

Package ‘extras’

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Title Helper Functions for Bayesian Analyses

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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>

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as_list	<i>As List</i>
---------	----------------

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	<i>As List</i>
-----------------	----------------

Description

Coerces an object to an list. All attributes are removed except any names. **[Deprecated]**

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	<i>Check Parameter Names</i>
----------	------------------------------

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

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

lower.tail	A flag specifying whether to return the lower or upper tail of the distribution.
p	A numeric 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_skewlnorm\(\)](#), [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 $\alpha = (2 * \text{prob}) / \text{theta}$ and $\beta = (2 * (1 - \text{prob})) / \text{theta}$. This parameterization of theta is unconventional, but has useful properties when modelling. When $\text{theta} = 0$, the beta-binomial reverts to the binomial distribution. When $\text{theta} = 1$ and $\text{prob} = 0.5$, 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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

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

dev_gamma_pois	<i>Gamma-Poisson Deviances</i>
----------------	--------------------------------

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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

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

dev_gamma_pois_zi	<i>Zero-Inflated Gamma-Poisson Deviances</i>
-------------------	--

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	<i>Log-Normal Deviances</i>
-----------	-----------------------------

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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

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

dev_neg_binom	<i>Negative Binomial Deviances</i>
---------------	------------------------------------

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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

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

dev_pois_zi	<i>Zero-Inflated Poisson Deviances</i>
-------------	--

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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

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

dev_skewlnorm	<i>Skew-Lognormal Deviances</i>
---------------	---------------------------------

Description

Skew-Lognormal Deviances

Usage

```
dev_skewlnorm(x, meanlog = 0, sdlog = 1, shape = 0, 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.
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_skewnorm\(\)](#), [dev_student\(\)](#)

Examples

```
dev_skewlnorm(exp(-2:2))
dev_skewlnorm(exp(-2:2), 0, 1, 5)
dev_skewlnorm(exp(-2:2), 0, 1, 5, res = TRUE)
```

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_skewlnorm\(\)](#), [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	<i>Student's t Deviances</i>
-------------	------------------------------

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_skewlnorm\(\)](#), [dev_skewnorm\(\)](#)

Examples

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

direction	<i>Direction of a distribution</i>
-----------	------------------------------------

Description

The direction of a distribution is the side (left/right) that the distribution's center falls on, relative to a threshold. The center can be calculated using a user-specified function, including the median (default), mean, geometric mean, mode, or any other custom function. By convention, values below the threshold fall to the left, while values above the threshold fall to the right. Center estimates equal to the threshold are assumed to fall to the right.

Usage

```
direction(x, estimate = xtr_median, threshold = 0, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values or any other numeric vector of samples.
estimate	A function for estimating the center of the distribution. Defaults to <code>xtr_median()</code> , but can also be <code>xtr_mean()</code> or any custom function that returns a number (a non-missing numeric vector of length 1). If <code>na_rm</code> is true, NA values are dropped before calling the function.
threshold	A number of the threshold value.
na_rm	A flag specifying whether to remove missing values.

Value

A string indicating if at least half of the observations are above the threshold ("right") or not ("left"), or `NA_character_` in the case of missing values when `na_rm = FALSE`.

See Also

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

Examples

```
direction(c(1, 2, 3))
direction(c(-1))
direction(c(0, 0, 0))
direction(c(-100, 1, 1))
direction(c(-100, 1, 1), mean)
direction(c(100, 0.01, 0.01), function(.x) exp(mean(log(.x))))
```

directional_information

Directional information

Description

The occurrence of an event (or lack thereof) transmits more or less information depending on the event's probability.

Usage

```
directional_information(
  x,
  ...,
  side = "median",
  threshold = 0,
  threshold_split = "proportional",
  skeptical = TRUE,
  na_rm = FALSE
)

p2info(p, n = Inf)
```

Arguments

x	A numeric vector of MCMC values.
...	Unused.
side	A string indicating whether to calculate the directional information relative to the left side ("left"; $x < \text{threshold}$), or the right side ("right"; $x > \text{threshold}$). Positive information suggests greater evidence for the specified side. Defaults to "median", which uses the side of the median of x via direction() .
threshold	A number of the threshold value.
threshold_split	A string indicating how to deal with threshold values: • "left" to include them on the left side, • "right" to include them on the right side, • "equal" to split them equally between the left and side, • "proportional" (default) to split them between the left and right sides proportionally to the values of x on the left and right sides, • "exclude" to drop the values of x equal to threshold (identical to using "proportional").
skeptical	A flag specifying whether or not to add one sample to the empty side of the threshold when 100% of samples are on one side. Avoids zero p-values and infinite s-values, and also imposes stronger bounds on directional information than $[-n, n]$, which assume the MCMC samples are independent and representative.

na_rm	A flag specifying whether to remove missing values.
p	A numeric vector of probabilities of direction.
n	A numeric vector of the number of posterior samples used to estimate each value of p. Used to limit the information to be within the interval $[-n, n]$.

Details

Quantifies the information about direction in a posterior distribution based on the directional probability. This function calculates such information using the difference in the probability of direction (see `probability_direction()`), after converting each probability to bits (also see `svalue()`).

When `skeptical = TRUE` (default), one sample is added to the empty side, giving bounds of $\pm \log_2(n)$ rather than $\pm n$, to mimic the behaviour of `pvalue()` and `svalue()`. When `skeptical = FALSE`, information is instead clamped to $[-n, n]$, which assumes the MCMC samples are independent and representative.

Value

A number indicating the directional information in bits. If x has NA values but `na_rm` is FALSE, returns `NA_real`.

Functions

- `directional_information()`: Calculate the directional information from a posterior distribution.
- `p2info()`: Calculate the information from a vector of probabilities.

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: `direction()`, `kurtosis()`, `lower()`, `probability_direction()`, `pvalue()`, `pzeros()`, `skewness()`, `svalue()`, `upper()`, `variance()`, `xtr_mean()`, `xtr_median()`, `xtr_sd()`, `zeros()`, `zscore()`

Examples

```
directional_information(0)
directional_information(1) # one coin flip of information
directional_information(c(1, 1)) # two coin flips
directional_information(c(1, 1, -1)) # x[2] and x[3] cancel out
directional_information(c(1, 1, -1, -1)) # both sides cancel out
directional_information(rnorm(1e3, mean = 0))
directional_information(rnorm(1e3, mean = 1))
directional_information(rnorm(1e3, mean = 10)) # all coin flips are positive
directional_information(rnorm(1e3, mean = -10)) # all coin flips are negative
```

```
directional_information(rnorm(1e3, mean = 1e3)) # only quantiles matter
directional_information(rnorm(1e6, mean = 1e3)) # more `x` implies more info
directional_information(rep(1, 1000)) # skeptical = TRUE (default) gives log2(n)
directional_information(rep(1, 1000), skeptical = FALSE) # skeptical = FALSE gives n

p2info(seq(0, 1, by = 0.1))
p2info(seq(0, 1, by = 0.1), n = 10) # limit information to be in [-10, 10]
```

dskewlnorm

Skew-Lognormal Distribution

Description

The skew-lognormal distribution of a value x whose natural logarithm follows a [Skew-Normal](#) distribution with location `meanlog`, scale `sdlog` and shape. It reduces to the Log-Normal distribution when `shape = 0`.

Usage

```
dskewlnorm(x, meanlog = 0, sdlog = 1, shape = 0, log = FALSE)

pskewlnorm(q, meanlog = 0, sdlog = 1, shape = 0)

qskewlnorm(p, meanlog = 0, sdlog = 1, shape = 0)

rskewlnorm(n = 1, meanlog = 0, sdlog = 1, shape = 0)
```

Arguments

<code>x</code>	A numeric vector of values.
<code>meanlog</code>	A numeric vector of the means on the log scale.
<code>sdlog</code>	A non-negative numeric vector of the standard deviations on the log scale.
<code>shape</code>	A numeric vector of values.
<code>log</code>	A flag specifying whether to return the log-transformed value.
<code>q</code>	A vector of quantiles.
<code>p</code>	A numeric vector of probabilities.
<code>n</code>	A non-negative whole number of the number of random samples to generate.

Value

`dskewlnorm` gives the density, `pskewlnorm` gives the distribution function, `qskewlnorm` gives the quantile function, and `rskewlnorm` generates random deviates. `pskewlnorm` and `qskewlnorm` use the lower tail probability.

Examples

```

dskewlnorm(x = 1:5, meanlog = 0, sdlog = 1, shape = 0.1)
dskewlnorm(x = 1:5, meanlog = 0, sdlog = 1, shape = -1)
qskewlnorm(p = c(0.1, 0.4), meanlog = 0, sdlog = 1, shape = 0.1)
qskewlnorm(p = c(0.1, 0.4), meanlog = 0, sdlog = 1, shape = -1)
pskewlnorm(q = 1:5, meanlog = 0, sdlog = 1, shape = 0.1)
pskewlnorm(q = 1:5, meanlog = 0, sdlog = 1, shape = -1)
rskewlnorm(n = 3, meanlog = 0, sdlog = 1, shape = 0.1)
rskewlnorm(n = 3, meanlog = 0, sdlog = 1, shape = -1)

```

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 numeric 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	<i>Fill All Values</i>
----------	------------------------

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 = "", ...)
```

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	<i>Inverse Log Base 10 Transformation</i>
--------	---

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	<i>Inverse Log Base 2 Transformation</i>
-------	--

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	<i>Inverse Logistic Transformation</i>
----------	--

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	<i>Inverse Logistic Transformation</i>
-----------	--

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	<i>Inverse Odds</i>
----------	---------------------

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: [direction\(\)](#), [directional_information\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [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<-\(x\)](#), [log<-\(x\)](#), [logit\(\)](#), [logit<-\(x\)](#), [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<-\(x\)](#), [log<-\(x\)](#), [logit\(\)](#), [logit<-\(x\)](#), [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	<i>Logistic Transformation</i>
-------	--------------------------------

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<-	<i>Logistic Transformation</i>
---------	--------------------------------

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	<i>Bernoulli Log-Likelihood</i>
--------------	---------------------------------

Description

Bernoulli Log-Likelihood

Usage

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

Arguments

<code>x</code>	A vector of 0s and 1s.
<code>prob</code>	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()`, `log_lik_beta_binom()`, `log_lik_binom()`, `log_lik_exp()`, `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_skewlnorm()`, `log_lik_skewnorm()`, `log_lik_student()`, `log_lik_unif()`

Examples

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

log_lik_beta	<i>Beta Log-Likelihood</i>
--------------	----------------------------

Description

Beta Log-Likelihood

Usage

```
log_lik_beta(x, alpha = 1, beta = 1, tlower = 0, tupper = 1)
```

Arguments

x	A vector of values between 0s and 1s.
alpha	The first shape parameter of the beta distribution.
beta	The second shape parameter of the beta distribution.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

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_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

```
log_lik_beta(c(0, 0.5, 0.7, 1), 0.7)
```

log_lik_beta_binom	<i>Beta-Binomial Log-Likelihood</i>
--------------------	-------------------------------------

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 $\alpha = (2 * \text{prob}) / \text{theta}$ and $\beta = (2 * (1 - \text{prob})) / \text{theta}$. This parameterization of theta is unconventional, but has useful properties when modelling. When $\text{theta} = 0$, the beta-binomial reverts to the binomial distribution. When $\text{theta} = 1$ and $\text{prob} = 0.5$, 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,
  tlower = 0,
  tupper = Inf,
  memoize = 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).
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.
memoize	Whether or not to memoize the function.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_binom	<i>Binomial Log-Likelihood</i>
---------------	--------------------------------

Description

Binomial Log-Likelihood

Usage

```
log_lik_binom(x, size = 1, prob = 0.5, tlower = 0, tupper = Inf)
```

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.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_exp	<i>Exponential Log-Likelihood</i>
-------------	-----------------------------------

Description

The exponential distribution is parameterized in terms of the rate.

Usage

```
log_lik_exp(x, rate = 1, tlower = 0, tupper = Inf)
```

Arguments

x	A non-negative numeric vector of values.
rate	A non-negative numeric vector of rate.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

A numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_gamma	<i>Gamma Log-Likelihood</i>
---------------	-----------------------------

Description

Gamma Log-Likelihood

Usage

```
log_lik_gamma(x, shape = 1, rate = 1, tlower = 0, tupper = Inf)
```

Arguments

- x A numeric vector of values.
- shape A non-negative numeric vector of shape.
- rate A non-negative numeric vector of rate.
- tlower A numeric vector of the lower truncation point.
- tupper A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_gamma_pois	<i>Gamma-Poisson Log-Likelihood</i>
--------------------	-------------------------------------

Description

Gamma-Poisson Log-Likelihood

Usage

```
log_lik_gamma_pois(x, lambda = 1, theta = 0, tlower = 0, tupper = Inf)
```

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).
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

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,
  tlower = 0,
  tupper = Inf
)
```

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.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_lnorm	<i>Log-Normal Log-Likelihood</i>
---------------	----------------------------------

Description

Log-Normal Log-Likelihood

Usage

```
log_lik_lnorm(x, meanlog = 0, sdlog = 1, tlower = 0, tupper = Inf)
```

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.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_neg_binom	<i>Negative Binomial Log-Likelihood</i>
-------------------	---

Description

Negative Binomial Log-Likelihood

Usage

```
log_lik_neg_binom(x, lambda = 1, theta = 0, tlower = 0, tupper = Inf)
```

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).
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_norm	<i>Normal Log-Likelihood</i>
--------------	------------------------------

Description

Normal Log-Likelihood

Usage

```
log_lik_norm(x, mean = 0, sd = 1, tlower = -Inf, tupper = Inf)
```

Arguments

x	A numeric vector of values.
mean	A numeric vector of the means.
sd	A non-negative numeric vector of the standard deviations.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_pois	<i>Poisson Log-Likelihood</i>
--------------	-------------------------------

Description

Poisson Log-Likelihood

Usage

```
log_lik_pois(x, lambda = 1, tlower = 0, tupper = Inf)
```

Arguments

x	A non-negative whole numeric vector of values.
lambda	A non-negative numeric vector of means.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_pois_zi	<i>Zero-Inflated Poisson Log-Likelihood</i>
-----------------	---

Description

Zero-Inflated Poisson Log-Likelihood

Usage

```
log_lik_pois_zi(x, lambda = 1, prob = 0, tlower = 0, tupper = Inf)
```

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.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_skewlnorm	<i>Skew-Lognormal Log-Likelihood</i>
-------------------	--------------------------------------

Description

Skew-Lognormal Log-Likelihood

Usage

```
log_lik_skewlnorm(
  x,
  meanlog = 0,
  sdlog = 1,
  shape = 0,
  tlower = 0,
  tupper = Inf
)
```

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.
shape	A numeric vector of shape.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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\(\)](#), [log_lik_unif\(\)](#)

Examples

```
log_lik_skewlnorm(1:5)
log_lik_skewlnorm(1:5, shape = -2)
log_lik_skewlnorm(1:5, shape = 2)
```

log_lik_skewnorm	<i>Skew Normal Log-Likelihood</i>
------------------	-----------------------------------

Description

Skew Normal Log-Likelihood

Usage

```
log_lik_skewnorm(x, mean = 0, sd = 1, shape = 0, tlower = -Inf, tupper = Inf)
```

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.
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_student\(\)](#), [log_lik_unif\(\)](#)

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	<i>Student's t Log-Likelihood</i>
-----------------	-----------------------------------

Description

Student's t Log-Likelihood

Usage

```
log_lik_student(x, mean = 0, sd = 1, theta = 0, tlower = -Inf, tupper = Inf)
```

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).
tlower	A numeric vector of the lower truncation point.
tupper	A numeric vector of the upper truncation point.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_unif\(\)](#)

Examples

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

log_lik_unif

Uniform Log-Likelihood

Description

Uniform Log-Likelihood

Usage

```
log_lik_unif(x, min = 0, max = 1)
```

Arguments

x	A numeric vector of values.
min	A numeric vector of the minimums.
max	A numeric vector of the maximums.

Value

An numeric vector of the corresponding log-likelihoods.

See Also

Other log_lik_dist: [log_lik_bern\(\)](#), [log_lik_beta\(\)](#), [log_lik_beta_binom\(\)](#), [log_lik_binom\(\)](#), [log_lik_exp\(\)](#), [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_skewlnorm\(\)](#), [log_lik_skewnorm\(\)](#), [log_lik_student\(\)](#)

Examples

```
log_lik_unif(c(0, 0.7, 1))
```

log_odds	<i>Log Odds</i>
----------	-----------------

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<-	<i>Inverse Log Odds Transformation</i>
------------	--

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	<i>Log-Odds Ratio</i>
----------------	-----------------------

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	<i>Log Odds Ratio2</i>
-----------------	------------------------

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	<i>Lower Credible Limit</i>
-------	-----------------------------

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: `direction()`, `directional_information()`, `kurtosis()`, `probability_direction()`, `pvalue()`, `pzeros()`, `skewness()`, `svalue()`, `upper()`, `variance()`, `xtr_mean()`, `xtr_median()`, `xtr_sd()`, `zeros()`, `zscore()`

Examples

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

numericise	<i>Numericise (or Numericize)</i>
------------	-----------------------------------

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<-	<i>Inverse Odds Transformation</i>
--------	------------------------------------

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	<i>Parameter Pattern</i>
-------------	--------------------------

Description

Parameter Pattern

Usage

```
par_pattern()
```

Value

A string of the regular expression for a parameter name.

Examples

```
par_pattern()
```

pextreme	<i>Extreme Probability</i>
----------	----------------------------

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	<i>Phi</i>
-----	------------

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)
```

probability_direction *Probability of Direction*

Description

The probability of direction (PD) is the proportion of the (posterior) distribution above (right) or below (left) a threshold.

Usage

```
probability_direction(x, side = "median", threshold = 0, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values.
side	A character vector of length 1 indicating whether to calculate the directional probability for the left tail ("left"; $x < \text{threshold}$), or the right tail ("right"; $x > \text{threshold}$). Defaults to "median", which uses the side of the median of x via <code>direction()</code> .
threshold	A number of the threshold value, which is excluded from the interval for the probability.
na_rm	A flag specifying whether to remove missing values.

Details

By default, the direction is based on the side of the median value, but it can be specified to measure support for specific hypotheses. A right-side PD of 0.9 indicates that the interval spanning from the threshold to infinity has a coverage of 90%. Can be used as a measure of certainty in the direction of the estimate (e.g., positive or negative when using a threshold of 0). **NOTE:** probability estimates of 0 or 1 are corrected towards 0.5 by adding or subtracting $1 / (\text{length}(x) + 1)$, where x is a vector of MCMC samples. Ideally, x should be large enough as to make the correction negligible.

Value

A number between 0 and 1. If x has NA values but na_rm is FALSE, returns NA_real.

References

Makowski, D., Ben-Shachar, M.S., Chen, S.H.A., and Lüdtke, D. 2019. Indices of Effect Existence and Significance in the Bayesian Framework. *Front. Psychol.* 10: 2767. doi:10.3389/fpsyg.2019.02767.

See Also

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

Examples

```
x <- rnorm(1e6, qnorm(0.05, lower.tail = TRUE))
probability_direction(x, side = "left")
probability_direction(x, side = "right") # = 1 - probability_direction(x, side = "left")
probability_direction(c(0, 0, 1), side = "right") # returns P(X > 0) = 1/3 instead of P(X >= 0) = 1
probability_direction(c(1, 1), side = "right") # p = 1 - 1/(n+1)
```

prob_bern	<i>Bernoulli Cumulative Distribution Function</i>
-----------	---

Description

Bernoulli Cumulative Distribution Function

Usage

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

Arguments

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

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_beta	<i>Beta Cumulative Distribution Function</i>
-----------	--

Description

Beta Cumulative Distribution Function

Usage

```
prob_beta(x, alpha = 1, beta = 1)
```

Arguments

x	A numeric vector of quantiles.
alpha	The first shape parameter of the beta distribution.
beta	The second shape parameter of the beta distribution.

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

 prob_beta_binom

Beta-Binomial Cumulative Distribution Function

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 $\alpha = (2 * \text{prob}) / \text{theta}$ and $\beta = (2 * (1 - \text{prob})) / \text{theta}$. This parameterization of theta is unconventional, but has useful properties when modelling. When $\text{theta} = 0$, the beta-binomial reverts to the binomial distribution. When $\text{theta} = 1$ and $\text{prob} = 0.5$, 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

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

 prob_binom

Binomial Cumulative Distribution Function

Description

Binomial Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_exp	<i>Exponential Cumulative Distribution Function</i>
----------	---

Description

Exponential Cumulative Distribution Function

Usage

```
prob_exp(x, rate = 1)
```

Arguments

x	A numeric vector of quantiles.
rate	A non-negative numeric vector of rate.

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_gamma	<i>Gamma Cumulative Distribution Function</i>
------------	---

Description

Gamma Cumulative Distribution Function

Usage

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

Arguments

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

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_gamma_pois

Gamma-Poisson Cumulative Distribution Function

Description

Gamma-Poisson Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_gamma_pois_zi	<i>Zero-Inflated Gamma-Poisson Cumulative Distribution Function</i>
--------------------	---

Description

Zero-Inflated Gamma-Poisson Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_lnorm	<i>Log-Normal Cumulative Distribution Function</i>
------------	--

Description

Log-Normal Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

```
prob_lnorm(10, 0, 2)
```

prob_neg_binom	<i>Negative Binomial Cumulative Distribution Function</i>
----------------	---

Description

Negative Binomial Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

 prob_norm

Normal Cumulative Distribution Function

Description

Normal Cumulative Distribution Function

Usage

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

Arguments

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

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

```
prob_norm(c(-2:2))
```

prob_pois	<i>Poisson Cumulative Distribution Function</i>
-----------	---

Description

Poisson Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
lambda	A non-negative numeric vector of means.

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_pois_zi	<i>Zero-Inflated Poisson Cumulative Distribution Function</i>
--------------	---

Description

Zero-Inflated Poisson Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_skewlnorm	<i>Skew-Lognormal Cumulative Distribution Function</i>
----------------	--

Description

Skew-Lognormal Cumulative Distribution Function

Usage

```
prob_skewlnorm(x, meanlog = 0, sdlog = 1, shape = 0)
```

Arguments

x	A numeric vector of quantiles.
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.
shape	A numeric vector of shape.

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

```
prob_skewlnorm(1:5)
prob_skewlnorm(1:5, shape = -2)
prob_skewlnorm(1:5, shape = 2)
```

prob_skewnorm	<i>Skew Normal Cumulative Distribution Function</i>
---------------	---

Description

Skew Normal Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_student\(\)](#), [prob_unif\(\)](#)

Examples

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

prob_student	<i>Student's t Cumulative Distribution Function</i>
--------------	---

Description

Student's t Cumulative Distribution Function

Usage

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

Arguments

x	A numeric vector of quantiles.
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 probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#)

Examples

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

prob_unif

Uniform Cumulative Distribution Function

Description

Uniform Cumulative Distribution Function

Usage

```
prob_unif(x, min = 0, max = 1)
```

Arguments

x	A numeric vector of quantiles.
min	A numeric vector of the minimums.
max	A numeric vector of the maximums.

Value

An numeric vector of the corresponding probabilities.

See Also

Other prob_dist: [prob_bern\(\)](#), [prob_beta\(\)](#), [prob_beta_binom\(\)](#), [prob_binom\(\)](#), [prob_exp\(\)](#), [prob_gamma\(\)](#), [prob_gamma_pois\(\)](#), [prob_gamma_pois_zi\(\)](#), [prob_lnorm\(\)](#), [prob_neg_binom\(\)](#), [prob_norm\(\)](#), [prob_pois\(\)](#), [prob_pois_zi\(\)](#), [prob_skewlnorm\(\)](#), [prob_skewnorm\(\)](#), [prob_student\(\)](#)

Examples

```
prob_unif(c(0, 0.5, 1))
```

proportional_change	<i>Proportional Change</i>
---------------------	----------------------------

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	<i>Proportional Change2</i>
----------------------	-----------------------------

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

<code>x</code>	A numeric object (vector, matrix or array) of non-negative numbers.
<code>x2</code>	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).

Usage

```
pvalue(x, ..., side = "both", threshold = 0, skeptical = TRUE, na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC values.
...	Unused.
side	A character vector of length 1 indicating whether to calculate p-values for the left tail ("left"), right tail ("right"), or two-sided ("both"; default).
threshold	A number of the threshold value.
skeptical	A flag specifying whether or not to add one sample to the empty side of the threshold when 100% of samples are on one side. Avoids zero p-values and infinite s-values, and also imposes stronger bounds on directional information than [-n, n], which assume the MCMC samples are independent and representative.
na_rm	A flag specifying whether to remove missing values.

Details

A p-value of 0.05 indicates that the 95% CRI just includes the threshold value.

Note that the function contains the sample-size correction $p_c = p * n / (n + 1)$ to avoid p-values of 0. The function can still return p-values of 1.

When `skeptical = TRUE` (default), a floor of $1/(n + 1)$ is applied to avoid p-values of 0 when all samples are on one side of the threshold. When `skeptical = FALSE`, p-values of 0 are allowed.

To use as a measure of certainty in the direction of the estimate (i.e., positive or negative), see [probability_direction\(\)](#).

For p-values converted to bits, see [svalue\(\)](#).

To convert MCMC objects to information, see [directional_information\(\)](#).

Value

A number between 0 and 1. If x has NA values but `na_rm` is `FALSE`, returns `NA_real`.

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

```
x <- rnorm(1e6, qnorm(0.05, lower.tail = TRUE))
pvalue(x) # should be 0.05 * 2
pvalue(x, side = "left") # should be 0.95
pvalue(x, side = "right") # should be 0.05
```

```
pvalue(rep(1, 10)) # skeptical = TRUE (default) avoids p = 0
pvalue(rep(1, 10), skeptical = FALSE) # skeptical = FALSE allows p = 0
```

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

quant_bern

Bernoulli Quantile Function

Description

Bernoulli Quantile Function

Usage

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

Arguments

- x A numeric vector of probabilities.
- prob A numeric vector of values between 0 and 1 of the probability of success.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_bern(c(0.3, 0.8), 0.7)
```

quant_beta	<i>Beta Quantile Function</i>
------------	-------------------------------

Description

Beta Quantile Function

Usage

```
quant_beta(x, alpha = 1, beta = 1)
```

Arguments

- x A numeric vector of probabilities.
- alpha The first shape parameter of the beta distribution.
- beta The second shape parameter of the beta distribution.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_beta(c(0.1, 0.4, 0.6), 2, 3)
```

quant_binom	<i>Binomial Quantile Function</i>
-------------	-----------------------------------

Description

Binomial Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_binom(c(0.1, 0.4, 0.6), 2, 0.3)
```

quant_exp	<i>Exponential Quantile Function</i>
-----------	--------------------------------------

Description

Exponential Quantile Function

Usage

```
quant_exp(x, rate = 1)
```

Arguments

x	A numeric vector of probabilities.
rate	A non-negative numeric vector of rate.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_exp(c(0.1, 0.4, 0.6), 2)
```

quant_gamma	<i>Gamma Quantile Function</i>
-------------	--------------------------------

Description

Gamma Quantile Function

Usage

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

Arguments

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

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_gamma(c(0.1, 0.4, 0.6), 1, 2)
```

quant_gamma_pois	<i>Gamma-Poisson Quantile Function</i>
------------------	--

Description

Gamma-Poisson Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_gamma_pois(c(0.1, 0.4, 0.6), 1, 1)
```

quant_gamma_pois_zi	<i>Zero-Inflated Gamma-Poisson Quantile Function</i>
---------------------	--

Description

Zero-Inflated Gamma-Poisson Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_gamma_pois_zi(c(0.1, 0.4, 0.6), 3, 1, prob = 0.5)
```

quant_lnorm	<i>Log-Normal Quantile Function</i>
-------------	-------------------------------------

Description

Log-Normal Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_lnorm(c(0.1, 0.4, 0.6), 0, 2)
```

quant_neg_binom	<i>Negative Binomial Quantile Function</i>
-----------------	--

Description

Negative Binomial Quantile Function

Usage

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

Arguments

- x A numeric vector of probabilities.
- 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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_neg_binom(c(0.1, 0.4, 0.6), 2, 1)
```

quant_norm	<i>Normal Quantile Function</i>
------------	---------------------------------

Description

Normal Quantile Function

Usage

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

Arguments

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

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_norm(c(0.1, 0.4, 0.6))
```

quant_pois	<i>Poisson Quantile Function</i>
------------	----------------------------------

Description

Poisson Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
lambda	A non-negative numeric vector of means.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_pois(c(0.1, 0.4, 0.6), 3)
```

quant_pois_zi	<i>Zero-Inflated Poisson Quantile Function</i>
---------------	--

Description

Zero-Inflated Poisson Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_pois_zi(c(0.1, 0.4, 0.6), 3, prob = 0.5)
```

quant_skewlnorm	<i>Skew-Lognormal Quantile Function</i>
-----------------	---

Description

Skew-Lognormal Quantile Function

Usage

```
quant_skewlnorm(x, meanlog = 0, sdlog = 1, shape = 0)
```

Arguments

x	A numeric vector of probabilities.
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.
shape	A numeric vector of shape.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_skewlnorm(c(0.1, 0.4, 0.6))
quant_skewlnorm(c(0.1, 0.4, 0.6), shape = -2)
quant_skewlnorm(c(0.1, 0.4, 0.6), shape = 2)
```

quant_skewnorm	<i>Skew Normal Quantile Function</i>
----------------	--------------------------------------

Description

Skew Normal Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_student\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_skewnorm(c(0.1, 0.4, 0.6))
quant_skewnorm(c(0.1, 0.4, 0.6), shape = -2)
quant_skewnorm(c(0.1, 0.4, 0.6), shape = 2)
```

quant_student	<i>Student's t Quantile Function</i>
---------------	--------------------------------------

Description

Student's t Quantile Function

Usage

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

Arguments

x	A numeric vector of probabilities.
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 quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_unif\(\)](#)

Examples

```
quant_student(c(0.1, 0.4, 0.6), mean = 1, sd = 2, theta = 1 / 3)
```

quant_unif

Uniform Quantile Function

Description

Uniform Quantile Function

Usage

```
quant_unif(x, min = 0, max = 1)
```

Arguments

x	A numeric vector of probabilities.
min	A numeric vector of the minimums.
max	A numeric vector of the maximums.

Value

An numeric vector of the corresponding quantiles.

See Also

Other quant_dist: [quant_bern\(\)](#), [quant_beta\(\)](#), [quant_binom\(\)](#), [quant_exp\(\)](#), [quant_gamma\(\)](#), [quant_gamma_pois\(\)](#), [quant_gamma_pois_zi\(\)](#), [quant_lnorm\(\)](#), [quant_neg_binom\(\)](#), [quant_norm\(\)](#), [quant_pois\(\)](#), [quant_pois_zi\(\)](#), [quant_skewlnorm\(\)](#), [quant_skewnorm\(\)](#), [quant_student\(\)](#)

Examples

```
quant_unif(c(0.1, 0.4, 0.6))
```

ran_bern	<i>Bernoulli Random Samples</i>
----------	---------------------------------

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

```
ran_bern(10)
```

ran_beta_binom	<i>Beta-Binomial Random Samples</i>
----------------	-------------------------------------

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 $\alpha = (2 * \text{prob}) / \text{theta}$ and $\beta = (2 * (1 - \text{prob})) / \text{theta}$. This parameterization of theta is unconventional, but has useful properties when modelling. When $\text{theta} = 0$, the beta-binomial reverts to the binomial distribution. When $\text{theta} = 1$ and $\text{prob} = 0.5$, 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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

```
ran_gamma(10)
```

ran_gamma_pois	<i>Gamma-Poisson Random Samples</i>
----------------	-------------------------------------

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

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

ran_gamma_pois_zi	<i>Zero-Inflated Gamma-Poisson Random Samples</i>
-------------------	---

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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

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

ran_norm	<i>Normal Random Samples</i>
----------	------------------------------

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

```
ran_norm(10)
```

ran_pois	<i>Poisson Random Samples</i>
----------	-------------------------------

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

```
ran_pois(10)
```

ran_pois_zi	<i>Zero-Inflated Poisson Random Samples</i>
-------------	---

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

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

ran_skewlnorm	<i>Skew-Lognormal Random Samples</i>
---------------	--------------------------------------

Description

Skew-Lognormal Random Samples

Usage

```
ran_skewlnorm(n = 1, meanlog = 0, sdlog = 1, shape = 0)
```

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.
- 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_skewnorm\(\)](#), [ran_student\(\)](#)

Examples

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

ran_skewnorm	<i>Skew Normal Random Samples</i>
--------------	-----------------------------------

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_skewlnorm\(\)](#), [ran_student\(\)](#)

Examples

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

ran_student	<i>Student's t Random Samples</i>
-------------	-----------------------------------

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_skewlnorm\(\)](#), [ran_skewnorm\(\)](#)

Examples

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

res_bern	<i>Bernoulli Residuals</i>
----------	----------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_beta_binom	<i>Beta-Binomial Residuals</i>
----------------	--------------------------------

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 $\alpha = (2 * \text{prob}) / \text{theta}$ and $\beta = (2 * (1 - \text{prob})) / \text{theta}$. 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

<code>x</code>	A non-negative whole numeric vector of values.
<code>size</code>	A non-negative whole numeric vector of the number of trials.
<code>prob</code>	A numeric vector of values between 0 and 1 of the probability of success.
<code>theta</code>	A non-negative numeric vector of the dispersion for the mixture models (student, gamma-Poisson and beta-binomial).
<code>type</code>	A string of the residual type. 'raw' for raw residuals 'dev' for deviance residuals and 'data' for the data.
<code>simulate</code>	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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_binom	<i>Binomial Residuals</i>
-----------	---------------------------

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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_gamma_pois_zi	<i>Zero-Inflated Gamma-Poisson Residuals</i>
-------------------	--

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_lnorm	<i>Log-Normal Residuals</i>
-----------	-----------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

```
res_lnorm(10)
```

res_neg_binom	<i>Negative Binomial Residuals</i>
---------------	------------------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_norm	<i>Normal Residuals</i>
----------	-------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_pois	<i>Poisson Residuals</i>
----------	--------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_pois_zi	<i>Zero-Inflated Poisson Residuals</i>
-------------	--

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_skewlnorm	<i>Skew-Lognormal Residuals</i>
---------------	---------------------------------

Description

Skew-Lognormal Residuals

Usage

```
res_skewlnorm(
  x,
  meanlog = 0,
  sdlog = 1,
  shape = 0,
  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.
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_skewnorm\(\)](#), [res_student\(\)](#)

Examples

```
res_skewlnorm(exp(-2:2))
```

res_skewnorm	<i>Skew Normal Residuals</i>
--------------	------------------------------

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_skewlnorm\(\)](#), [res_student\(\)](#)

Examples

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

res_student	<i>Student's t Residuals</i>
-------------	------------------------------

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_skewlnorm\(\)](#), [res_skewnorm\(\)](#)

Examples

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

sens_beta	<i>Adjust Beta Distribution Parameters for Sensitivity Analyses</i>
-----------	---

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 $\text{mean}(x) * (1 - \text{mean}(x))$, where $\text{mean}(x) = \alpha / (\alpha + \beta)$. 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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_exp	<i>Adjust Exponential Distribution Parameters for Sensitivity Analyses</i>
----------	--

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_skewlnorm\(\)](#), [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 ($\text{sd_mult} > 1$) or reduces ($\text{sd_mult} < 1$) 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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_gamma_pois	<i>Adjust Gamma-Poisson Distribution Parameters for Sensitivity Analyses</i>
-----------------	--

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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_gamma_pois_zi	<i>Adjust Zero-Inflated Gamma-Poisson Distribution Parameters for Sensitivity Analyses</i>
--------------------	--

Description

Expands ($\text{sd_mult} > 1$) or reduces ($\text{sd_mult} < 1$) 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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_lnorm	<i>Adjust Log-Normal Distribution Parameters for Sensitivity Analysis</i>
------------	---

Description

Expands ($\text{sd_mult} > 1$) or reduces ($\text{sd_mult} < 1$) the standard deviation of the Log-Normal distribution. With high values of sdlog (i.e., > 9), and $\text{sd_mult} > 1$, 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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_neg_binom	<i>Adjust Negative Binomial Distribution Parameters for Sensitivity Analyses</i>
----------------	--

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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_norm	<i>Adjust Normal Distribution Parameters for Sensitivity Analyses</i>
-----------	---

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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

<code>sens_pois</code>	<i>Adjust Poisson Distribution Parameters for Sensitivity Analyses</i>
------------------------	--

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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

<code>sens_skewlnorm</code>	<i>Adjust Skew-Lognormal Distribution Parameters for Sensitivity Analyses</i>
-----------------------------	---

Description

Expands (`sd_mult > 1`) or reduces (`sd_mult < 1`) the standard deviation of the Skew-Lognormal distribution while preserving its mean and shape. The adjustment is made on the natural scale (i.e. for x , not for $\log(x)$), mirroring [sens_lnorm\(\)](#), to which it reduces when `shape = 0`.

Usage

```
sens_skewlnorm(meanlog, sdlog, shape, 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.
- 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_skewnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_skewnorm	<i>Adjust Skew Normal Distribution Parameters for Sensitivity Analyses</i>
---------------	--

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_skewlnorm\(\)](#), [sens_student\(\)](#)

Examples

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

sens_student	<i>Adjust Student's t Distribution Parameters for Sensitivity Analyses</i>
--------------	--

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_skewlnorm\(\)](#), [sens_skewnorm\(\)](#)

Examples

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

sextreme	<i>Extreme Surprisal</i>
----------	--------------------------

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	<i>Skewness</i>
----------	-----------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

step	<i>Step</i>
------	-------------

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 a probability 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: $-\log_2(p)$, where p is the p-value of interest. See the details section for some examples.

Usage

```
svalue(x, ..., side = "both", threshold = 0, skeptical = TRUE, na_rm = FALSE)

p2svalue(p)
```

Arguments

x	A numeric object of MCMC values.
...	Unused.
side	A character indicating whether to calculate s-values using p-values for the left tail ("left"), right tail ("right"), or both tails ("both"; default).
threshold	A number of the threshold value.
skeptical	A flag specifying whether or not to add one sample to the empty side of the threshold when 100% of samples are on one side. Avoids zero p-values and infinite s-values, and also imposes stronger bounds on directional information than $[-n, n]$, which assume the MCMC samples are independent and representative.
na_rm	A flag specifying whether to remove missing values.
p	A numeric vector of probabilities.

Details

A near-certain event has an s-value near 0 because it is similar to getting 0 successful coin flips out of 0 tosses, which is certain and unsurprising.

An event with a probability of 0.5 is as surprising as getting a successful coin toss.

A near-impossible event has a very large s-value because its occurrence would be extremely surprising, like observing many consecutive successes on a fair coin.

When `skeptical = TRUE` (default), a ceiling of $\log_2(n+1)$ is applied to the s-value to avoid s-values of Inf when all samples are on one side of the threshold. When `skeptical = FALSE`, s-values of Inf are allowed.

Value

A non-negative number. If x has NA values but `na_rm` is FALSE, returns `NA_real`.

Functions

- `svalue()`: Calculate an s-value from a posterior distribution.
- `p2svalue()`: Calculate an s-value from a vector of probabilities.

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: `direction()`, `directional_information()`, `kurtosis()`, `lower()`, `probability_direction()`, `pvalue()`, `pzeros()`, `skewness()`, `upper()`, `variance()`, `xtr_mean()`, `xtr_median()`, `xtr_sd()`, `zeros()`, `zscore()`

Examples

```
svalue(as.numeric(0:100))
svalue(as.numeric(0:100), side = "left")
svalue(as.numeric(0:100), side = "right")
svalue(rnorm(1e4, mean = 1), side = "left")
svalue(rnorm(1e4, mean = 1), side = "right")
svalue(rep(1, 10)) # skeptical = TRUE (default) avoids Inf
svalue(rep(1, 10), skeptical = FALSE) # skeptical = FALSE allows Inf

p2svalue(seq(0, 1, by = 0.1))
```

upper	<i>Upper Credible Limit</i>
-------	-----------------------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

variance	<i>Variance</i>
----------	-----------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

xtr_ci	<i>Credible Intervals</i>
--------	---------------------------

Description

Calculates Bayesian credible intervals (CI) using one of the available methods:

- "HDI": highest density interval (see [xtr_ci_hdi\(\)](#)),
- "ETI": equal tailed intervals (see [xtr_ci_eti\(\)](#)).

Usage

```
xtr_ci(x, level = 0.95, ..., type = "HDI", na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC samples.
level	A number > 0 and ≤ 1 specifying the probability coverage of the interval.
...	Currently unused.
type	A string indicating which type of CI to return. Currently allows Highest Density Intervals ("HDI"; default) and Equal-Tailed Intervals ("ETI").
na_rm	A flag indicating whether to remove missing values.

Value

A [data.frame](#) of the lower and upper limits for the credible interval. Note that the interval is not guaranteed to be one-sided or two-sided.

See Also

[mcmcrr::coef](#)

Examples

```
xtr_ci(rnorm(1e4), type = "HDI")
```

xtr_ci_eti	<i>Equal-Tailed Interval</i>
------------	------------------------------

Description

Calculates Bayesian credible intervals using the equal-tailed interval (ETI), i.e., the CI such that the left and right tails outside the CI have the same coverage.

Usage

```
xtr_ci_eti(x, level = 0.95, ..., na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC samples.
level	A number > 0 and <= 1 specifying the probability coverage of the interval.
...	Currently unused.
na_rm	A flag indicating whether to remove missing values.

Details

The interval is guaranteed to be two-sided, unlike `[xtr_ci_hdi()]`. Does not return integer outputs even if the input data are integers, unlike `xtr_ci_hdi()`. The interval limits are always real (double) numeric values.

Value

A [data.frame](#) of the lower and upper limits for the credible interval.

See Also

[xtr_ci\(\)](#) and [xtr_ci_hdi\(\)](#)

Examples

```
xtr_ci_eti(rnorm(1e4))
```

xtr_ci_hdi	<i>Highest Density Interval</i>
------------	---------------------------------

Description

Calculates Bayesian credible intervals using the highest density interval (HDI), i.e., the narrowest CI with the specified minimum coverage.

Usage

```
xtr_ci_hdi(x, level = 0.95, ..., na_rm = FALSE)
```

Arguments

x	A numeric vector of MCMC samples.
level	A number > 0 and <= 1 specifying the probability coverage of the interval.
...	Currently unused.
na_rm	A flag indicating whether to remove missing values.

Value

A [data.frame](#) of the lower and upper limits for the credible interval. Note that the interval is not guaranteed to be one-sided or two-sided. Returns integer limits if the input data are integers and double otherwise.

See Also

[xtr_ci\(\)](#) and [xtr_ci_eti\(\)](#)

Examples

```
xtr_ci_hdi(1:10, level = 0.1) # only 10% of values inside
xtr_ci_hdi(1:10, level = 0.2) # only 20% of values inside
xtr_ci_hdi(1:10, level = 0.2 + 0.01) # at least 20.1% of values inside
xtr_ci_hdi(1:100) # inclusive interval [3, 98] with 95% of values inside
```

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

xtr_rope	<i>Region of Practical Equivalence</i>
----------	--

Description

Calculates the proportion of the posterior (or credible interval if level < 1) that falls within the region of practical equivalence (ROPE) to a threshold.

Usage

```
xtr_rope(  
  x,  
  threshold = 0,  
  interval = c(-0.1, 0.1),  
  ...,  
  level = 1,  
  type = "HDI",  
  na_rm = FALSE  
)
```

Arguments

x	A numeric vector of MCMC samples.
threshold	A number specifying the center of the ROPE.
interval	A numeric vector of length 2 to be added to threshold to calculate the ROPE. Generally, threshold[1] == - threshold[2] and threshold[1] < 0 should both be true.
...	Currently unused.
level	A number > 0 and <= 1 specifying the probability coverage of the interval to use. The default of 1 uses the full posterior.
type	A string indicating which type of CI to return. Currently allows Highest Density Intervals ("HDI"; default) and Equal-Tailed Intervals ("ETI").
na_rm	A flag indicating whether to remove missing values.

Details

The ROPE is calculated as threshold + interval. Note that the default is not appropriate for all models, since the interval is sensitive to unit conversions.

Value

A number indicating the proportion of the posterior (or credible interval) within the region of practical equivalence.

See Also

[xtr_ci](#)

Examples

```
xtr_rope(c(-Inf, -1, -0.1, 0.1, 1, Inf))
xtr_rope(rnorm(1e4))
```

xtr_sd	<i>Standard Deviation</i>
--------	---------------------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [zeros\(\)](#), [zscore\(\)](#)

Examples

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

zeros	<i>Zeros</i>
-------	--------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zscore\(\)](#)

Examples

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

zscore	<i>Z-Score</i>
--------	----------------

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: [direction\(\)](#), [directional_information\(\)](#), [kurtosis\(\)](#), [lower\(\)](#), [probability_direction\(\)](#), [pvalue\(\)](#), [pzeros\(\)](#), [skewness\(\)](#), [svalue\(\)](#), [upper\(\)](#), [variance\(\)](#), [xtr_mean\(\)](#), [xtr_median\(\)](#), [xtr_sd\(\)](#), [zeros\(\)](#)

Examples

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

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