Package 'intrval'

May 20, 2024

Type Package

Title Relational Operators for Intervals

Version 0.1-3

Date 2024-05-19

Author Peter Solymos

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Description Evaluating if values
of vectors are within different open/closed intervals
(`x %[]% c(a, b)`), or if two closed
intervals overlap (`c(a1, b1) %[]o[]% c(a2, b2)`).
Operators for negation and directional relations also implemented.

License GPL-2

URL https://github.com/psolymos/intrval

BugReports https://github.com/psolymos/intrval/issues

LazyLoad yes

NeedsCompilation no

Repository CRAN

Date/Publication 2024-05-20 12:30:15 UTC

R topics documented:

intrval-package *Relational Operators for Intervals*

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Details

The DESCRIPTION file:

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LazyLoad:	yes
LazyData:	true

Index of help topics:

Relational operators for value-to-interval comparisons: `%[]%` and alikes.

Relational operators for interval-to-interval comparisons: `%[o]%` and alikes.

Negated value matching: `%ni%`.

Author(s)

Peter Solymos

Maintainer: Peter Solymos <psolymos@gmail.com>

intrval *Relational Operators Comparing Values to Intervals*

Description

Functions for evaluating if values of vectors are within intervals.

Usage

```
x %[]% interval
x %)(% interval
x %[<]% interval
x %[>]% interval

x %[)% interval
x %)[% interval
x %[<)% interval
x %[>)% interval

x %(]% interval
x %](% interval
x %(<]% interval
x %(>]% interval

x %()% interval
x %][% interval
x %(<)% interval
x %(>)% interval

intrval_types(type = NULL, plot = FALSE)
```

Arguments

x	vector or NULL: the values to be compared to interval endpoints.
interval	vector, 2-column matrix, list, or NULL: the interval end points.
type	character, type of operator for subsetting the results. The default NULL means that all types will be displayed.
plot	logical, whether to plot the results, or print a table to the console instead.

Details

Values of x are compared to interval endpoints a and b (a <= b). Endpoints can be defined as a vector with two values (c(a, b)): these values will be compared as a single interval with each value in x. If endpoints are stored in a matrix-like object or a list, comparisons are made element-wise. If lengths do not match, shorter objects are recycled. These value-to-interval operators work for numeric (integer, real) and ordered vectors, and object types which are measured at least on ordinal

scale (e.g. dates), see Examples. Note: interval endpoints are sorted internally thus ensuring the condition a <= b is not necessary.

The `type` argument or the specification of the special function determines the open (`(` and `)`) or closed (`[` and `]`) endpoints and relations.

There are four types of intervals (`[]`, `[)`, `(]`, `()`), their negation `)(`, `)[`, `](`, `][`, respectively), less than (`[<]`, `[<)`, `(<]`, `(<)`), and greater than (`[>]`, `[>)`, `(>]`, `(>)`) relations.

Note that some operators return identical results but are syntactically different: `%[<]%` and `%[<)%` both evaluate `x < a`; `%[>]%` and `%(>]%` both evaluate `x > b`; `%(<]%` and `%(<)%` evaluate `x <= a`; `%[>)%` and `%(>)%` both evaluate `x >= b`. This is so because we evaluate only one end of the interval but still conceptually referring to the relationship defined by the right-hand-side `interval` object and given that a <= b. This implies 2 conditional logical evaluations instead of treating it as a single 3-level ordered factor.

Value

A logical vector, indicating if `x` is in the specified interval. Values are `TRUE`, `FALSE`, or `NA` (when any of the 3 values (`x` or endpoints in `interval`) are `NA`).

The helper function `intrval_types` can be used to understand and visualize the operators' effects. It returns a matrix explaining the properties of the operators.

Author(s)

Peter Solymos <solymos@ualberta.ca>

See Also

See help page for relational operators: `Comparison`.

See `%[o]%` for relational operators for interval-to-interval comparisons.

See `factor` for the behavior with factor arguments. See also `%in%` for value matching and `%ni%` for negated value matching for factors.

See `Syntax` for operator precedence.

Examples

```
## motivating example from example(lm)

## Annette Dobson (1990) "An Introduction to Generalized Linear Models".
## Page 9: Plant Weight Data.
ctl <- c(4.17,5.58,5.18,6.11,4.50,4.61,5.17,4.53,5.33,5.14)
trt <- c(4.81,4.17,4.41,3.59,5.87,3.83,6.03,4.89,4.32,4.69)
group <- gl(2, 10, 20, labels = c("Ctl","Trt"))
weight <- c(ctl, trt)
lm.D9 <- lm(weight ~ group)
## compare 95% confidence intervals with 0
(CI.D9 <- confint(lm.D9))
0 %[]% CI.D9

## comparing dates
```

```
DATE <- as.Date(c("2000-01-01","2000-02-01", "2000-03-31"))
DATE %[<]% as.Date(c("2000-01-151", "2000-03-15"))
DATE %[]% as.Date(c("2000-01-151", "2000-03-15"))
DATE %[>]% as.Date(c("2000-01-151", "2000-03-15"))

## interval formats

x <- rep(4, 5)
a <- 1:5
b <- 3:7
cbind(x=x, a=a, b=b)
x %[]% cbind(a, b) # matrix
x %[]% data.frame(a=a, b=b) # data.frame
x %[]% list(a, b) # list

## helper functions

intrval_types() # print
intrval_types(plot = TRUE) # plot

## graphical examples

## bounding box
set.seed(1)
n <- 10^4
x <- runif(n, -2, 2)
y <- runif(n, -2, 2)
iv1 <- x %[]% c(-1, 1) & y %[]% c(-1, 1)
plot(x, y, pch = 19, cex = 0.25, col = iv1 + 1, main = "Bounding box")

## time series filtering
x <- seq(0, 4*24*60*60, 60*60)
dt <- as.POSIXct(x, origin="2000-01-01 00:00:00")
f <- as.POSIXlt(dt)$hour %[]% c(0, 11)
plot(sin(x) ~ dt, type="l", col="grey",
    main = "Filtering date/time objects")
points(sin(x) ~ dt, pch = 19, col = f + 1)

## watch precedence
(2 * 1:5) %[]% (c(2, 3) * 2)
2 * 1:5 %[]% (c(2, 3) * 2)
(2 * 1:5) %[]% c(2, 3) * 2
2 * 1:5 %[]% c(2, 3) * 2
```

---

ovrlap *Relational Operators Comparing Two Intervals*

Description

Functions for evaluating if two intervals overlap or not.

Usage

```
interval1 %[o]% interval2
interval1 %)o(% interval2
interval1 %[<o]% interval2
interval1 %[o>]% interval2

interval1 %(o)% interval2
interval1 %]o[% interval2
interval1 %(<o)% interval2
interval1 %(o>)% interval2

interval1 %[]o[]% interval2
interval1 %[]o()% interval2
interval1 %[]o(]% interval2
interval1 %[]o()% interval2
interval1 %()o[]% interval2
interval1 %()o()% interval2
interval1 %()o(]% interval2
interval1 %()o()% interval2
interval1 %(]o[]% interval2
interval1 %(]o()% interval2
interval1 %(]o(]% interval2
interval1 %(]o()% interval2
interval1 %()o[]% interval2
interval1 %()o()% interval2
interval1 %()o(]% interval2
interval1 %()o()% interval2
```

Arguments

`interval1, interval2`
: vector, 2-column matrix, list, or `NULL`: the interval end points of two (sets) of closed intervals to compare.

Details

The operators define the open/closed nature of the lower/upper limits of the intervals on the left and right hand side of the `o` in the middle.

The overlap of two closed intervals, [a1, b1] and [a2, b2], is evaluated by the `%[o]%` (alias for `%[]o[]%`) operator (a1 <= b1, a2 <= b2). Endpoints can be defined as a vector with two values (`c(a1, b1)`)or can be stored in matrix-like objects or a lists in which case comparisons are made element-wise. If lengths do not match, shorter objects are recycled. These value-to-interval operators work for numeric (integer, real) and ordered vectors, and object types which are measured at least on ordinal scale (e.g. dates), see Examples. Note: interval endpoints are sorted internally thus ensuring the conditions a1 <= b1 and a2 <= b2 is not necessary. `%)o(%` is used for the negation of two closed interval overlap, directional evaluation is done via the operators `%[<o]%` and `%[o>]%`.

The overlap of two open intervals is evaluated by the `%(o)%` (alias for `%()o()%`). `%]o[%` is used for the negation of two open interval overlap, directional evaluation is done via the operators `%(<o)%`

and %(o>)%.

Overlap operators with mixed endpoint do not have negation and directional counterparts.

Value

A logical vector, indicating if interval1 overlaps interval2. Values are TRUE, FALSE, or NA.

Author(s)

Peter Solymos <solymos@ualberta.ca>

See Also

See help page for relational operators: Comparison.

See %[]% for relational operators for value-to-interval comparisons.

See factor for the behavior with factor arguments. See also %in% for value matching and %ni% for negated value matching for factors.

See Syntax for operator precedence.

Examples

```
## motivating examples from example(lm)

## Annette Dobson (1990) "An Introduction to Generalized Linear Models".
## Page 9: Plant Weight Data.
ctl <- c(4.17,5.58,5.18,6.11,4.50,4.61,5.17,4.53,5.33,5.14)
trt <- c(4.81,4.17,4.41,3.59,5.87,3.83,6.03,4.89,4.32,4.69)
group <- gl(2, 10, 20, labels = c("Ctl","Trt"))
weight <- c(ctl, trt)
lm.D90 <- lm(weight ~ group - 1) # omitting intercept
## compare 95% confidence of the 2 groups to each other
(CI.D90 <- confint(lm.D90))
CI.D90[1,] %[o]% CI.D90[2,]

## simple interval comparisons
c(2:3) %[o]% c(0:1)

## vectorized comparisons
c(2:3) %[o]% list(0:4, 1:5)
c(2:3) %[o]% cbind(0:4, 1:5)
c(2:3) %[o]% data.frame(a=0:4, b=1:5)
list(0:4, 1:5) %[o]% c(2:3)
cbind(0:4, 1:5) %[o]% c(2:3)
data.frame(a=0:4, b=1:5) %[o]% c(2:3)

list(0:4, 1:5) %[o]% cbind(rep(2,5), rep(3,5))
cbind(rep(2,5), rep(3,5)) %[o]% list(0:4, 1:5)

cbind(rep(3,5),rep(4,5)) %)o(% cbind(1:5, 2:6)
cbind(rep(3,5),rep(4,5)) %[<o]% cbind(1:5, 2:6)
cbind(rep(3,5),rep(4,5)) %[o>]% cbind(1:5, 2:6)
```

```
## open intervals

list(0:4, 1:5) %(o)% cbind(rep(2,5), rep(3,5))
cbind(rep(2,5), rep(3,5)) %(o)% list(0:4, 1:5)

cbind(rep(3,5),rep(4,5)) %]o[% cbind(1:5, 2:6)
cbind(rep(3,5),rep(4,5)) %(<o)% cbind(1:5, 2:6)
cbind(rep(3,5),rep(4,5)) %(o>)% cbind(1:5, 2:6)

dt1 <- as.Date(c("2000-01-01", "2000-03-15"))
dt2 <- as.Date(c("2000-03-15", "2000-06-07"))

dt1 %[]o[]% dt2
dt1 %[]o[)% dt2
dt1 %[]o(]% dt2
dt1 %[]o()% dt2
dt1 %[)o[]% dt2
dt1 %[)o[)% dt2
dt1 %[)o(]% dt2
dt1 %[)o()% dt2
dt1 %(]o[]% dt2
dt1 %(]o[)% dt2
dt1 %(]o(]% dt2
dt1 %(]o()% dt2
dt1 %()o[]% dt2
dt1 %()o[)% dt2
dt1 %()o(]% dt2
dt1 %()o()% dt2

## watch precedence
(2 * c(1, 3)) %[o]% (c(2, 4) * 2)
(2 * c(1, 3)) %[o]% c(2, 4) * 2
2 * c(1, 3) %[o]% (c(2, 4) * 2)
2 * c(1, 3) %[o]% c(2, 4) * 2
```

`%[c]%` *Dividing a Range Into 3 Intervals*

Description

Functions for evaluating if values of vectors are within intervals, or less than or higher than interval endpoints. The c within the brackets refer to `cut`, a similar function.

Usage

```
x %[c]% interval
x %[c)% interval
x %(c]% interval
x %(c)% interval
```

Arguments

x	vector or NULL: the values to be compared to interval endpoints.
interval	vector, 2-column matrix, list, or NULL: the interval end points.

Value

Values of x are compared to interval endpoints a and b (a <= b) (see %[]% for details). The functions return an integer vector taking values -1L (value of x is less than or equal to a, depending on the interval type), 0L (value of x is inside the interval), or 1L (value of x is greater than or equal to b, depending on the interval type).

Author(s)

Peter Solymos <solymos@ualberta.ca>

See Also

Similar functions (but not quite): sign, cut, .bincode, findInterval.

See relational operators for intervals: %[]%.

See Syntax for operator precedence.

Examples

```
x <- 1:5
x %[c]% c(2,4)
x %[c)% c(2,4)
x %(c]% c(2,4)
x %(c)% c(2,4)
```

%ni% *Negated Value Matching*

Description

%ni% is the negation of %in%, which returns a logical vector indicating if there is a non-match or not for its left operand. %nin% and %notin% are aliases for better code readability (%in% can look very much like %ni%).

Usage

```
x %ni% table
x %nin% table
x %notin% table
```

Arguments

x	vector or NULL: the values to be matched.
table	vector or NULL: the values to be matched against.

Value

A logical vector, indicating if a non-match was located for each element of `x`: thus the values are `TRUE` or `FALSE` and never `NA`.

Author(s)

Peter Solymos <solymos@ualberta.ca>

See Also

All the opposite of what is written for `%in%`.

See relational operators for intervals: `%[]%`.

See `Syntax` for operator precedence.

Examples

```
1:10 %ni% c(1,3,5,9)
1:10 %nin% c(1,3,5,9)
1:10 %notin% c(1,3,5,9)

sstr <- c("c","ab","B","bba","c",NA,"@","bla","a","Ba","%")
sstr[sstr %ni% c(letters, LETTERS)]
```

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