances

Usage

```
dev_binom(x, size = 1, prob = 0.5, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
size	A non-negative whole numeric vector of the number of trials.
prob	A numeric vector of values between 0 and 1 of the probability of success.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_binom(c(0, 1, 2), 2, 0.3)
```

dev_gamma *Gamma Deviances*

Description

Gamma Deviances

Usage

```
dev_gamma(x, shape = 1, rate = 1, res = FALSE)
```

Arguments

x	A numeric vector of values.
shape	A non-negative numeric vector of shape.
rate	A non-negative numeric vector of rate.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_gamma(c(0, 1, 2), 1, 2)
```

---

dev_gamma_pois *Gamma-Poisson Deviances*

Description

Gamma-Poisson Deviances

Usage

```
dev_gamma_pois(x, lambda = 1, theta = 0, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_gamma_pois(c(1, 3, 4), 3, 2)
```

---

dev_gamma_pois_zi *Zero-Inflated Gamma-Poisson Deviances*

Description

Zero-Inflated Gamma-Poisson Deviances

Usage

```
dev_gamma_pois_zi(x, lambda = 1, theta = 0, prob = 0, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
prob	A numeric vector of values between 0 and 1 of the probability of success.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

Examples

```
dev_gamma_pois_zi(c(1, 3, 4), 3, 2)
```

dev_lnorm *Log-Normal Deviances*

Description

Log-Normal Deviances

Usage

```
dev_lnorm(x, meanlog = 0, sdlog = 1, res = FALSE)
```

Arguments

x	A numeric vector of values.
meanlog	A numeric vector of the means on the log scale.
sdlog	A non-negative numeric vector of the standard deviations on the log scale.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_lnorm(exp(-2:2))
```

dev_neg_binom *Negative Binomial Deviances*

Description

Negative Binomial Deviances

Usage

```
dev_neg_binom(x, lambda = 1, theta = 0, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_neg_binom(c(1, 2, 5), 2, 3)
```

---

dev_norm *Normal Deviances*

Description

Normal Deviances

Usage

```
dev_norm(x, mean = 0, sd = 1, res = FALSE)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_pois(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_norm(c(-2:2))
```

---

dev_pois *Poisson Deviances*

Description

Poisson Deviances

Usage

```
dev_pois(x, lambda, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois_zi(), dev_skewnorm(), dev_student()

Examples

```
dev_pois(c(1, 3, 4), 3)
```

dev_pois_zi *Zero-Inflated Poisson Deviances*

Description

Zero-Inflated Poisson Deviances

Usage

```
dev_pois_zi(x, lambda, prob = 0, res = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
prob	A numeric vector of values between 0 and 1 of the probability of success.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_skewnorm(), dev_student()

Examples

```
dev_pois_zi(c(1, 3, 4), 3)
```

dev_skewnorm *Skew Normal Deviances*

Description

Skew Normal Deviances

Usage

```
dev_skewnorm(x, mean = 0, sd = 1, shape = 0, res = FALSE)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A numeric vector of shape.
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_student()

Examples

```
dev_skewnorm(c(-2:2))
dev_skewnorm(-2:2, 0, 1, 5)
dev_skewnorm(-2:2, 0, 1, 5, res = TRUE)
```

---

dev_student *Student's t Deviances*

Description

Student's t Deviances

Usage

```
dev_student(x, mean = 0, sd = 1, theta = 0, res = FALSE)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
res	A flag specifying whether to return the deviance residual as opposed to the deviance.

Value

An numeric vector of the corresponding deviances or deviance residuals.

See Also

Other dev_dist: dev_bern(), dev_beta_binom(), dev_binom(), dev_gamma(), dev_gamma_pois(), dev_lnorm(), dev_neg_binom(), dev_norm(), dev_pois(), dev_pois_zi(), dev_skewnorm()

Examples

```
dev_student(c(1, 3.5, 4), 3)
```

---

dskewnorm *Skew-Normal Distribution*

Description

Skew-Normal Distribution

Usage

```
dskewnorm(x, mean = 0, sd = 1, shape = 0, log = FALSE)

pskewnorm(q, mean = 0, sd = 1, shape = 0)

qskewnorm(p, mean = 0, sd = 1, shape = 0)

rskewnorm(n = 1, mean = 0, sd = 1, shape = 0)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A numeric vector of values.
log	A flag specifying whether to return the log-transformed value.
q	A vector of quantiles.
p	A vector of probabilities.
n	A non-negative whole number of the number of random samples to generate.

Value

dskewnorm gives the density, pskewnorm gives the distribution function, qskewnorm gives the quantile function, and rskewnorm generates random deviates. pskewnorm and qskewnorm use the lower tail probability.

Examples

```
dskewnorm(x = -2:2, mean = 0, sd = 1, shape = 0.1)
dskewnorm(x = -2:2, mean = 0, sd = 1, shape = -1)
qskewnorm(p = c(0.1, 0.4), mean = 0, sd = 1, shape = 0.1)
qskewnorm(p = c(0.1, 0.4), mean = 0, sd = 1, shape = -1)
pskewnorm(q = -2:2, mean = 0, sd = 1, shape = 0.1)
pskewnorm(q = -2:2, mean = 0, sd = 1, shape = -1)
rskewnorm(n = 3, mean = 0, sd = 1, shape = 0.1)
rskewnorm(n = 3, mean = 0, sd = 1, shape = -1)
```

---

exp10 *Exponential Transformation of Base 10*

Description

Returns the transformation of 10^x.

Usage

```
exp10(x)
```

Arguments

x	An numeric atomic object.

Value

A numeric atomic object with the value of 10^x.

See Also

Other translations: exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
x <- c(5, 10.5)
exp10(x)
```

exp2 *Exponential Transformation of Base 2*

Description

Returns the transformation of 2^x.

Usage

```
exp2(x)
```

Arguments

x	An numeric atomic object.

Value

A numeric atomic object with the value of 2^x.

See Also

Other translations: exp10(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
x <- c(5, 10.5)
exp2(x)
```

fabs *Absolute*

Description

Computes the absolute value of x. Used in TMB as replacement for abs() which is seemingly ambiguous.

Usage

```
fabs(x)
```

Arguments

x	An existing R object.

Details

A wrapper on `abs()`.

Value

A numeric vector of the corresponding absolute values.

See Also

Other translations: `exp10()`, `exp2()`, `ilog()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `logit<-()`, `phi()`, `pow()`, `step()`

Examples

```
fabs(c(0, -1, 2))
```

`fill_all` *Fill All Values*

Description

Fills all of an object's (missing and non-missing) values while preserving the object's dimensionality and class.

Usage

```
fill_all(x, value, ...)

## S3 method for class 'logical'
fill_all(x, value = FALSE, nas = TRUE, ...)

## S3 method for class 'integer'
fill_all(x, value = 0L, nas = TRUE, ...)

## S3 method for class 'numeric'
fill_all(x, value = 0, nas = TRUE, ...)

## S3 method for class 'character'
fill_all(x, value = "0", nas = TRUE, ...)
```

Arguments

`x`	An object.
`value`	A scalar of the value to replace values with.
`...`	Other arguments passed to methods.
`nas`	A flag specifying whether to also fill missing values.

Details

It should only be defined for objects with values of consistent class ie not standard data.frames.

Value

The modified object.

Methods (by class)

- `fill_all(logical)`: Fill All for logical Objects
- `fill_all(integer)`: Fill All for integer Objects
- `fill_all(numeric)`: Fill All for numeric Objects
- `fill_all(character)`: Fill All for character Objects

See Also

Other fill: `fill_na()`

Examples

```
# logical
fill_all(c(TRUE, NA, FALSE))
fill_all(c(TRUE, NA, FALSE, nas = FALSE))
fill_all(c(TRUE, NA, FALSE, value = NA))

# integer
fill_all(matrix(1:4, nrow = 2), value = -1)

# numeric
fill_all(c(1, 4, NA), value = TRUE)
fill_all(c(1, 4, NA), value = TRUE, nas = FALSE)

# character
fill_all(c("some", "words"), value = TRUE)
```

---

fill_na *Fill Missing Values*

Description

Fills all of an object's missing values while preserving the object's dimensionality and class.

Usage

```
fill_na(x, value, ...)

## S3 method for class 'logical'
fill_na(x, value = FALSE, ...)

## S3 method for class 'integer'
fill_na(x, value = 0L, ...)

## S3 method for class 'numeric'
fill_na(x, value = 0, ...)

## S3 method for class 'character'
fill_na(x, value = "0", ...)
```

Arguments

x	An object.
value	A scalar of the value to replace values with.
...	Other arguments passed to methods.

Details

It should only be defined for objects with values of consistent class ie not standard data.frames.

Value

The modified object.

Methods (by class)

- `fill_na(logical)`: Fill Missing Values for logical Objects
- `fill_na(integer)`: Fill Missing Values for integer Objects
- `fill_na(numeric)`: Fill Missing Values for numeric Objects
- `fill_na(character)`: Fill Missing Values for character Objects

See Also

Other fill: `fill_all()`

Examples

```
# logical
fill_na(c(TRUE, NA))

# integer
fill_na(c(1L, NA), 0)
```

```
# numeric
fill_na(c(1, NA), Inf)

# character
fill_na(c("text", NA))
fill_na(matrix(c("text", NA)), value = Inf)
```

`ilog` *Inverse Log Transformation*

Description

Inverse log transforms a numeric atomic object.

Usage

```
ilog(x)
```

Arguments

`x`	An object.

Details

A wrapper on `exp(value)`.

Value

A numeric atomic object.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `logit<-()`, `phi()`, `pow()`, `step()`

Examples

```
x <- 1
ilog(x)
```

ilog10 *Inverse Log Base 10 Transformation*

Description

Inverse log transforms a numeric atomic object with base 10.

Usage

```
ilog10(x)
```

Arguments

x	An object.

Details

A wrapper on `exp10(value)`.

Value

A numeric atomic object.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `logit<-()`, `phi()`, `pow()`, `step()`

Examples

```
x <- c(2, 4.5)
ilog10(x)
```

ilog2 *Inverse Log Base 2 Transformation*

Description

Inverse log transforms a numeric atomic object with base 2.

Usage

```
ilog2(x)
```

Arguments

x	An object.

Details

A wrapper on exp2(value).

Value

A numeric atomic object.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
x <- c(2, 4.5)
ilog2(x)
```

---

ilogit *Inverse Logistic Transformation*

Description

Inverse logistically transforms a numeric atomic object.

Usage

```
ilogit(x)
```

Arguments

x	A numeric atomic object.

Details

A wrapper on stats::plogis().

Value

A numeric atomic object.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
ilogit(c(-1, 0, 5))
```

invlogit *Inverse Logistic Transformation*

Description

Inverse logistically transforms a numeric atomic object.

Usage

```
invlogit(x)
```

Arguments

x	A numeric atomic object.

Details

A wrapper on `stats::plogis()`.

Value

A numeric atomic object.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `logit<-()`, `phi()`, `pow()`, `step()`

Examples

```
invlogit(c(-1, 0, 5))
```

inv_logit *Inverse Logistic Transformation*

Description

Inverse logistically transforms a numeric atomic object.

Usage

```
inv_logit(x)
```

Arguments

x	A numeric atomic object.

Details

A wrapper on stats::plogis().

Value

A numeric atomic object.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
inv_logit(c(-1, 0, 5))
```

---

inv_odds *Inverse Odds*

Description

Calculates the probabilities for odds.

Usage

```
inv_odds(x)
```

Arguments

x	A numeric object (vector, matrix or array) of odds.

Value

A numeric object of the the probabilities for each odd.

See Also

Other odds: log_odds(), log_odds<-(), log_odds_ratio(), odds(), odds<-(), odds_ratio()

Examples

```
inv_odds(c(0, 1, 9, 9999))
```

kurtosis *Kurtosis*

Description

Kurtosis

Usage

```
kurtosis(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
kurtosis(1:10)
```

log10<- *Log Base 10 Transformation*

Description

Replaces a object with the base 10 exponent of value.

Usage

```
log10(x) <- value
```

Arguments

x	An object.
value	A numeric atomic object.

Details

A wrapper on exp10(value).

Value

Called for the side effect of updating x.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log2<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
x <- NULL
log10(x) <- c(0.5, 5)
x
```

---

log2<- *Log Base 2 Transformation*

Description

Replaces a object with the base 2 exponent of value.

Usage

```
log2(x) <- value
```

Arguments

x	An object.
value	A numeric atomic object.

Details

A wrapper on exp2(value).

Value

Called for the side effect of updating x.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log<-(), logit(), logit<-(), phi(), pow(), step()

Examples

```
x <- NULL
log2(x) <- c(0.5, 5)
x
```

`log<-` *Log Transformation*

Description

Replaces a object with the exponent of value.

Usage

```
log(x) <- value
```

Arguments

`x`	An object.
`value`	A numeric atomic object.

Details

A wrapper on `exp(value)`.

Value

Called for the side effect of updating `x`.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `logit()`, `logit<-()`, `phi()`, `pow()`, `step()`

Examples

```
x <- NULL
log(x) <- 0.5
x
```

logit *Logistic Transformation*

Description

Logistic transforms a numeric atomic object.

Usage

```
logit(x)
```

Arguments

x	A numeric atomic object.

Details

A wrapper on stats::qlogis().

Value

The logistically transformed numeric atomic object.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit<-(), phi(), pow(), step()

Examples

```
logit(c(0.25, 0.5, 0.75))
```

logit<- *Logistic Transformation*

Description

Logistic Transformation

Usage

```
logit(x) <- value
```

Arguments

x	An existing object.
value	A numeric atomic object of the value to inverse logistically transform.

Details

A wrapper on `stats::plogis(value)`.

Value

Called for the side effect of updating `x`.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `phi()`, `pow()`, `step()`

Examples

```
x <- 1
logit(x) <- 0.5
x
```

---

log_lik_bern *Bernoulli Log-Likelihood*

Description

Bernoulli Log-Likelihood

Usage

```
log_lik_bern(x, prob = 0.5)
```

Arguments

`x`	A vector of 0s and 1s.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: `log_lik_beta_binom()`, `log_lik_binom()`, `log_lik_gamma()`, `log_lik_gamma_pois()`, `log_lik_gamma_pois_zi()`, `log_lik_lnorm()`, `log_lik_neg_binom()`, `log_lik_norm()`, `log_lik_pois()`, `log_lik_pois_zi()`, `log_lik_skewnorm()`, `log_lik_student()`

Examples

```
log_lik_bern(c(TRUE, FALSE), 0.7)
```

log_lik_beta_binom *Beta-Binomial Log-Likelihood*

Description

This parameterization of the beta-binomial distribution uses an expected probability parameter, `prob`, and a dispersion parameter, `theta`. The parameters of the underlying beta mixture are `alpha = (2 * prob) / theta` and `beta = (2 * (1 - prob)) / theta`. This parameterization of `theta` is unconventional, but has useful properties when modelling. When `theta = 0`, the beta-binomial reverts to the binomial distribution. When `theta = 1` and `prob = 0.5`, the parameters of the beta distribution become `alpha = 1` and `beta = 1`, which correspond to a uniform distribution for the beta-binomial probability parameter.

Usage

```
log_lik_beta_binom(x, size = 1, prob = 0.5, theta = 0)
```

Arguments

`x`	A non-negative whole numeric vector of values.
`size`	A non-negative whole numeric vector of the number of trials.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: `log_lik_bern()`, `log_lik_binom()`, `log_lik_gamma()`, `log_lik_gamma_pois()`, `log_lik_gamma_pois_zi()`, `log_lik_lnorm()`, `log_lik_neg_binom()`, `log_lik_norm()`, `log_lik_pois()`, `log_lik_pois_zi()`, `log_lik_skewnorm()`, `log_lik_student()`

Examples

```
log_lik_beta_binom(c(0, 1, 2), 3, 0.5, 0)
```

log_lik_binom *Binomial Log-Likelihood*

Description

Binomial Log-Likelihood

Usage

```
log_lik_binom(x, size = 1, prob = 0.5)
```

Arguments

x	A non-negative whole numeric vector of values.
size	A non-negative whole numeric vector of the number of trials.
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_binom(c(0, 1, 2), 2, 0.3)
```

log_lik_gamma *Gamma Log-Likelihood*

Description

Gamma Log-Likelihood

Usage

```
log_lik_gamma(x, shape = 1, rate = 1)
```

Arguments

x	A numeric vector of values.
shape	A non-negative numeric vector of shape.
rate	A non-negative numeric vector of rate.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_gamma(c(0, 1, 2), 1, 2)
```

---

log_lik_gamma_pois *Gamma-Poisson Log-Likelihood*

Description

Gamma-Poisson Log-Likelihood

Usage

```
log_lik_gamma_pois(x, lambda = 1, theta = 0)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_gamma_pois(c(0, 1, 2), 1, 1)
```

log_lik_gamma_pois_zi *Zero-Inflated Gamma-Poisson Log-Likelihood*

Description

Zero-Inflated Gamma-Poisson Log-Likelihood

Usage

```
log_lik_gamma_pois_zi(x, lambda = 1, theta = 0, prob = 0)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_gamma_pois_zi(c(1, 3, 4), 3, 1, prob = 0.5)
```

log_lik_lnorm *Log-Normal Log-Likelihood*

Description

Log-Normal Log-Likelihood

Usage

```
log_lik_lnorm(x, meanlog = 0, sdlog = 1)
```

Arguments

x	A numeric vector of values.
meanlog	A numeric vector of the means on the log scale.
sdlog	A non-negative numeric vector of the standard deviations on the log scale.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_lnorm(10, 0, 2)
```

---

log_lik_neg_binom *Negative Binomial Log-Likelihood*

Description

Negative Binomial Log-Likelihood

Usage

```
log_lik_neg_binom(x, lambda = 1, theta = 0)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_neg_binom(c(0, 1, 2), 2, 1)
```

`log_lik_norm` *Normal Log-Likelihood*

Description

Normal Log-Likelihood

Usage

```
log_lik_norm(x, mean = 0, sd = 1)
```

Arguments

`x`	A numeric vector of values.
`mean`	A numeric vector of the means.
`sd`	A non-negative numeric vector of the standard deviations.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: `log_lik_bern()`, `log_lik_beta_binom()`, `log_lik_binom()`, `log_lik_gamma()`, `log_lik_gamma_pois()`, `log_lik_gamma_pois_zi()`, `log_lik_lnorm()`, `log_lik_neg_binom()`, `log_lik_pois()`, `log_lik_pois_zi()`, `log_lik_skewnorm()`, `log_lik_student()`

Examples

```
log_lik_norm(c(-2:2))
```

log_lik_pois *Poisson Log-Likelihood*

Description

Poisson Log-Likelihood

Usage

```
log_lik_pois(x, lambda = 1)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois_zi(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_pois(c(1, 3, 4), 3)
```

log_lik_pois_zi *Zero-Inflated Poisson Log-Likelihood*

Description

Zero-Inflated Poisson Log-Likelihood

Usage

```
log_lik_pois_zi(x, lambda = 1, prob = 0)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_skewnorm(), log_lik_student()

Examples

```
log_lik_pois_zi(c(1, 3, 4), 3, prob = 0.5)
```

---

log_lik_skewnorm *Skew Normal Log-Likelihood*

Description

Skew Normal Log-Likelihood

Usage

```
log_lik_skewnorm(x, mean = 0, sd = 1, shape = 0)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A numeric vector of shape.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_student()

Examples

```
log_lik_skewnorm(c(-2:2))
log_lik_skewnorm(c(-2:2), shape = -2)
log_lik_skewnorm(c(-2:2), shape = 2)
```

log_lik_student *Student's t Log-Likelihood*

Description

Student's t Log-Likelihood

Usage

```
log_lik_student(x, mean = 0, sd = 1, theta = 0)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: log_lik_bern(), log_lik_beta_binom(), log_lik_binom(), log_lik_gamma(), log_lik_gamma_pois(), log_lik_gamma_pois_zi(), log_lik_lnorm(), log_lik_neg_binom(), log_lik_norm(), log_lik_pois(), log_lik_pois_zi(), log_lik_skewnorm()

Examples

```
log_lik_student(c(1, 3.5, 4), mean = 1, sd = 2, theta = 1 / 3)
```

log_odds *Log Odds*

Description

Calculates the log odds for probabilities.

Usage

```
log_odds(x)
```

Arguments

x	A numeric object (vector, matrix or array) of probabilities.

Value

A numeric object of the the log odds for each probability.

See Also

Other odds: inv_odds(), log_odds<-(), log_odds_ratio(), odds(), odds<-(), odds_ratio()

Examples

```
log_odds(c(0, 0.5, 0.9, 1))
```

---

log_odds<- *Inverse Log Odds Transformation*

Description

Replaces an object with the inverse log odds of value.

Usage

```
log_odds(x) <- value
```

Arguments

x	An existing R object.
value	A numeric atomic object.

Value

Called for the side effect of updating x.

See Also

Other odds: inv_odds(), log_odds(), log_odds_ratio(), odds(), odds<-(), odds_ratio()

Examples

```
x <- NULL
log_odds(x) <- 0.5
x
```

log_odds_ratio *Log-Odds Ratio*

Description

Calculates the log odds ratio for two probabilities.

Usage

```
log_odds_ratio(x, x2)
```

Arguments

x	A numeric object (vector, matrix or array) of probabilities.
x2	A second numeric object of probabilities.

Value

A numeric object of the log odds ratios.

See Also

Other odds: `inv_odds()`, `log_odds()`, `log_odds<-()`, `odds()`, `odds<-()`, `odds_ratio()`

Examples

```
log_odds_ratio(0.5, 0.75)
```

log_odds_ratio2 *Log Odds Ratio2*

Description

Calculates the log odds ratio for a vector of two probabilities.

Usage

```
log_odds_ratio2(x)
```

Arguments

x	A numeric vector of length 2.

Value

A number.

See Also

Other odds fun2: odds_ratio2()

Examples

```
log_odds_ratio2(c(0.5, 0.9))
log_odds_ratio2(c(0.9, 0.5))
```

---

lower *Lower Credible Limit*

Description

Calculates the quantile-based lower credible limit.

Usage

```
lower(x, conf_level = 0.95, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values.
conf_level	A numeric scalar between 0 and 1 specifying the confidence level.
na_rm	A flag specifying whether to remove missing values.

Details

By default it returns the 95% credible limit which corresponds to the 2.5% quantile.

Value

A number.

See Also

Other summary: kurtosis(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
lower(as.numeric(0:100))
```

numericise *Numericise (or Numericize)*

Description

Coerce an R object to a numeric atomic object.

Usage

```
numericise(x, ...)

numericize(x, ...)

## S3 method for class 'logical'
numericise(x, ...)

## S3 method for class 'integer'
numericise(x, ...)

## S3 method for class 'double'
numericise(x, ...)

## S3 method for class 'factor'
numericise(x, ...)

## S3 method for class 'Date'
numericise(x, ...)

## S3 method for class 'POSIXct'
numericise(x, ...)

## S3 method for class 'hms'
numericise(x, ...)

## S3 method for class 'matrix'
numericise(x, ...)

## S3 method for class 'array'
numericise(x, ...)

## S3 method for class 'data.frame'
numericise(x, ...)
```

Arguments

x	An object.
...	Other arguments passed to methods.

Details

`numericize()` is an alias for numericise. If you want to implement a method for a class `"foo"`, implement `numericise.foo()`.

Value

A numeric atomic object.

Methods (by class)

- `numericise(logical)`: Numericise a logical Object
- `numericise(integer)`: Numericise an integer Object
- `numericise(double)`: Numericise an double Object
- `numericise(factor)`: Numericise a factor
- `numericise(Date)`: Numericise a Date vector
- `numericise(POSIXct)`: Numericise a POSIXct vector
- `numericise(hms)`: Numericise a hms vector
- `numericise(matrix)`: Numericise a matrix
- `numericise(array)`: Numericise an array
- `numericise(data.frame)`: Numericise a data.frame

Examples

```
# logical
numericise(TRUE)
numericise(matrix(c(TRUE, FALSE), nrow = 2))

# integer
numericise(2L)

# double
numericise(c(1, 3))

# factor
numericise(factor(c("c", "a")))

# Date
numericise(as.Date("1972-01-01"))

# POSIXct
numericise(as.POSIXct("1972-01-01", tz = "UTC"))

# hms

numericise(hms::as_hms("00:01:03"))


# matrix
```

```
numericise(matrix(TRUE))

# array
numericise(array(TRUE))

# data.frame
numericise(data.frame(
  logical = c(TRUE, FALSE, NA),
  integer = 1:3,
  numeric = c(4, 10, NA),
  factor = as.factor(c("c", "A", "green"))
))
```

---

odds *Odds*

Description

Calculates the odds for probabilities.

Usage

```
odds(x)
```

Arguments

x	A numeric object (vector, matrix or array) of probabilities.

Value

A numeric object of the the odds for each probability.

See Also

Other odds: `inv_odds()`, `log_odds()`, `log_odds<-()`, `log_odds_ratio()`, `odds<-()`, `odds_ratio()`

Examples

```
odds(c(0, 0.5, 0.9, 1))
```

odds<- *Inverse Odds Transformation*

Description

Replaces an object with the inverse odds of value.

Usage

```
odds(x) <- value
```

Arguments

x	An existing R object.
value	A numeric atomic object.

Value

Called for the side effect of updating x.

See Also

Other odds: inv_odds(), log_odds(), log_odds<-(), log_odds_ratio(), odds(), odds_ratio()

Examples

```
x <- NULL
odds(x) <- 0.5
x
```

odds_ratio *Odds Ratio*

Description

Calculates the odds ratio for two probabilities.

Usage

```
odds_ratio(x, x2)
```

Arguments

x	A numeric object (vector, matrix or array) of probabilities.
x2	A second numeric object of probabilities.

Value

A numeric object of the odds ratios.

See Also

Other odds: `inv_odds()`, `log_odds()`, `log_odds<-()`, `log_odds_ratio()`, `odds()`, `odds<-()`

Examples

```
odds_ratio(0.5, 0.75)
```

`odds_ratio2` *Odds Ratio2*

Description

Calculates the odds ratio for a vector of two probabilities.

Usage

```
odds_ratio2(x)
```

Arguments

`x`	A numeric vector of length 2.

Value

A number.

See Also

Other odds fun2: `log_odds_ratio2()`

Examples

```
odds_ratio2(c(0.5, 0.9))
odds_ratio2(c(0.9, 0.5))
```

par_pattern *Parameter Pattern*

Description

Parameter Pattern

Usage

```
par_pattern()
```

Value

A string of the regular expression for a parameter name.

Examples

```
par_pattern()
```

pextreme *Extreme Probability*

Description

Calculates the probability that a cumulative distribution function probability is at least that extreme. **[Deprecated]**

Usage

```
pextreme(x)
```

Arguments

x	A numeric vector of values between 0 and 1.

Value

A numeric vector of values between 0 and 1.

See Also

Other residuals: `sextreme()`

Examples

```
pextreme(seq(0, 1, by = 0.1))
```

phi *Phi*

Description

The standard normal cumulative density function.

Usage

```
phi(x)
```

Arguments

x	A numeric atomic object.

Details

A wrapper on `stats::pnorm()`.

Value

A numeric atomic object.

See Also

Other translations: `exp10()`, `exp2()`, `fabs()`, `ilog()`, `ilog10()`, `ilog2()`, `ilogit()`, `inv_logit()`, `invlogit()`, `log10<-()`, `log2<-()`, `log<-()`, `logit()`, `logit<-()`, `pow()`, `step()`

Examples

```
phi(0:2)
```

pow *Power*

Description

R equivalent to the power function.

Usage

```
pow(x, n)
```

Arguments

x	A numeric atomic object of the base.
n	A numeric atomic object of the exponent.

Details

Wrapper on x^n.

Value

A numeric atomic object of x raised to n.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), step()

Examples

```
pow(10, 2)
```

---

proportional_change *Proportional Change*

Description

Calculates the proportional change for two sets of numbers.

Usage

```
proportional_change(x, x2)
```

Arguments

x	A numeric object (vector, matrix or array) of non-negative numbers.
x2	A second numeric object of non-negative numbers.

Value

A numeric object of the proportional change.

See Also

Other proportional: proportional_difference()

Examples

```
proportional_change(1, 2)
proportional_change(2, 1)
```

proportional_change2 *Proportional Change2*

Description

Calculates the proportional change for a vector of two non-negative numbers.

Usage

```
proportional_change2(x)
```

Arguments

x	A numeric vector of length 2.

Value

A number.

See Also

Other proportional fun2: `proportional_difference2()`

Examples

```
proportional_change2(c(1, 2))
proportional_change2(c(2, 1))
```

proportional_difference *Proportional Difference*

Description

Calculates the proportional difference for two sets of numbers.

Usage

```
proportional_difference(x, x2)
```

Arguments

x	A numeric object (vector, matrix or array) of non-negative numbers.
x2	A second numeric object of non-negative numbers.

Value

A numeric object of the proportional change.

See Also

Other proportional: `proportional_change()`

Examples

```
proportional_difference(1, 2)
proportional_difference(2, 1)
```

`proportional_difference2`
Proportional Difference2

Description

Calculates the proportional difference for a vector of two non-negative numbers.

Usage

```
proportional_difference2(x)
```

Arguments

x	A numeric vector of length 2.

Value

A number.

See Also

Other proportional fun2: `proportional_change2()`

Examples

```
proportional_difference2(c(1, 2))
proportional_difference2(c(2, 1))
```

pvalue *Bayesian P-Value*

Description

A Bayesian p-value (p) is here defined in terms of the quantile-based (1-p) * 100% credible interval (CRI) that just includes a threshold (Kery and Schaub 2011). By default a p-value of 0.05 indicates that the 95% CRI just includes 0.

Usage

```
pvalue(x, threshold = 0, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values.
threshold	A number of the threshold value.
na_rm	A flag specifying whether to remove missing values.

Value

A number between 0 and 1.

References

Kery, M., and Schaub, M. 2011. Bayesian population analysis using WinBUGS: a hierarchical perspective. Academic Press, Boston. Available from https://www.vogelwarte.ch/en/research/population-biology/book-bpa/.

See Also

Other summary: kurtosis(), lower(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
pvalue(as.numeric(0:100))
```

pzeros *Proportion of Zeros*

Description

The proportion of zeros in an numeric object.

Usage

```
pzeros(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number between 0 and 1.

See Also

Other summary: kurtosis(), lower(), pvalue(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
pzeros(c(0:2))
```

ran_bern *Bernoulli Random Samples*

Description

Bernoulli Random Samples

Usage

```
ran_bern(n = 1, prob = 0.5)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_bern(10)
```

---

ran_beta_binom *Beta-Binomial Random Samples*

Description

This parameterization of the beta-binomial distribution uses an expected probability parameter, prob, and a dispersion parameter, theta. The parameters of the underlying beta mixture are alpha = (2 * prob) / theta and beta = (2 * (1 - prob)) / theta. This parameterization of theta is unconventional, but has useful properties when modelling. When theta = 0, the beta-binomial reverts to the binomial distribution. When theta = 1 and prob = 0.5, the parameters of the beta distribution become alpha = 1 and beta = 1, which correspond to a uniform distribution for the beta-binomial probability parameter.

Usage

```
ran_beta_binom(n = 1, size = 1, prob = 0.5, theta = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
size	A non-negative whole numeric vector of the number of trials.
prob	A numeric vector of values between 0 and 1 of the probability of success.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_beta_binom(10, 1, 0.5, 0)
```

`ran_binom` *Binomial Random Samples*

Description

Binomial Random Samples

Usage

```
ran_binom(n = 1, size = 1, prob = 0.5)
```

Arguments

`n`	A non-negative whole number of the number of random samples to generate.
`size`	A non-negative whole numeric vector of the number of trials.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: `ran_bern()`, `ran_beta_binom()`, `ran_gamma()`, `ran_gamma_pois()`, `ran_gamma_pois_zi()`, `ran_lnorm()`, `ran_neg_binom()`, `ran_norm()`, `ran_pois()`, `ran_pois_zi()`, `ran_skewnorm()`, `ran_student()`

Examples

```
ran_binom(10)
```

ran_gamma *Gamma Random Samples*

Description

Gamma Random Samples

Usage

```
ran_gamma(n = 1, shape = 1, rate = 1)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
shape	A non-negative numeric vector of shape.
rate	A non-negative numeric vector of rate.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_gamma(10)
```

ran_gamma_pois *Gamma-Poisson Random Samples*

Description

Gamma-Poisson Random Samples

Usage

```
ran_gamma_pois(n = 1, lambda = 1, theta = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_gamma_pois(10, theta = 1)
```

---

ran_gamma_pois_zi *Zero-Inflated Gamma-Poisson Random Samples*

Description

Zero-Inflated Gamma-Poisson Random Samples

Usage

```
ran_gamma_pois_zi(n = 1, lambda = 1, theta = 0, prob = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_gamma_pois_zi(10, lambda = 3, theta = 1, prob = 0.5)
```

---

ran_lnorm *Log-Normal Random Samples*

Description

Log-Normal Random Samples

Usage

```
ran_lnorm(n = 1, meanlog = 0, sdlog = 1)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
meanlog	A numeric vector of the means on the log scale.
sdlog	A non-negative numeric vector of the standard deviations on the log scale.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_lnorm(10)
```

ran_neg_binom *Negative Binomial Random Samples*

Description

Identical to Gamma-Poisson Random Samples.

Usage

```
ran_neg_binom(n = 1, lambda = 1, theta = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_neg_binom(10, theta = 1)
```

ran_norm *Normal Random Samples*

Description

Normal Random Samples

Usage

```
ran_norm(n = 1, mean = 0, sd = 1)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_pois(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_norm(10)
```

---

ran_pois *Poisson Random Samples*

Description

Poisson Random Samples

Usage

```
ran_pois(n = 1, lambda = 1)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
lambda	A non-negative numeric vector of means.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois_zi(), ran_skewnorm(), ran_student()

Examples

```
ran_pois(10)
```

ran_pois_zi *Zero-Inflated Poisson Random Samples*

Description

Zero-Inflated Poisson Random Samples

Usage

```
ran_pois_zi(n = 1, lambda = 1, prob = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
lambda	A non-negative numeric vector of means.
prob	A numeric vector of values between 0 and 1 of the probability of success.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_skewnorm(), ran_student()

Examples

```
ran_pois_zi(10, prob = 0.5)
```

ran_skewnorm *Skew Normal Random Samples*

Description

Skew Normal Random Samples

Usage

```
ran_skewnorm(n = 1, mean = 0, sd = 1, shape = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A numeric vector of shape.

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_student()

Examples

```
ran_skewnorm(10, shape = -1)
ran_skewnorm(10, shape = 0)
ran_skewnorm(10, shape = 1)
```

---

ran_student *Student's t Random Samples*

Description

Student's t Random Samples

Usage

```
ran_student(n = 1, mean = 0, sd = 1, theta = 0)
```

Arguments

n	A non-negative whole number of the number of random samples to generate.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).

Value

A numeric vector of the random samples.

See Also

Other ran_dist: ran_bern(), ran_beta_binom(), ran_binom(), ran_gamma(), ran_gamma_pois(), ran_gamma_pois_zi(), ran_lnorm(), ran_neg_binom(), ran_norm(), ran_pois(), ran_pois_zi(), ran_skewnorm()

Examples

```
ran_student(10, theta = 1 / 2)
```

---

res_bern *Bernoulli Residuals*

Description

Bernoulli Residuals

Usage

```
res_bern(x, prob = 0.5, type = "dev", simulate = FALSE)
```

Arguments

x	A vector of 0s and 1s.
prob	A numeric vector of values between 0 and 1 of the probability of success.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_bern(c(TRUE, FALSE), 0.7)
```

`res_beta_binom` *Beta-Binomial Residuals*

Description

This parameterization of the beta-binomial distribution uses an expected probability parameter, `prob`, and a dispersion parameter, `theta`. The parameters of the underlying beta mixture are `alpha = (2 * prob) / theta` and `beta = (2 * (1 - prob)) / theta`. This parameterization of `theta` is unconventional, but has useful properties when modelling. When `theta = 0`, the beta-binomial reverts to the binomial distribution. When `theta = 1` and `prob = 0.5`, the parameters of the beta distribution become `alpha = 1` and `beta = 1`, which correspond to a uniform distribution for the beta-binomial probability parameter.

Usage

```
res_beta_binom(
  x,
  size = 1,
  prob = 0.5,
  theta = 0,
  type = "dev",
  simulate = FALSE
)
```

Arguments

`x`	A non-negative whole numeric vector of values.
`size`	A non-negative whole numeric vector of the number of trials.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
`type`	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
`simulate`	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: `res_bern()`, `res_binom()`, `res_gamma()`, `res_gamma_pois()`, `res_gamma_pois_zi()`, `res_lnorm()`, `res_neg_binom()`, `res_norm()`, `res_pois()`, `res_pois_zi()`, `res_skewnorm()`, `res_student()`

Examples

```
res_beta_binom(c(0, 1, 2), 4, 0.5, 0.1)
```

`res_binom` *Binomial Residuals*

Description

Binomial Residuals

Usage

```
res_binom(x, size = 1, prob = 0.5, type = "dev", simulate = FALSE)
```

Arguments

`x`	A non-negative whole numeric vector of values.
`size`	A non-negative whole numeric vector of the number of trials.
`prob`	A numeric vector of values between 0 and 1 of the probability of success.
`type`	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
`simulate`	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: `res_bern()`, `res_beta_binom()`, `res_gamma()`, `res_gamma_pois()`, `res_gamma_pois_zi()`, `res_lnorm()`, `res_neg_binom()`, `res_norm()`, `res_pois()`, `res_pois_zi()`, `res_skewnorm()`, `res_student()`

Examples

```
res_binom(c(0, 1, 2), 2, 0.3)
```

res_gamma *Gamma Residuals*

Description

Gamma Residuals

Usage

```
res_gamma(x, shape = 1, rate = 1, type = "dev", simulate = FALSE)
```

Arguments

x	A numeric vector of values.
shape	A non-negative numeric vector of shape.
rate	A non-negative numeric vector of rate.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_gamma(c(0, 1, 2), 1, 2)
```

res_gamma_pois *Gamma-Poisson Residuals*

Description

Gamma-Poisson Residuals

Usage

```
res_gamma_pois(x, lambda = 1, theta = 0, type = "dev", simulate = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_gamma_pois(c(0, 1, 2), 1, 1)
```

---

res_gamma_pois_zi *Zero-Inflated Gamma-Poisson Residuals*

Description

Zero-Inflated Gamma-Poisson Residuals

Usage

```
res_gamma_pois_zi(
  x,
  lambda = 1,
  theta = 0,
  prob = 0,
  type = "dev",
  simulate = FALSE
)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
prob	A numeric vector of values between 0 and 1 of the probability of zero-inflation.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: `res_bern()`, `res_beta_binom()`, `res_binom()`, `res_gamma()`, `res_gamma_pois()`, `res_lnorm()`, `res_neg_binom()`, `res_norm()`, `res_pois()`, `res_pois_zi()`, `res_skewnorm()`, `res_student()`

Examples

```
res_gamma_pois_zi(c(0, 1, 2), 1, 1, 0.5)
```

---

res_lnorm *Log-Normal Residuals*

Description

Log-Normal Residuals

Usage

```
res_lnorm(x, meanlog = 0, sdlog = 1, type = "dev", simulate = FALSE)
```

Arguments

x	A numeric vector of values.
meanlog	A numeric vector of the means on the log scale.
sdlog	A non-negative numeric vector of the standard deviations on the log scale.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_neg_binom(), res_norm(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_lnorm(10)
```

---

res_neg_binom *Negative Binomial Residuals*

Description

Negative Binomial Residuals

Usage

```
res_neg_binom(x, lambda = 1, theta = 0, type = "dev", simulate = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_norm(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_neg_binom(c(0, 1, 5), 2, 3)
```

res_norm *Normal Residuals*

Description

Normal Residuals

Usage

```
res_norm(x, mean = 0, sd = 1, type = "dev", simulate = FALSE)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_pois(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_norm(c(-2:2))
```

res_pois *Poisson Residuals*

Description

Poisson Residuals

Usage

```
res_pois(x, lambda = 1, type = "dev", simulate = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois_zi(), res_skewnorm(), res_student()

Examples

```
res_pois(c(1, 3, 4), 3)
```

---

res_pois_zi *Zero-Inflated Poisson Residuals*

Description

Zero-Inflated Poisson Residuals

Usage

```
res_pois_zi(x, lambda = 1, prob = 0, type = "dev", simulate = FALSE)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
prob	A numeric vector of values between 0 and 1 of the probability of zero-inflation.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois(), res_skewnorm(), res_student()

Examples

```
res_pois_zi(c(1, 3, 4), 6, 0.5, type = "raw")
```

---

res_skewnorm *Skew Normal Residuals*

Description

Skew Normal Residuals

Usage

```
res_skewnorm(x, mean = 0, sd = 1, shape = 0, type = "dev", simulate = FALSE)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A numeric vector of shape.
type	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
simulate	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: res_bern(), res_beta_binom(), res_binom(), res_gamma(), res_gamma_pois(), res_gamma_pois_zi(), res_lnorm(), res_neg_binom(), res_norm(), res_pois(), res_pois_zi(), res_student()

Examples

```
res_skewnorm(c(-2:2))
```

`res_student` *Student's t Residuals*

Description

Student's t Residuals

Usage

```
res_student(x, mean = 0, sd = 1, theta = 0, type = "dev", simulate = FALSE)
```

Arguments

`x`	A non-negative whole numeric vector of values.
`mean`	A numeric vector of the means.
`sd`	A non-negative numeric vector of the standard deviations.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
`type`	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
`simulate`	A flag specifying whether to simulate residuals.

Value

An numeric vector of the corresponding residuals.

See Also

Other res_dist: `res_bern()`, `res_beta_binom()`, `res_binom()`, `res_gamma()`, `res_gamma_pois()`, `res_gamma_pois_zi()`, `res_lnorm()`, `res_neg_binom()`, `res_norm()`, `res_pois()`, `res_pois_zi()`, `res_skewnorm()`

Examples

```
res_student(c(1, 3.5, 4), mean = 6, sd = 0.5, theta = 1 / 3, type = "raw")
```

sens_beta *Adjust Beta Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Beta distribution. The Beta distribution has a maximum variance of `mean(x) * (1 - mean(x)`, where `mean(x) = alpha / (alpha + beta)`. If the inputs produce a desired variance that is greater than the maximum possible variance, or provides alpha and/or beta parameters that are `< 1` and thus push more probability weight towards extreme probability values, this function returns `alpha = 1` and `beta = 1` (the uniform distribution).

Usage

```
sens_beta(alpha, beta, sd_mult = 2)
```

Arguments

`alpha`	The first shape parameter of the Beta distribution.
`beta`	The second shape parameter of the Beta distribution.
`sd_mult`	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: `sens_exp()`, `sens_gamma()`, `sens_gamma_pois()`, `sens_gamma_pois_zi()`, `sens_lnorm()`, `sens_neg_binom()`, `sens_norm()`, `sens_pois()`, `sens_skewnorm()`, `sens_student()`

Examples

```
sens_beta(10, 10, 2)
sens_beta(10, 10, 0.8)
```

sens_exp *Adjust Exponential Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the exponential distribution. Due to the parameterization of this distribution, adjusting the standard deviation necessarily changes the mean value.

Usage

```
sens_exp(rate, sd_mult = 2)
```

Arguments

rate	A non-negative numeric vector of rate.
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_neg_binom(), sens_norm(), sens_pois(), sens_skewnorm(), sens_student()

Examples

```
sens_exp(10, 2)
sens_exp(10, 0.8)
```

---

sens_gamma *Adjust Gamma Distribution Parameters for Sensitivity Analyses*

Description

Expands (sd_mult > 1) or reduces (sd_mult < 1) the standard deviation of the Gamma distribution.

Usage

```
sens_gamma(shape, rate, sd_mult = 2)
```

Arguments

shape	A non-negative numeric vector of shape.
rate	A non-negative numeric vector of rate.
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_neg_binom(), sens_norm(), sens_pois(), sens_skewnorm(), sens_student()

Examples

```
sens_gamma(10, 2, 2)
sens_gamma(10, 2, 0.2)
```

`sens_gamma_pois` *Adjust Gamma-Poisson Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) the standard deviation of the Negative Binomial distribution. This function does not currently have the option to reduce the standard deviation.

Usage

```
sens_gamma_pois(lambda, theta, sd_mult = 2)
```

Arguments

`lambda`	A non-negative numeric vector of means.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
`sd_mult`	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: `sens_beta()`, `sens_exp()`, `sens_gamma()`, `sens_gamma_pois_zi()`, `sens_lnorm()`, `sens_neg_binom()`, `sens_norm()`, `sens_pois()`, `sens_skewnorm()`, `sens_student()`

Examples

```
sens_gamma_pois(10, 0.1, 2)
```

sens_gamma_pois_zi *Adjust Zero-Inflated Gamma-Poisson Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Zero-Inflated Gamma-Poisson distribution.

Usage

```
sens_gamma_pois_zi(lambda, theta, prob, sd_mult = 2)
```

Arguments

`lambda`	A non-negative numeric vector of means.
`theta`	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
`prob`	A numeric vector of values between 0 and 1 of the probability of success.
`sd_mult`	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: `sens_beta()`, `sens_exp()`, `sens_gamma()`, `sens_gamma_pois()`, `sens_lnorm()`, `sens_neg_binom()`, `sens_norm()`, `sens_pois()`, `sens_skewnorm()`, `sens_student()`

Examples

```
sens_gamma_pois_zi(10, 0.1, 0.3, 2)
```

sens_lnorm *Adjust Log-Normal Distribution Parameters for Sensitivity Analysis*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Log-Normal distribution. With high values of `sdlog` (i.e., `> 9`), and `sd_mult > 1`, the mean of the adjusted distribution can be expected to have a mean value that is very different from the original mean, however, the proportional difference in these values should not be very different.

Usage

```
sens_lnorm(meanlog, sdlog, sd_mult = 2)
```

Arguments

meanlog	A numeric vector of the means on the log scale.
sdlog	A non-negative numeric vector of the standard deviations on the log scale.
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_neg_binom(), sens_norm(), sens_pois(), sens_skewnorm(), sens_student()

Examples

```
sens_lnorm(0, 1, 2)
sens_lnorm(0, 1, 0.8)
```

---

sens_neg_binom *Adjust Negative Binomial Distribution Parameters for Sensitivity Analyses*

Description

Expands (sd_mult > 1) the standard deviation of the Negative Binomial distribution. This function does not currently have the option to reduce the standard deviation.

Usage

```
sens_neg_binom(lambda, theta, sd_mult = 2)
```

Arguments

lambda	A non-negative numeric vector of means.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_norm(), sens_pois(), sens_skewnorm(), sens_student()

Examples

```
sens_neg_binom(10, 0.1, 2)
```

---

sens_norm *Adjust Normal Distribution Parameters for Sensitivity Analyses*

Description

Expands (sd_mult > 1) or reduces (sd_mult < 1) the standard deviation of the Normal distribution without changing the mean.

Usage

```
sens_norm(mean, sd, sd_mult = 2)
```

Arguments

mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_neg_binom(), sens_pois(), sens_skewnorm(), sens_student()

Examples

```
sens_norm(10, 3, 2)
sens_norm(10, 3, 0.8)
```

sens_pois *Adjust Poisson Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Poisson distribution. Due to the parameterization of this distribution, adjusting the standard deviation necessarily changes the mean value.

Usage

```
sens_pois(lambda, sd_mult = 2)
```

Arguments

`lambda`	A non-negative numeric vector of means.
`sd_mult`	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: `sens_beta()`, `sens_exp()`, `sens_gamma()`, `sens_gamma_pois()`, `sens_gamma_pois_zi()`, `sens_lnorm()`, `sens_neg_binom()`, `sens_norm()`, `sens_skewnorm()`, `sens_student()`

Examples

```
sens_pois(10, 2)
sens_pois(10, 0.8)
```

sens_skewnorm *Adjust Skew Normal Distribution Parameters for Sensitivity Analyses*

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Skew Normal distribution without changing the mean.

Usage

```
sens_skewnorm(mean, sd, shape, sd_mult = 2)
```

Arguments

mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
shape	A non-negative numeric vector of shape.
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_neg_binom(), sens_norm(), sens_pois(), sens_student()

Examples

```
sens_skewnorm(10, 3, -1, 2)
sens_skewnorm(10, 3, 3, 0.8)
```

---

sens_student *Adjust Student's t Distribution Parameters for Sensitivity Analyses*

Description

Expands (sd_mult > 1) or reduces (sd_mult < 1) the standard deviation of the Student's t distribution. Because the variance of this distribution is not defined for every degree of freedom, the adjustment to the standard deviation is approximate, and the mean of the adjusted distribution can be expected to have shifted.

Usage

```
sens_student(mean, sd, theta, sd_mult = 2)
```

Arguments

mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
theta	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
sd_mult	A non-negative multiplier on the standard deviation of the distribution.

Value

A named list of the adjusted distribution's parameters.

See Also

Other sens_dist: sens_beta(), sens_exp(), sens_gamma(), sens_gamma_pois(), sens_gamma_pois_zi(), sens_lnorm(), sens_neg_binom(), sens_norm(), sens_pois(), sens_skewnorm()

Examples

```
sens_student(10, 3, 0.1, 2)
sens_student(10, 3, 0.1, 0.8)
```

---

sextreme *Extreme Surprisal*

Description

Calculates the surprisal (in bits) that a cumulative distribution function probability is at least that extreme. **[Deprecated]**

Usage

```
sextreme(x, directional = FALSE)
```

Arguments

x	A numeric vector of values between 0 and 1.
directional	A flag specifying whether probabilities less than 0.5 should be returned as negative values.

Value

A numeric vector of surprisal values.

See Also

Other residuals: pextreme()

Examples

```
sextreme(seq(0.1, 0.9, by = 0.1))
sextreme(seq(0.1, 0.9, by = 0.1), directional = TRUE)
```

skewness *Skewness*

Description

Skewness

Usage

```
skewness(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
skewness(1:10)
```

step *Step*

Description

Step

Usage

```
step(x)
```

Arguments

x	A numeric atomic object.

Value

A logical value.

See Also

Other translations: exp10(), exp2(), fabs(), ilog(), ilog10(), ilog2(), ilogit(), inv_logit(), invlogit(), log10<-(), log2<-(), log<-(), logit(), logit<-(), phi(), pow()

Examples

```
step(1)
```

---

svalue *Surprisal Value*

Description

The surprisal value (Greenland 2019) is the pvalue expressed in terms of how many consecutive heads would have to be thrown on a fair coin in a single attempt to achieve the same probability.

Usage

```
svalue(x, threshold = 0, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
threshold	A number of the threshold value.
na_rm	A flag specifying whether to remove missing values.

Value

A non-negative number.

References

Greenland, S. 2019. Valid P -Values Behave Exactly as They Should: Some Misleading Criticisms of P -Values and Their Resolution With S -Values. The American Statistician 73(sup1): 106–114. doi:10.1080/00031305.2018.1529625.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
svalue(as.numeric(0:100))
```

upper *Upper Credible Limit*

Description

Calculates the quantile-based upper credible limit.

Usage

```
upper(x, conf_level = 0.95, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values.
conf_level	A numeric scalar between 0 and 1 specifying the confidence level.
na_rm	A flag specifying whether to remove missing values.

Details

By default it returns the 95% credible limit which corresponds to the 97.5% quantile.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
upper(as.numeric(0:100))
```

variance *Variance*

Description

Variance

Usage

```
variance(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), xtr_mean(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
variance(1:10)
```

---

xtr_mean *Mean*

Description

Mean

Usage

```
xtr_mean(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_median(), xtr_sd(), zeros(), zscore()

Examples

```
xtr_mean(1:10)
```

xtr_median *Median*

Description

Median

Usage

```
xtr_median(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_sd(), zeros(), zscore()

Examples

```
xtr_mean(1:10)
```

xtr_sd *Standard Deviation*

Description

Standard Deviation

Usage

```
xtr_sd(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), zeros(), zscore()

Examples

```
xtr_sd(1:10)
```

---

zeros *Zeros*

Description

The number of zeros in an numeric object.

Usage

```
zeros(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A non-negative integer.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zscore()

Examples

```
zeros(c(0:2))
```

zscore *Z-Score*

Description

The Bayesian z-score is here defined as the number of standard deviations from the mean estimate to zero.

Usage

```
zscore(x, na_rm = FALSE)
```

Arguments

x	A numeric object of MCMC values.
na_rm	A flag specifying whether to remove missing values.

Value

A number.

See Also

Other summary: kurtosis(), lower(), pvalue(), pzeros(), skewness(), svalue(), upper(), variance(), xtr_mean(), xtr_median(), xtr_sd(), zeros()

Examples

```
zscore(as.numeric(0:100))
```

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