R cheat sheet

Modified from: P. Dalgaard (2002). Introductory Statistics with R. Springer, New York.

1. Basics

Commands	`objects()`	List of objects in workspace
	`ls()`	Same
	`rm(object)`	Delete '`object`'
Assignments	`<-`	Assign value to a variable
	`=`	Same
Getting help	`help(fun)`	Display help file for function `fun()`
	`args(fun)`	List arguments of function `fun()`
Libraries / packages	`library(pkg)`	Open package (library) '`pkg`'
	`library(help=pkg)`	Display description of package '`pkg`'

2. Vectors and data types

Generating	`seq(-4,4,0.1)`	Sequence: -4.0, -3.9, -3.8, ..., 3.9, 4.0
	`2:7`	Same as `seq(2,7,1)`
	`c(5,7,9,1:3)`	Concatenation (vector): 5 7 9 1 2 3
	`rep(1,5)`	1 1 1 1 1
	`rep(4:6,1:3)`	4 5 5 6 6 6
	`gl(3,2,12)`	Factor with 3 levels, repeat each level in blocks of 2, up to length 12 (1 1 2 2 3 3 1 1 2 2 3 3)
Coercion	`as.numeric(x)`	Convert to numeric
	`as.character(x)`	Convert to text string
	`as.logical(x)`	Convert to logical
	`factor(x)`	Create factor from vector x
	`unlist(x)`	Convert list, result from `table()` etc. to vector

3. Data frames

Accessing data	`data.frame(height, weight)`	Collect vectors '`height`' and '`weight`' into data frame
	`dfr&var`	Select vector '`var`' in data frame '`dfr`'
	`attach(dfr)`	Put data frame in search path
	`detach()`	- and remove it from the path
Editing	`dfr2 <- edit(dfr)`	open data frame '`dfr`' in spreadsheet, write changed version into new data frame '`dfr2`'
	`fix(dfr)`	open data frame '`dfr`' in spreadsheet, changes will overwrite entries in '`dfr`'
Summary	`dim(dfr)`	Number of rows and columns in data frame '`dfr`', works also for matrices and arrays
	`summary(dfr)`	Summary statistics for each variable in '`dfr`'

4. Input and export of data

General	`data(name)`	Built-in data set
	`read.table("file.txt")`	Read from external ASCII file
Arguments to `read.table()`	`header = TRUE`	First line has variable names
	`row.names = 1`	First column has row names
	`sep = ","`	Data are separated by commas
	`sep = "\t"`	Data are separated by tabs
	`dec = ","`	Decimal point is comma
	`na.strings = "."`	Missing value is dot
Variants of `read.table()`	`read.csv("file.csv")`	Comma separated
	`read.delim("file.txt")`	Tab delimited text file
Export	`write.table()`	see `help(write.table)` for details
Adding names	`names()`	Column names for data frame or list only
	`dimnames()`	Row and column names, also for matrix

5. Indexing / selection / sorting

Vectors	`x[1]`	First element
	`x[1:5]`	Subvector containing the first five elements
	`x[c(2,3,5)]`	Elements nos. 2, 3, and 5
	`x[y <= 30]`	Selection by logical expression
	`x[sex = = "male"]`	Selection by factor variable
	`i <-c(2,3,5); x[i]`	Selection by numerical variable
	`k <- (y <=30); x[k]`	Selection by logical variable
	`length(x)`	Returns length of vector x
Matrices, data frames	`m[4, ]`	Fourth row
	`m[ ,3]`	Third column
	`drf[drf$var <=30, ]`	Partial data frame (not for matrices)
	`subset(dfr,var<=30)`	Same, often simpler (not for matrices)
	`m[m[ ,3]<=30, ]`	Partial matrix (also for data frames)
Sorting	`sort(c(7,9,10,6))`	Returns the sorted values: 6, 7, 9, 10
	`order(c(7,9,10,6))`	Returns the element number in order of ascending values: 4, 1, 2, 3
	`order(c(7,9,10,6), decreasing = TRUE)`	same, but in order of decreasing values: 3, 2, 1, 4
	`rank(c(7,9,10,6))`	Returns the ranks in order of ascending values: 2, 3, 4, 1

6. Missing values

Functions	`is.na(x)`	Logical vector. `TRUE` where x has `NA`
	`complete.cases(x1,x2,...)`	Neither missing in x1, nor x2, nor ...
Arguments to other functions	`na.rm =`	In statistical functions: Remove missing if `TRUE`, returns `NA` if `FALSE`
	`na.last =`	In 'sort' `TRUE, FALSE` and `NA` means "last", "first", and "discard"
	`na.action =`	in '`lm()`', etc., values `na.fail, na.omit, na.exclude`
	`na.print =`	In '`summary()`' and '`print()`': How to represent `NA` in output
	`na.strings =`	In '`read.table()`': Codes(s) for `NA` in input

7. Numerical functions

Mathematical	`log(x)`	Logarithm of x, natural logarithm
	`log(x, 10)`	Base10 logarithm of x
	`exp(x)`	Exponential function e^x
	`sin(x)`	Sine
	`cos(x)`	Cosine
	`tan(x)`	Tangent
	`asin(x)`	Arcsin (inverse sine)
	`min(x)`	Smallest value in vector
	`min(x1, x2, ...)`	minimum number over several vectors
	`max(x)`	Largest value in vector
	`range(x)`	Like `c(min(x), max(x))`
	`pmin(x1, x2, ...)`	Parallel (elementwise) minimum over multiple equally long vectors
	`length(x)`	Number of elements in vector
	`sum(x)`	Sum of values in vector
	`cumsum(x)`	Cumulative sum of values in vector
	`sum(complete.cases(x))`	Number of non-missing elements
Statistical	`mean(x)`	Average
	`median(x)`	Median
	`quantile(x, p)`	Quantiles: median = `quantile(x, 0.5)`
	`var(x)`	Variance
	`sd(x)`	Standard deviation
	`cor(x, y)`	Pearson correlation
	`cor(x, y, method = "spearman")`	Spearman rank correlation

8. Programming

Conditional execution	`if(p< 0.5)` `print("Hooray")`	Print "Hooray" if condition is true

	`if(p < 0.5)`
	`{ print("Hooray")`
	`i = i + 1 }`
		If condition is true, perform all commands within the curved brackets { }

	`if(p < 0.5)`
	`{ print("Hooray")}`
	`else`
	`{ i = i + 1}`
		Conditional execution with an alternative

Loop	`for(i in 1:10)` `{ print(i) }`	Go through loop 10 times

	`i <- 1`
	`while(i <= 10)`
	`{ print(i)`
	`i = i + 1 }`
		Same, but more complicated

User-defined function	`fun<- function(a, b, doit = FALSE)`
	`{ if(doit) {a + b}`
	`else 0 }`
		Defines a function 'fun' that returns the sum of a and b if the argument '`doit`' is set to `TRUE`, or zero, if '`doit`' is `FALSE`

9. Operators

Arithmetic	`+`	Addition
	`-`	Subtraction
	`*`	Multiplication
	`/`	Division
	`^`	Raise to the power of
	`% / %`	Integer division: `5 %/% 3 = 1`
	`% %`	Remainder from integer division: `5 %% 3 = 2`
Logical or relational	`= =`	Equal to
	`! =`	Not equal to
	`<`	Less than
	`>`	Greater than
	`< =`	Less than or equal to
	`> =`	Greater than or equal to
	`is.na(x)`	Missing?
	`&`	Logical AND
	`|`	Logical OR
	`!`	Logical NOT

10. Tabulation, grouping, recoding

General	`table(x)`	Frequency table of vector (factor) x
	`table(x, y)`	Crosstabulation of x and y
	`xtabs(~ x + y)`	Formula interface for crosstabulation: use `summary()` for chi-square test
	`factor(x)`	Convert vector to factor
	`cut(x, breaks)`	Groups from cutpoints for continuous variable, breaks is a vector of cutpoints
Arguments to `factor()`	`levels = c()`	Values of x to code. Use if some values are not present in data, or if the order would be wrong.
	`labels = c()`	Values associated with factor levels
	`exclude = c()`	Values to exclude. Default `NA`. Set to `NULL` to have missing values included as a level.
Arguments to `cut()`	`breaks = c()`	Cutpoints. Note values of x outside of '`breaks`' gives `NA`. Can also be a single number, the number of cutpoints.
	`labels = c()`	Names for groups. Default is 1, 2, ...
Factor recoding	`levels(f) <- names`	New level names
	`factor(newcodes[f])`	Combining levels: '`newcodes`', e.g., `c(1,1,1,2,3)` to amalgamate the first 3 of 5 groups of factor f

11. Manipulations of matrices and lists

Matrix algebra	`m1 % * % m2`	Matrix product
	`t(m)`	Matrix transpose
	`m[lower.tri(m)]`	Returns the values from the lower triangle of matrix m as a vector
	`diag(m)`	Returns the diagonal elements of matrix m
	`matrix(x, dim1, dim2)`	Fill the values of vector x into a new matrix with dim1 rows and dim2 columns,
Marginal operations etc.	`apply(m, dim, fun)`	Applies the function '`fun`' to each row (`dim` = 1) or column (`dim`= 2) of matrix m
	`tapply(m, list(f1, f2), fun)`	Can be used to aggregate columns or rows within matrix m as defined by f1, f2, using the function '`fun`' (e.g., mean, max)
	`split(x, f)`	Split vector, matrix or data frame by factor x. Different results for matrix and data frame! The result is a list with one object for each level of f.
	`sapply(list, fun)` `sapply(split(x,f), fun)`	applies the function 'fun' to each object in a list, e.g. as created by the split function

12. Statistical standard methods

Parametric tests, continuous data	`t.test`	One- and two-sample t-test
	`pairwise.t.test`	Pairwise comparison of means
	`cor.test`	Significance test for correlation coeff.
	`var.test`	Comparison of two variances (F-test)
	`lm(y ~ x)`	Regression analysis
	`lm(y ~ f)`	One-way analysis of variance
	`lm(y ~ x1 + x2 + x3)`	Multiple regression
	`lm(y ~ f1 * f2)`	Two-way analysis of variance
Non-parametric	`wilcox.test`	One- and two-sample Wilcox test
	`kruskal.test`	Kruskal-Wallis test
	`friedman.test`	Friedman's two-way analysis of variance
cor.test variant	`method = "spearman"`	Spearman rank correlation
Discrete response	`binom.test`	Binomial test (incl. sign test)
	`prop.test`	Comparison of proportions
	`fisher.test`	Exact test in 2 x 2 tables
	`chisq.test`	Chi-square test of independence
	`glm(y ~ x1+x2, binomial)`	Logistic regression

13. Statistical distributions

Normal distribution	`dnorm(x)`	Density function
	`pnorm(x)`	Cumulative distribution function `P(X<=x)`
	`qnorm(p)`	p-quantile, returns x in: `P(X<=x) = p`
	`rnorm(n)`	n random normally distributed numbers
Distributions	`pnorm(x, mean, sd)`	Normal
	`plnorm*x, mean, sd)`	Lognormal
	`pt(x, df)`	Student's t distribution
	`pf(x, n1, n2)`	F distribution
	`pchisq(x, df)`	Chi-square distribution
	`pbinom(x, n, p)`	Binomial
	`ppois(x, lambda)`	Poisson
	`punif(x, min, max)`	Uniform
	`pexp(x, rate)`	Exponential
	`pgamma(x, shape, scale)`	Gamma
	`pbeta(x, a, b)`	Beta

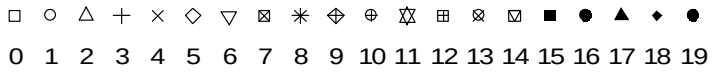
14. Models

Model formulas	`~`	As explained by
	`+`	Additive effects
	`:`	Interaction
	`*`	Main effects + interaction: `a*b =a+b+a:b`
	`-1`	Remove intercept
Linear models	`lm.out <- lm(y ~ x)`	Fit model and save results as 'lm.out'
	`summary(lm.out)`	Coefficients etc.
	`anova(lm.out)`	Analysis of variance table
	`fitted(lm.out)`	Fitted values
	`resid(lm.out)`	Residuals
	`predict(lm.out,newdata)`	Predictions for a new data frame
Other models	`glm(y ~ x, binomial)`	Logistic regression
	`glm(y ~ x, poisson)`	Poisson regression
	`gam(y ~ s(x))`	General additive model for non-linear regression with smoothing. Package: `gam`
	`tree(y ~ x1+x2+x3)`	Classification (y = factor) or regression (y = numeric) tree. Package: `tree`
Diagnostics	`rstudent(lm.out)`	Studentized residuals
	`dfbetas(lm.out)`	Change in standardized regression coefficients beta if observation removed
	`dffits(lm.out)`	Change in fit if observation removed
Survival analysis	`S <- Surv(time,ev)`	Create survival object. Package: survival
	`survfit(S)`	Kaplan-Meier estimate
	`plot(survfit(S))`	Survival curve
	`survdiff(S ~ g)`	(Log-rank) test for equal survival curves
	`coxph(S ~ x1 + x2)`	Cox's proportional hazards model
Multivariate	`dist()`	Calculate Euclidean or other distances
	`hclust()`	Hierarchical cluster analysis
	`kmeans()`	k-means cluster analysis
	`rda()`	Perform principal component analysis PCA or redundancy analysis RDA. Package 'vegan'.
	`cca()`	Perform (canonical) correspondence analysis, CA /CCA. Package: 'vegan'
	`diversity()`	Calculate diversity indices. Pkg: 'vegan'

15. Graphics

Standard plots	`plot(x, y)`	Scatterplot (or other type of plot if x and y are not numeric vectors)
	`plot(f, y)`	Set of boxplots for each level of factor f
	`hist()`	Histogram
	`boxplot()`	Boxplot
	`barplot()`	Bar diagram
	`dotplot()`	Dot diagram
	`piechart()`	Pie chart
	`interaction.plot()`	Interaction plot (analysis of variance)
Plotting elements (adding to a plot)	`lines()`	Lines
	`abline()`	Regression line
	`points()`	Points
	`arrows()`	Arrows (NB: `angle = 90` for error bars)
	`box()`	Frame around plot
	`title()`	Title (above plot)
	`text()`	Text in plot
	`mtext()`	Text in margin
	`legend()`	List of symbols
Graphical pars.: arguments to par()	`pch`	Symbol (see below)
	`mfrow, mfcol`	Several plots in one (multiframe)
	`xlim, ylim`	Plot limits
	`lty, lwd`	Line type / width (see below)
	`col`	Color for lines or symbols (see below)

Point symbols (pch)



Colors (col)

1 black
2 red
3 green
4 blue
5 light blue
6 purple
7 yellow
8 grey

Line types (lty)