The rv Package

November 17, 2005

Title Simulation-based random variable object class in R

Version 0.911

Date 2005/11/17

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Description Simulation-based random variable object class

Namespace rv

Depends R(>= 1.9.0)

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R topics documented:

`Math.rv` *Mathematical functions and Operators for rv Objects*

Description

Mathematical functions and operators adapted to work with random variable (rv) objects.

Usage

```
Math.rv(x, ...)
Ops.rv(e1, e2)
```

Arguments

`x`	object
`e1`	object
`e2`	object
`...`	further arguments passed to or from other methods

Details

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(10)
-x
x + 1:10
cumsum(x)
cumprod(exp(x))
```

abline.rv *Random Vectors*

Description

`abline.rv` plots `n` lines corresponding to `n` first simulations of rv object `x`

Usage

```
abline.rv(x, sims=1:20, ...)
```

Arguments

`x`	an object
`sims`	number of lines to draw
`...`	further arguments passed to or from other methods

Details

...

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

as.rv.bugs *Coerce an R2WinBUGS object to an rv object*

Description

`as.rv.bugs` coerces an `R2WinBUGS` object to an `rv` object.

Usage

```
as.rv.bugs(x)
```

Arguments

`x`	a bugs (R2WinBUGS) object

Details

Value

A random vector with the names attribute set to the names of the parameters.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

split.rv to split the named random vector so you can “attach" it with rvattach.

---

as.vector.rv *Coerce an rv object*

Description

as.vector.rv coerces a given rv object into a vector; matrices lose their dimension attributes, but rv objects stay as rv objects (since they are considered to be “vectors").

Usage

```
as.vector.rv(x, mode="any")
```

Arguments

x	an object
mode	(currently not used)

Details

as.vector.rv removes the dimension attribute and returns the rv object. Needed for compatibility with code that uses as.vector.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

cbind.rv *Combine random vectors by columns or rows*

Description

Combines random vectors by columns (`cbind.rv`) or rows (`rbind.rv`).

Usage

```
cbind.rv(..., deparse.level = 1)
rbind.rv(..., deparse.level = 1)
```

Arguments

`...`	vectors or matrices, can be rv objects
`deparse.level`	(passed on to cbind)

Details

See cbind and rbind for details.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(10)
y <- rvnorm(10)
cbind(x,y)
rbind(x,y)
```

constant *Constant Vectors*

Description

Tests or coerces objects that are non-random.

Usage

```
is.constant(x)
## S3 method for class 'rv':
is.constant(x)
## Default S3 method:
is.constant(x)
## S3 method for class 'rvsim':
is.constant(x)
as.constant(x)
## S3 method for class 'rvsim':
as.constant(x)
## S3 method for class 'rv':
as.constant(x)
```

Arguments

`x`	an object, random variable (rv) or not

Details

`is.constant` returns `TRUE` for each component of the argument object if the implied variance (sample variance of the simulations) is zero or if there is only one simulation (that is, the variable is “constant").

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
is.constant(1)         # TRUE
is.constant(rvnorm(1)) # FALSE
```

Covariance/Variance Statistic

Distribution of the Covariance Statistic of a Random Vector and Array

---

Description

`cov`

Usage

```
cov(x, y=NULL, ...)
var(x, ...)
```

Arguments

x	an object
y	
...	further arguments passed to or from other methods

Details

cov gives the distribution (that is, a random variable object) of the covariance statistic, as computed by the standard R function cov.

This is implemented simply by applying the numerical cov function to the rows of the simulation matrices of x and y and forming a new rv object from the resulting vector of simulations.

Similarly, var computes the variance.

This has been implemented by “trapping" the original function cov since cov is not a generic method.

Value

A random vector or array.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

See cov for details.

Examples

```
#
```

---

detachrv *Detach the rv package*

Description

detachrv detaches the rv package and restores the original functions in base and stats packages. Currently equivalent to detach("package:rv").

Usage

```
detachrv()
```

Details

detachrv

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
  ## Not run:
  library(rv)
  detachrv()

## End(Not run)
```

---

doc *Show a document (pdf) file from the package directory*

Description

Show a document file (a pdf file) from the package "doc" directory

Usage

```
doc(topic, package = NULL, lib.loc=NULL)
```

Arguments

topic	a character string giving the (base) name of the pdf file to view. If omitted, all available pdf files are listed.
package	a character vector with the names of packages to search through, or NULL in which case all available packages in the library trees specified by lib.loc are searched.
lib.loc	a character vector of directory names of R libraries, or NULL. The default value of NULL corresponds to all libraries currently known.

Details

If "package" is omitted, all packages are scanned for the file name.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
## Not run: doc("rv")
## Not run: doc("R2WinBUGS")
```

`hist.rv` *Histogram of a random vector*

Description

`hist.rv` shows a grid of histograms generated from random draws of the random vector argument.

Usage

```
## S3 method for class 'rv':
hist(x, grid = c(4, 5), xlim = x.range, main = paste(xname, "simulation"), ...)
```

Arguments

`x`	an object
`grid`	a vector of two numbers, indicating the size of the grid to plot the histograms
`xlim`	x limits
`main`	main title
`...`	Other arguments passed on to hist

Details

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(30)
hist(x)
```

`hrvplot` *Horizontal interval plot of components of a random vector*

Description

`hrvplot` plots uncertainty (that is, “credible") intervals for the scalar components of the given random vector.

Usage

```
hrvplot(x, labels=NULL, pos=NULL, output.file=NULL)
## S3 method for class 'matrix':
hrvplot(x, labels, pos=NULL, output.file=NULL)
## S3 method for class 'rv':
hrvplot(x, labels=NULL, ...)
```

Arguments

`x`	an object
`labels`	alternative labeling
`pos`	
`output.file`	alternative output file name
`...`	

Details

`hrvplot`

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

is.atomic.rv *Random vectors are atomic*

Description

`is.atomic(x)` returns `TRUE` for rv objects. This is necessary to make R believe that rvs are as good as other vectors.

Usage

```
## S3 method for class 'rv':
is.atomic(x)
```

Arguments

`x`	an object

Details

`is.atomic.rv`

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
is.atomic(rvnorm(1)) # TRUE, believe it or not.
```

is.na.rv *Distribution of the Indicator Function of Missing Data*

Description

`is.na.rv`

Usage

```
## S3 method for class 'rv':
is.na(x)
```

Arguments

`x`	an rv object

Details

Internally, `is.na.rv` applies the function `is.na` to each simulation of each component of the argument vector.

Value

A “Bernoulli" random vector of the same length and dimension as those of `x`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`lines.rv` *Plot some realized series of random vectors*

Description

`lines.rv`

Usage

```
lines.rv(x, simrows=1:3, lcolors=c("blue", "red", "green", "orange", "yellow")
```

Arguments

`x`	an object
`simrows`	which rows of the simulation matrix to plot
`lcolors`	colors to use when plotting a series
`...`	further arguments passed to `lines`

Details

...

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`matsimapply` *Apply a two-argument function to simulations*

Description

(Used internally)

Usage

```
matsimapply(X,Y,FUN, ...)
```

Arguments

`X`	
`Y`	
`FUN`	
`...`	further arguments passed to or from other methods

Details

`matsimapply`

Value

A random variable object.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

mcmcarray *Coerce an rv object into a three-way array*

Description

mcmcarray

Usage

```
mcmcarray(x)
```

Arguments

x	an rv object that was coerced from a three-way array

Details

mcmcarray

Value

A three-way array.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

mean.rv *Distribution of the Arithmetic Mean of a Random Vector*

Description

mean.rv computes the distribution of the arithmetic average of its argument rv object.

Usage

```
## S3 method for class 'rv':
mean(x, ...)
```

Arguments

`x`	an object
`...`	further arguments passed to or from other methods

Details

`mean.rv` gives the distribution (that is, a random variable object) of the statistic $\frac{1}{n}\sum_{i=1}^{n} x_i$ (sum(x)/length(x)).

In particular, `mean(x)` of a random vector `x` of length one is equal to `x` as it would be in the case of numerical x.

To find the expectation of a random vector `x` (that is, the individual means of random components in a vector), use `rvmean(x)` (same as `E(x)` and `Pr(x)`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`rvmean`

Examples

```
#
```

`nsims` *Number of simulations stored in each component of an rv object*

Description

`nsims` returns the number of simulations stored in each component of its argument.

Usage

```
nsims(x)
```

Arguments

`x`	an rv object

Details

If the argument is a number, `nsims` returns 1.

Value

A vector of integers.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
nsims(1.23)
x <- rvnorm(1)
nsims(x)
nsims(x)==nrow(sims(x)) # Should be TRUE
nsims(x)==rvnsims()     # Should be TRUE
```

---

plot.rv *Plotting Random Vectors*

Description

Draw a "random scatter plot". Currently only the y coordinate can be random, so intervals are plotted for each fixed x-coordinate..

Usage

```
## S3 method for class 'rv':
plot(x, y, what=c("95%","50%","mean","median"), ylim=range(sims(y)), xlim=rang
```

Arguments

`x`	(optional) fixed x-coordinate
`y`	random vector
`what`	what to plot: an interval or a dot
`xlim`	the x limits of the plot
`ylim`	the y limits of the plot
`rvcol`	colors for the intervals (passed on to `link{points.rv}`)
`...`	other arguments passed on to `plot`

Details

(This function is still under development.)

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
x <- 1:30
y <- rvnorm(mean=x, sd=1)
## Not run: plot.rv(x,y)  # x is not an rv, so be explicit and specify plot.rv
## Not run: plot(y)       # y is an rv, so R knows to call plot.rv.
```

`points.rv` *Add Points and Intervals to a Plot*

Description

Draw a sequence of points or uncertainty intervals at specified (fixed) x-coordinates.

Usage

```
points.rv(x, y = NULL, what=NULL, rvcol=c("green", "red"), ...)
```

Arguments

`x`	x-coordinates
`y`	y-coordinates
`what`	what to plot: intervals, means, medians...
`rvcol`	colors for the intervals
`...`	further arguments passed to `points`

Details

(Under development.)

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

postsim — *Generate Posterior Simulations for lm or glm Objects*

Description

Generate posterior simulations for a given fitted linear or general linear model, assuming the standard "noninformative" priors on the unknowns.

Usage

```
postsim(fit)
## S3 method for class 'lm':
postsim(fit)
## S3 method for class 'glm':
postsim(fit)
```

Arguments

fit	an lm or glm object

Value

A (named) random vector for each fitted coefficient.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- 1:20
y <- rnorm(length(x), mean=x, sd=10)
print(summary(lm.fit <- lm(y ~ x)))
random.estimates <- postsim(lm.fit)
```

print.rv — *Print Distribution Summaries of Random Variables*

Description

print.rv

Usage

```
print.rv(x, ...)
```

Arguments

x	an rv object
...	further arguments passed to or from other methods

Details

print.rv

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
print(rvnorm(mean=rvnorm(1)))
```

---

quantile.rv *Distribution of a Quantile of a Random Vector*

Description

quantile.rv returns the distribution of the quantile of a random vector (as a random variable).

Usage

```
## S3 method for class 'rv':
quantile(x, ...)
```

Arguments

x	an object
...	further arguments passed to or from other methods

Value

A random vector (rv object) with components giving the distribution of the desired quantiles.

Note

quantile.rv does not return the simulated quantiles of the quantiles of the argument x. This is done by rvquantile.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(30)
quantile(x)
```

`range.rv` *Distribution of the Range of a Random Vector*

Description

`range.rv` returns a 2-component random vector containing the distributions of the minimum and the maximum values of all the given arguments.

Usage

```
## S3 method for class 'rv':
range(..., na.rm=FALSE, finite=FALSE)
```

Arguments

`...`	further arguments passed to or from other methods
`na.rm`	logical, indicating if NAs should be omitted
`finite`	logical, indicating if all non-finite elements should be omitted

Details

This is the rv-compatible version of the function `range`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`quantile.rv`

Examples

```
x <- rvnorm(mean=1:10, sd=1)
print(range(x))
print(quantile(x, c(0,1)))
```

rowapply — *Apply a Function to Rows of a Random Matrix*

Description

`rowapply` takes a random matrix and applies a function to its rows, returning another rv object.

Usage

```
rowapply(X, FUN, ...)
```

Arguments

`X`	random matrix (an rv object with non-null `dim`ension)
`FUN`	a function to apply
`...`	further arguments passed to `FUN`

Value

A random variable (an rv object).

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

Extract.rv — *Extract or Replace Parts of a Random Vector*

Description

Details

Extracting rv objects works the same way as extracting components of a numerical vector or array. The return value is always an object of class 'rv'. Type ?Extract for details.

Value

A random variable (an rv object).

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

---

rv *Random Vectors*

Description

Creates or tests for objects of type "rv".

Usage

```
rv(length = 0)
as.rv(x)
is.rv(x)
is.random(x)
```

Arguments

length	desired length.
x	object to be coerced or tested.

Details

rv creates a random vector vector of the specified length. The elements of the vector are all equal to 0.

is.rv returns TRUE if its argument is a rv object, FALSE otherwise.

as.rv attempts to coerce its argument to the random vector (rv) type.

is.random returns TRUE or FALSE for each component of the argument vector, depending on whether the component is a random variable object.

Note

rv objects are internally lists with the class attribute set to "rv".

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York. http://www.stat.columbia.edu/~kerman/Research/postsim.pdf

See Also

For a short version of the paper, type `doc("rv")`.

Examples

```
x <- rv(1)
```

`rvAdapted` *Functions adapted to accept random variable (rv) objects*

Description

Functions that have been adapted to work with rv objects.

Usage

```
c(..., recursive=FALSE)
x %*% y
is.vector(x, mode="any")
max(..., na.rm = FALSE)
pmax(..., na.rm = FALSE)
min(..., na.rm = FALSE)
pmin(..., na.rm = FALSE)
median(x, na.rm = FALSE)
```

Details

These functions have been adapted to work with rv objects (since no *real* object-oriented generic version is available). They check whether an rv object has been passed as an argument; if false, the original function will be called.

To restore the original functions, detach the package; use `detachrv()`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`cov` for details about the `cov` and `var` functions adapted for random variable objects.

Examples

```
x <- rvnorm(10) # A random vector.
median(x)       # A random variable.
max(x)          # Another random variable.
```

rvRhat — *R-hat Convergence Diagnostic*

Description

Retrieves the R-hat convergence diagnostic for each component of the argument

Usage

```
rvRhat(x)
```

Arguments

x	an object

Details

The R-hat values are assumed to be saved as attributes. If they are not available, NA will be returned.

Value

Vector of numbers, NA if R-hat is not available.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

rvattach — *Attach / detach elements of rv objects to search path*

Description

rvattach

Usage

```
rvattach(what, name='rvattach', ...)
```

Arguments

what	
name	
...	further arguments passed to or from other methods

Details

rvattach

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

---

rvattr *Attributes of Random Variables*

Description

rvattr

Usage

```
rvattr(x, attrib)
rvattr(x, attrib) <- value
```

Arguments

x	an object
attrib	
value	

Details

rvattr

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvbern` *Generate a Random Vector from a Bernoulli Sampling Model*

Description

`rvbern` generates a random vector where each simulation comes from a Bernoulli sampling distribution.

Usage

```
rvbern(n=1, prob)
```

Arguments

`n`	number of random scalars to draw
`prob`	probability of “success"; may be a random vector itself

Details

`rvbern` is a special case of `rvbinom` with the argument size=1.

Value

A random vector (an rv object) of length `n`.

Note

The resulting vector will not be independent and identically distributed Bernoulli unless `prob` is a fixed number.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
rvbern(10, prob=0.5)
rvbinom(10, size=1, prob=0.5) # Equivalent
```

rvbeta — *Generate Random Vectors from a Beta Sampling Model*

Description

rvbeta

Usage

```
rvbeta(n=1, shape1, shape2)
```

Arguments

n	integer, number of random variables to generate
shape1	positive number or rv, 1st shape parameter
shape2	positive number or rv, 2nd shape parameter

Details

rvbeta

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

rvbinom — *Generate Random Variables from a Binomial Sampling Model*

Description

Generates a random vector from a binomial sampling model.

Usage

```
rvbinom(n=1, size, prob)
```

Arguments

n	integer, number of random variables to generate
size	integer or integer-valued rv: the number of trials (size of each sample)
prob	prior probability of success of each trial (may be constant or an rv object)

Details

`rvbinom` generates a random vector with given length, the distribution for size and the distribution for the probability of success.

Value

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
s <- 1+rvpois(1,lambda=3)        # A prior distribution on the 'size' parameter.
rvbinom(1, size=s, prob=0.5)     # The 'size' is random.
p <- rvbinom(1, 10, prob=0.5)/10 # Prior probability of success.
rvbinom(1, size=10, prob=p)      # Now the probability is random.
rvbinom(1, size=s, prob=p)       # Both the size and the probability are random.
```

`rvboot` *Generate a Random Vector from an Empirical Distribution*

Description

`rvboot` generates a random vector of the same length as data from the empirical distribution of the data.

Usage

```
rvboot(data)
```

Arguments

`data`	A vector of constants

Details

`rvboot`

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
y <- rnorm(30) # Some data.
x <- rvboot(y) # A random vector of length 30 (each component has the same distributior
print(mean(x)) # Bootstrap estimate of the mean.
print(sd(x))   # Bootstrap estimate of the sd.
rvinci(mean(x), 0) # Hypothesis test: mean of x is zero (at 5
```

---

rvcauchy *Generate Random Variables from a Cauchy Sampling Model*

Description

Random vector generation for the Cauchy distribution.

Usage

```
rvcauchy(n=1, location=0, scale=1)
```

Arguments

n	integer: number of variables to generate
location	location parameter (may be random)
scale	scale parameter (may be random)

Details

For details on the Cauchy distribution, see Cauchy. See also `rvt`; Cauchy is a special case of the t-distribution with 1 degree of freedom, and therefore `rvcauchy(n,location,scale)` is equivalent to `rvt(n, mu, scale, df=1)`.

Value

A random vector (rv object) of length `n`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

`rvchisq` *Generate Random Variables from a Chi-Square Sampling Model*

Description

Generates a random vector from a chi-square sampling model.

Usage

```
rvchisq(n=1, df, ncp = 0)
```

Arguments

`n`	number of variables to generate
`df`	integer, degrees of freedom, may be random
`ncp`	non-centrality parameter, may be random

Details

If any of the arguments are random, the resulting simulations may have non-Poisson marginal distributions.

Value

A random vector (rv object) of length `n`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvci *Credible (Uncertainty) Intervals for Random Scalars*

Description

Computes credible (uncertainty) intervals for a given vector.

Usage

```
rvci(obj, interval=0.95, one.sided=FALSE, left=TRUE)
```

Arguments

obj	random scalar or vector
interval	a number between 0 and 1
one.sided	logical, FALSE if two-sided interval is desired
left	logical, indicating if the left one-sided interval is desired

Value

For two-sided intervals, an array of numbers of dimension `c(2,length(x))`, for one-sided intervals, a vector of the same length as `x`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
rvci(rvnorm(1), interval=0.683) # Should be about c(-1,1).
```

rvconst *Random Vector with a Point-Mass Distribution*

Description

Coerces a given vector of constants into a random vector with 1 simulation in each component.

Usage

```
rvconst(n=1,x)
```

Arguments

n	integer: number of variables to generate
x	a vector of constants

Details

Coerces a given vector of constants into a random vector with 1 simulation in each component.

Value

A random vector (rv object) of length n.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

---

rvcov *Covariance Between Components of Random Vectors*

Description

rvcov

Usage

```
rvcov(x, y=NULL, ...)
```

Arguments

x	a random vector
y	(optional) a random vector
...	further arguments passed to or from other methods

Details

rvcov

Value

A covariance matrix.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(mean=1:3)
y <- rvnorm(mean=2:4)
rvcov(x,y)
rvcov(x,x)
```

---

rvdirichlet *Generate Random Variables from a Dirichlet Sampling Model*

Description

Generates random variables from a Dirichlet sampling model.

Usage

```
rvdirichlet(n=1, alpha)
```

Arguments

n	integer: number of vectors to generate
alpha	the parameter vector

Details

The Dirichlet distribution is a generalization of the Beta distribution. (If alpha is of length two, `rvdirichlet` draws from the Beta model.)

Value

A random vector (rv object) of length `n`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvexp — *Generate Random Vectors from an Exponential Sampling Model*

Description

rvexp

Usage

```
rvexp(n=1, rate = 1)
```

Arguments

n	integer: number of variables to generate
rate	prior distribution for the rate parameter (constant or random)

Details

rvexp

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
y <- rvexp(1, rate=rvexp(1)) # What marginal distribution does y have now?
```

rvgamma — *Generate Random Variables from a Gamma Sampling Model*

Description

Generates random variables from a Gamma sampling model.

Usage

```
rvgamma(n=1, shape, rate = 1, scale = 1/rate)
```

Arguments

n	integer: number of variables to generate
shape	shape parameter, may be a rv
rate	rate parameter, may be a rv
scale	inverse of rate, may be specified optionally instead of rate

Details

`rvgamma`

Value

A random vector (rv object).

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvhist` *Histogram of Distributions of Components of a Random Vector*

Description

`rvhist`

Usage

```
rvhist(x, main=NULL, ...)
```

Arguments

`x`	an rv object
`main`	main title
`...`	further arguments passed to the hist function

Details

`rvhist`

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvinci` *Is a value inside a confidence interval?*

Description

`rvinci` returns `TRUE` iff a given value is inside a given interval.

Usage

```
rvinci(obj, x, interval=0.95, one.sided=FALSE, left=FALSE)
```

Arguments

`obj`	
`x`	an object
`interval`	
`one.sided`	
`left`	

Details

Value

A logical vector.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvinvchisq` *Generate Random Variables from a Inverse-Chi-Square Sampling Model*

Description

`rvinvchisq`

Usage

```
rvinvchisq(n=1, df, scale=1)
```

Arguments

`n`	integer: number of variables to generate
`df`	degrees of freedom (may be random)
`scale`	scale parameter (may be random)

Details

`rvinvchisq`

Value

A random vector (rv object).

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvmatrix *Matrices and Arrays of Random Vectors*

Description

rvarray...

Usage

```
rvmatrix(...)
rvarray(...)
```

Arguments

...	arguments passed to matrix or to array

Details

rvarray ...

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvmax *Maximum Simulated Value of Random Variable*

Description

rvmax

Usage

```
rvmax(x, ...)
```

Arguments

x	an rv object
...	further arguments passed to max

Details

rvmax

Value

A *numeric* vector of the same dimension as x.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

rvmin, rvmedian, rvmean.

Examples

```
rvmax(rvnorm(1))
```

---

rvmean *Expectation of a Random Variable*

Description

rvmean

Usage

```
rvmean(x, ...)
```

Arguments

x	an rv object
...	further arguments passed to mean

Details

rvmean computes the means of the simulations of all individual components of a random vector (rv) object.

E is an alias for rvmean, standing for "Expectation."

Pr is another alias for rvmean, standing for "Probability of"; suggested to be used when the argument is a logical statement involving random variables (that is, a description of an event such as x>0 or x>y). Then Pr(x>0) gives the probability of the event "x>0". The statement x>0 returns a Bernoulli (indicator) random variable object (having 1/0 or TRUE/FALSE values) and the expectation of such variable is just the probability of the event where the indicator is one.

Value

A *numerical* vector with the same dimension as x.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

mean.rv: distribution of the arithmetic mean of a vector; rvmin, rvmax, rvmedian, link{rvvar}, rvsd.

Examples

```
x <- rvnorm(mean=(1:10)/5, sd=1)
rvmean(x)  # means of the 10 components
E(x)       # same as rvmean(x)
Pr(x>1)    # probabilities that each component is >1.
```

---

rvmedian *Medians of the Components of a Random Vector*

Description

rvmedian

Usage

```
rvmedian(x, ...)
```

Arguments

x	an rv object
...	further arguments passed to median

Details

rvmedian applies median to the simulations of each component of x.

Value

A *numeric* vector of the same dimension as x.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`rvmin`, `rvmax`, `rvmean`.

Examples

```
#
```

`rvmin` *Minimum Simulated Value of Random Variable*

Description

`rvmin`

Usage

```
rvmin(x, ...)
```

Arguments

`x`	an object
`...`	further arguments passed to or from other methods

Details

`rvmin`

Value

A *numeric* vector of the same dimension as `x`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`rvmax`, `rvmedian`, `rvmean`.

Examples

```
#
```

`rvnchains` *Number of Markov Chains Used to Generate Simulations of a Random Vector*

Description

Retrieves the number of mcmc chains in each components of the argument.

Usage

```
rvnchains(x)
```

Arguments

x	an rv object (supposed to be generated by a MCMC process)

Details

Assumes that the rv object was generated by a MCMC process. Umacs and R2WinBUGS are compatible.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Kerman, Jouni. Umacs: A Universal Markov Chain Sampler. Technical report, Columbia University, New York.

See Also

`as.rv.bugs`

Examples

```
#
```

rvneff — *Number of Effective Draws in Each Component of a Random Variable*

Description

Retrieves the number of effective draws in each component of the argument (supposed to have been saved by the simulation generating program).

Usage

```
rvneff(x)
```

Arguments

x	an object

Details

rvneff

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvnorm — *Generate Random Variables from a Gaussian (Normal) Sampling Model*

Description

Generates a random vector from a Gaussian sampling model.

Usage

```
rvnorm(n=1, mean=0, sd=1, var=NULL, precision)
```

Arguments

n	integer: number of variables to generate
mean	mean, may be a rv
sd	standard deviation; scalar or vector (constant or rv, not matrix)
var	variance, can be given instead of sd. Scalar, vector, or matrix.
precision	inverse variance or variance matrix, may be given instead of sd or var

Value

A random vector (rv object) of length `n`.

Note

If any of the arguments are random, the resulting simulations may have non-normal marginal distributions; for example, if an inverse-chi-squared scalar rv `var` and zero `mean` is given, the resulting rv will have a t-distribution.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(mean=1:10, sd=1:10) # A vector of length 10.
Sigma <- diag(1:10)
y <- rvnorm(mean=1:10, var=Sigma)
```

`rvnsims` *Set or Get the Default Number of Simulations to Generate for rv Objects*

Description

Sets or retrieves the default number of simulations.

Usage

```
rvnsims(nsims)
rvnsims()
```

Arguments

`nsims`	Number of simulations.

Details

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
rvnsims(10000)
print(rvnsims()) # prints 10000
```

rvpermut *Generate the Permutation Distribution of a Data Vector or Array*

Description

Generates a random vector that has the permutation distribution of a given constant vector or array.

Usage

```
rvpermut(data)
```

Arguments

data	a constant vector or array

Details

rvpermut

Value

A random vector or array of the same dimension as data.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvplot *Scatterplot of Simulations of a Random Vector*

Description

Produces a 2-dimensional scatterplot of the simulations of a random vector.

Usage

```
rvplot(x,y,...)
```

Arguments

`x`	an rv object; only two first components are used
`y`	(optional) rv object
`...`	further arguments passed to `plot`

Details

Only the two first scalars are used if only `x` is specified. If both `x` and `y` are specified, they are assumed to be scalars.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvpois` *Generate Random Vectors from a Poisson Sampling Model*

Description

Generates random variables from a Poisson sampling model.

Usage

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

Arguments

`n`	integer: number of variables to generate
`lambda`	a vector of (positive) mean parameters; (may be random)

Note

If any of the arguments are random, the resulting simulations may have non-Poisson marginal distributions.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvpois(lambda=10)  # A Poisson rv with mean 10
lbd <- rvchisq(1,1)     # Some positive rv
y <- rvpois(lambda=lbd) # Not a Poisson rv, although each simulation is a draw from Poi
```

---

rvquantile *Componentwise Quantiles of Random Variables*

Description

Computes componentwise quantiles of random vectors or arrays.

Usage

```
rvquantile(x, ...)
```

Arguments

x	an object
...	further arguments passed to quantile

Details

rvquantile applies the quantile function to each column of sims(x).

Value

A *numeric* vector of quantiles.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvrange` *Range of Simulations in a Random Variable*

Description

Returns the range (min, max) of the simulations for each component of the given random vector or array.

Usage

```
rvrange(x, ...)
```

Arguments

`x`	an rv object
`...`	arguments passed to `range`

Details

`rvrange`

Value

A numeric (constant) array with 2 rows (=min, max) and `length(x)` columns.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`range.rv` returns the *distribution* of the range of a random vector.

Examples

```
#
```

`rvsample` *Sample from the Simulation Matrix of a Random Variable*

Description

Draws a sample of desired size from each component of a given random variable `x`.

Usage

```
rvsample(x, size=1, replace=TRUE, prob=NULL)
```

Arguments

`x`	an object
`size`	size of the sample
`replace`	sample with replacement?
`prob`	optional probability vector, usually not needed

Details

Value

A *numeric* array of dimensions `size` times `length(x)`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvsd` *Variances of Components of Random Vectors*

Description

Computes the means of the simulations of all individual components of a random vector (rv) object.

Usage

```
rvsd(x, ...)
```

Arguments

`x`	an object
`...`	further arguments passed to `var`

Details

`rvsd` applies the function `sd` to the vector of simulations of each component of `x`, thus computing "columnwise" standard deviations of the matrix of simulations of `x`.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`rvmin`, `rvmax`, `rvmedian`, `link{rvvar}`.

Examples

```
x <- rvnorm(mean=0, sd=1:10)
print(rvsd(x))
```

rvsimapply — *Apply a Function to Columns of the Matrix of Simulation of a Random Variable*

Description

rvsimapply

Usage

```
rvsimapply(x, FUN, ...)
```

Arguments

x	an object
FUN	
...	further arguments passed to the function FUN

Details

rvsimapply

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

rvsims — *Create a Random Vector from a Matrix of Simulations*

Description

rvsims takes a vector, matrix, or 3-way array (sims) containing simulations, and returns a random vector (an object of type 'rv')

Usage

```
rvsims(sims, n.sims=rvnsims(), permute=FALSE, save.order=FALSE)
```

Arguments

`sims`	an array of simulations (1, 2, or 3-dimensional)
`n.sims`	number of simulations to save
`permute`	logical, indicate if scramble the simulations
`save.order`	logical, indicate if the original order of simulations should be saved (only if permute is `TRUE`)

Details

A vector is interpreted to contain simulations for one single random variable; if `sims` is two-dimensional, the columns are supposed to contain simulations for several random variables. If `sims` is three-dimensional, it is supposed to be output from a Markov chain simulation program: the first dimension corresponds to the simulations, the second corresponds to the chains (typically 3 or 5), and the last dimension corresponds to the variables.

If `permute` is `TRUE`, the simulations are scrambled, i.e. the *rows* are permuted randomly. If `permute=TRUE` *and* `save.order=TRUE`, the original order of the simulations is saved in an attribute `rvsim$order`.

If `sims` is three-dimensional, the simulations are always scrambled.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ http://www.stat.columbia.edu/~kerman

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
# x and y have the same distributions:
x <- sims(rnorm(1000))
y <- rvnorm(1)
```

`rvt` *Generate Random Variables from a Student-t Sampling Model*

Description

Generates a random variable from a Student-t sampling model.

Usage

```
rvt(n=1, mu=0, scale=1, df, Sigma)
```

Arguments

`n`	integer, number of scalars to generate
`mu`	location, may be a rv
`scale`	scale, may be a rv
`Sigma`	(optional) scaling matrix for multivariate generation
`df`	degrees of freedom, may be a rv

Details

This function generates both univariate (independent and identically distributed) Student-t random variables and multivariate Student-t distributed vectors (with a given scaling matrix).

Note

If any of the arguments are random, the resulting simulations may have non-t marginal distributions.

Author(s)

Jouni Kerman ⟨kerman@stat.columbia.edu⟩ `http://www.stat.columbia.edu/~kerman`

References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
```

`rvunif` *Generate Random Vectors from a Uniform Sampling Model*

Description

Generates random variables from a Uniform sampling model.

Usage

```
rvunif(n=1, min=0, max=1)
```

Arguments

`n`	integer: number of scalars to generate
`min`	lower limit of the distribution, (may be random)
`max`	upper limit of the distribution, (may be random)

Details

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
y <- rvunif(1, min=rvunif(1)-1, rvunif(1)+1) # What marginal distribution does y have r
```

---

rvvar *Variances of Components of Random Vectors*

Description

rvvar

Usage

```
rvvar(x, ...)
```

Arguments

x	an object
...	further arguments passed to var

Details

rvvar computes the means of the simulations of all individual components of a random vector (rv) object.

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

rvmin, rvmax, rvmedian, rvsd.

Examples

```
x <- rvnorm(mean=0, sd=1:10)
print(rvvar(x))
```

simapply *Apply a Function to Rows of Random Vectors*

Description

simapply applies a given function FUN to each row of the simulation matrix, returning an rv object.

Usage

```
simapply(x, FUN, ...)
```

Arguments

x	a rv object
FUN	a function
...	further arguments passed to FUN

Details

simapply ...

Author(s)

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
#
x <- rvnorm(10)
simapply(x, mean) # Same result as that of mean(x).
```

sims *Retrieve the Simulations of Random Vectors*

Description

Returns the simulation matrix for the random variable object x.

Usage

```
sims(x, n.sims=NULL, dimensions=FALSE, sim.matrix=FALSE, mc.array=FALSE)
## Default S3 method:
sims(x, ...)
## S3 method for class 'rv':
sims(x, n.sims=NULL, dimensions=FALSE, sim.matrix=FALSE, mc.array=FALSE)
```

Arguments

`x`	a random variable object
`n.sims`	(optional) number of simulations
`dimensions`	logical, try to preserve the dimensions of `x`
`sim.matrix`	logical, (if dimensions is TRUE) indicate if want to return the plain simulation matrix as attribute “sim.matrix"
`mc.array`	logical, indicate if want to return the original 3-way mcmc matrix, if possible
`...`	omitted arguments

Details

`sims` returns the matrix of simulations for a given random variable object `x`.

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References

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Examples

```
x <- rvnorm(24)              # Suppose that L is the number of simulations per scalar
dim(x) <- c(2,3,4)
dim(sims(x))                 # Lx24
dim(sims(x, dimensions=TRUE)) # Lx2x3x4
dim(attr(sims(x, dimensions=TRUE, sim.matrix=TRUE), "sim.matrix")) # Lx24
## Not run: dim(sims(x, mc.array=TRUE)) # Error: x was not generated by a mcmc process
```

`sort` *Distribution of Order Statistics of a Random Vector*

Description

`sort` is a replacement for the standard `sort` function, which is called if `x` is not an `rv` object.

Usage

```
sort(x, ...)
```

Arguments

`x`	an object
`...`	further arguments passed to `sort`

Details

Once `sort` becomes a generic (and truly object-oriented) method, this function will also become a truly object-oriented method.

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

The original help page for `sort`. Other adapted functions: rvAdapted, `cov`.

Examples

```
#
```

`split.rv` *Split a Random Vector into a List by Name*

Description

Split a random vector into a list by name.

Usage

```
split.rv(x, f, drop=FALSE, ...)
```

Arguments

`x`	a random vector
`f`	a “factor" that specifies the grouping, by default the variable names derived from `names{x}`.
`drop`	logical indicating if levels that do not occur should be dropped (if f is a factor or a list).
`...`	further potential arguments passed to methods.

Details

If `f` is omitted, splitting is done by `names(x)`, but with the possible brackets (as in “`alpha[10]`") omitted.

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

See Also

`split`.

Examples

```
x <- rvnorm(3)
names(x) <- c("alpha[1]", "alpha[2]", "theta")
split(x)
```

`Summary.rv` *Summary of a Random Vector*

Description

`Summary.rv`

Usage

```
Summary.rv(..., na.rm=FALSE)
```

Arguments

`...`	rv object
`na.rm`	logical, remove NAs?

Details

Author(s)

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References

Kerman, Jouni and Gelman, Andrew. Manipulating and Summarizing Posterior Simulations Using Random Variable Objects. Technical report, Columbia University, New York.

Examples

```
x <- rvnorm(6)
dim(x) <- c(2,3)
summary(x)
```

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