Package 'convdistr'

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Type Package

Title Convolute Probabilistic Distributions

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https://johnaponte.github.io/convdistr/

Description Convolute probabilistic distributions using the random generator function of each distribution. A new random number generator function is created that perform the mathematical operation on the individual random samples from the random generator function of each distribution. See the documentation for examples.

License GPL (>= 3)

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R topics documented:

`add_total` *Adds a total dimension*

Description

This function returns a `DISTRIBUTION` with a new dimension created by row sum of the dimensions of the distribution.

Usage

```
add_total(p_distribution, p_totalname = "TOTAL")
```

Arguments

p_distribution	an object of class DISTRIBUTION
p_totalname	the name of the new dimension

Details

Only works with multidimensional distributions.

Value

a DISTRIBUTION

Author(s)

John J. Aponte

Examples

```
d1 <- new_DIRICHLET(c(0.2,0.5,0.3))
d2 <- add_total(d1)
```

BETA *Factory for a BETA distribution object*

Description

Returns an BETA distribution object that produce random numbers from a beta distribution using the rbeta function

Usage

```
new_BETA(p_shape1, p_shape2, p_dimnames = "rvar")

new_BETA_lci(p_mean, p_lci, p_uci, p_dimnames = "rvar")

new_BETA_lci2(p_mean, p_lci, p_uci, p_dimnames = "rvar")
```

Arguments

p_shape1	non-negative parameters of the Beta distribution
p_shape2	non-negative parameters of the Beta distribution
p_dimnames	A character that represents the name of the dimension
p_mean	A numeric that represents the expected value of the proportion
p_lci	A numeric for the lower 95% confidence interval
p_uci	A numeric for the upper 95% confidence interval

Value

An object of class `DISTRIBUTION`, `BETA`

Functions

- `new_BETA_lci()`: Constructor based on confidence intervals. Preserve expected value.
- `new_BETA_lci2()`: Constructor based on ML confidence intervals

Note

When using confidence intervals, the shape parameters are obtained using the following formula:

$varp = (p_u ci - p_l ci)/4^2$

$shape1 = p_m ean * (p_m ean * (1 - p_m ean)/varp - 1)$

$shape2 = (1 - p_m ean) * (p_m ean * (1 - p_m ean)/varp - 1)$

new_BETA_lci2 estimate parameters using maximum likelihood myDistr <- new_BETA_lci2(0.30,0.25,0.35) myDistr$rfunc(10)

Author(s)

John J. Aponte

Examples

```
myDistr <- new_BETA(1,1)
myDistr$rfunc(10)
myDistr <- new_BETA_lci(0.30,0.25,0.35)
myDistr$rfunc(10)
```

`BETABINOMIAL` *Factory for a BETABINOMIAL distribution object*

Description

Returns an BETABINOMIAL distribution object that produce random numbers from a betabinomial distribution using the `rbbinom` function

Usage

```
new_BETABINOMIAL(p_size, p_shape1, p_shape2, p_dimnames = "rvar")

new_BETABINOMIAL_od(p_size, p_mu, p_od, p_dimnames = "rvar")

new_BETABINOMIAL_icc(p_size, p_mu, p_icc, p_dimnames = "rvar")
```

Arguments

p_size	a non-negative parameter for the number of trials
p_shape1	non-negative parameters of the Betabinomial distribution
p_shape2	non-negative parameters of the Betabinomial distribution
p_dimnames	A character that represents the name of the dimension
p_mu	mean proportion for the binomial part of the distribution
p_od	over dispersion parameter
p_icc	intra-class correlation parameter

Value

An object of class DISTRIBUTION, BETADISTRIBUION

Functions

- new_BETABINOMIAL_od(): parametrization based on dispersion
- new_BETABINOMIAL_icc(): parametrization based on intra-class correlation

Note

There are several parametrization for the betabinomial distribution. The one based on shape1 and shape2 are parameters alpha and beta of the beta part of the distribution, but it can be parametrized as mu, and od where mu is the expected mean proportion and od is a measure of the overdispersion.

$p_mu = p_shape1/(p_shape1 + p_shape2)$

$p_od = p_shape1 + p_shape2$

$p_shape1 = p_mu * p_od$

$p_shape2 < -(1 - p_mu) * p_od$

Another parametrization is based on mu and the icc where mu is the mean proportion and icc is the intra-class correlation.

$p_mu = p_shape1/(p_shape1 + p_shape2)$

$p_icc = 1/(p_shape1 + p_shape2 + 1)$

$p_shape1 = p_mu * (1 - p_icc)/p_icc$

$p_shape2 = (1 - p_mu) * (1 - p_icc)/p_icc$

Author(s)

John J. Aponte

Examples

```
myDistr <- new_BETABINOMIAL(10,1,1)
myDistr$rfunc(10)
```

BINOMIAL *Factory for a BINOMIAL distribution object*

Description

Returns a BINOMIAL distribution object that produce random numbers from a binomial distribution using the rbinom function

Usage

```
new_BINOMIAL(p_size, p_prob, p_dimnames = "rvar")
```

Arguments

p_size	integer that represent the number of trials
p_prob	probability of success
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, BINOMIAL

Author(s)

John J. Aponte

Examples

```
myDistr <- new_BINOMIAL(1000,0.3)
myDistr$rfunc(10)
```

cinqnum *cinqnum*

Description

Produce 5 numbers of the distribution (mean_, sd_, lci_, uci_, median_).

Usage

```
cinqnum(x, ...)

## S3 method for class 'DISTRIBUTION'
cinqnum(x, n, ...)

## S3 method for class '`NA`'
cinqnum(x, n, ...)

## S3 method for class 'DIRAC'
cinqnum(x, n, ...)
```

Arguments

x	an object of class DISTRIBUTION
...	further parameters
n	number of drawns

Details

Uses the stored seed to have the same sequence always and produce the same numbers This is an internal function for the summary function

Value

a vector with the mean, sd, lci, uci and median values

Methods (by class)

- `cinqnum(DISTRIBUTION)`: Generic method for a DISTRIBUTION
- `cinqnum(`NA`)`: Generic method for optimized for a NA distribution
- `cinqnum(DIRAC)`: Generic method optimized for a DIRAC distribution

Author(s)

John J. Aponte

CONVOLUTION *Make the convolution of two or more DISTRIBUTION objects*

Description

The convolution of the simple algebraic operations is made by the operation of individual drawns of the distributions. The DISTRIBUTION objects must have the same dimensions.

Usage

```
new_CONVOLUTION(listdistr, op, omit_NA = FALSE)

new_SUM(..., omit_NA = FALSE)

## S3 method for class 'DISTRIBUTION'
e1 + e2

new_SUBTRACTION(..., omit_NA = FALSE)

## S3 method for class 'DISTRIBUTION'
e1 - e2

new_MULTIPLICATION(..., omit_NA = FALSE)

## S3 method for class 'DISTRIBUTION'
e1 * e2

new_DIVISION(..., omit_NA = FALSE)

## S3 method for class 'DISTRIBUTION'
e1 / e2
```

Arguments

listdistr	a list of DISTRIBUTION objects
op	a function to convolute '+', '-', '*', '\'
omit_NA	if TRUE, NA distributions will be omitted
...	DISTRIBUTION objects or a list of distribution objects
e1	object of class DISTRIBUTION
e2	object of class DISTRIBUTION

Details

If any of the distributions is of class NA (NA_DISTRIBUTION) the result will be a new distribution of class NA unless the omit_NA option is set to TRUE

Value

and object of class CONVOLUTION, DISTRIBUTION

Functions

- new_SUM(): Sum of distributions
- new_SUBTRACTION(): Subtraction for distributions
- new_MULTIPLICATION(): Multiplication for distributions
- new_DIVISION(): DIVISION for distributions

Author(s)

John J. Aponte

Examples

```
x1 <- new_NORMAL(0,1)
x2 <- new_UNIFORM(1,2)
new_CONVOLUTION(list(x1,x2), `+`)
new_SUM(x1,x2)
x1 + x2
new_SUBTRACTION(x1,x2)
x1 - x2
new_MULTIPLICATION(list(x1,x2))
x1 * x2
new_DIVISION(list(x1,x2))
x1 / x2
```

CONVOLUTION_assoc *Convolution with association of dimensions*

Description

In case of different dimensions of the distribution this function perform the operation on the common distributions and add without modifications the other dimensions of the distribution.

Usage

```
new_CONVOLUTION_assoc(dist1, dist2, op)

new_SUM_assoc(dist1, dist2)

new_SUBTRACTION_assoc(dist1, dist2)

new_MULTIPLICATION_assoc(dist1, dist2)

new_DIVISION_assoc(dist1, dist2)
```

Arguments

dist1	an object of class DISTRIBUTION
dist2	and object of class DISTRIBUTION
op	one of ‘+‘,‘-‘,‘*‘,‘/‘

Details

If distribution A have dimensions a and b and distribution B have dimensions b and c, the A + B would produce a distribution with dimensions a, c, b+b,

Value

an object of class DISTRIBUTION

Functions

- new_SUM_assoc(): Sum of distributions
- new_SUBTRACTION_assoc(): Subtraction of distributions
- new_MULTIPLICATION_assoc(): Multiplication of distributions
- new_DIVISION_assoc(): Division of distributions

Author(s)

John J. Aponte

Examples

```
x1 <- new_MULTINORMAL(c(0,1), matrix(c(1,0.5,0.5,1),ncol=2), p_dimnames = c("A","B"))
x2 <- new_MULTINORMAL(c(10,1), matrix(c(1,0.4,0.4,1),ncol=2), p_dimnames = c("B","C"))
new_CONVOLUTION_assoc(x1,x2, `+`)
new_SUM_assoc(x1,x2)
new_SUBTRACTION_assoc(x1,x2)
new_MULTIPLICATION_assoc(x1,x2)
new_DIVISION_assoc(x1,x2)
```

CONVOLUTION_comb *Convolution with combination of dimensions*

Description

In case of different dimensions of the distribution this function perform the operation on the combination of the distributions of both distribution.

Usage

```
new_CONVOLUTION_comb(dist1, dist2, op, p_dimnames)

new_SUM_comb(dist1, dist2)

new_SUBTRACTION_comb(dist1, dist2)

new_MULTIPLICATION_comb(dist1, dist2)

new_DIVISION_comb(dist1, dist2)
```

Arguments

dist1	an object of class DISTRIBUTION
dist2	and object of class DISTRIBUTION
op	one of '+','-','*','/'
p_dimnames	a character vector with the name of the dimensions. If missing the combination of the individual dimensions will be used

Details

If distribution A have dimensions a and b and distribution B have dimensions b and c, the A + B would produce a distribution with dimensions a_b,a_c,b_b, b_c

Value

an object of class DISTRIBUTION

Functions

- new_SUM_comb(): Sum of distributions
- new_SUBTRACTION_comb(): Subtraction of distributions
- new_MULTIPLICATION_comb(): Multiplication of distributions
- new_DIVISION_comb(): Division of distributions

Note

In case of the same dimensions, only the first combination is taken

Author(s)

John J. Aponte

Examples

```
x1 <- new_MULTINORMAL(c(0,1), matrix(c(1,0.5,0.5,1),ncol=2), p_dimnames = c("A","B"))
x2 <- new_MULTINORMAL(c(10,1), matrix(c(1,0.4,0.4,1),ncol=2), p_dimnames = c("B","C"))
new_CONVOLUTION_comb(x1,x2, `+`)
new_SUM_comb(x1,x2)
new_SUBTRACTION_comb(x1,x2)
new_MULTIPLICATION_comb(x1,x2)
new_DIVISION_comb(x1,x2)
```

DIRAC *Factory for a DIRAC distribution object*

Description

Returns an DIRAC distribution object that always return the same number, or the same matrix of numbers in case multiple dimensions are setup

Usage

```
new_DIRAC(p_scalar, p_dimnames = "rvar")
```

Arguments

p_scalar	A numeric that set the value for the distribution
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, DIRAC

Author(s)

John J. Aponte

Examples

```
myDistr <- new_DIRAC(1)
myDistr$rfunc(10)
```

DIRICHLET *Factory for a DIRICHLET distribution object*

Description

Returns an DIRICHLET distribution object that draw random numbers generated by the function rdirichlet

Usage

```
new_DIRICHLET(p_alpha, p_dimnames)
```

Arguments

p_alpha	k-value vector for concentration parameter. Must be positive
p_dimnames	A vector of characters for the names of the k-dimensions

Details

A name can be provided for the dimensions. Otherwise rvar1, rvar2, ..., rvark will be assigned

Value

An object of class DISTRIBUTION, p_distribution$distribution, TRUNCATED

Author(s)

John J. Aponte

Examples

```
myDistr <- new_DIRICHLET(c(0.3,0.2,0.5), c("a","b","c"))
myDistr$rfunc(10)
```

DISCRETE *Factory for a DISCRETE distribution object*

Description

Returns an DISCRETE distribution object that sample from the vector p_supp of options with probability the vector of probabilities p_prob.

Usage

```
new_DISCRETE(p_supp, p_prob, p_dimnames = "rvar")
```

Arguments

p_supp	A numeric vector of options
p_prob	A numeric vector of probabilities.
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, DISCRETE

Note

If the second argument is missing, all options will be sample with equal probability. If provided, the second argument would add to 1 and must be the same length that the first argument

Author(s)

John J. Aponte

Examples

```
myDistr <- new_DISCRETE(p_supp=c(1,2,3,4), p_prob=c(0.40,0.30,0.20,0.10))
myDistr$rfunc(10)
```

DISTRIBUTION *DISTRIBUTION class*

Description

DISTRIBUTION is a kind of abstract class (or interface) that the specific constructors should implement.

Details

It contains 4 fields

distribution A character with the name of the distribution implemented

seed A numerical that is used for `details` to produce reproducible details of the distribution

oval Observed value. Is the value expected. It is used as a number for the mathematical operations of the distributions as if they were a simple scalar

rfunc A function that generate random numbers from the distribution. Its only parameter `n` is the number of draws of the distribution. It returns a matrix with as many rows as n, and as many columns as the dimensions of the distributions

The DISTRIBUTION objects could support multidimensional distributions for example `DIRICHLET`. The names of the dimensions should coincides with the names of the `oval` vector. If only one dimension, the default name is `rvar`.

It is expected that the `rfunc` is included in the creation of new distributions by convolution so the environment should be carefully controlled to avoid reference leaking that is possible within the R language. For that reason, `rfunc` should be created within a `restrict_environment` function

Once the object is instanced, the fields are immutable and should not be changed. If the seed needs to be modified, a new object can be created using the `set_seed` function

Objects are defined for the following distributions

- `UNIFORM`
- `NORMAL`
- `BETA`
- `TRIANGULAR`
- `POISSON`
- `EXPONENTIAL`
- `DISCRETE`
- `DIRAC`
- `DIRICHLET`
- `TRUNCATED`
- `NA_DISTRIBUTION`

Value

a DISTRIBUTION object

Author(s)

John J. Aponte

`DISTRIBUTION_factory` *A factory of* `DISTRIBUTION` *classes*

Description

Generate a function that creates `DISTRIBUTION` objects

Usage

```
DISTRIBUTION_factory(distname, rfunction, ovalfunc)
```

Arguments

`distname`	name of the distribution. By convention they are upper case
`rfunction`	a function to generate random numbers from the distribution
`ovalfunc`	a function that calculate the oval value, should used only the same arguments that the `rfunction`

Value

A function that is able to create `DISTRIBUTION` objects.

Note

The function return a new function, that have as arguments the formals of the `rfunction` plus a new argument `dimnames` for the dimension names. If The distribution is unidimensional, the default value `dimnames = "rvar"` will works well, but if not, the `dimnames` argument should be specified when the generated function is used as in the example for the `new_MyDIRICHLET`

Author(s)

John J. Aponte

Examples

```
new_MYDISTR <- DISTRIBUTION_factory("MYDISTR", rnorm, function(){mean})
d1 <- new_MYDISTR(0,1)
summary(d1)
require(extraDistr)
new_MyDIRICHLET <- DISTRIBUTION_factory('rdirichlet',
                      rdirichlet,
                      function() {
                        salpha = sum(alpha)
                        alpha / salpha
                      })
d2 <- new_MyDIRICHLET(c(10, 20, 70), dimnames = c("A", "B", "C"))
summary(d2)
```

EXPONENTIAL *Factory for a EXPONENTIAL distribution using confidence intervals*

Description

Returns an EXPONENTIAL distribution object that produce random numbers from an exponential distribution using the rexp function

Usage

```
new_EXPONENTIAL(p_rate, p_dimnames = "rvar")
```

Arguments

p_rate	A numeric that represents the rate of events
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, EXPONENTIAL

Author(s)

John J. Aponte

Examples

```
myDistr <- new_EXPONENTIAL(5)
myDistr$rfunc(10)
```

`fitbeta` *Fits a beta distribution based on quantiles*

Description

Fits a beta distribution based on quantiles

Usage

```
fitbeta_ml(point, lci, uci)

fitbeta(point, lci, uci)
```

Arguments

`point`	Point estimates corresponding to the median
`lci`	Lower limit (quantile 0.025)
`uci`	Upper limit (quantile 0.975)

Value

parameters shape1 and shape2 of a beta distribution

Functions

- `fitbeta_ml()`: using ML to estimate parameters
- `fitbeta()`: preserve the expected value

Note

This is a wrap of the `fitdist` to obtain the best parameters for a beta distribution based on quantiles.

When using confidence intervals (not ML), the shape parameters are obtained using the following formula:

$varp = (p_uci - p_lci)/4^2$

$shape1 = p_mean * (p_mean * (1 - p_mean)/varp - 1)$

$shape2 = (1 - p_mean) * (p_mean * (1 - p_mean)/varp - 1)$

Author(s)

John J. Aponte

See Also

`fitdist`

Examples

```
fitbeta_ml(0.45,0.40,0.50)
fitbeta(0.45,0.40,0.50)
```

`fitdirichlet` *Fits a Dirichlet distribution,*

Description

Fits a Dirichlet distribution based on the parameters of Beta distributions

Usage

```
fitdirichlet(..., plotBeta = FALSE, n.fitted = "opt")
```

Arguments

`...`	named vectors with the distribution parameters shape1, shape2
`plotBeta`	if TRUE a ggplot of the densities are plotted
`n.fitted`	Method to fit the values

Details

Each one of the arguments is a named vector with values for shape1, shape2. Values from `fitbeta` are suitable for this. This is a wrap of `fitDirichlet`

Value

a vector with the parameters for a Dirichlet distribution

Author(s)

John J. Aponte

See Also

`fitDirichlet`

Examples

```
a <- fitbeta(0.3, 0.2, 0.4)
c <- fitbeta(0.2, 0.1, 0.3)
b <- fitbeta(0.5, 0.4, 0.6)
fitdirichlet(cat1=a,cat2=b,cat3=c)
```

ggDISTRIBUTION *Plot of* DISTRIBUTION *objects using* ggplot2

Description

Plot of DISTRIBUTION objects using ggplot2

Usage

```
ggDISTRIBUTION(x, n = 10000)
```

Arguments

x	an object of class DISTRIBUTION
n	number of observation

Value

a ggplot object with the density of the distribution

Examples

```
x <- new_NORMAL(0,1)
ggDISTRIBUTION(x)
y <- new_DIRICHLET(c(10,20,70))
ggDISTRIBUTION(x)
```

LOGNORMAL *Factory for a LOGNORMAL distribution object*

Description

Returns a LOGNORMAL distribution object that produce random numbers from a log normal distribution using the rlnorm function

Usage

```
new_LOGNORMAL(p_meanlog, p_sdlog, p_dimnames = "rvar")
```

Arguments

p_meanlog	mean of the distribution on the log scale
p_sdlog	A numeric that represents the standard deviation on the log scale
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, LOGNORMAL

Author(s)

John J. Aponte

Examples

```
myDistr <- new_LOGNORMAL(0,1)
myDistr$rfunc(10)
```

`metadata` *Metadata for a DISTRIBUTION*

Description

Shows the distribution and the oval values of a DISTRIBUTION object

Usage

```
metadata(x)

## S3 method for class 'DISTRIBUTION'
metadata(x)

## Default S3 method:
metadata(x)
```

Arguments

x	a DISTRIBUTION object

Value

A data.frame with the metadata of the distributions

Methods (by class)

- `metadata(DISTRIBUTION)`: Metadata for DISTRIBUTION objects
- `metadata(default)`: Metadata for other objects

Note

The number of columns depends on the dimensions of the distribution. There will be one column `distribution` with the name of the distribution and one column for each dimension with the names from the `oval` field.

Author(s)

John J. Aponte

`NA_DISTRIBUTION` *Factory for a NA distribution object*

Description

Returns an NA distribution object that always return `NA_real_` This is useful to handle `NA`. By default only one dimension `rvar` is produced, but if several names are provided more columns will be added to the return matrix

Usage

```
new_NA(p_dimnames = "rvar")
```

Arguments

`p_dimnames`	A character that represents the the names of the dimensions. By default only one dimension with name `rvar`

Value

An object of class `DISTRIBUTION`, `NA`

Author(s)

John J. Aponte

Examples

```
myDistr <- new_NA(p_dimnames = "rvar")
myDistr$rfunc(10)
```

`new_MIXTURE` *Mixture of* `DISTRIBUTION` *objects*

Description

Produce a new distribution that obtain random drawns of the mixture of the `DISTRIBUTION` objects

Usage

```
new_MIXTURE(listdistr, mixture)
```

Arguments

listdistr	a list of DISTRIBUTION objects
mixture	a vector of probabilities to mixture the distributions. Must add 1 If missing the drawns are obtained from the distributions with the same probability

Value

an object of class MIXTURE, DISTRIBUTION

Author(s)

John J. Aponte

Examples

```
x1 <- new_NORMAL(0,1)
x2 <- new_NORMAL(4,1)
x3 <- new_NORMAL(6,1)
new_MIXTURE(list(x1,x2,x3))
```

---

new_MULTINORMAL *Multivariate Normal Distribution*

Description

Return a DISTRIBUTION object that draw random numbers from a multivariate normal distribution using the mvrnorm function.

Usage

```
new_MULTINORMAL(p_mu, p_sigma, p_dimnames, tol = 1e-06, empirical = FALSE)
```

Arguments

p_mu	a vector of means
p_sigma	a positive-definite symmetric matrix for the covariance matrix
p_dimnames	A character that represents the name of the dimension
tol	tolerance (relative to largest variance) for numerical lack of positive-definiteness in p_sigma.
empirical	logical. If true, mu and Sigma specify the empirical not population mean and covariance matrix.

Value

An object of class DISTRIBUTION, MULTINORMAL

Author(s)

John J. Aponte

See Also

mvrnorm

Examples

```
msigma <- matrix(c(1,0,0,1), ncol=2)
d1 <- new_MULTINORMAL(c(0,1), msigma)
rfunc(d1, 10)
```

NORMAL *Factory for a NORMAL distribution object*

Description

Returns a NORMAL distribution object that produce random numbers from a normal distribution using the rnorm function

Usage

```
new_NORMAL(p_mean, p_sd, p_dimnames = "rvar")
```

Arguments

p_mean	A numeric that represents the mean value
p_sd	A numeric that represents the standard deviation
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, NORMAL

Author(s)

John J. Aponte

Examples

```
myDistr <- new_NORMAL(0,1)
myDistr$rfunc(10)
```

omit_NA *Omit* NA *distributions from a list of distributions*

Description

Omit NA distributions from a list of distributions

Usage

```
omit_NA(listdistr)
```

Arguments

listdistr	a list of DISTRIBUTION objects

Value

the list without the NA_DISTRIBUTION

Author(s)

John J. Aponte

plot.DISTRIBUTION *plot of* DISTRIBUTION *objects*

Description

Plot an histogram of the density of the distribution using random numbers from the distribution

Usage

```
## S3 method for class 'DISTRIBUTION'
plot(x, n = 10000, ...)
```

Arguments

x	an object of class DISTRIBUTION
n	number of observations
...	other parameters to the hist function

Value

No return value. Side effect plot the histogram.

Examples

```
x <- new_NORMAL(0,1)
plot(x)
y <- new_DIRICHLET(c(10,20,70))
plot(x)
```

POISSON *Factory for a POISSON distribution using confidence intervals*

Description

Returns an POISSON distribution object that produce random numbers from a Poisson distribution using the rpois function

Usage

```
new_POISSON(p_lambda, p_dimnames = "rvar")
```

Arguments

p_lambda	A numeric that represents the expected number of events
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, POISSON

Author(s)

John J. Aponte

Examples

```
myDistr <- new_POISSON(5)
myDistr$rfunc(10)
```

`restrict_environment` *Build a new function with a smaller environment*

Description

As standard feature, R include in the environment of a function all the variables that are available when the function is created. This, however is prompt to leak reference when you have a factory of function and they are created within a list.. it will include all the component of the list in the function environment. To prevent that, the random generator functions are encapsulated with a restricted environment where only the variables that the function requires to work are included

Usage

```
restrict_environment(f, ...)
```

Arguments

`f`	input function
`...`	define the set of variables to be included as variable = value.

Value

new function with a restricted environment

Author(s)

John J. Aponte

Examples

```
a = 0
b = 1
myfunc <- restrict_environment(
 function(n) {
   rnorm(meanvalue, sdvalue)
 },
 meanvalue = a, sdvalue = b)

myfunc(10)
ls(envir=environment(myfunc))
```

rfunc *Generate random numbers from a DISTRIBUTION object*

Description

This is a generic method that calls the rfunc slot of the object

Usage

```
rfunc(x, n)
```

Arguments

x	an object
n	the number of random samples

Value

a matrix with as many rows as n and as many columns as dimensions have distribution

Author(s)

John J. Aponte

rfunc.default *Default function*

Description

Default function

Usage

```
## Default S3 method:
rfunc(x, n)
```

Arguments

x	an object of class different from DISTRIBUTION
n	the number of random samples

Value

No return value. Raise an error message.

Author(s)

John J. Aponte

rfunc.DISTRIBUTION *Generic function for a DISTRIBUTION object*

Description

Generic function for a DISTRIBUTION object

Usage

```
## S3 method for class 'DISTRIBUTION'
rfunc(x, n)
```

Arguments

x	an object of class DISTRIBUTION
n	the number of random samples

Value

a matrix with as many rows as n and as many columns as

Author(s)

John J. Aponte

same_dimensions *Check the dimensions of a list of distributions*

Description

Check the dimensions of a list of distributions

Usage

```
same_dimensions(listdistr)
```

Arguments

listdistr	a list of DISTRIBUTION objects

Value

return TRUE if all the dimensions are the same

set_seed *Modify a the seed of a Distribution object*

Description

This create a new DISTRIBUTION object but with the specified seed

Usage

```
set_seed(distribution, seed)
```

Arguments

distribution	a DISTRIBUTION object
seed	the new seed

Value

a DISTRIBUTION object of the same class

Author(s)

John J. Aponte

summary.DISTRIBUTION *Summary of Distributions*

Description

Summary of Distributions

Usage

```
## S3 method for class 'DISTRIBUTION'
summary(object, n = 10000, ...)
```

Arguments

object	object of class DISTRIBUTION
n	the number of random samples from the distribution
...	other parameters. Not used

Value

A data.frame with as many rows as dimensions had the distribution and with the following columns

- distribution name
- varname name of the dimension
- oval value
- nsample number of random samples
- mean_ mean value of the sample
- sd_ standard deviation of the sample
- lci_ lower 95
- median_ median value of the sample
- uci_ upper 95

Note

The sample uses the seed saved in the object those it will provide the same values fir an n value

Author(s)

John J. Aponte

TRIANGULAR *Factory for a TRIANGULAR distribution object*

Description

Returns an TRIANGULAR distribution object that produce random numbers from a triangular distribution using the rtriang function

Usage

```
new_TRIANGULAR(p_min, p_max, p_mode, p_dimnames = "rvar")
```

Arguments

p_min	A numeric that represents the lower limit
p_max	A numeric that represents the upper limit
p_mode	A numeric that represents the mode
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, TRIANGULAR

Author(s)

John J. Aponte

Examples

```
myDistr <- new_TRIANGULAR(-1,1,0)
myDistr$rfunc(10)
```

TRUNCATED *Factory for a TRUNCATED distribution object*

Description

Returns an TRUNCATED distribution object that limits the values that are generated by the distribution to be in the limits `p_min`, `p_max`

Usage

```
new_TRUNCATED(p_distribution, p_min = -Inf, p_max = Inf)
```

Arguments

`p_distribution`	An object of class DISTRIBUTION to truncate
`p_min`	A numeric that set the lower limit of the distribution
`p_max`	A numeric that set the upper limit of the distribution

Value

An object of class `DISTRIBUTION`, `p_distribution$distribution`, `TRUNCATED`

Note

The expected value of a truncated distribution could be very different from the expected value of the unrestricted distribution. Be careful as the `oval` field is not changed and may not represent any more the expected value of the distribution.

If the distribution is multidimensional, the limits will apply to all dimensions.

Author(s)

John J. Aponte

Examples

```
myDistr <- new_TRUNCATED(p_distribution = new_NORMAL(0,1), p_min = -1, p_max = 1)
myDistr$rfunc(10)
```

UNIFORM *Factory for a UNIFORM distribution object*

Description

Returns an UNIFORM distribution object that produce random numbers from a uniform distribution using the runif function

Usage

```
new_UNIFORM(p_min, p_max, p_dimnames = "rvar")
```

Arguments

p_min	A numeric that represents the lower limit
p_max	A numeric that represents the upper limit
p_dimnames	A character that represents the name of the dimension

Value

An object of class DISTRIBUTION, UNIFORM

Author(s)

John J. Aponte

Examples

```
myDistr <- new_UNIFORM(0,1)
myDistr$rfunc(10)
```

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