Package 'disordR'

September 17, 2026

Type Package

Title Non-Ordered Vectors

Version 0.9-8-7

Imports digest, methods, Matrix (>= 1.3-3)

Suggests mvp,knitr,rmarkdown,testthat,covr

VignetteBuilder knitr

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Description Functionality for manipulating values of associative maps. The package is a dependency for mvp-type packages that use the STL map class: it traps plausible idiom that is ill-defined (implementation-specific) and returns an informative error, rather than returning a possibly incorrect result. To cite the package in publications please use Hankin (2022) <doi:10.48550/ARXIV.2210.03856>.

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URL https://github.com/RobinHankin/disordR, https://robinhankin.github.io/disordR/

BugReports https://github.com/RobinHankin/disordR/issues

Encoding UTF-8

Config/roxygen2/version 8.0.0

NeedsCompilation no

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Repository CRAN

Date/Publication 2026-09-17 08:30:02 UTC

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`Arith` *Arithmetic operations*

Description

Arithmetic operations including low-level helper functions

Usage

```
disord_inverse(a)
disord_mod_disord(a,b)
disord_mod_numeric(a,b)
disord_negative(a)
disord_plus_disord(a,b)
disord_plus_numeric(a,b)
disord_power_disord(a,b)
disord_power_numeric(a,b)
numeric_power_disord(a,b)
disord_prod_disord(a,b)
disord_prod_numeric(a,b)
disord_arith_unary(e1,e2)
disord_arith_disord(e1,e2)
disord_arith_numeric(e1,e2)
numeric_arith_disord(e1,e2)
```

Arguments

a, b	at least one is a disord object
e1, e2	Formal arguments for S4 dispatch

Details

Basic low-level arithmetic operations, intended to be called from S4 dispatch.

These functions return a `disord` object or a regular vector as appropriate. Consistency is required. The hash is set to be that of the disord object if appropriate.

Value

Return a disord object or logical

Methods

Arith `signature(e1="disord", e2="disord")`: Dispatched to `disord_arith_disord()`

Arith `signature(e1="disord", e2="numeric")`: Dispatched to `disord_arith_numeric()`

Arith `signature(e1="numeric", e2="disord")`: Dispatched to `numeric_arith_disord()`

Arith `signature(e1="disord", e2="missing")`: Dispatched to `disord_arith_unary()`

Author(s)

Robin K. S. Hankin

Examples

```
a <- rdis()
a
a + 2*a
a > 5
a[a > 5] <- a[a > 5] + 100
a
```

---

c *Concatenation*

Description

Concatenation simply does not make sense for `disord` objects.

Value

Returns an error.

Note

I could not figure out how to stop idiom like "`c(1,rdis())`" from returning a result. Just don't use it, OK?

Author(s)

Robin K. S. Hankin

Compare-methods *Methods for comparison of* disord *objects*

Description

Arithmetic comparison methods (greater than, etc) for disord objects.

Methods

Compare signature(e1="disord", e2="disord"): Dispatched to disord_compare_disord()

Compare signature(e1="disord", e2="ANY"): Dispatched to disord_compare_any()

Compare signature(e1="ANY", e2="disord"): Dispatched to any_compare_disord()

Note

All the comparison methods use drop=TRUE to avoid inconsistent results when all the values are the same [that is, all TRUE or all FALSE]. Comparing two disord objects requires their hash code to agree as per **disordR** discipline. Comparing a disord with a numeric returns a disord object. In each case, the hash code of the original object is preserved in the returned value.

Examples

```
rdis() > 4
rdis() > 1000
```

consistent *Check for consistency*

Description

The **disordR** package is designed to make permitted operations transparent and to prevent forbidden operations from being executed.

Function consistent() checks for matching hash codes of its arguments and returns a Boolean. It is called by function check_matching_hash() which either returns TRUE or reports an informative error message if not.

Usage

```
consistent(x,y)
x %~% y
check_matching_hash(e1,e2,use=NULL)
```

Arguments

x, y, e1, e2	Objects of class disord
use	optional object designed to give a more intelligible error message; typically match.call()

Details

Function consistent() checks that its arguments have the same hash code, and thus their elements can be paired up (e.g. added). Idiom a %~% b is equivalent to consistent(a,b).

The package generally checks for consistency with function check_matching_hash() which provides some helpful diagnostics if consistent() finds a hash mismatch.

Value

Boolean or an error as appropriate

Author(s)

Robin K. S. Hankin

See Also

disord

Examples

```
# rdis() + rdis() # this would make check_matching_hash() report an error, if executed
```

---

disindex-class *Experimental class* "disindex"

Description

Experimental disindex class provides a disordR-compliant method for indexing disord objects. The idea is that which(x), where x is Boolean of class disord, should have meaning under disordR discipline. Thus which() gives a disindex object. This object can be used as an index for other disord objects. One application would be the dismat class of matrices, currently under development.

Function values() coerces its argument to an integer vector.

Objects from the Class

Objects can be created by calls of the form new("disindex", ...), although which() is more natural.

Slots

`value`: Numeric vector

`hash`: Object of class `character` that specifies the hash code

Author(s)

Robin K. S. Hankin

Examples

```
(x <- disord(c(1,2,1,2,2,7)))

x==2
w <- which(x==2)
w

x[w] <- 100
x
```

`disord` *Functionality for* `disord` *objects*

Description

Allows arithmetic operators to be used for disord objects; the canonical application is coefficients of multivariate polynomials (as in the **mvp** package). The issue is that the storage order of disord objects is implementation-specific but the order (whatever it is) must be consistent between the list of keys and values in an associative array.

Usage

```
is.disord(x)
hash(x)
hashcal(x,ultra_strict=FALSE)
disord(v,h,drop=TRUE)
elements(x)
```

Arguments

x	Object of class disord
v	Vector of coefficients
h	Hash code
drop	Boolean, with default FALSE meaning to return a disord object and TRUE meaning to call drop() before returning
ultra_strict	Boolean, with default FALSE meaning to use just x to generate the hash, and TRUE meaning to use the date and a random number as well [this ensures that the hash is generated only once]

Details

A detailed vignette is provided that motivates the package. In applications such as the **mvp** or **clifford** packages, the user will not need to even think about the **disordR** package: it works in the background. The purpose of the package is to trap plausible idiom that is ill-defined (implementation-specific) and return an informative error, rather than returning a possibly incorrect result.

The package provides a single S4 class, disord, which has two slots, .Data and hash.

Function disord() takes an R object such as a vector or list and returns a disord object, which is useful in the context of the STL map class.

Function hash() returns the hash of an object (compare hashcal() which is used to actually calculate the hash code).

The package detects acceptable and forbidden operations using hash codes: function consistent() checks for its arguments having the same hash code, and thus their elements can be paired up (e.g. added). Idiomatically, a %~% b is equivalent to consistent(a,b).

Function elements() takes a disord and returns a regular R object, typically a vector or a list.

Value

Boolean, hash code, or object of class disord as appropriate.

Author(s)

Robin K. S. Hankin

Examples

```
(a <- rdis())
(b <- rdis())

a + 2*a + 2^a  # fine
# a + b # this would give an error if executed

a[a<0.5] <- 0       # round down; replacement works as expected

elements(a)
```

disord-class *Class* "disord"

Description

The disord class provides basic arithmetic and extract/replace methods for disord objects.

Objects from the Class

Objects can be created by calls of the form new("disord", ...), although functions disord() and (eventually) as.disord() are more user-friendly.

Slots

.Data: Object of class vector that specifies the elements

hash: Object of class character that specifies the hash code

Author(s)

Robin K. S. Hankin

Examples

```
showClass("disord")
```

drop *Drop redundant information*

Description

Coerce disord objects to vector when this makes sense

Usage

```
drop(x)
allsame(x)
```

Arguments

x	disord object

Details

If one has a disord object all of whose elements are identical, one usually wants to drop the disord attribute and coerce to a vector. This can be done without breaking disordR discipline. Function `disord()` takes a `drop` argument, defaulting to `TRUE`, which drops the `disord` class from its return value if all the elements are the same.

Similarly, function `drop()` takes a disord object and if all elements are identical it returns the elements in the form of a vector. Some extraction methods take a `drop` argument, which does the same thing if `TRUE`. This is only useful for disord objects created with `disord(...,drop=FALSE)`

The `drop` functionality is conceptually similar to the `drop` argument of base R's array extraction, as in

```
a <- matrix(1:30,5,6)
a[1,,drop=TRUE]
a[1,,drop=FALSE]
```

Function `allsame()` takes a vector and returns `TRUE` if all elements are identical.

Value

Function `drop()` returns either a vector or object of class `disord` as appropriate; `allsame()` returns a Boolean.

Author(s)

Robin K. S. Hankin

Examples

```
disord(c(3,3,3,3,3))             # default is drop=TRUE
disord(c(3,3,3,3,3),drop=FALSE)  # retains disord class

drop(disord(c(3,3,3,3),drop=FALSE))

## In extraction, argument drop discards disorderliness when possible:
a <- rdis()
a
a[] <- 6 # a becomes a vector
a
```

extract *Extraction and replacement methods for class* "disord"

Description

The disord class provides basic arithmetic and extract/replace methods for disord objects.

Class *index* is taken from the excellent **Matrix** package and is a setClassUnion() of classes numeric, logical, and character.

Methods

[signature(x = "disord", i = "ANY", j = "ANY"): ...

[signature(x = "disord", i = "index", j = "index"): ...

[signature(x = "disord", i = "index", j = "missing"): ...

[signature(x = "disord", i = "missing", j = "index"): ...

[signature(x = "disord", i = "missing", j = "missing"): ...

[signature(x = "disord", i = "matrix", j = "missing"): ...

[<- signature(x = "disord", i = "index", j = "index"): ...

[<- signature(x = "disord", i = "index", j = "missing"): ...

[<- signature(x = "disord", i = "missing", j = "index"): ...

[<- signature(x = "disord", i = "matrix", j = "missing"): ...

[<- signature(x = "disord", i = "missing", j = "missing"): ...

[[signature(x = "disord", i = "index"): ...

[[<- signature(x = "disord", i = "index",value="ANY"): ...

[signature(x="disord",i="disindex",j="missing",drop="ANY"): ...

[signature(x="disord",i="disindex",j="ANY",drop="ANY"): ...

[signature(x="ANY",i="disindex",j="ANY",drop="ANY"): ...

[signature(x="disord",i="disindex",j="missing",value="ANY"): ...

[signature(x="disord",i="disindex",j="ANY",value="ANY"): ...

[<- signature(x="disord",i="disindex",j="missing",drop="ANY"): ...

[[signature("disord",i="disindex"): ...

[[signature("ANY",i="disindex"): ...

[[<- signature(x="disord",i="disindex",j="missing",value="ANY") ...

[[<- signature(x="ANY",i="disindex",j="ANY",value="ANY") ...

The extraction method takes a drop argument which if TRUE, returns the drop() of its value. Extraction, as in x[i], is rarely useful. It is only defined if one extracts either all, or none, of the elements: anything else is undefined. Note that the hash code is unchanged if all elements are extracted (because the order might have changed) but unchanged if none are (because there is only one way to extract no elements).

Missing arguments for extraction and replacement are slightly idiosyncratic. Extraction idiom such as `x[]` returns an object identical to `x` except for the hash code, which is changed. I can't quite see a sensible use-case for this, but the method allows one to define an object `y <- x[]` for which `x` and `y` are incompatible. Replacement idiom `x[] <- v` always coerces to a vector.

Double square extraction, as in `x[[i]]` and `x[[i]] <- value`, is via (experimental) `disindex` functionality.

Note

Package versions prior to `disordR_0.0-9-6` allowed idiom such as

```
a <- disord(1:9)
a[a<3] + a[a>7]
```

but this is now disallowed. The issue is discussed in `inst/note_on_extraction.Rmd`.

Author(s)

Robin K. S. Hankin

See Also

drop,misc

Examples

```
a <- disord(sample(9))
a
a + 6*a^2
a[a>5]  # "give me all elements of a that exceed 5"

a[] # a disord object, same elements as 'a', but with a different hash

a[a<5] <- a[a<5] + 100  # "replace all elements of 'a' less than 5 with their value plus 100"
a

## Following expressions would return an error if executed:
if(FALSE){
  a[1]
  a[1] <- 44
  a[1:2] <- a[3:4]
}

b <- disord(sample(9))
## Following expressions would also return an error if executed:
if(FALSE){
  a+b  # (not really an example of extraction)
  a[b>5]
  a[b>5] <- 100
  a[b>5] <- a[b>5] + 44
```

```
}
```

`Logic` *Logical operations*

Description

Logical operations including low-level helper functions

Usage

```
disord_logical_negate(x)
disord_logic_disord(e1,e2)
disord_logic_any(e1,e2)
any_logic_disord(e1,e2)
```

Arguments

`e1`, `e2`, `x`	Formal arguments for S4 dispatch: logical `disord` object

Details

Basic low-level logical operations, intended to be called from S4 dispatch.

These functions return a logical `disord` object. appropriate. Consistency is required. The hash is set to be that of the disord object if appropriate.

Value

Return a disord object or logical

Methods

Logic `signature(e1="disord", e2="disord")`: Dispatched to `disord_logic_disord()`

Logic `signature(e1="disord", e2="ANY")`: Dispatched to `disord_logic_any()`

Logic `signature(e1="ANY", e2="disord")`: Dispatched to `any_logic_disord()`

Author(s)

Robin K. S. Hankin

Examples

```
a <- disord(1:7)
l <- a>3
sum(l)
any(l)
all(l | !l)
```

misc *Miscellaneous functions*

Description

This page documents various functions that work for disords, and I will add to these from time to time as I add new functions that make sense for disord objects (or identify functions that break disord discipline).

Usage

```
## S4 method for signature 'disord'
length(x)
## S4 method for signature 'disord'
sort(x, decreasing = FALSE, ...)
## S4 method for signature 'disord'
rev(x)
## S4 method for signature 'disord'
sapply(X, FUN, ..., simplify = TRUE, USE.NAMES = TRUE)
## S4 method for signature 'disord'
lapply(X, FUN, ...)
## S4 method for signature 'disord,ANY'
match(x, table, nomatch = NA_integer_, incomparables = NULL)
## S4 method for signature 'ANY,disord'
match(x, table, nomatch = NA_integer_, incomparables = NULL)
## S4 method for signature 'disord,disord'
match(x, table, nomatch = NA_integer_, incomparables = NULL)
## S4 method for signature 'disord'
unlist(x, recursive = TRUE)
## S4 method for signature 'disord'
diff(x, ...)
## S4 method for signature 'disord'
jitter(x, factor=1, amount=NULL)
binder(x,y)
```

Arguments

x, y, X	A disord or disindex object
table	Target table for matching
nomatch	The value to be returned in the case when no match is found
incomparables	A vector of values that cannot be matched
FUN	The function to be applied
decreasing	Logical indicating if the sort order should be decreasing
recursive, simplify, USE.NAMES	Standard options passed to base functions

factor, amount	Passed to jitter()
...	Further arguments passed to underlying methods

Details

Functions like sin() and abs() work as expected: they take and return disord objects with the same hash as x (which means that idiom like x + sin(x) is accepted). However, there are a few functions that are a little more involved:

- rev() reverses its argument and returns a disord object with a reversed hash, which ensures that rev(rev(x))==x (and the two are consistent).
- sort() returns a vector of sorted elements (not a disord)
- length() returns the length of the data component of the object
- sapply(X,f) returns a disord object which is the result of applying f() to each element of X.
- match(x,table) should behave as expected but note that if table is a disord, the result is not defined (because it is not known where the elements of x occur in table). Nevertheless x %in% table is defined and returns a disord object.
- lapply(x,f) returns disord(lapply(elements(x),f,...),h=hash(x)). Note that double square bracket extraction, as in x[[i]], is disallowed (see extract.Rd).
- which() returns a disind object when given a Boolean disord
- unlist() takes a disord list, flattens it and returns a disord vector. It requires the recursive flag of base::unlist() to be TRUE, which it is by default, interpreting this to mean "kill all the structure in any sublists". If the list comprises only length-one vectors, the returned value retains the same hash as the argument; if not, a new hash is generated.
- diff() is undefined for disord objects.
- rbind() and cbind() are undefined for disord objects as they break disord discipline. Function binder() returns a generic, and hopefully informative, error message [the package defines methods for rbind2() and cbind2()]
- jitter() takes a disord object, jitters the elements, and returns a disord object with the correct hash code.

Value

Returns a disord

Note

Some functionality is not yet implemented. Factors, lists, and named vectors do not behave entirely consistently in the package; paste() gives inconsistent results when called with disords.

Also, for() loops are incompatible with disord discipline, as they impose an ordering (for() accesses the .Data slot of its argument, which is a regular R vector). Thus:

```
> (a <- disord(1:3))
A disord object with hash 555f6bea49e58a2c2541060a21c2d4f9078c3086 and elements
[1] 1 2 3
```

```
(in some order)
> for(i in a){print(i)}
[1] 1
[1] 2
[1] 3
>
```

Above, we see that `for()` uses the ordering of the `.Data` slot of S4 object `a`, even though `elements()` has not been explicitly called.

Author(s)

Robin K. S. Hankin

See Also

extract

Examples

```
a <- disord(c(a=1,b=2,c=7))
a
names(a)
length(a)
sqrt(a)


# powers() and vars() in the mvp package return lists; see the vignette
# for more discussion.

l <- disord(list(3, 6:9, 1:10))
sapply(l, length)

unlist(l)

## Quick illustration of rev():

revstring <- function(s){paste(rev(unlist(strsplit(s, NULL))),collapse="")}
x <- rdis()
revstring(hash(x)) == hash(rev(x))
```

---

rdis *Random disord objects*

Description

Returns a random disord object

Usage

```
rdis(n=9)
```

Arguments

n	Set to sample from, as interpreted by `sample()`

Details

A simple `disord` object, intended as a quick "get you going" example

Value

A `disord` object.

Author(s)

Robin K. S. Hankin

Examples

```
rdis()
rdis(99)
rdis(letters)
```

`show` *Print method for disord objects*

Description

Show methods for disords

Usage

```
## S4 method for signature 'disord'
show(x)
disord_show(x)
```

Arguments

x	Object of class disord

Details

The print method simply prints the object's hash and its elements, together with a reminder that the elements are listed in an implementation-specific order. Function `disord_show()` is a helper function, not really intended for the end-user.

Author(s)

Robin K. S. Hankin

Examples

```
print(rdis())

a <- rdis()
print(a)
print(a+100)  # same hash code
```

`summary.disordR` *Summaries of disord objects*

Description

A summary method for disord objects, and a print method for summaries.

Usage

```
## S4 method for signature 'disord'
summary(object, ...)
## S4 method for signature 'disindex'
summary(object, ...)
## S3 method for class 'summary.disord'
print(x, ...)
```

Arguments

`object`, `x`	Object of class `disord`
`...`	Further arguments, currently ignored

Details

A `summary.disord` object is summary of a `disord` object `x`: a list with first element being the `hash(x)` and the second being `summary(elements(x))`. The print method is just a wrapper for this.

Author(s)

Robin K. S. Hankin

Examples

```
summary(rdis(1000))
```

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