

R Reference Card

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Help

Most R functions have online documentation.

help(topic) documentation on *topic*

?*topic* *id*.

help.search("topic") search the help system

apropos("topic") the names of all objects in the search list matching the regular expression "topic"

help.start() start the HTML version of help

Fundamentals

<- assign to an object, equivalent to **=(?)**

<<- lexical assignment (*NOT* global assignment)

getwd() get the working directory

setwd() set the working directory

system() call the operating system (shell)

system.time() time an evaluation

Sys.sleep() pause

str(a) display the internal *str*ucture of an R object *a*

summary(a) gives a "summary" of *a*, usually a statistical summary but it is *generic* meaning it has different operations for different classes of *a*

ls() show objects in the search path; specify *pat*="pat" to search on a pattern

ls.str() str() for each variable in the search path

dir() show files in the current directory

methods(a) shows S3 methods of *a*

methods(class=class(a)) lists all the methods to handle objects of class *a*

Input and output

load() load the datasets written with **save**

data(x) loads specified data sets

library(x) load add-on packages

read.table(file) reads a file in table format and creates a data frame from it; the default separator *sep*=" " is any whitespace; use *header*=TRUE to read the first line as a header of column names; use *as.is*=TRUE to prevent character vectors from being converted to factors; use *comment.char*=" " to prevent "#" from being interpreted as a comment; use *skip*=*n* to skip *n* lines before reading data; see the help for options on row naming, NA treatment, and others

read.csv("filename", header=TRUE) *id.* but with defaults set for reading comma-delimited files

read.delim("filename", header=TRUE) *id.* but with defaults set for reading tab-delimited files

read.fwf(file, widths, header=FALSE, sep=" ", as.is=FALSE) read a table of *fixed width* formatted data into a 'data.frame'; *widths* is an integer vector, giving the widths of the fixed-width fields

save(file, ...) saves the specified objects (...) in the XDR platform-independent binary format

save.image(file) saves all objects

cat(..., file="", sep=" ") prints the arguments after coercing to character; *sep* is the character separator between arguments

print(a, ...) prints its arguments; *generic*, meaning it can have different methods for different objects

format(x, ...) format an R object for pretty printing

write.table(x, file="", row.names=TRUE, col.names=TRUE, sep=" ") prints *x* after converting to a data frame; if *quote* is TRUE, character or factor columns are surrounded by quotes (""); *sep* is the field separator; *eol* is the end-of-line separator; *na* is the string for missing values; use *col.names*=NA to add a blank column header to get the column headers aligned correctly for spreadsheet input

sink(file) output to file, until **sink()**

Most of the I/O functions have a *file* argument. This can often be a character string naming a file or a connection. *file*="" means the standard input or output. Connections can include files, pipes, zipped files, and R variables.

On windows, the file connection can also be used with *description* = "clipboard". To read a table copied from Excel, use

x <- read.delim("clipboard")

To write a table to the clipboard for Excel, use

write.table(*x*, "clipboard", *sep*="\t", *col.names*=NA)

For database interaction, see packages RODBC, DBI, RMySQL, RPgSQL, and ROracle. See packages XML, hdf5, netCDF for reading other file formats.

Data creation

c(...) *generic* function to combine arguments with the default forming a vector; with *recursive*=TRUE descends through lists combining all elements into one vector

from:to generates a sequence; ":" has operator priority; 1:4 + 1 is "2,3,4,5"

seq(from,to) generates a sequence by= specifies increment; length= specifies desired length

seq(along=x) generates 1, 2, ..., length(along); useful for for loops

rep(x,times) replicate *x* *times*; use *each*= to repeat "each" element of *x* each *times*; rep(c(1,2,3),2) is 1 2 3 1 2 3; rep(c(1,2,3),each=2) is 1 1 2 2 3 3

data.frame(...) create a data frame of the named or unnamed arguments; data.frame(*v*=1:4, *ch*=c("a", "B", "c", "d"), *n*=10); shorter vectors are recycled to the length of the longest

list(...) create a list of the named or unnamed arguments; list(*a*=c(1,2), *b*="hi", *c*=3*i*);

array(x,dim=) array with data *x*; specify dimensions like *dim*=c(3,4,2); elements of *x* recycle if *x* is not long enough

matrix(x,nrow=,ncol=) matrix; elements of *x* recycle

factor(x,levels=) encodes a vector *x* as a factor

gl(n,k,length=n*k,labels=1:n) generate levels (factors) by specifying the pattern of their levels; *k* is the number of levels, and *n* is the number of replications

expand.grid() a data frame from all combinations of the supplied vectors or factors

rbind(...) combine arguments by rows for matrices, data frames, and others

cbind(...) *id.* by columns

Slicing and extracting data

Indexing vectors

x[*n*]

x[-*n*]

x[1:*n*]

x[-(1:*n*)]

x[c(1,4,2)]

x["name"]

x[*x* > 3]

x[*x* > 3 & *x* < 5]

x[*x* %in% c("a", "and", "the")]

Indexing lists

x[*n*] list with elements *n*

x[[*n*]] *n*th element of the list

x[["name"]] element of the list named "name"

x\$*name* *id.*

Indexing matrices

x[*i*,*j*] element at row *i*, column *j*

x[*i*,] row *i*

x[, *j*] column *j*

x[,c(1,3)] columns 1 and 3

x["name",] row named "name"

Indexing data frames (matrix indexing plus the following)

x[["name"]] column named "name"

x\$*name* *id.*

*n*th element

all *but* the *n*th element

first *n* elements

elements from *n*+1 to the end

specific elements

element named "name"

all elements greater than 3

all elements between 3 and 5

elements in the given set

Variable conversion

as.array(x), as.list(x), as.data.frame(x), as.numeric(x), as.logical(x), as.complex(x), as.character(x), etc ... convert type; for a complete list, use methods(*as*)

Variable information

is.na(x), is.null(x), is.array(x), is.data.frame(x), is.numeric(x), is.complex(x), is.character(x), ... test for type; for a complete list, use methods(*is*)

any(x) any TRUE elements of *x*?

all(x) all TRUE elements of *x*?

length(x) number of elements in *x*

dim(x) Retrieve or set the dimension of an object; *dim*(*x*) <- c(3,2)

dimnames(x) Retrieve or set the dimension names of an object

nrow(x) number of rows; *NROW*(*x*) is the same but treats a vector as a one-row matrix

ncol(x) and **NCOL(x)** *id.* for columns

class(x) get or set the class of *x*; *class*(*x*) <- "myclass"

unclass(x) remove the class attribute of *x*

attr(x,which) get or set the attribute *which* of *x*

attributes(obj) get or set the list of attributes of *obj*

Data selection and manipulation

which.max(x) returns the index of the greatest element of *x*

which.min(x) returns the index of the smallest element of *x*

rev(x) reverses the elements of *x*

sort(x) sorts the elements of *x* in increasing order; to sort in decreasing order: *rev*(*sort*(*x*))

cut(x,breaks) divides *x* into intervals (factors); *breaks* is the number of cut intervals or a vector of cut points

x %in% y logical vector indicating if there is a match or not for its left operand

match(x, y) returns a vector of the same length than x with the elements of x which are in y (NA otherwise)

which(x == a) returns a vector of the indices of x if the comparison operation is true (TRUE), in this example the values of i for which x[i] == a (the argument of this function must be a variable of mode logical)

choose(n, k) computes the combinations of k events among n repetitions = $n! / [(n - k)!k!]$

combn(n, k) Generate All Combinations of n Elements, Taken m at a Time.

na.omit(x) suppresses the observations with missing data (NA) (suppresses the corresponding line if x is a matrix or a data frame)

na.fail(x) returns an error message if x contains at least one NA

unique(x) if x is a vector or a data frame, returns a similar object but with the duplicate elements suppressed

table(x) returns a table with the numbers of the differents values of x (typically for integers or factors)

subset(x, ...) returns a selection of x with respect to criteria (...), typically comparisons: x\$V1 < 10; if x is a data frame, the option select gives the variables to be kept or dropped using a minus sign

sample(x, size) resample randomly and without replacement size elements in the vector x, the option replace = TRUE allows to resample with replacement

prop.table(x,margin=) table entries as fraction of marginal table

Characters (Strings)

paste(...) concatenate vectors after converting to character; sep= is the string to separate terms (a single space is the default); collapse= is an optional string to separate “collapsed” results

substr(x, start, stop) substrings in a character vector; can also assign, as substr(x, start, stop) <- value

strsplit(x, split) split x according to the substring split

grep(pattern, x) searches for matches to pattern within x; see ?regex

gsub(pattern, replacement, x) replacement of matches determined by regular expression matching sub() is the same but only replaces the first occurrence.

tolower(x) convert to lowercase

toupper(x) convert to uppercase

match(x, table) a vector of the positions of first matches for the elements of x among table

x %in% table id. but returns a logical vector

pmatch(x, table) partial matches for the elements of x among table

nchar(x) number of characters

assign assign a value to a name **get** get a value from a name

eval(parse(text=' 1+1 ')) compute on the language!!

Dates and Times

The class Date has dates without times. POSIXct has dates and times, including time zones. Comparisons (e.g. >), seq(), and difftime() are useful. Date also allows + and -. ?DateTimeClasses gives more information. See also package chron.

as.Date(s) and **as.POSIXct(s)** convert to the respective class; format(dt) converts to a string representation. The default string format is “2001-02-21”. These accept a second argument to specify a format for conversion. Some common formats are:

%a, %A Abbreviated and full weekday name.

%b, %B Abbreviated and full month name.

%d Day of the month (01–31).

%H Hours (00–23).

%I Hours (01–12).

%j Day of year (001–366).

%m Month (01–12).

%M Minute (00–59).

%p AM/PM indicator.

%S Second as decimal number (00–61).

%U Week (00–53); the first Sunday as day 1 of week 1.

%w Weekday (0–6, Sunday is 0).

%W Week (00–53); the first Monday as day 1 of week 1.

%Y Year without century (00–99). Don’t use.

%Y Year with century.

%z (output only.) Offset from Greenwich; -0800 is 8 hours west of.

%Z (output only.) Time zone as a character string (empty if not available).

Where leading zeros are shown they will be used on output but are optional on input. See ?strftime.

as.POSIXct(strptime(, format=))
format()

Math

%%, %/% modulo/quotient, remainder

sin, cos, tan, asin, acos, atan, atan2, log, log10, exp

max(x) maximum of the elements of x

min(x) minimum of the elements of x

range(x) id. then c(min(x), max(x))

sum(x) sum of the elements of x

diff(x) lagged and iterated differences of vector x

prod(x) product of the elements of x

mean(x) mean of the elements of x

median(x) median of the elements of x

quantile(x, probs=) sample quantiles corresponding to the given probabilities (defaults to 0., 25., 5., 75., 1)

weighted.mean(x, w) mean of x with weights w

rank(x) ranks of the elements of x

var(x) or cov(x) variance of the elements of x (calculated on n – 1); if x is a matrix or a data frame, the variance-covariance matrix is calculated

sd(x) standard deviation of x

cor(x) correlation matrix of x if it is a matrix or a data frame (1 if x is a vector)

var(x, y) or cov(x, y) covariance between x and y, or between the columns of x and those of y if they are matrices or data frames

cor(x, y) linear correlation between x and y, or correlation matrix if they are matrices or data frames

round(x, n) rounds the elements of x to n decimals

log(x, base) computes the logarithm of x with base base

scale(x) if x is a matrix, centers and reduces the data; to center only use the option center=FALSE, to reduce only scale=FALSE (by default center=TRUE, scale=TRUE)

pmin(x, y, ...) a vector which ith element is the minimum of x[i], y[i], ...

pmax(x, y, ...) id. for the maximum

cumsum(x) a vector which ith element is the sum from x[1] to x[i]

cumprod(x) id. for the product

cummin(x) id. for the minimum

cummax(x) id. for the maximum

union(x, y), intersect(x, y), setdiff(x, y), setequal(x, y), is.element(el, set) “set” functions

Re(x) real part of a complex number

Im(x) imaginary part

Mod(x) modulus; abs(x) is the same

Arg(x) angle in radians of the complex number

Conj(x) complex conjugate

convolve(x, y) compute the several kinds of convolutions of two sequences

fft(x) Fast Fourier Transform of an array

mvfft(x) FFT of each column of a matrix

filter(x, filter) applies linear filtering to a univariate time series or to each series separately of a multivariate time series

Many math functions have a logical parameter na.rm=FALSE to specify missing data (NA) removal.

Matrices

%o%, **outer()** outer products on arrays

kronecker kronecker products on arrays

t(x) transpose

diag(x) diagonal

%*% matrix multiplication

solve(a, b) solves a %*% x = b for x

solve(a) matrix inverse of a

rowsum(x) sum of rows for a matrix-like object; **rowSums(x)** is a faster version

colsum(x), colSums(x) id. for columns

rowMeans(x) fast version of row means

colMeans(x) id. for columns

Advanced data processing and HOFs

The base apply family of function is standardized and parallelized by the plyr package.

apply(X, INDEX, FUN=) a vector or array or list of values obtained by applying a function FUN to margins (INDEX) of X

lapply(X, FUN) apply FUN to each element of the list X

tapply(X, INDEX, FUN=) apply FUN to each cell of a ragged array given by X with indexes INDEX

by(data, INDEX, FUN) apply FUN to data frame data subsetted by INDEX
The 6 common higher-order functions:

Reduce(f, x, init, right = FALSE, accumulate = FALSE)

Filter(f, x)

Find(f, x, right = FALSE, nomatch = NULL)

Map(f, ...)

Negate(f)

Position(f, x, right = FALSE, nomatch = NA.integer.)
 Others
optimise() One Dimensional Optimization
merge(a, b) merge two data frames by common columns or row names
xtabs(a ~ b, data=x) a contingency table from cross-classifying factors
aggregate(x, by, FUN) splits the data frame x into subsets, computes summary statistics for each, and returns the result in a convenient form; by is a list of grouping elements, each as long as the variables in x
stack(x, ...) transform data available as separate columns in a data frame or list into a single column
unstack(x, ...) inverse of stack()
reshape(x, ...) reshapes a data frame between 'wide' format with repeated measurements in separate columns of the same record and 'long' format with the repeated measurements in separate records; use (direction="wide") or (direction="long")

Optimization and model fitting

optim(par, fn, method = c("Nelder-Mead", "BFGS", "CG", "L-BFGS-B", "SANN")) general-purpose optimization; par is initial values, fn is function to optimize (normally minimize)
nlm(f, p) minimize function f using a Newton-type algorithm with starting values p
lm(formula) fit linear models; formula is typically of the form response termA + termB + ...; use I(x*y) + I(x^2) for terms made of nonlinear components
glm(formula, family=) fit generalized linear models, specified by giving a symbolic description of the linear predictor and a description of the error distribution; family is a description of the error distribution and link function to be used in the model; see ?family
nls(formula) nonlinear least-squares estimates of the nonlinear model parameters
approx(x, y=) linearly interpolate given data points; x can be an xy plotting structure
spline(x, y=) cubic spline interpolation
loess(formula) fit a polynomial surface using local fitting
 Many of the formula-based modeling functions have several common arguments: data= the data frame for the formula variables, subset= a subset of variables used in the fit, na.action= action for missing values: "na.fail", "na.omit", or a function. The following generics often apply to model fitting functions:
predict(fit, ...) predictions from fit based on input data
df.residual(fit) returns the number of residual degrees of freedom
coef(fit) returns the estimated coefficients (sometimes with their standard-errors)
residuals(fit) returns the residuals
deviance(fit) returns the deviance
fitted(fit) returns the fitted values
logLik(fit) computes the logarithm of the likelihood and the number of parameters
AIC(fit) computes the Akaike information criterion or AIC

Statistics

aov(formula) analysis of variance model
anova(fit, ...) analysis of variance (or deviance) tables for one or more fitted model objects

density(x) kernel density estimates of x
binom.test(), pairwise.t.test(), power.t.test(), prop.test(), t.test(), ... use help.search("test")

Distributions

rnorm(n, mean=0, sd=1) Gaussian (normal)
rexp(n, rate=1) exponential
rgamma(n, shape, scale=1) gamma
rpois(n, lambda) Poisson
rweibull(n, shape, scale=1) Weibull
rcauchy(n, location=0, scale=1) Cauchy
rbeta(n, shape1, shape2) beta
rt(n, df) 'Student' (t)
rf(n, df1, df2) Fisher-Snedecor (F) (χ^2)
rchisq(n, df) Pearson
rbinom(n, size, prob) binomial
rgeom(n, prob) geometric
rhyper(nn, m, n, k) hypergeometric
rlogis(n, location=0, scale=1) logistic
rlnorm(n, meanlog=0, sdlog=1) lognormal
rnbinom(n, size, prob) negative binomial
runif(n, min=0, max=1) uniform
rwilcox(nn, m, n), rsignrank(nn, n) Wilcoxon's statistics
 All these functions can be used by replacing the letter r with d, p or q to get, respectively, the probability density (dfunc(x, ...)), the cumulative probability density (pfunc(x, ...)), and the value of quantile (qfunc(p, ...)), with 0 < p < 1).

Programming

function(arglist) expr function definition
return(value)
if(cond) expr
if(cond) cons.expr else alt.expr
for(var in seq) expr
while(cond) expr
repeat expr
break
next
 Use braces {} around statements
ifelse(test, yes, no) a value with the same shape as test filled with elements from either yes or no
do.call(funname, args) executes a function call from the name of the function and a list of arguments to be passed to it

Plotting

plot(x) plot of the values of x (on the y-axis) ordered on the x-axis
plot(x, y) bivariate plot of x (on the x-axis) and y (on the y-axis)
hist(x) histogram of the frequencies of x
barplot(x) histogram of the values of x; use horiz=FALSE for horizontal bars
dotchart(x) if x is a data frame, plots a Cleveland dot plot (stacked plots line-by-line and column-by-column)
pie(x) circular pie-chart
boxplot(x) "box-and-whiskers" plot

sunflowerplot(x, y) id. than plot() but the points with similar coordinates are drawn as flowers which petal number represents the number of points
stripplot(x) plot of the values of x on a line (an alternative to boxplot() for small sample sizes)
coplot(x~y | z) bivariate plot of x and y for each value or interval of values of z
interaction.plot(f1, f2, y) if f1 and f2 are factors, plots the means of y (on the y-axis) with respect to the values of f1 (on the x-axis) and of f2 (different curves); the option fun allows to choose the summary statistic of y (by default fun=mean)
matplot(x, y) bivariate plot of the first column of x vs. the first one of y, the second one of x vs. the second one of y, etc.
fourfoldplot(x) visualizes, with quarters of circles, the association between two dichotomous variables for different populations (x must be an array with dim=c(2, 2, k), or a matrix with dim=c(2, 2) if k = 1)
assocplot(x) Cohen-Friendly graph showing the deviations from independence of rows and columns in a two dimensional contingency table
mosaicplot(x) 'mosaic' graph of the residuals from a log-linear regression of a contingency table
pairs(x) if x is a matrix or a data frame, draws all possible bivariate plots between the columns of x
plot.ts(x) if x is an object of class "ts", plot of x with respect to time, x may be multivariate but the series must have the same frequency and dates
ts.plot(x) id. but if x is multivariate the series may have different dates and must have the same frequency
qqnorm(x) quantiles of x with respect to the values expected under a normal law
qqplot(x, y) quantiles of y with respect to the quantiles of x
contour(x, y, z) contour plot (data are interpolated to draw the curves), x and y must be vectors and z must be a matrix so that dim(z)=c(length(x), length(y)) (x and y may be omitted)
filled.contour(x, y, z) id. but the areas between the contours are coloured, and a legend of the colours is drawn as well
image(x, y, z) id. but with colours (actual data are plotted)
persp(x, y, z) id. but in perspective (actual data are plotted)
stars(x) if x is a matrix or a data frame, draws a graph with segments or a star where each row of x is represented by a star and the columns are the lengths of the segments
symbols(x, y, ...) draws, at the coordinates given by x and y, symbols (circles, squares, rectangles, stars, thermometres or "boxplots") which sizes, colours ... are specified by supplementary arguments
termplot(mod.obj) plot of the (partial) effects of a regression model (mod.obj)
 The following parameters are common to many plotting functions:
add=FALSE if TRUE superposes the plot on the previous one (if it exists)
axes=TRUE if FALSE does not draw the axes and the box
type="p" specifies the type of plot, "p": points, "l": lines, "b": points connected by lines, "o": id. but the lines are over the points, "h": vertical lines, "s": steps, the data are represented by the top of the vertical lines, "S": id. but the data are represented by the bottom of the vertical lines

xlim=, **ylim=** specifies the lower and upper limits of the axes, for example with `xlim=c(1, 10)` or `xlim=range(x)`
xlab=, **ylab=** annotates the axes, must be variables of mode character
main= main title, must be a variable of mode character
sub= sub-title (written in a smaller font)

Low-level plotting commands

dev.new() open a new graphics device (typically a window). see similar in help.

points(x, y) adds points (the option `type=` can be used)

lines(x, y) id. but with lines

text(x, y, labels, ...) adds text given by labels at coordinates (x,y); a typical use is: `plot(x, y, type="n"); text(x, y, names)`

mtext(text, side=3, line=0, ...) adds text given by text in the margin specified by side (see `axis()` below); line specifies the line from the plotting area

segments(x0, y0, x1, y1) draws lines from points (x0,y0) to points (x1,y1)

arrows(x0, y0, x1, y1, angle= 30, code=2) id. with arrows at points (x0,y0) if code=2, at points (x1,y1) if code=1, or both if code=3; angle controls the angle from the shaft of the arrow to the edge of the arrow head

abline(a,b) draws a line of slope b and intercept a

abline(h=y) draws a horizontal line at ordinate y

abline(v=x) draws a vertical line at abscissa x

abline(lm.obj) draws the regression line given by `lm.obj`

rect(x1, y1, x2, y2) draws a rectangle which left, right, bottom, and top limits are x1, x2, y1, and y2, respectively

polygon(x, y) draws a polygon linking the points with coordinates given by x and y

legend(x, y, legend) adds the legend at the point (x,y) with the symbols given by legend

title() adds a title and optionally a sub-title

axis(side, vect) adds an axis at the bottom (`side=1`), on the left (`2`), at the top (`3`), or on the right (`4`); `vect` (optional) gives the abscissa (or ordinates) where tick-marks are drawn

rug(x) draws the data x on the x-axis as small vertical lines

locator(n, type="n", ...) returns the coordinates (x,y) after the user has clicked n times on the plot with the mouse; also draws symbols (`type="p"`) or lines (`type="l"`) with respect to optional graphic parameters (...); by default nothing is drawn (`type="n"`)

Graphical parameters

These can be set globally with **par(...)**; many can be passed as parameters to plotting commands.

adj controls text justification (0 left-justified, 0.5 centred, 1 right-justified)
bg specifies the colour of the background (ex. : `bg="red"`, `bg="blue"`, ... the list of the 657 available colours is displayed with `colors()`)

bty controls the type of box drawn around the plot, allowed values are: "o", "l", "7", "c", "u" ou "]" (the box looks like the corresponding character); if `bty="n"` the box is not drawn

cex a value controlling the size of texts and symbols with respect to the default; the following parameters have the same control for numbers on the axes, `cex.axis`, the axis labels, `cex.lab`, the title, `cex.main`, and the sub-title, `cex.sub`

col controls the color of symbols and lines; use color names: "red", "blue" see `colors()` or as "#RRGGBB"; see `rgb()`, `hsv()`, `gray()`, and `rainbow()`; as for cex there are: `col.axis`, `col.lab`, `col.main`, `col.sub`

font an integer which controls the style of text (1: normal, 2: italics, 3: bold, 4: bold italics); as for cex there are: `font.axis`, `font.lab`, `font.main`, `font.sub`

las an integer which controls the orientation of the axis labels (0: parallel to the axes, 1: horizontal, 2: perpendicular to the axes, 3: vertical)

lty controls the type of lines, can be an integer or string (1: "solid", 2: "dashed", 3: "dotted", 4: "dotdash", 5: "longdash", 6: "twodash", or a string of up to eight characters (between "0" and "9") which specifies alternatively the length, in points or pixels, of the drawn elements and the blanks, for example `lty="44"` will have the same effect than `lty=2`

lwd a numeric which controls the width of lines, default 1

mar a vector of 4 numeric values which control the space between the axes and the border of the graph of the form `c(bottom, left, top, right)`, the default values are `c(5.1, 4.1, 4.1, 2.1)`

mfc a vector of the form `c(nr,nc)` which partitions the graphic window as a matrix of nr lines and nc columns, the plots are then drawn in columns

mfrow id. but the plots are drawn by row

pch controls the type of symbol, either an integer between 1 and 25, or any single character within ""

ps an integer which controls the size in points of texts and symbols

pty a character which specifies the type of the plotting region, "s": square, "m": maximal

tck a value which specifies the length of tick-marks on the axes as a fraction of the smallest of the width or height of the plot; if `tck=1` a grid is drawn

tcl a value which specifies the length of tick-marks on the axes as a fraction of the height of a line of text (by default `tcl=-0.5`)

xaxt if `xaxt="n"` the x-axis is set but not drawn (useful in conjunction with `axis(side=1, ...)`)

yaxt if `yaxt="n"` the y-axis is set but not drawn (useful in conjunction with `axis(side=2, ...)`)

Lattice (Trellis) graphics

xyplot(y~x) bivariate plots (with many functionalities)

barchart(y~x) histogram of the values of y with respect to those of x

dotplot(y~x) Cleveland dot plot (stacked plots line-by-line and column-by-column)

densityplot(~x) density functions plot

histogram(~x) histogram of the frequencies of x

bwplot(y~x) “box-and-whiskers” plot

qqmath(~x) quantiles of x with respect to the values expected under a theoretical distribution

stripplot(y~x) single dimension plot, x must be numeric, y may be a factor

qq(y~x) quantiles to compare two distributions, x must be numeric, y may be numeric, character, or factor but must have two ‘levels’

splom(~x) matrix of bivariate plots

parallel(~x) parallel coordinates plot

levelplot(z~x*y|g1*g2) coloured plot of the values of z at the coordinates given by x and y (x, y and z are all of the same length)

wireframe(z~x*y|g1*g2) 3d surface plot

cloud(z~x*y|g1*g2) 3d scatter plot

In the normal Lattice formula, `y | g1*g2` has combinations of optional conditioning variables g1 and g2 plotted on separate panels. Lattice functions take many of the same arguments as base graphics plus also `data=` the data frame for the formula variables and `subset=` for subsetting. Use `panel=` to define a custom panel function (see apropos("panel") and ?l1ines). Lattice functions return an object of class trellis and have to be print-ed to produce the graph. Use `print(xyplot(...))` inside functions where automatic printing doesn’t work. Use `lattice.theme` and `lset` to change Lattice defaults.