

# Package ‘chron’

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**Title** Chronological Objects which can Handle Dates and Times

**Description** Provides chronological objects which can handle dates and times.

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**Imports** graphics, stats

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**Enhances** zoo

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chron *Create a Chronological Object*

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**Description**

Create chronological objects which represent dates and times of day.

**Usage**

```
chron(dates., times., format = c(dates = "m/d/y", times = "h:m:s"),
      out.format, origin.)
```

**Arguments**

- dates.** character or numeric vector specifying dates. If character, `dates.` are assumed to be in one of the date formats below; if numeric, `dates.` are assumed to be Julian dates, i.e., number of days since `origin.`
- times.** optional character or numeric vector specifying times of day. If character, `times.` are assumed to be in one of the time formats below; if numeric, `times.` are assumed to be fractions of a day.
- format** vector or list specifying the input format of the input. The format can be either strings specifying one of the recognized formats below or a list of user-supplied functions to convert dates from character into Julian dates and vice versa. The dates format can be any permutation of the characters "d", "m", or "y" delimited by a separator (possibly null), e.g., "m/d/y", "d-m-y", "ymd", are all valid; the format can also be permutations of the words "day", "month" and "year" (with non-null separator), which produces the month name, e.g., "month day year" produces "April 20 1992", "day mon year" produces "20 Apr 1992". The times format can be any permutation of "h", "m", and "s" separated by any one non-special character. The default is "h:m:s".
- out.format** vector or list specifying date and time format for printing and output. Default is same as `format`.
- origin.** a vector specifying the date with respect to which Julian dates are computed. Default is `c(month = 1, day = 1, year = 1970)`; you may set the option `chron.origin` to specify your own default, e.g., `options(chron.origin = c(month=1, day=1, year=`

**Value**

An object of class "times" if only `times.` were specified, "dates" if only `dates.`, or "chron" if both `dates.` and `times.` were supplied. All these inherit from class "times".

These objects represent dates and times of day, and allow the following arithmetic and summaries: subtraction `d1-d2`, constant addition `d1+constants`, all logical comparisons, summaries `min()`, `max()`, and `range()` (which drop NAs by default); constants specify days (fractions are converted to time-of-day, e.g., 2.5 represents 2 days and 12 hours). Operations such as sorting, differencing, etc., are automatically handled.

There are methods for `as.character()`, `as.numeric()`, `cut()`, `is.na()`, `print()`, `summary()`, `plot()`, `lines()`, `lag()`, and the usual subsetting functions `[]`, `[-`. The functions `days()`, `months()`, `quarters()`, `years()`, `weeks()`, `weekdays()`, `hours()`, `minutes()`, and `seconds()` take any `chron` object as input and extract the corresponding time interval. `cut()` is used to create ordered factors from `chron` objects. Chronological objects may be used with the modeling software.

If `x` is character then it will be converted using `as.POSIXct` (with the `format` argument, if any, passed to `as.POSIXct`) and `tz = "GMT"` and then converted to `chron`. If `x` is numeric and `format` is not specified then it will be converted to `chron` using `chron(x)`. If `x` is numeric and `format` is specified then `x` will be converted to character and then processed using `as.POSIXct` as discussed above. If the `format` is specified as `NULL` it will be treated the same as if it were missing.

The current implementation of `chron` objects does not handle time zones nor daylight savings time.

### See Also

[dates](#), [times](#), [julian.default](#), [cut.dates](#), [seq.dates](#).

### Examples

```
dts <- dates(c("02/27/92", "02/27/92", "01/14/92",
              "02/28/92", "02/01/92"))

dts
# [1] 02/27/92 02/27/92 01/14/92 02/28/92 02/01/92
tms <- times(c("23:03:20", "22:29:56", "01:03:30",
              "18:21:03", "16:56:26"))

tms
# [1] 23:03:20 22:29:56 01:03:30 18:21:03 16:56:26
x <- chron(dates = dts, times = tms)
x
# [1] (02/27/92 23:03:19) (02/27/92 22:29:56) (01/14/92 01:03:30)
# [4] (02/28/92 18:21:03) (02/01/92 16:56:26)

# We can add or subtract scalars (representing days) to dates or
# chron objects:
c(dts[1], dts[1] + 10)
# [1] 02/27/92 03/08/92
dts[1] - 31
# [1] 01/27/92

# We can subtract dates which results in a times object that
# represents days between the operands:
dts[1] - dts[3]
# Time in days:
# [1] 44

# Logical comparisons work as expected:
dts[dts > "01/25/92"]
# [1] 02/27/92 02/27/92 02/28/92 02/01/92
dts > dts[3]
# [1] TRUE TRUE FALSE TRUE TRUE

# Summary operations which are sensible are permitted and work as
```

```

# expected:
range(dts)
# [1] 01/14/92 02/28/92
diff(x)
# Time in days:
# [1] -0.02319444 -44.89335648 45.72052083 -27.05876157
sort(dts)[1:3]
# [1] 01/14/92 02/01/92 02/27/92

```

---

cut.dates

---

*Create a Factor from a Chron or Dates Object*


---

### Description

Divide the range of a chron or dates object `x` into intervals and code the values in `x` according to which interval they fall.

### Usage

```

## S3 method for class 'dates'
cut(x, breaks, labels, start.on.monday = TRUE, ...)

```

### Arguments

<code>x</code>	chron or dates object (see <code>chron</code> ), character dates such as "10/04/91" or Julian dates).
<code>breaks</code>	either a vector of break points (a dates vector, character dates such as "10/04/91" or Julian dates), a constant specifying number of equally spaced intervals extending from <code>min(x)-1</code> to <code>max(x)+1</code> , or one of the strings in <code>c("days", "weeks", "months", "year")</code> specifying a time period.
<code>labels</code>	character labels for intervals.
<code>start.on.monday</code>	should weeks be assumed to start on Mondays? Default is TRUE. Set to FALSE if weeks start on Sundays; for other days of the week specify the corresponding number: Sunday == 0, Monday == 1, Tuesday == 2, ..., Saturday == 6.
<code>...</code>	further arguments to be passed to or from methods.

### Value

an ordered factor whose levels represent the various time intervals.

### See Also

[seq.dates](#)

## Examples

```
# days from 07/01/92 thru 07/15/92 fell into 3 Monday-started weeks
cut(dates("07/01/92") + 0:14, "weeks")
# [1] week 1 week 1 week 1 week 1 week 1 week 2 week 2 week 2
# [9] week 2 week 2 week 2 week 2 week 3 week 3 week 3

dts <- dates(c("02/27/92", "02/27/92", "01/14/92",
              "02/28/92", "02/01/92"))
cut(dts, "months")
# [1] Feb 92 Feb 92 Jan 92 Feb 92 Feb 92
boxplot(runif(5) ~ cut(dts, "months"))
```

---

dates

*Generate Dates and Times Components from Input*

---

## Description

Create objects which represent dates or times.

## Usage

```
dates(x, ...)
times(x, ...)
```

## Arguments

x	a chron object, a character vector, or a numeric vector specifying time. If character, it must be in a format recognized by <code>chron()</code> . If numeric, it specifies Julian dates, i.e., number of days since an origin.
...	parameters for <code>chron()</code> .

## Value

An object of class `dates` or `times`, depending of the function called.

These functions return objects inheriting from `dates` and `times`, respectively. They call `chron()` if `x` does not belong to any of the chronological classes.

## See Also

[chron](#), [times](#), [seq.dates](#), [cut.dates](#)

**Examples**

```
dts <- dates(c("02/27/92", "02/27/92", "01/14/92",
              "02/28/92", "02/01/92"))
dts
# [1] 02/27/92 02/27/92 01/14/92 02/28/92 02/01/92
class(dts)

x <- chron(dates = c("02/27/92", "02/27/92", "01/14/92", "02/28/92"),
           times = c("23:03:20", "22:29:56", "01:03:30", "18:21:03"))
dates(x)
# [1] 02/27/92 02/27/92 01/14/92 02/28/92
```

---

day.of.week

---

*Convert between Julian and Calendar Dates*


---

**Description**

Utility functions to convert between Julian dates (numbers of days since an origin, by default 1970-01-01) and calendar dates given by year, month, and day within the month.

**Usage**

```
## Default S3 method:
julian(x, d, y, origin., ...)
month.day.year(jul, origin.)
leap.year(y)
day.of.week(month, day, year)
```

**Arguments**

x, month	vector of month numbers.
d, day	vector of day numbers.
y, year	vector of years.
jul	vector of Julian Dates, i.e., number of days since origin..
origin.	vector specifying the origin as month, day, and year. If missing, it defaults to <code>getOption("chron.origin")</code> if this is non-null, otherwise <code>c(month = 1, day = 1, year = 1970)</code> .
...	further arguments to be passed to or from methods.

**Value**

A vector of Julian dates (number of days since origin.) when `julian()` is called, or a list with members `month`, `day`, `year` corresponding to the input Julian dates if `month.day.year()` is called. `leap.year()` returns a logical vector indicating whether the corresponding year is a leap year. `day.of.week()` returns a number between 0 and 6 to specify day of the week—0 refers to Sunday.

These functions were taken from Becker, Chambers, and Wilks (1988), and were slightly modified to take `chron` and `dates` objects; some also take the extra argument `origin.`

**See Also**[chron](#), [dates](#), [times](#)**Examples**

```

julian(1, 1, 1970)
# [1] 0
unlist(month.day.year(0))
# month day year
#    1    1 1970

```

---

**days***Return Various Periods from a Chron or Dates Object*

---

**Description**

Given a `chron` or `dates` object, extract the year, quarter, month, day (within the month) or weekday (days within the week) of the date it represents.

**Usage**

```

days(x)
## Default S3 method:
weekdays(x, abbreviate = TRUE)
## Default S3 method:
months(x, abbreviate = TRUE)
## Default S3 method:
quarters(x, abbreviate = TRUE)
years(x)

```

**Arguments**

`x` an object inheriting from class `"dates"`, or coercible to such via `as.chron`.

`abbreviate` should abbreviated names be returned? Default is `TRUE`.

**Details**

Note that `months`, `quarters` and `weekdays` are generics defined in package `base` which also provides methods for objects of class `"Date"` as generated, e.g., by `Sys.Date`. These methods return `character` rather than `factor` variables as the default methods in `chron` do. To take advantage of the latter, `Date` objects can be converted to `dates` objects using `as.chron`, see the examples.

**Value**

an ordered factor corresponding to days, weekdays, months, quarters, or years of `x` for the respective function.

**See Also**

[is.weekend](#), [is.holiday](#)

**Examples**

```
dts <- dates("07/01/78") + trunc(50 * rnorm(30))
plot(weekdays(dts))
plot(months(dts))

## The day in the current timezone as a Date object.
Dt <- Sys.Date()
## Using the months method for Date objects.
months(Dt)
## Using the months default method.
months(as.chron(Dt))
```

---

format.chron	<i>Format a chron object</i>
--------------	------------------------------

---

**Description**

Format a chron object.

**Usage**

```
## S3 method for class 'chron'
format(x, format = att$format, origin. = att$origin,
       sep = " ", simplify, enclosed = c("(", ")"), ...)
```

**Arguments**

x	A chron object.
format	As in <a href="#">chron</a> or a single character string with percent codes as detailed in <a href="#">strptime</a> .
origin.	As in <a href="#">chron</a> .
sep	A character string that separates the dates and times in the output. Ignored if percent codes are used in format.
simplify	As in <a href="#">format.dates</a> . Ignored if percent codes are used in format.
enclosed	A character vector of length 2 containing the strings that begin and end each output date/time. Ignored if percent codes are used in format.
...	Not currently used.

**Value**

A character vector.



**See Also**

[chron.format.dates.strptime.](#)

**Examples**

```
format(chron(0, 0), c("yy/m/d", "h:m:s"), sep = "T", enclose = c("", ""))
format(chron(0, 0), "%Y-%m-%dT%H:%M:%S") # same
```

---

hours

*Return Hours, Minutes, or Seconds from a Times Object*

---

**Description**

Given a `chron` or `times` object, extract the hours, minutes or seconds of the time it represents.

**Usage**

```
hours(x)
minutes(x)
seconds(x)
```

**Arguments**

`x` an object inheriting from class `"times"`, or coercible to such via [as.chron](#).

**Value**

the corresponding time period as an ordered factor.

**See Also**

[chron](#), [dates](#), [times](#)

**Examples**

```
x <- chron(dates = c("02/27/92", "02/27/92", "01/14/92", "02/28/92"),
           times = c("23:03:20", "22:29:56", "01:03:30", "18:21:03"))
h <- hours(x)
y <- runif(4)
boxplot(y ~ h)
```

---

 is.holiday

*Find Weekends and Holidays in a Chron or Dates Object*


---

### Description

Determine the date represented by a chron or dates object is a weekend or a holiday.

### Usage

```
is.weekend(x)
is.holiday(x, holidays)
.Holidays
```

### Arguments

x	an object inheriting from "dates", or coercible to "chron".
holidays	optional "chron" or "dates" object listing holidays. If argument holidays is missing, either the value of the object .Holidays (if it exists) or NULL will be used.

### Value

a logical object indicating whether the corresponding date is a weekend in the case of is.weekend() or a holiday in the case of is.holiday().

### See Also

[days](#), [weekdays.default](#), [months.default](#), [quarters.default](#), [years](#); [chron](#), [dates](#), [cut.dates](#), [seq.dates](#)

### Examples

```
dts <- dates("01/01/98") + trunc(365 * runif(50))
table(is.weekend(dts))

.Holidays
# New Year Memorial Indepen. Labor day Thanksgiving Christmas
# 01/01/92 05/25/92 07/04/92 09/07/92 11/26/92 12/25/92
# NOTE: Only these 6 holidays from 1992 are defined by default!
```

**Description**

`chron_trans` is a **ggplot2** transformer for `chron`. `scale_x_chron` and `scale_y_chron` are **ggplot2** scales.

**Usage**

```
chron_trans(format = "%Y-%m-%d", n = 5)
scale_x_chron(..., format = "%Y-%m-%d", n = 5)
scale_y_chron(..., format = "%Y-%m-%d", n = 5)
```

**Arguments**

`format` format string as described in [strptime](#).  
`n` Approximate number of axis ticks.  
`...` Passed to [scale\\_x\\_continuous](#).

**Examples**

```
if(require("ggplot2")) {
  dd <- data.frame(tt = chron(1:10), value = 101:110)
  p <- ggplot(dd, aes(tt, value)) +
    geom_point() + scale_x_chron(format = "%m-%d")
  print(p)
}
```

**Description**

Generate a regular sequence of dates.

**Usage**

```
## S3 method for class 'dates'
seq(from, to, by = "days", length., ...)
```

**Arguments**

from	starting date; it can be a chron or dates object, a character string, e.g., "05/23/91", or a Julian date.
to	ending date, like from.
by	either a numeric value or one of the valid strings "days", "weeks", "months", or "years".
length.	optional number of elements in the sequence.
...	further arguments to be passed to or from methods.

**Value**

a sequence with values (from, from + by, from + 2\*by, ..., to) of class class(from) and origin origin(from). Note that from must be less than or equal to the argument to.

**See Also**

[chron](#), [dates](#), [cut.dates](#)

**Examples**

```
seq.dates("01/01/92", "12/31/92", by = "months")
# [1] 01/01/92 02/01/92 03/01/92 04/01/92 05/01/92 06/01/92
# [7] 07/01/92 08/01/92 09/01/92 10/01/92 11/01/92 12/01/92

end.of.the.month <- seq.dates("02/29/92", by = "month", length = 15)
end.of.the.month
# [1] 02/29/92 03/31/92 04/30/92 05/31/92 06/30/92 07/31/92
# [7] 08/31/92 09/30/92 10/31/92 11/30/92 12/31/92 01/31/93
# [13] 02/28/93 03/31/93 04/30/93
```

---

trunc.times

*Truncate times Objects*


---

**Description**

Truncate times objects.

**Usage**

```
## S3 method for class 'times'
trunc(x, units = "days", eps = 1e-10, ...)
```

**Arguments**

x	a "times" object.
units	Can be one of "days", "hours", "minutes", "seconds" or an unambiguous abbreviated version of any of those.
eps	Comparison tolerance. Times are considered equal if their absolute difference is less than eps.
...	further arguments to be passed to or from methods.

**Details**

The time is truncated to the second, minute, hour or day or to the value specified.

There is also a round method which has the same arguments as the trunc method, and performs rounding instead of truncation.

**Value**

An object of class "times".

**See Also**

[trunc](#) for the generic function and default methods.

**Examples**

```
tt <- times(c("12:13:14", "15:46:17"))
trunc(tt, "minutes")
trunc(tt, "min")
trunc(tt, times("00:01:00"))
trunc(tt, "00:01:00")
trunc(tt, 1/(24*60))

tt2 <- structure(c(3.0, 3.1, 3.5, 3.9), class = "times")
trunc(tt2, "day")
trunc(tt2)
```

---

yearmon

*Convert monthly or quarterly data to chron*


---

**Description**

These functions can be used to convert the times of "ts" series with frequency of 12 or 4 or objects of "yearmon" and "yearqtr" class, as defined in the "**zoo**" package, to chron dates.

**Usage**

```
## S3 method for class 'yearmon'
as.chron(x, frac = 0, holidays = FALSE, ...)
## S3 method for class 'yearqtr'
as.chron(x, frac = 0, holidays = FALSE, ...)
## S3 method for class 'ts'
as.chron(x, frac = 0, holidays = FALSE, ...)
```

**Arguments**

x	an object of class "yearmon" or "yearqtr" or "ts" objects, or a numeric vector interpreted "in years" and fractions of years.
frac	Number between zero and one inclusive representing the fraction of the way through the month or quarter.
holidays	If TRUE or a vector of chron dates, indicated holidays and weekends are excluded so the return value will be a non-holiday weekday.
...	Other arguments passed to <a href="#">chron</a> .

**Details**

The "yearmon" and "yearqtr" classes are defined in package **zoo**. If holidays is TRUE or a vector of dates then the `is.holiday` function is used to determine whether days are holidays.

The method for ts objects converts the times corresponding to `time(x)` to `chron`. The ts series must have a frequency that is a divisor of 12.

**Value**

Returns a `chron` object.

**See Also**

[is.holiday](#), [ts](#)

**Examples**

```
## Monthly time series data.
as.chron(AirPassengers)
as.chron(time(AirPassengers))
## convert to first day of the month that is not a weekend or holiday
as.chron(AirPassengers, frac = 0, holidays = TRUE)
## convert to last day of the month
as.chron(AirPassengers, frac = 1)
## convert to last day of the month that is not a weekend or holiday
as.chron(AirPassengers, frac = 1, holidays = TRUE)
## convert to last weekday of the month
as.chron(AirPassengers, frac = 1, holidays = c())

## Quarterly time series data.
as.chron(presidents)
as.chron(time(presidents))
```

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