Package 'statnet.common'

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Title Common R Scripts and Utilities Used by the Statnet Project Software

Description Non-statistical utilities used by the software developed by the Statnet Project. They may also be of use to others.

Depends R (>= 4.1)

Imports utils, methods, coda, parallel, tools, Matrix

BugReports https://github.com/statnet/statnet.common/issues

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Contents

`all_identical` *Test if all items in a vector or a list are identical.*

Description

Test if all items in a vector or a list are identical.

Usage

```
all_identical(x, .p = identical, .ref = 1L, ...)
```

Arguments

`x`	a vector or a list
`.p`	a predicate function of two arguments returning a logical. Defaults to `identical()`.
`.ref`	integer; index of element of `x` to which all the remaining ones will be compared. Defaults to 1.
`...`	additional arguments passed to `.p()`

Value

By default `TRUE` if all elements of `x` are identical to each other, `FALSE` otherwise. In the general case, `all_identical()` returns `TRUE` if and only if `.p()` returns `TRUE` for all the pairs involving the first element and the remaining elements.

See Also

`identical()`, `all.equal()`

Examples

```
stopifnot(!all_identical(1:3))

stopifnot(all_identical(list("a", "a", "a")))

# Using with `all.equal()` has its quirks
# because of numerical tolerance:
x <- seq(
  .Machine$double.eps,
  .Machine$double.eps + 1.1 * sqrt(.Machine$double.eps),
  length = 3
```

```
)
# Results with `all.equal()` are affected by ordering
all_identical(x, all.equal) # FALSE
all_identical(x[c(2,3,1)], all.equal) # TRUE
# ... because `all.equal()` is intransitive
all_identical(x[-3], all.equal) # is TRUE and
all_identical(x[-1], all.equal) # is TRUE, but
all_identical(x[-2], all.equal) # is FALSE
```

`arr_from_coo` *Conveniently covert between coordinate-value and array representations*

Description

These function similarly to **Matrix**'s utilities but is simpler and allows arbitrary baseline and handling of missing values. (It is also almost certainly much slower.) Also, since it is likely that operations will be performed on the elements of the array, their argument is first for easier piping.

Usage

```
arr_from_coo(x, coord, dim = lengths(dimnames), x0 = NA, dimnames = NULL)

arr_to_coo(X, x0, na.rm = FALSE)
```

Arguments

`x`	values of elements differing from the default.
`coord`	an integer matrix of their indices.
`dim`	dimension vector; recycled to `ncol(coord)`; if not given, inferred from `dimnames`.
`x0`	the default value.
`dimnames`	dimension name list.
`X`	an array.
`na.rm`	whether the `NA` elements of the array should be omitted from the list.

Details

If `x0` is `NA`, non-`NA` elements are returned; if `x0` is `NULL`, all elements are.

Value

`coo_to_arr()` returns a matrix or an array.

`arr_to_coo()` returns a list with the following elements:

`x`	the values distinct from `x0`

coord	a matrix with a column for each dimension containing indexes of values distinct from x0
dim	the dimension vector of the matrix
dimnames	the dimension name list of the matrix

Examples

```
m <- matrix(rpois(25, 1), 5, 5)
arr_to_coo(m, 0L)
stopifnot(identical(do.call(arr_from_coo, arr_to_coo(m, 0L)), m))

stopifnot(length(arr_to_coo(m, NULL)$x) == 25) # No baseline

m[sample.int(25L, 2L)] <- NA
m
arr_to_coo(m, 0L) # Return NAs

arr_to_coo(m, 0L, na.rm = TRUE) # Drop NAs
```

---

as.control.list *Convert to a control list.*

Description

Convert to a control list.

Usage

```
as.control.list(x, ...)

## S3 method for class 'control.list'
as.control.list(x, ...)

## S3 method for class 'list'
as.control.list(x, FUN = NULL, unflat = TRUE, ...)
```

Arguments

x	An object, usually a list, to be converted to a control list.
...	Additional arguments to methods.
FUN	Either a control.*() function or its name or suffix (to which "control." will be prepended); defaults to taking the nearest (in the call traceback) function that does not begin with "as.control.list", and prepending "control." to it. (This is typically the function that called as.control.list() in the first place.)
unflat	Logical, indicating whether an attempt should be made to detect whether some of the arguments are appropriate for a lower-level control function and pass them down.

Value

a control.list object.

Methods (by class)

- as.control.list(control.list): Idempotent method for control lists.
- as.control.list(list): The method for plain lists, which runs them through FUN.

Examples

```
myfun <- function(..., control=control.myfun()){
  as.control.list(control)
}
control.myfun <- function(a=1, b=a+1){
  list(a=a,b=b)
}

myfun()
myfun(control = list(a=2))
myfun2 <- function(..., control=control.myfun2()){
  as.control.list(control)
}
control.myfun2 <- function(c=3, d=c+2, myfun=control.myfun()){
  list(c=c,d=d,myfun=myfun)
}

myfun2()
# Argument to control.myfun() (i.e., a) gets passed to it, and a
# warning is issued for unused argument e.
myfun2(control = list(c=3, a=2, e=3))
```

---

attr *A wrapper for base::attr which defaults to exact matching.*

Description

A wrapper for base::attr which defaults to exact matching.

Usage

```
attr(x, which, exact = TRUE)
```

Arguments

x, which, exact as in base::attr, but with exact defaulting to TRUE in this implementation

Value

as in base::attr

Examples

```
x <- list()
attr(x, "name") <- 10

base::attr(x, "n")

stopifnot(is.null(attr(x, "n")))

base::attr(x, "n", exact = TRUE)
```

`check.control.class` *Ensure that the class of the control list is one of those that can be used by the calling function*

Description

This function converts an ordinary `list` into a control list (if needed) and checks that the control list passed is appropriate for the function to be controlled.

Usage

```
check.control.class(
  OKnames = as.character(ult(sys.calls(), 2)[[1L]]),
  myname = as.character(ult(sys.calls(), 2)[[1L]]),
  control = get("control", pos = parent.frame())
)
```

Arguments

`OKnames`	List of control function names which are acceptable.
`myname`	Name of the calling function (used in the error message).
`control`	The control list or a list to be converted to a control list using `control.myname()`. Defaults to the `control` variable in the calling function. See Details for detailed behavior.

Details

`check.control.class()` performs the check by looking up the class of the `control` argument (defaulting to the `control` variable in the calling function) and checking if it matches a list of acceptable given by `OKnames`.

Before performing any checks, the `control` argument (including the default) will be converted to a control list by calling `as.control.list()` on it with the first element of `OKnames` to construct the control function.

If `control` is missing, it will be assumed that the user wants to modify it in place, and a variable with that name in the parent environment will be overwritten.

Value

A valid control list for the function in which it is to be used. If `control` argument is missing, it will also overwrite the variable `control` in the calling environment with it.

Note

In earlier versions, `OKnames` and `myname` were autodetected. This capability has been deprecated and results in a warning issued once per session. They now need to be set explicitly.

See Also

`set.control.class()`, `print.control.list()`, `as.control.list()`

---

compress_rows *A generic function to compress a row-weighted table*

Description

Compress a matrix or a data frame with duplicated rows, updating row weights to reflect frequencies, or reverse the process, reconstructing a matrix like the one compressed (subject to permutation of rows and weights not adding up to an integer).

Usage

```
compress_rows(x, ...)

decompress_rows(x, ...)
```

Arguments

`x`	a weighted matrix or data frame.
`...`	extra arguments for methods.

Value

For `compress_rows` A weighted matrix or data frame of the same type with duplicated rows removed and weights updated appropriately.

compress_rows.data.frame *"Compress" a data frame.*

Description

compress_rows.data.frame "compresses" a data frame, returning unique rows and a tally of the number of times each row is repeated, as well as a permutation vector that can reconstruct the original data frame. decompress_rows.compressed_rows_df reconstructs the original data frame.

Usage

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

## S3 method for class 'compressed_rows_df'
decompress_rows(x, ...)
```

Arguments

x	For compress_rows.data.frame a data.frame to be compressed. For decompress_rows.compress_rc a list as returned by compress_rows.data.frame.
...	Additional arguments, currently unused.

Value

For compress_rows.data.frame, a list with three elements:

rows	Unique rows of x
frequencies	A vector of the same length as the number or rows, giving the number of times the corresponding row is repeated
ordering	A vector such that if c is the compressed data frame, c$rows[c$ordering,,drop=FALSE] equals the original data frame, except for row names
rownames	Row names of x

For decompress_rows.compressed_rows_df, the original data frame.

See Also

data.frame

Examples

```
(x <- data.frame(V1=sample.int(3,30,replace=TRUE),
                 V2=sample.int(2,30,replace=TRUE),
                 V3=sample.int(4,30,replace=TRUE)))

(c <- compress_rows(x))

stopifnot(all(decompress_rows(c)==x))
```

`control.list.accessor` *Named element accessor for ergm control lists*

Description

Utility method that overrides the standard '$' list accessor to disable partial matching for ergm `control.list` objects

Usage

```
## S3 method for class 'control.list'
object$name
```

Arguments

`object`	list-coearceable object with elements to be searched
`name`	literal character name of list element to search for and return

Details

Executes `getElement` instead of `$` so that element names must match exactly to be returned and partially matching names will not return the wrong object.

Value

Returns the named list element exactly matching `name`, or `NULL` if no matching elements found

Author(s)

Pavel N. Krivitsky

See Also

see `getElement`

`control.remap` *Overwrite control parameters of one configuration with another.*

Description

Given a `control.list`, and two prefixes, `from` and `to`, overwrite the elements starting with `to` with the corresponding elements starting with `from`.

Usage

```
control.remap(control, from, to)
```

Arguments

`control`	An object of class `control.list`.
`from`	Prefix of the source of control parameters.
`to`	Prefix of the destination of control parameters.

Value

An `control.list` object.

Author(s)

Pavel N. Krivitsky

See Also

`print.control.list`

Examples

```
(l <- set.control.class("test", list(a.x=1, a.y=2)))
control.remap(l, "a", "b")
```

default_options *Set* options() *according to a named list, skipping those already set.*

Description

This function can be useful for setting default options, which do not override options set elsewhere.

Usage

```
default_options(...)
```

Arguments

...	see options(): either a list of name=value pairs or a single unnamed argument giving a named list of options to set.

Value

The return value is same as that of options() (omitting options already set).

Examples

```
options(onesetting=1)

default_options(onesetting=2, anothersetting=3)
stopifnot(getOption("onesetting")==1) # Still 1.
stopifnot(getOption("anothersetting")==3)

default_options(list(yetanothersetting=5, anothersetting=4))
stopifnot(getOption("anothersetting")==3) # Still 3.
stopifnot(getOption("yetanothersetting")==5)
```

deInf *Truncate values of high magnitude in a vector.*

Description

Truncate values of high magnitude in a vector.

Usage

```
deInf(x, replace = 1/.Machine$double.eps)
```

Arguments

x	a numeric or integer vector.
replace	a number or a string "maxint" or "intmax".

Value

Returns `x` with elements whose magnitudes exceed `replace` replaced replaced by `replace` (or its negation). If `replace` is `"maxint"` or `"intmax"`, `.Machine$integer.max` is used instead.

`NA` and `NAN` values are preserved.

`deprecation-utilities` *Utilities to help with deprecating functions.*

Description

`.Deprecate_once` calls `.Deprecated()`, passing all its arguments through, but only the first time it's called.

`.Deprecate_method` calls `.Deprecated()`, but only if a method has been called by name, i.e., *METHOD*`.`*CLASS*. Like `.Deprecate_once` it only issues a warning the first time.

Usage

```
.Deprecate_once(...)

.Deprecate_method(generic, class)
```

Arguments

`...`	arguments passed to `.Deprecated()`.
`generic, class`	strings giving the generic function name and class name of the function to be deprecated.

Examples

```
## Not run:
options(warn=1) # Print warning immediately after the call.
f <- function(){
   .Deprecate_once("new_f")
}
f() # Deprecation warning
f() # No deprecation warning

## End(Not run)
## Not run:
options(warn=1) # Print warning immediately after the call.
summary.packageDescription <- function(object, ...){
   .Deprecate_method("summary", "packageDescription")
   invisible(object)
}

summary(packageDescription("statnet.common")) # No warning.
summary.packageDescription(packageDescription("statnet.common")) # Warning.
```

```
summary.packageDescription(packageDescription("statnet.common")) # No warning.

## End(Not run)
```

`despace` *A one-line function to strip whitespace from its argument.*

Description

A one-line function to strip whitespace from its argument.

Usage

```
despace(s)
```

Arguments

`s`	a character vector.

Examples

```
stopifnot(despace("\n \t  ")=="")
```

`diff.control.list` *Identify and the differences between two control lists.*

Description

Identify and the differences between two control lists.

Usage

```
## S3 method for class 'control.list'
diff(x, y = eval(call(class(x)[[1L]])), ignore.environment = TRUE, ...)

## S3 method for class 'diff.control.list'
print(x, ..., indent = "")
```

Arguments

`x`	a `control.list`
`y`	a reference `control.list`; defaults to the default settings for `x`.
`ignore.environment`	whether environment for environment-bearing parameters (such as formulas and functions) should be considered when comparing.
`...`	Additional arguments to methods.
`indent`	an argument for recursive calls, to facilitate indentation of nested lists.

Value

An object of class `diff.control.list`: a named list with an element for each non-identical setting. The element is either itself a `diff.control.list` (if the setting is a control list) or a named list with elements `x` and `y`, containing `x`'s and `y`'s values of the parameter for that setting.

Methods (by generic)

- `print(diff.control.list)`: A print method.

---

empty_env *Replace an object's environment with a simple, static environment.*

Description

Replace an object's environment with a simple, static environment.

Usage

```
empty_env(object)

base_env(object)
```

Arguments

`object`	An object with the `environment()<-` method.

Value

An object of the same type as `object`, with updated environment.

Examples

```
f <- y~x
environment(f) # GlobalEnv

environment(empty_env(f)) # EmptyEnv



environment(base_env(f)) # base package environment
```

ERRVL *Attempt a series of statements and return the first one that is not an error.*

Description

`ERRVL()` expects the potentially erring statements to be wrapped in `try()`. In addition, all expressions after the first may contain a `.`, which is substituted with the `try-error` object returned by the previous expression.

`ERRVL2()` does *not* require the potentially erring statements to be wrapped in `try()` and will, in fact, treat them as non-erring; it does not perform dot substitution.

`ERRVL3()` behaves as `ERRVL2()`, but it does perform dot-substitution with the `condition` object.

Usage

```
ERRVL(...)

ERRVL2(...)

ERRVL3(...)
```

Arguments

`...`	Expressions to be attempted; for `ERRVL()`, should be wrapped in `try()`.

Value

The first argument that is not an error. Stops with an error if all are.

Note

This family of functions behave similarly to the `NVL()` and the `EVL()` families.

These functions use lazy evaluation, so, for example `ERRVL(1, stop("Error!"))` will never evaluate the `stop()` call and will not produce an error, whereas `ERRVL2(solve(0), stop("Error!"))` would.

See Also

`try()`, `inherits()`, `tryCatch()`

Examples

```
print(ERRVL(1,2,3)) # 1
print(ERRVL(try(solve(0)),2,3)) # 2
print(ERRVL(1, stop("Error!"))) # No error

## Not run:
```

```
# Error:
print(ERRVL(try(solve(0), silent=TRUE),
            stop("Error!")))

## End(Not run)

# Capture and print the try-error object:
ERRVL(try(solve(0), silent=TRUE),
      print(paste0("Stopped with an error: ", .)))

print(ERRVL2(1,2,3)) # 1
print(ERRVL2(solve(0),2,3)) # 2
print(ERRVL2(1, stop("Error!"))) # No error


## Not run:
# Error:
ERRVL3(solve(0), stop("Error!"))

## End(Not run)

# Capture and print the error object:
ERRVL3(solve(0), print(paste0("Stopped with an error: ", .)))

# Shorthand for tryCatch(expr, error = function(e) e):
ERRVL3(solve(0), .)
```

`fixed.pval` *Format a p-value in fixed notation.*

Description

This is a thin wrapper around `format.pval()` that guarantees fixed (not scientific) notation, links (by default) the `eps` argument to the `digits` argument and vice versa, and sets `nsmall` to equal `digits`.

Usage

```
fixed.pval(
  pv,
  digits = max(1, getOption("digits") - 2),
  eps = 10^-digits,
  na.form = "NA",
  ...
)
```

Arguments

`pv`, `digits`, `eps`, `na.form`, `...`
see `format.pval()`.

Value

A character vector.

Examples

```
pvs <- 10^((0:-12)/2)

# Jointly:
fpf <- fixed.pval(pvs, digits = 3)
fpf
format.pval(pvs, digits = 3) # compare

# Individually:
fpf <- sapply(pvs, fixed.pval, digits = 3)
fpf
sapply(pvs, format.pval, digits = 3) # compare

# Control eps:
fpf <- sapply(pvs, fixed.pval, eps = 1e-3)
fpf
```

---

forkTimeout *Evaluate an* R *expression with a hard time limit by forking a process*

Description

This function uses `parallel::mcparallel()`, so the time limit is not enforced on Windows. However, unlike functions using `setTimeLimit()`, the time limit is enforced even on native code.

Usage

```
forkTimeout(
  expr,
  timeout,
  unsupported = c("warning", "error", "message", "silent"),
  onTimeout = NULL
)
```

Arguments

`expr`	expression to be evaluated.
`timeout`	number of seconds to wait for the expression to evaluate.
`unsupported`	a character vector of length 1 specifying how to handle a platform that does not support `parallel::mcparallel()`,
	`"warning"` **or** `"message"` Issue a warning or a message, respectively, then evaluate the expression without the time limit enforced.

"error" Stop with an error.

"silent" Evaluate the expression without the time limit enforced, without any notice.

Partial matching is used.

onTimeout Value to be returned on time-out.

Value

Result of evaluating expr if completed, onTimeout otherwise.

Note

onTimeout can itself be an expression, so it is, for example, possible to stop with an error by passing onTimeout=stop().

Note that this function is not completely transparent: side-effects may behave in unexpected ways. In particular, RNG state will not be updated.

Examples

```
forkTimeout({Sys.sleep(1); TRUE}, 2) # TRUE
forkTimeout({Sys.sleep(1); TRUE}, 0.5) # NULL (except on Windows)
```

---

formula.utilities *Functions for Querying, Validating and Extracting from Formulas*

Description

A suite of utilities for handling model formulas of the style used in Statnet packages.

Usage

```
append_rhs.formula(
  object = NULL,
  newterms,
  keep.onesided = FALSE,
  env = if (is.null(object)) NULL else environment(object)
)

append.rhs.formula(object, newterms, keep.onesided = FALSE)

filter_rhs.formula(object, f, ...)

nonsimp_update.formula(object, new, ..., from.new = FALSE)

nonsimp.update.formula(object, new, ..., from.new = FALSE)

term.list.formula(rhs, sign = +1)
```

```
list_summands.call(object)

list_rhs.formula(object)

eval_lhs.formula(object)
```

Arguments

object	formula object to be updated or evaluated
newterms	a term_list object, or any list of terms (names or calls) to append to the formula, or a formula whose RHS terms will be used; its "sign" attribute vector can give the sign of each term (+1 or -1), and its "env" attribute vector will be used to set its environment, with the first available being used and subsequent ones producing a warning.
keep.onesided	if the initial formula is one-sided, keep it whether to keep it one-sided or whether to make the initial formula the new LHS
env	an environment for the new formula, if object is NULL
f	a function whose first argument is the term and whose additional arguments are forwarded from ... that returns either TRUE or FALSE, for whether that term should be kept.
...	Additional arguments. Currently unused.
new	new formula to be used in updating
from.new	logical or character vector of variable names. controls how environment of formula gets updated.
rhs, sign	Arguments to the deprecated term.list.formula.

Value

append_rhs.formula each return an updated formula object; if object is NULL (the default), a one-sided formula containing only the terms in newterms will be returned.

nonsimp_update.formula each return an updated formula object

list_summands.call returns an object of type term_list; its "env" attribute is set to a list of NULLs, however.

list_rhs.formula returns an object of type term_list.

eval_lhs.formula an object of whatever type the LHS evaluates to.

Functions

- append_rhs.formula(): append_rhs.formula appends a list of terms to the RHS of a formula. If the formula is one-sided, the RHS becomes the LHS, if keep.onesided==FALSE (the default).
- append.rhs.formula(): append.rhs.formula has been renamed to append_rhs.formula.
- filter_rhs.formula(): filter_rhs.formula filters through the terms in the RHS of a formula, returning a formula without the terms for which function f(term, ...) is FALSE. Terms inside another term (e.g., parentheses or an operator other than + or -) will be unaffected.

- `nonsimp_update.formula()`: `nonsimp_update.formula` is a reimplementation of `update.formula` that does not simplify. Note that the resulting formula's environment is set as follows. If `from.new==FALSE`, it is set to that of object. Otherwise, a new sub-environment of object, containing, in addition, variables in new listed in from.new (if a character vector) or all of new (if TRUE).
- `nonsimp.update.formula()`: `nonsimp.update.formula` has been renamed to `nonsimp_update.formula`.
- `term.list.formula()`: `term.list.formula` is an older version of `list_rhs.formula` that required the RHS call, rather than the formula itself.
- `list_summands.call()`: `list_summands.call`, given an unevaluated call or expression containing the sum of one or more terms, returns an object of class `term_list` with the terms being summed, handling `+` and `-` operators and parentheses, and keeping track of whether a term has a plus or a minus sign.
- `list_rhs.formula()`: `list_rhs.formula` returns an object of type `term_list`, containing terms in a given formula, handling `+` and `-` operators and parentheses, and keeping track of whether a term has a plus or a minus sign.
- `eval_lhs.formula()`: `eval_lhs.formula` extracts the LHS of a formula, evaluates it in the formula's environment, and returns the result.

Examples

```
## append_rhs.formula

(f1 <- append_rhs.formula(y~x,list(as.name("z1"),as.name("z2"))))
(f2 <- append_rhs.formula(~y,list(as.name("z"))))
(f3 <- append_rhs.formula(~y+x,structure(list(as.name("z")),sign=-1)))
(f4 <- append_rhs.formula(~y,list(as.name("z")),TRUE))
(f5 <- append_rhs.formula(y~x,~z1-z2))
(f6 <- append_rhs.formula(NULL,list(as.name("z"))))
(f7 <- append_rhs.formula(NULL,structure(list(as.name("z")),sign=-1)))

fe <- ~z2+z3
environment(fe) <- new.env()
(f8 <- append_rhs.formula(NULL, fe)) # OK
(f9 <- append_rhs.formula(y~x, fe)) # Warning
(f10 <- append_rhs.formula(y~x, fe, env=NULL)) # No warning, environment from fe.
(f11 <- append_rhs.formula(fe, ~z1)) # Warning, environment from fe



## filter_rhs.formula
(f1 <- filter_rhs.formula(~a-b+c, `!=`, "a"))
(f2 <- filter_rhs.formula(~-a+b-c, `!=`, "a"))
(f3 <- filter_rhs.formula(~a-b+c, `!=`, "b"))
(f4 <- filter_rhs.formula(~-a+b-c, `!=`, "b"))
(f5 <- filter_rhs.formula(~a-b+c, `!=`, "c"))
(f6 <- filter_rhs.formula(~-a+b-c, `!=`, "c"))
(f7 <- filter_rhs.formula(~c-a+b-c(a),
                          function(x) (if(is.call(x)) x[[1]] else x)!="c"))
```

```
stopifnot(identical(list_rhs.formula(a~b),
          structure(alist(b), sign=1, env=list(globalenv()), class="term_list")))
stopifnot(identical(list_rhs.formula(~b),
          structure(alist(b), sign=1, env=list(globalenv()), class="term_list")))
stopifnot(identical(list_rhs.formula(~b+NULL),
          structure(alist(b, NULL),
                    sign=c(1,1), env=rep(list(globalenv()), 2), class="term_list")))
stopifnot(identical(list_rhs.formula(~-b+NULL),
          structure(alist(b, NULL),
                    sign=c(-1,1), env=rep(list(globalenv()), 2), class="term_list")))
stopifnot(identical(list_rhs.formula(~+b-NULL),
          structure(alist(b, NULL),
                    sign=c(1,-1), env=rep(list(globalenv()), 2), class="term_list")))
stopifnot(identical(list_rhs.formula(~+b-(NULL+c)),
          structure(alist(b, NULL, c),
                    sign=c(1,-1,-1), env=rep(list(globalenv()), 3), class="term_list")))

## eval_lhs.formula

(result <- eval_lhs.formula((2+2)~1))

stopifnot(identical(result,4))
```

`handle.controls` *Handle standard* `control.*()` *function semantics.*

Description

This function takes the arguments of its caller (whose name should be passed explicitly), plus any `...` arguments and produces a control list based on the standard semantics of `control.*()` functions, including handling deprecated arguments, identifying undefined arguments, and handling arguments that should be passed through `match.arg()`.

Usage

```
handle.controls(myname, ...)
```

Arguments

`myname`	the name of the calling function.
`...`	the `...` argument of the control function, if present.

Details

The function behaves based on the information it acquires from the calling function. Specifically,

- The values of formal arguments (except `...`, if present) are taken from the environment of the calling function and stored in the list.

- If the calling function has a `...` argument *and* defines an `old.controls` variable in its environment, then it remaps the names in `...` to their new names based on `old.controls`. In addition, if the value is a list with two elements, `action` and `message`, the standard deprecation message will have `message` appended to it and then be called with `action()`.
- If the calling function has a `match.arg.pars` in its environment, the arguments in that list are processed through `match.arg()`.

Value

a list with formal arguments of the calling function.

`is.SPD` *Test if the object is a matrix that is symmetric and positive definite*

Description

Test if the object is a matrix that is symmetric and positive definite

Usage

```
is.SPD(x, tol = .Machine$double.eps)
```

Arguments

`x`	the object to be tested.
`tol`	the tolerance for the reciprocal condition number.

`locate_function` *Locate a function with a given name and return it and its environment.*

Description

These functions first search the given environment, then search all loaded environments, including those where the function is not exported. If found, they return an unambiguous reference to the function.

Usage

```
locate_function(name, env = globalenv(), ...)

locate_prefixed_function(
  name,
  prefix,
  errname,
  env = globalenv(),
  ...,
  call. = FALSE
)
```

Arguments

name	a character string giving the function's name.
env	an environment where it should search first.
...	additional arguments to the warning and error warning messages. See Details.
prefix	a character string giving the prefix, so the searched-for function is prefix.name.
errname	a character string; if given, if the function is not found an error is raised, with errname prepended to the error message.
call.	a logical, whether the call (locate_prefixed_function) should be a part of the error message; defaults to FALSE (which is different from stop()'s default).

Details

If the initial search fails, a search using getAnywhere() is attempted, with exported ("visible") functions with the specified name preferred over those that are not. When multiple equally qualified functions are available, a warning is printed and an arbitrary one is returned.

Because getAnywhere() can be slow, past searches are cached.

Value

If the function is found, an unevaluated call of the form ENVNAME:::FUNNAME, which can then be used to call the function even if it is unexported. If the environment does not have a name, or is GlobalEnv, only FUNNAME is returned. Otherwise, NULL is returned.

Functions

- locate_function(): a low-level function returning the reference to the function named name, or NULL if not found.
- locate_prefixed_function(): a helper function that searches for a function of the form prefix.name and produces an informative error message if not found.

Examples

```
# Locate a random function in base.
locate_function(".row_names_info")
```

---

logspace.utils *Utilities for performing calculations on logarithmic scale.*

Description

A small suite of functions to compute sums, means, and weighted means on logarithmic scale, minimizing loss of precision.

Usage

```
log_sum_exp(logx, use_ldouble = FALSE)

log_mean_exp(logx, use_ldouble = FALSE)

lweighted.mean(x, logw)

lweighted.var(x, logw, onerow = NA)

lweighted.cov(x, y, logw, onerow = NA)

log1mexp(x)
```

Arguments

logx	Numeric vector of $\log(x)$, the natural logarithms of the values to be summed or averaged.
use_ldouble	Whether to use long double precision in the calculation. If TRUE, 's C built-in logspace_sum() is used. If FALSE, the package's own implementation based on it is used, using double precision, which is (on most systems) several times faster, at the cost of precision.
x, y	Numeric vectors or matrices of x and y, the (raw) values to be summed, averaged, or whose variances and covariances are to be calculated.
logw	Numeric vector of $\log(w)$, the natural logarithms of the weights.
onerow	If given a matrix or matrices with only one row (i.e., sample size 1), var() and cov() will return NA. But, since weighted matrices are often a product of compression, the same could be interpreted as a variance of variables that do not vary, i.e., 0. This argument controls what value should be returned.

Value

The functions return the equivalents of the R expressions given below, but faster and with less loss of precision.

Functions

- log_sum_exp(): log(sum(exp(logx)))
- log_mean_exp(): log(mean(exp(logx)))
- lweighted.mean(): weighted mean of x: sum(x*exp(logw))/sum(exp(logw)) for x scalar and colSums(x*exp(logw))/sum(exp(logw)) for x matrix
- lweighted.var(): weighted variance of x: crossprod(x-lweighted.mean(x,logw)*exp(logw/2))/sum(exp(logw
- lweighted.cov(): weighted covariance between x and y: crossprod(x-lweighted.mean(x,logw)*exp(logw/2), y-lweighted.mean(y,logw)*exp(logw/2))/sum(exp(logw))
- log1mexp(): log(1-exp(-x)) for x >= 0 (a wrapper for the eponymous C macro provided by R)

Author(s)

Pavel N. Krivitsky

Examples

```
x <- rnorm(1000)
stopifnot(all.equal(log_sum_exp(x), log(sum(exp(x))), check.attributes=FALSE))
stopifnot(all.equal(log_mean_exp(x), log(mean(exp(x))), check.attributes=FALSE))

logw <- rnorm(1000)
stopifnot(all.equal(m <- sum(x*exp(logw))/sum(exp(logw)),lweighted.mean(x, logw)))
stopifnot(all.equal(sum((x-m)^2*exp(logw))/sum(exp(logw)),
                    lweighted.var(x, logw), check.attributes=FALSE))

x <- cbind(x, rnorm(1000))
stopifnot(all.equal(mx <- colSums(x*exp(logw))/sum(exp(logw)),
                    lweighted.mean(x, logw), check.attributes=FALSE))
stopifnot(all.equal(crossprod(t(t(x)-mx)*exp(logw/2))/sum(exp(logw)),
                    lweighted.var(x, logw), check.attributes=FALSE))


y <- cbind(x, rnorm(1000))
my <- colSums(y*exp(logw))/sum(exp(logw))
stopifnot(all.equal(crossprod(t(t(x)-mx)*exp(logw/2), t(t(y)-my)*exp(logw/2))/sum(exp(logw)),
                    lweighted.cov(x, y, logw), check.attributes=FALSE))
stopifnot(all.equal(crossprod(t(t(y)-my)*exp(logw/2), t(t(x)-mx)*exp(logw/2))/sum(exp(logw)),
                    lweighted.cov(y, x, logw), check.attributes=FALSE))

x <- rexp(1000)
stopifnot(isTRUE(all.equal(log1mexp(x), log(1-exp(-x)))))
```

`match_names` *Construct a named vector with semantics useful for parameter vectors*

Description

This is a helper function that constructs a named vector with names in `names` with values taken from `v` and optionally `default`, performing various checks. It supersedes `vector.namesmatch()`.

Usage

```
match_names(v, names, default = NULL, partial = TRUE, errname = NULL)
```

Arguments

`v`	a vector
`names`	a character vector of element names

default	value to be used for elements of names not found in v
partial	whether partial matching is allowed
errname	optional, name to be reported in any error messages; defaults to deparse1(substitute(v))

Details

If v is not named, it is required to be the same length as names and is simply given the corresponding names. If it is named, nonempty names are matched to the corresponding elements of names, with partial matching supported.

Default values can be specified by the caller in default or by the end-user by adding an element with an empty ("") name in addition to the others. If given, the latter overrides the former.

Duplicated names in v or names are resolved sequentially, though note the example below for caveat about partial matching.

Zero-length v is handled as follows:

- If length of names is empty, return v unchanged.
- If it is not and default is not NULL, return the default vector.
- Otherwise, raise an error.

An informative error is raised under any of the following conditions:

- v is not named but has length that differs from that of names.
- More than one element of v has an empty name.
- Not all elements of names are matched by an element of v, and no default is specified.
- Not all elements of v are used up for elements of names.
- There is ambiguity that pmatch() cannot resolve.

Value

A named vector with names names (in that order). See Details.

Note

At this time, passing partial=FALSE will use a crude sentinel to prevent partial matching, which in some, extremely improbable, circumstances might not work.

Examples

```
# Unnamed:
test <- as.numeric(1:3)
stopifnot(identical(
  match_names(test, c('a', 'c', 'b')),
  c(a = 1, c = 2, b = 3)
))

# Named, reordered:
test <- c(c = 1, b = 2, a = 3)
stopifnot(identical(
```

```
  match_names(test, c('a', 'c', 'b')),
  c(a = 3, c = 1, b = 2)
))

# Default value specified by default= assigned to a
test <- c(c = 1, b = 2)
stopifnot(identical(
  match_names(test, c('a', 'c', 'b'), NA),
  c(a = NA, c = 1, b = 2)
))

# Default value specified in v assigned to a and b:
test <- c(c = 1, 2)
stopifnot(identical(
  match_names(test, c('a', 'c', 'b')),
  c(a = 2, c = 1, b = 2)
))

# Partial matching
test <- c(c = 1, 2)
stopifnot(identical(
  match_names(test, c('a', 'cab', 'b')),
  c(a = 2, cab = 1, b = 2)
))

# Multiple matching
test <- c(c = 1, 2, c = 3)
stopifnot(identical(
  match_names(test, c('a', 'c', 'c')),
  c(a = 2, c = 1, c = 3)
))

# Partial + multiple matching caveat: exact match will match first.
test <- c(c = 1, a = 2, ca = 3)
stopifnot(identical(
  match_names(test, c('a', 'ca', 'ca')),
  c(a = 2, ca = 3, ca = 1)
))
```

`mcmc-utilities` *Utility operations for* `mcmc.list` *objects*

Description

`colMeans.mcmc.list` is a "method" for (non-generic) `colMeans()` applicable to `mcmc.list` objects.

`var.mcmc.list` is a "method" for (non-generic) `var()` applicable to `mcmc.list` objects. Since MCMC chains are assumed to all be sampling from the same underlying distribution, their pooled mean is used.

`sweep.mcmc.list` is a "method" for (non-generic) `sweep()` applicable to `mcmc.list` objects.

`lapply.mcmc.list` is a "method" for (non-generic) `lapply()` applicable to `mcmc.list` objects.

Usage

```
colMeans.mcmc.list(x, ...)

var.mcmc.list(x, ...)

sweep.mcmc.list(x, STATS, FUN = "-", check.margin = TRUE, ...)

lapply.mcmc.list(X, FUN, ...)
```

Arguments

`x`	a `mcmc.list` object.
`...`	additional arguments to the functions evaluated on each chain.
`STATS, FUN, check.margin`	See help for `sweep()`.
`X`	An `mcmc.list` object.

Details

These implementations should be equivalent (within numerical error) to the same function being called on `as.matrix(x)`, while avoiding construction of the large matrix.

Value

`colMeans.mcmc` returns a vector with length equal to the number of mcmc chains in `x` with the mean value for each chain.

`sweep.mcmc.list` returns an appropriately modified version of `x`

`lapply.mcmc.list` returns an `mcmc.list` each of whose chains had been passed through `FUN`.

See Also

`mcmc.list`

`colMeans()`

`var()`

`sweep()`

`lapply()`

Examples

```
data(line, package="coda")
colMeans(as.matrix(line)) # also coda
colMeans.mcmc.list(line) # "Method"

data(line, package="coda")
var(as.matrix(line)) # coda
var.mcmc.list(line) # "Method"

data(line, package="coda")
colMeans.mcmc.list(line)-1:3
colMeans.mcmc.list(sweep.mcmc.list(line, 1:3))

data(line, package="coda")
colMeans.mcmc.list(line)[c(2,3,1)]
colMeans.mcmc.list(lapply.mcmc.list(line, `[`,,c(2,3,1)))
```

`message_print` *print objects to the message output.*

Description

A thin wrapper around `print` that captures its output and prints it as a `message`, usually to STDERR.

Usage

```
message_print(..., messageArgs = NULL)
```

Arguments

`...`	arguments to `print`.
`messageArgs`	a list of arguments to be passed directly to `message`.

Examples

```
cat(1:5)

print(1:5)
message_print(1:5) # Looks the same (though may be in a different color on some frontends).

suppressMessages(print(1:5)) # Still prints
suppressMessages(message_print(1:5)) # Silenced
```

`modify_in_place` *Modify the argument in the calling environment of the calling function*

Description

This is a helper function that enables a function to modify its argument in place, emulating behavior of **R6** classes and methods in the **network**. It should typically be the last line of the calling function.

Usage

```
modify_in_place(x, value = x)
```

Arguments

`x`	the argument (not its name!) to be modified
`value`	the value to assign (defaulting to the current value of `x`)

Details

This function determines whether the argument can be assigned to by actually attempting to do so. If this results in an error, for example, because the argument is anonymous, the error is silently ignored.

It can be called multiple times by the same function to modify multiple arguments. It uses the `on.exit()` mechanism, adding to the list. Thus, if some other function calls `on.exit(..., add = FALSE)` (the default) afterwards, `modify_in_place()` will fail silently.

Value

`value`, invisibly, while attempting to modify `x` in place

Examples

```
## A function that increments its argument in place:
inc <- function(x){
  modify_in_place(x, x+1)
}

y <- 1
z <- 1

stopifnot(inc(z) == 2)
stopifnot(z == 2)
stopifnot(inc(y) == 2)
stopifnot(y == 2)
stopifnot(inc(z) == 3)
stopifnot(z == 3)

stopifnot(inc(identity(z)) == 4)
```

```
stopifnot(z == 3) # Not updated!

## Modify an argument that's been updated in place:
inc2 <- function(y){
  y <- y + 1
  modify_in_place(y)
}

z
stopifnot(inc2(z) == 4)
stopifnot(z == 4)

## Decrement the first argument, increment the second:
incdec <- function(x,y){
  modify_in_place(x, x-1)
  modify_in_place(y, y+1)
}

c(y,z)
incdec(y,z)
stopifnot(all(c(y,z) == c(1,5)))
```

NVL *Convenience functions for handling* NULL *objects.*

Description

Convenience functions for handling NULL objects.

Usage

```
NVL(...)

NVL2(test, notnull, null = NULL)

NVL3(test, notnull, null = NULL)

EVL(...)

EVL2(test, notnull, null = NULL)

EVL3(test, notnull, null = NULL)

NVL(x) <- value

EVL(x) <- value
```

Arguments

..., test	expressions to be tested.
notnull	expression to be returned if test is not NULL.
null	expression to be returned if test is NULL.
x	an object to be overwritten if NULL.
value	new value for x.

Functions

- NVL(): Inspired by SQL function NVL, returns the first argument that is not NULL, or NULL if all arguments are NULL.
- NVL2(): Inspired by Oracle SQL function NVL2, returns the second argument if the first argument is not NULL and the third argument if the first argument is NULL. The third argument defaults to NULL, so NVL2(a, b) can serve as shorthand for (if(!is.null(a)) b).
- NVL3(): Inspired by Oracle SQL NVL2 function and magittr %>% operator, behaves as NVL2 but .s in the second argument are substituted with the first argument.
- EVL(): As NVL, but for any objects of length 0 (*E*mpty) rather than just NULL. Note that if no non-zero-length arguments are given, NULL is returned.
- EVL2(): As NVL2, but for any objects of length 0 (*E*mpty) rather than just NULL.
- EVL3(): As NVL3, but for any objects of length 0 (*E*mpty) rather than just NULL.
- NVL(x) <- value: Assigning to NVL overwrites its first argument if that argument is NULL. Note that it will *always* return the right-hand-side of the assignment (value), regardless of what x is.
- EVL(x) <- value: As assignment to NVL, but for any objects of length 0 (*E*mpty) rather than just NULL.

Note

Whenever possible, these functions use lazy evaluation, so, for example NVL(1, stop("Error!")) will never evaluate the stop call and will not produce an error, whereas NVL(NULL, stop("Error!")) would.

See Also

NULL, is.null, if

Examples

```
a <- NULL

a # NULL
NVL(a,0) # 0

b <- 1

b # 1
```

```
NVL(b,0) # 1

# Here, object x does not exist, but since b is not NULL, x is
# never evaluated, so the statement finishes.
NVL(b,x) # 1

# Also,
NVL(NULL,1,0) # 1
NVL(NULL,0,1) # 0
NVL(NULL,NULL,0) # 0
NVL(NULL,NULL,NULL) # NULL

NVL2(a, "not null!", "null!") # "null!"
NVL2(b, "not null!", "null!") # "not null!"

NVL3(a, "not null!", "null!") # "null!"
NVL3(b, .+1, "null!") # 2

NVL(NULL*2, 1) # numeric(0) is not NULL
EVL(NULL*2, 1) # 1


NVL(a) <- 2
a # 2
NVL(b) <- 2
b # still 1
```

`once` *Evaluate a function once for a given input.*

Description

This is a `purrr`-style adverb that checks if a given function has already been called with a given configuration of arguments and skips it if it has.

Usage

```
once(f, expire_after = Inf, max_entries = Inf)
```

Arguments

`f`	A function to modify.
`expire_after`	The number of seconds since it was added to the database before a particular configuration is "forgotten". This can be used to periodically remind the user without overwhelming them.
`max_entries`	The number of distinct configurations to remember. If not `Inf`, *earliest-inserted* configurations will be removed from the database when capacity is exceeded. (This exact behavior may change in the future.)

Details

Each modified function instance returned by `once()` maintains a database of previous argument configurations. They are not in any way compressed, so this database may grow over time. Thus, this wrapper should be used with caution if arguments are large objects. This may be replaced with hashing in the future. In the meantime, you may want to set the `max_entries` argument to be safe.

Different instances of a modified function do not share databases, even if the function is the same. This means that if you, say, modify a function within another function, the modified function will call once per call to the outer function. Modified functions defined at package level count as the same "instance", however. See example.

Note

Because the function needs to test whether a particular configuration of arguments have already been used, do not rely on lazy evaluation behaviour.

Examples

```
msg <- once(message)
msg("abc") # Prints.
msg("abc") # Silent.

msg <- once(message) # Starts over.
msg("abc") # Prints.

f <- function(){
  innermsg  <- once(message)
  innermsg("efg") # Prints once per call to f().
  innermsg("efg") # Silent.
  msg("abcd") # Prints only the first time f() is called.
  msg("abcd") # Silent.
}
f() # Prints "efg" and "abcd".
f() # Prints only "efg".

msg3 <- once(message, max_entries=3)
msg3("a") # 1 remembered.
msg3("a") # Silent.
msg3("b") # 2 remembered.
msg3("a") # Silent.
msg3("c") # 3 remembered.
msg3("a") # Silent.
msg3("d") # "a" forgotten.
msg3("a") # Printed.

msg2s <- once(message, expire_after=2)
msg2s("abc") # Prints.
msg2s("abc") # Silent.
Sys.sleep(1)
msg2s("abc") # Silent after 1 sec.
Sys.sleep(1.1)
msg2s("abc") # Prints after 2.1 sec.
```

opttest *Optionally test code depending on environment variable.*

Description

A convenience wrapper to run code based on whether an environment variable is defined.

Usage

```
opttest(
  expr,
  testname = NULL,
  testvar = "ENABLE_statnet_TESTS",
  yesvals = c("y", "yes", "t", "true", "1"),
  lowercase = TRUE
)
```

Arguments

expr	An expression to be evaluated only if `testvar` is set to a non-empty value.
testname	Optional name of the test. If given, and the test is skipped, will print a message to that end, including the name of the test, and instructions on how to enable it.
testvar	Environment variable name. If set to one of the `yesvals`, `expr` is run. Otherwise, an optional message is printed.
yesvals	A character vector of strings considered affirmative values for `testvar`.
lowercase	Whether to convert the value of `testvar` to lower case before comparing it to `yesvals`.

order *Implement the* `sort` *and* `order` *methods for* `data.frame` *and* `matrix`*, sorting it in lexicographic order.*

Description

These function return a data frame sorted in lexcographic order or a permutation that will rearrange it into lexicographic order: first by the first column, ties broken by the second, remaining ties by the third, etc..

Usage

```
order(..., na.last = TRUE, decreasing = FALSE)

## Default S3 method:
order(..., na.last = TRUE, decreasing = FALSE)

## S3 method for class 'data.frame'
order(..., na.last = TRUE, decreasing = FALSE)

## S3 method for class 'matrix'
order(..., na.last = TRUE, decreasing = FALSE)

## S3 method for class 'data.frame'
sort(x, decreasing = FALSE, ...)
```

Arguments

...	Ignored for sort. For order, first argument is the data frame to be ordered. (This is needed for compatibility with order.)
na.last	See order documentation.
decreasing	Whether to sort in decreasing order.
x	A data.frame to sort.

Value

For sort, a data frame, sorted lexicographically. For order, a permutation I (of a vector 1:nrow(x)) such that x[I,,drop=FALSE] equals x ordered lexicographically.

See Also

data.frame, sort, order, matrix

Examples

```
data(iris)

head(iris)

head(order(iris))

head(sort(iris))

stopifnot(identical(sort(iris),iris[order(iris),]))
```

paste.and — *Concatenates the elements of a vector (optionaly enclosing them in quotation marks or parentheses) adding appropriate punctuation and conjunctions.*

Description

A vector x becomes "x[1]", "x[1] and x[2]", or "x[1], x[2], and x[3]", depending on the langth of x.

Usage

```
paste.and(x, oq = "", cq = "", con = "and")
```

Arguments

x	A vector.
oq	Opening quotation symbol. (Defaults to none.)
cq	Closing quotation symbol. (Defaults to none.)
con	Conjunction to be used if length(x)>1. (Defaults to "and".)

Value

A string with the output.

See Also

paste, cat

Examples

```
print(paste.and(c()))

print(paste.and(1))

print(paste.and(1:2))

print(paste.and(1:3))

print(paste.and(1:4,con='or'))
```

persistEval *Evaluate an expression, restarting on error*

Description

A pair of functions paralleling `eval()` and `evalq()` that make multiple attempts at evaluating an expression, retrying on error up to a specified number of attempts, and optionally evaluating another expression before restarting.

Usage

```
persistEval(
  expr,
  retries = NVL(getOption("eval.retries"), 5),
  beforeRetry,
  envir = parent.frame(),
 enclos = if (is.list(envir) || is.pairlist(envir)) parent.frame() else baseenv(),
  verbose = FALSE
)

persistEvalQ(
  expr,
  retries = NVL(getOption("eval.retries"), 5),
  beforeRetry,
  envir = parent.frame(),
 enclos = if (is.list(envir) || is.pairlist(envir)) parent.frame() else baseenv(),
  verbose = FALSE
)
```

Arguments

`expr`	an expression to be retried; note the difference between `eval()` and `evalq()`.
`retries`	number of retries to make; defaults to `"eval.retries"` option, or 5.
`beforeRetry`	if given, an expression that will be evaluated before each retry if the initial attempt fails; it is evaluated in the same environment and with the same quoting semantics as `expr`, but its errors are not handled.
`envir, enclos`	see `eval()`.
`verbose`	Whether to output retries.

Value

Results of evaluating `expr`, including side-effects such as variable assignments, if successful in `retries` retries.

Note

If `expr` returns a `"try-error"` object (returned by `try()`), it will be treated as an error. This behavior may change in the future.

Examples

```
x <- 0
persistEvalQ({if((x<-x+1)<3) stop("x < 3") else x},
             beforeRetry = {cat("Will try incrementing...\n")})

x <- 0
e <- quote(if((x<-x+1)<3) stop("x < 3") else x)
persistEval(e,
            beforeRetry = quote(cat("Will try incrementing...\n")))
```

---

print.control.list *Pretty print the control list*

Description

This function prints the control list, including what it can control and the elements.

Usage

```
## S3 method for class 'control.list'
print(x, ..., indent = "")
```

Arguments

`x`	A list generated by a `control.*` function.
`...`	Additional argument to print methods for individual settings.
`indent`	an argument for recursive calls, to facilitate indentation of nested lists.

See Also

`check.control.class`, `set.control.class`

`replace` *Replace values in a vector according to functions*

Description

This is a thin wrapper around `base::replace()` that allows `list` and/or `values` to be functions that are evaluated on `x` to obtain the replacement indices and values. The assignment version replaces `x`.

Usage

```
replace(x, list, values, ...)

replace(x, list, ...) <- value
```

Arguments

`x`	a vector.
`list`	either an index vector or a function (*not* a function name).
`values`, `value`	either a vector of replacement values or a function (*not* a function name).
`...`	additional arguments to `list` if it is a function; otherwise ignored.

Details

`list` function is passed the whole vector `x` at once (not elementwise) and any additional arguments to `replace()`, and must return an indexing vector (numeric, logical, character, etc.). `values`/`value` function is passed `x` after subsetting it by the result of calling `list()`.

If passing named arguments, `x`, `list`, and `values` may cause a conflict.

Value

A vector with the values replaced.

See Also

`purrr::modify()` family of functions.

Examples

```
(x <- rnorm(10))

### Replace elements of x that are < 1/4 with 0.

# Note that this code is pipeable.
x |> replace(`<`, 0, 1/4)
# More readable, using lambda notation.
x |> replace(\(.x) .x < 1/4, 0)
# base equivalent.
```

```
stopifnot(identical(replace(x, `<`, 0, 1/4),
                    base::replace(x, x < 1/4, 0)))

### Multiply negative elements of x by 1i.

x |> replace(\(.x) .x < 0, \(.x) .x * 1i)
stopifnot(identical(replace(x, \(.x) .x < 0, \(.x) .x * 1i),
                    base::replace(x, x < 0, x[x < 0] * 1i)))

### Modify the list in place.

y <- x
replace(x, `<`, 1/4) <- 0
x
stopifnot(identical(x, replace(y, `<`, 0, 1/4)))
```

`set.control.class` *Set the class of the control list*

Description

This function sets the class of the control list, with the default being the name of the calling function.

Usage

```
set.control.class(
  myname = as.character(ult(sys.calls(), 2)[[1L]]),
  control = get("control", pos = parent.frame())
)
```

Arguments

`myname`	Name of the class to set.
`control`	Control list. Defaults to the `control` variable in the calling function.

Value

The control list with class set.

Note

In earlier versions, `OKnames` and `myname` were autodetected. This capability has been deprecated and results in a warning issued once per session. They now need to be set explicitly.

See Also

`check.control.class()`, `print.control.list()`

set_diag *Return the matrix with diagonal set to a specified value*

Description

This function simply assigns `value` to diagonal of `x` and returns `x`.

Usage

```
set_diag(x, value)
```

Arguments

`x`	a square matrix.
`value`	a value or a vector (recycled to the required length).

simplify_simple *Convert a list to an atomic vector if it consists solely of atomic elements of length 1.*

Description

This behaviour is not dissimilar to that of `simplify2array()`, but it offers more robust handling of empty or NULL elements and never promotes to a matrix or an array, making it suitable to be a column of a `data.frame`.

Usage

```
simplify_simple(
  x,
  toNA = c("null", "empty", "keep"),
  empty = c("keep", "unlist"),
  ...
)
```

Arguments

`x`	an R `list` to be simplified.
`toNA`	a character string indicating whether `NULL` entries (if `"null"`) or 0-length entries including `NULL` (if `"empty"`) should be replaced with `NA`s before attempting conversion; specifying `keep` or `FALSE` leaves them alone (typically preventing conversion).
`empty`	a character string indicating how empty lists should be handled: either `"keep"`, in which case they are unchanged or `"unlist"`, in which cases they are unlisted (typically to `NULL`).
`...`	additional arguments passed to `unlist()`.

Value

an atomic vector or a list of the same length as x.

Examples

```
(x <- as.list(1:5))
stopifnot(identical(simplify_simple(x), 1:5))

x[3] <- list(NULL) # Put a NULL in place of 3.
x
stopifnot(identical(simplify_simple(x, FALSE), x)) # Can't be simplified without replacing the NULL.

stopifnot(identical(simplify_simple(x), c(1L,2L,NA,4L,5L))) # NULL replaced by NA and simplified.

x[[3]] <- integer(0)
x
stopifnot(identical(simplify_simple(x), x)) # A 0-length vector is not replaced by default,
stopifnot(identical(simplify_simple(x, "empty"), c(1L,2L,NA,4L,5L))) # but can be.

(x <- lapply(1:5, function(i) c(i,i+1L))) # Elements are vectors of equal length.
simplify2array(x) # simplify2array() creates a matrix,
stopifnot(identical(simplify_simple(x), x)) # but simplify_simple() returns a list.
```

---

snctrl *Statnet Control*

Description

A utility to facilitate argument completion of control lists.

Usage

```
snctrl(...)
```

Arguments

...	The parameter list is updated dynamically as packages are loaded and unloaded. Their current list is given below.

Details

In and of itself, snctrl copies its named arguments into a list. However, its argument list is updated dynamically as packages are loaded, as are those of its reexports from other packages. This is done using an API provided by helper functions. (See API?snctrl.)

Currently recognised control parameters

This list is updated as packages are loaded and unloaded.

Note

You may see messages along the lines of

```
The following object is masked from 'package:PKG':
snctrl
```

when loading packages. They are benign.

`snctrl_names` *Helper functions used by packages to facilitate* `snctrl` *updating.*

Description

Helper functions used by packages to facilitate `snctrl` updating.

Usage

```
snctrl_names()

update_snctrl(myname, arglists = NULL, callback = NULL)

collate_controls(x = NULL, ...)

UPDATE_MY_SCTRL_EXPR

COLLATE_ALL_MY_CONTROLS_EXPR
```

Arguments

`myname`	Name of the package defining the arguments.
`arglists`	A named list of argument name-default pairs. If the list is not named, it is first passed through `collate_controls()`.
`callback`	A function with no arguments that updates the packages own copy of `snctrl()`.
`x`	Either a function, a list of functions, or an environment. If `x` is an environment, all functions starting with dQuote(`control.`) are obtained.
`...`	Additional functions or lists of functions.

Format

`UPDATE_MY_SCTRL_EXPR` is a quoted expression meant to be passed directly to `eval()`.

`COLLATE_ALL_MY_CONTROLS_EXPR` is a quoted expression meant to be passed directly to `eval()`.

Value

`update_snctrl()` has no return value and is used for its side-effects.

`collate_controls()` returns the combined list of name-default pairs of each function.

Functions

- `snctrl_names()`: Typeset the currently defined list of argument names by package and control function.
- `update_snctrl()`: Typically called from `.onLoad()`, Update the argument list of `snctrl()` to include additional argument names associated with the package, and set a callback for the package to update its own copy.
- `collate_controls()`: Obtain and concatenate the argument lists of specified functions or all functions starting with dQuote(`control.`) in the environment.
- `UPDATE_MY_SCTRL_EXPR`: A stored expression that, if evaluated, will create a callback function `update_my_snctrl()` that will update the client package's copy of `snctrl()`.
- `COLLATE_ALL_MY_CONTROLS_EXPR`: A stored expression that, if evaluated on loading, will add arguments of the package's `control.*()` functions to `snctrl()` and set the callback.

Examples

```
## Not run:
# In the client package (outside any function):
eval(UPDATE_MY_SCTRL_EXPR)

## End(Not run)
## Not run:
# In the client package:
.onLoad <- function(libame, pkgname){
  # ... other code ...
  eval(statnet.common::COLLATE_ALL_MY_CONTROLS_EXPR)
  # ... other code ...
}

## End(Not run)
```

---

split.array *A `split()` method for `array` and `matrix` types on a margin.*

Description

These methods split an `array` and `matrix` into a list of arrays or matrices with the same number of dimensions according to the specified margin.

Usage

```
## S3 method for class 'array'
split(x, f, drop = FALSE, margin = NULL, ...)

## S3 method for class 'matrix'
split(x, f, drop = FALSE, margin = NULL, ...)
```

Arguments

x	A matrix or an array.
f, drop	See help for split(). Note that drop here is *not* for array dimensions: these are always preserved.
margin	Which margin of the array to split along. NULL splits as split.default, dropping dimensions.
...	Additional arguments to split().

Examples

```
x <- diag(5)
f <- rep(1:2, c(2,3))
split(x, f, margin=1) # Split rows.
split(x, f, margin=2) # Split columns.

# This is similar to how data frames are split:
stopifnot(identical(split(x, f, margin=1),
          lapply(lapply(split(as.data.frame(x), f), as.matrix), unname)))
```

---

ssolve *Wrappers around matrix algebra functions that pre-scale their arguments*

Description

Covariance matrices of variables with very different orders of magnitude can have very large ratios between their greatest and their least eigenvalues, causing them to appear to the algorithms to be near-singular when they are actually very much SPD. These functions first scale the matrix's rows and/or columns by its diagonal elements and then undo the scaling on the result.

Usage

```
ssolve(a, b, ..., snnd = TRUE)

sginv(X, ..., snnd = TRUE)

ginv_eigen(X, tol = sqrt(.Machine$double.eps), ...)

xTAx_seigen(x, A, tol = sqrt(.Machine$double.eps), ...)

srcond(x, ..., snnd = TRUE)

snearPD(x, ...)

xTAx_ssolve(x, A, ...)
```

```
xTAx_qrssolve(x, A, tol = 1e-07, ...)

sandwich_ssolve(A, B, ...)

qrssolve(a, b, tol = 1e-07, ..., snnd = TRUE)

qrsolve(a, b, tol = 1e-07, ...)

sandwich_qrssolve(A, B, ...)

sandwich_qrsolve(A, B, ...)
```

Arguments

snnd	assume that the matrix is symmetric non-negative definite (SNND). This typically entails scaling that converts covariance to correlation and use of eigendecomposition rather than singular-value decomposition. If it's "obvious" that the matrix is not SSND (e.g., negative diagonal elements), an error is raised.
x, a, b, X, A, B, tol, ...	corresponding arguments of the wrapped functions.

Details

`ginv_eigen()` reimplements `MASS::ginv()` but using eigendecomposition rather than SVD; this means that it is only suitable for symmetric matrices, but that detection of negative eigenvalues is more robust.

`ssolve()`, `sginv()`, `sginv_eigen()`, and `snearPD()` wrap `solve()`, `MASS::ginv()`, `ginv_eigen()`, and `Matrix::nearPD()`, respectively. `srcond()` returns the reciprocal condition number of `rcond()` net of the above scaling. `xTAx_ssolve()`, `xTAx_qrssolve()`, `xTAx_seigen()`, and `sandwich_ssolve()` wrap the corresponding **statnet.common** functions. `qrssolve()` solves the linear system via QR decomposition after scaling by diagonal.

Examples

```
x <- rnorm(2, sd=c(1,1e12))
x <- c(x, sum(x))
A <- matrix(c(1, 0, 1,
              0, 1e24, 1e24,
              1, 1e24, 1e24), 3, 3)
stopifnot(isTRUE(all.equal(
  xTAx_qrssolve(x,A),
  structure(drop(x%*%sginv(A)%*%x), rank = 2L, nullity = 1L)
)))

stopifnot(isTRUE(all.equal(c(A %*% qrssolve(A, x)), x)))

x <- rnorm(2, sd=c(1,1e12))
x <- c(x, rnorm(1, sd=1e12))
A <- matrix(c(1, 0, 1,
              0, 1e24, 1e24,
```

```
                1, 1e24, 1e24), 3, 3)

stopifnot(try(xTAx_qrssolve(x,A), silent=TRUE) ==
  "Error in xTAx_qrssolve(x, A) : x is not in the span of A\n")
```

`statnet.cite` `CITATION` *file utilities for Statnet packages (DEPRECATED)*

Description

These functions automate citation generation for Statnet Project packages. They no longer appear to work with CRAN and are thus deprecated.

Usage

```
statnet.cite.head(pkg)

statnet.cite.foot(pkg)

statnet.cite.pkg(pkg)
```

Arguments

pkg	Name of the package whose citation is being generated.

Value

For `statnet.cite.head` and `statnet.cite.foot`, an object of type `citationHeader` and `citationFooter`, respectively, understood by the `citation` function, with package name substituted into the template.

For `statnet.cite.pkg`, an object of class `bibentry` containing a 'software manual' citation for the package constructed from the current version and author information in the `DESCRIPTION` and a template.

See Also

citation, citHeader, citFooter, bibentry

Examples

```
## Not run:
statnet.cite.head("statnet.common")

statnet.cite.pkg("statnet.common")

statnet.cite.foot("statnet.common")

## End(Not run)
```

`statnetStartupMessage` *Construct a "standard" startup message to be printed when the package is loaded.*

Description

This function uses information returned by `packageDescription()` to construct a standard package startup message according to the policy of the Statnet Project.

Usage

```
statnetStartupMessage(pkgname, friends = c(), nofriends = c())
```

Arguments

`pkgname`	Name of the package whose information is used.
`friends`, `nofriends`	No longer used.

Value

A string containing the startup message, to be passed to the `packageStartupMessage()` call or `NULL`, if policy prescribes printing default startup message. (Thus, if `statnetStartupMessage()` returns `NULL`, the calling package should not call `packageStartupMessage()` at all.)

Note

Earlier versions of this function printed a more expansive message. This may change again as the Statnet Project policy evolves.

See Also

`packageDescription()`, `packageStartupMessage()`

Examples

```
## Not run:
.onAttach <- function(lib, pkg){
  sm <- statnetStartupMessage("ergm")
  if(!is.null(sm)) packageStartupMessage(sm)
}

## End(Not run)
```

sweep_cols.matrix *Suptract a elements of a vector from respective columns of a matrix*

Description

An optimized function equivalent to `sweep(x, 2, STATS)` for a matrix `x`.

Usage

```
sweep_cols.matrix(x, STATS, disable_checks = FALSE)
```

Arguments

`x`	a numeric matrix;
`STATS`	a numeric vector whose length equals to the number of columns of `x`.
`disable_checks`	if `TRUE`, do not check that `x` is a numeric matrix and its number of columns matches the length of `STATS`; set in production code for a significant speed-up.

Value

A matrix of the same attributes as `x`.

Examples

```
x <- matrix(runif(1000), ncol=4)
s <- 1:4

stopifnot(all.equal(sweep_cols.matrix(x, s), sweep(x, 2, s)))
```

term_list *A helper class for list of terms in an formula*

Description

Typically generated by `list_rhs.formula()`, it contains, in addition to a list of `call()` or similar objects, attributes `"sign"` and `"env"`, containing, respectively a vector of signs that the terms had in the original formula and a list of environments of the formula from which the term has been extracted. Indexing and concatenation methods preserve these.

Usage

```
term_list(x, sign = +1, env = NULL)

as.term_list(x, ...)

## S3 method for class 'term_list'
as.term_list(x, ...)

## Default S3 method:
as.term_list(x, sign = +1, env = NULL, ...)

## S3 method for class 'term_list'
c(x, ...)

## S3 method for class 'term_list'
x[i, ...]

## S3 method for class 'term_list'
print(x, ...)
```

Arguments

x	a list of terms or a term; a term_list
sign	a vector specifying the signs associated with each term (-1 and +1)
env	a list specifying the environments, or NULL
...	additional arguments to methods
i	list index

See Also

list_rhs.formula(), list_summands.call()

Examples

```
e1 <- new.env()
f1 <- a~b+c
environment(f1) <- e1
f2 <- ~-NULL+1

(l1 <- list_rhs.formula(f1))
(l2 <- list_rhs.formula(f2))

(l <- c(l1,l2))


(l <- c(l2[1], l1[2], l1[1], l1[1], l2[2]))
```

trim_env *Make a copy of an environment with just the selected objects.*

Description

Make a copy of an environment with just the selected objects.

Usage

```
trim_env(object, keep = NULL, ...)

## S3 method for class 'environment'
trim_env(object, keep = NULL, ...)

## Default S3 method:
trim_env(object, keep = NULL, ...)
```

Arguments

object	An environment or an object with environment() and environment()<- methods.
keep	A character vector giving names of variables in the environment (including its ancestors) to copy over, defaulting to dropping all. Variables that cannot be resolved are silently ignored.
...	Additional arguments, passed on to lower-level methods.

Value

An object of the same type as object, with updated environment. If keep is empty, the environment is baseenv(); if not empty, it's a new environment with baseenv() as parent.

Methods (by class)

- trim_env(environment): A method for environment objects.
- trim_env(default): Default method, for objects such as formula and function that have environment() and environment()<- methods.

`ult` *Extract or replace the* ult*imate (last) element of a vector or a list, or an element counting from the end.*

Description

Extract or replace the *ult*imate (last) element of a vector or a list, or an element counting from the end.

Usage

```
ult(x, i = 1L)

ult(x, i = 1L) <- value
```

Arguments

`x`	a vector or a list.
`i`	index from the end of the list to extract or replace (where 1 is the last element, 2 is the penultimate element, etc.).
`value`	Replacement value for the `i`th element from the end.

Value

An element of `x`.

Note

Due to the way in which assigning to a function is implemented in R, `ult(x) <- e` may be less efficient than `x[[length(x)]] <- e`.

Examples

```
x <- 1:5
(last <- ult(x))
(penultimate <- ult(x, 2)) # 2nd last.



(ult(x) <- 6)
(ult(x, 2) <- 7) # 2nd last.
x
```

unused_dots_warning *An error handler for* `rlang::check_dots_used()` *that issues a warning that only lists argument names.*

Description

This handler parses the error message produced by `rlang::check_dots_used()`, extracting the names of the unused arguments, and formats them into a more gentle warning message. It relies on **rlang** maintaining its current format.

Usage

```
unused_dots_warning(e)
```

Arguments

e	a condition object, typically not passed by the end-user; see example below.

Examples

```
g <- function(b=NULL, ...){
  invisible(force(b))
}

f <- function(...){
  rlang::check_dots_used(error = unused_dots_warning)
  g(...)
}

f() # OK
f(b=2) # OK
f(a=1, b=2, c=3) # Warning about a and c but not about b
```

unwhich *Construct a logical vector with* `TRUE` *in specified positions.*

Description

This function is basically an inverse of `which`.

Usage

```
unwhich(which, n)
```

Arguments

which	a numeric vector of indices to set to TRUE.
n	total length of the output vector.

Value

A logical vector of length n whose elements listed in which are set to TRUE, and whose other elements are set to FALSE.

Examples

```
x <- as.logical(rbinom(10,1,0.5))
stopifnot(all(x == unwhich(which(x), 10)))
```

---

vector.namesmatch *reorder vector v into order determined by matching the names of its elements to a vector of names*

Description

This function is deprecated in favor of match_names() and will be removed in a future release.

Usage

```
vector.namesmatch(v, names, errname = NULL)
```

Arguments

v	a vector (or list) with named elements, to be reorderd
names	a character vector of element names, corresponding to names of v, specificying desired orering of v
errname	optional, name to be reported in any error messages. default to deparse(substitute(v))

Value

returns v, with elements reordered

Note

earlier versions of this function did not order as advertised

Examples

```
test<-list(c=1,b=2,a=3)
vector.namesmatch(test,names=c('a','c','b'))
```

`Welford` *A Welford accumulator for sample mean and variance*

Description

A simple class for keeping track of the running mean and the sum of squared deviations from the mean for a vector.

Usage

```
Welford(dn, means, vars)

## S3 method for class 'Welford'
update(object, newdata, ...)
```

Arguments

`dn`, `means`, `vars`	initialization of the Welford object: if `means` and `vars` are given, they are treated as the running means and variances, and `dn` is their associated sample size, and if not, `dn` is the dimension of the vector (with sample size 0).
`object`	a `Welford` object.
`newdata`	either a numeric vector of length `d`, a numeric matrix with `d` columns for a group update, or another `Welford` object with the same `d`.
`...`	additional arguments to methods.

Value

an object of type `Welford`: a list with four elements:

1. `n`: Running number of observations
2. `means`: Running mean for each variable
3. `SSDs`: Running sum of squared deviations from the mean for each variable
4. `vars`: Running variance of each variable

Methods (by generic)

- `update(Welford)`: Update a `Welford` object with new data.

Examples

```
X <- matrix(rnorm(200), 20, 10)
w0 <- Welford(10)

w <- update(w0, X)
stopifnot(isTRUE(all.equal(w$means, colMeans(X))))
stopifnot(isTRUE(all.equal(w$vars, apply(X,2,var))))
```

```
w <- update(w0, X[1:12,])
w <- update(w, X[13:20,])
stopifnot(isTRUE(all.equal(w$means, colMeans(X))))
stopifnot(isTRUE(all.equal(w$vars, apply(X,2,var))))

w <- Welford(12, colMeans(X[1:12,]), apply(X[1:12,], 2, var))
w <- update(w, X[13:20,])
stopifnot(isTRUE(all.equal(w$means, colMeans(X))))
stopifnot(isTRUE(all.equal(w$vars, apply(X,2,var))))
```

`wmatrix` *A data matrix with row weights*

Description

A representation of a numeric matrix with row weights, represented on either linear (`linwmatrix`) or logarithmic (`logwmatrix`) scale.

Usage

```
logwmatrix(
  data = NA,
  nrow = 1,
  ncol = 1,
  byrow = FALSE,
  dimnames = NULL,
  w = NULL
)

linwmatrix(
  data = NA,
  nrow = 1,
  ncol = 1,
  byrow = FALSE,
  dimnames = NULL,
  w = NULL
)

is.wmatrix(x)

is.logwmatrix(x)

is.linwmatrix(x)

as.linwmatrix(x, ...)

as.logwmatrix(x, ...)
```

```
## S3 method for class 'linwmatrix'
as.linwmatrix(x, ...)

## S3 method for class 'logwmatrix'
as.linwmatrix(x, ...)

## S3 method for class 'logwmatrix'
as.logwmatrix(x, ...)

## S3 method for class 'linwmatrix'
as.logwmatrix(x, ...)

## S3 method for class 'matrix'
as.linwmatrix(x, w = NULL, ...)

## S3 method for class 'matrix'
as.logwmatrix(x, w = NULL, ...)

## S3 method for class 'wmatrix'
print(x, ...)

## S3 method for class 'logwmatrix'
print(x, ...)

## S3 method for class 'linwmatrix'
print(x, ...)

## S3 method for class 'logwmatrix'
compress_rows(x, ...)

## S3 method for class 'linwmatrix'
compress_rows(x, ...)

## S3 method for class 'wmatrix'
decompress_rows(x, target.nrows = NULL, ...)

## S3 method for class 'wmatrix'
x[i, j, ..., drop = FALSE]

## S3 replacement method for class 'wmatrix'
x[i, j, ...] <- value
```

Arguments

data, nrow, ncol, byrow, dimnames	passed to matrix.
w	row weights on the appropriate scale.

x	an object to be coerced or tested.
...	extra arguments, currently unused.
target.nrows	the approximate number of rows the uncompressed matrix should have; if not achievable exactly while respecting proportionality, a matrix with a slightly different number of rows will be constructed.
i, j, value	rows and columns and values for extraction or replacement; as matrix.
drop	Used for consistency with the generic. Ignored, and always treated as FALSE.

Value

An object of class linwmatrix/logwmatrix and wmatrix, which is a matrix but also has an attribute w containing row weights on the linear or the natural-log-transformed scale.

Note

Note that wmatrix itself is an "abstract" class: you cannot instantiate it.

Note that at this time, wmatrix is designed as, first and foremost, as class for storing compressed data matrices, so most methods that operate on matrices may not handle the weights correctly and may even cause them to be lost.

See Also

rowweights, lrowweights, compress_rows

Examples

```
(m <- matrix(1:3, 2, 3, byrow=TRUE))
(m <- rbind(m, 3*m, 2*m, m))
(mlog <- as.logwmatrix(m))
(mlin <- as.linwmatrix(m))
(cmlog <- compress_rows(mlog))
(cmlin <- compress_rows(mlin))

stopifnot(all.equal(as.linwmatrix(cmlog),cmlin))

cmlog[2,] <- 1:3
(cmlog <- compress_rows(cmlog))
stopifnot(sum(rowweights(cmlog))==nrow(m))

(m3 <- matrix(c(1:3,(1:3)*2,(1:3)*3), 3, 3, byrow=TRUE))
(rowweights(m3) <- c(4, 2, 2))

stopifnot(all.equal(compress_rows(as.logwmatrix(m)), as.logwmatrix(m3),check.attributes=FALSE))
stopifnot(all.equal(rowweights(compress_rows(as.logwmatrix(m))),
                    rowweights(as.logwmatrix(m3)),check.attributes=FALSE))
```

wmatrix_weights *Set or extract weighted matrix row weights*

Description

Set or extract weighted matrix row weights

Usage

```
rowweights(x, ...)

## S3 method for class 'linwmatrix'
rowweights(x, ...)

## S3 method for class 'logwmatrix'
rowweights(x, ...)

lrowweights(x, ...)

## S3 method for class 'logwmatrix'
lrowweights(x, ...)

## S3 method for class 'linwmatrix'
lrowweights(x, ...)

rowweights(x, ...) <- value

## S3 replacement method for class 'linwmatrix'
rowweights(x, update = TRUE, ...) <- value

## S3 replacement method for class 'logwmatrix'
rowweights(x, update = TRUE, ...) <- value

lrowweights(x, ...) <- value

## S3 replacement method for class 'linwmatrix'
lrowweights(x, update = TRUE, ...) <- value

## S3 replacement method for class 'logwmatrix'
lrowweights(x, update = TRUE, ...) <- value

## S3 replacement method for class 'matrix'
rowweights(x, ...) <- value

## S3 replacement method for class 'matrix'
lrowweights(x, ...) <- value
```

Arguments

x	a linwmatrix, a logwmatrix, or a matrix; a matrix is coerced to a weighted matrix of an appropriate type.
...	extra arguments for methods.
value	weights to set, on the appropriate scale.
update	if TRUE (the default), the old weights are updated with the new weights (i.e., corresponding weights are multiplied on linear scale or added on on log scale); otherwise, they are overwritten.

Value

For the accessor functions, the row weights or the row log-weights; otherwise, a weighted matrix with modified weights. The type of weight (linear or logarithmic) is converted to the required type and the type of weighting of the matrix is preserved.

---

xTAx *Common quadratic forms*

Description

Common quadratic forms

Usage

```
xTAx(x, A)

xAxT(x, A)

xTAx_solve(x, A, ...)

xTAx_qrsolve(x, A, tol = 1e-07, ...)

sandwich_solve(A, B, ...)

xTAx_eigen(x, A, tol = sqrt(.Machine$double.eps), ...)

sandwich_sginv(A, B, ...)

sandwich_ginv(A, B, ...)
```

Arguments

x	a vector
A	a square matrix
...	additional arguments to subroutines
tol	tolerance argument passed to the relevant subroutine
B	a square matrix

Details

These are somewhat inspired by emulator::quad.form.inv() and others.

Functions

- `xTAx()`: Evaluate $x'Ax$ for vector x and square matrix A.
- `xAxT()`: Evaluate xAx' for vector x and square matrix A.
- `xTAx_solve()`: Evaluate $x'A^{-1}x$ for vector x and invertible matrix A using `solve()`.
- `xTAx_qrsolve()`: Evaluate $x'A^{-1}x$ for vector x and matrix A using QR decomposition and confirming that x is in the span of A if A is singular; returns `rank` and `nullity` as attributes just in case subsequent calculations (e.g., hypothesis test degrees of freedom) are affected.
- `sandwich_solve()`: Evaluate $A^{-1}B(A')^{-1}$ for B a square matrix and A invertible.
- `xTAx_eigen()`: Evaluate $x'A^{-1}x$ for vector x and matrix A (symmetric, nonnegative-definite) via eigendecomposition and confirming that x is in the span of A if A is singular; returns `rank` and `nullity` as attributes just in case subsequent calculations (e.g., hypothesis test degrees of freedom) are affected.

  Decompose $A = PLP'$ for L diagonal matrix of eigenvalues and P orthogonal. Then $A^{-1} = PL^{-1}P'$.

  Substituting,

  $$x'A^{-1}x = x'PL^{-1}P'x = h'L^{-1}h$$

  for $h = P'x$.

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