R reference card

Essentials

`q()` quit. You will be asked if "Save workspace?" type
"y" to save to .RData in current directory

`<-` or `=` assignment, e.g.: `x <- 13.76`

`help(command1)` gives syntax, details & examples

Extensions

`help.start()` start browser help

`apropos("topic1")` lists commands relevant to topic1

`help.search("topic1")` like apropos, but gives short
description

`RSiteSearch("topic1")` like help.search plus a google
search on topic1 at the R-project site. Returns out-
put to your browser.

`example(command1)` examples of `command1`

`demo(package1)` demos related to package1

Numbers and Matrices

`v1 <- c(1,2,3.4)` creates a string of numbers with no
dimension

`1:3` a string of integers `1,2,3` (with no dimensions)

`rep(x1,n1)` repeats the vector `x1` `n1` times

`matrix(v1,r1,c1)` make `v1` into a matrix with `r1` rows
and `c1` columns.
Note: matrices are stored as stacked columns.

`cbind(a1,b1,c1)` binds columns into a matrix

`rbind(a1,b1,c1)` binds rows into a matrix

`dim(matrix1)` dimensions of `matrix1`

`length(v1)` length of `v1`

`m1[4,3]` element of matrix `m1` in 4th row, 3rd column

`m1[,2]` column 2 of matrix `m1`

`m1[,2:5]` or `m1[,c(2,3,4,5)]` columns 2 thru 5

`m1[6:4,]` or `m1[,c(6,5,4)]` rows 6 thru 4

`t(m1)` transpose matrix, switch rows and columns

`dimnames(m1)` returns or assigns names to
rows/columns of `m1`

`%*%` matrix multiplication

Arithmetic

$-$, $+$, `*`, and `/` are applied element–wise to matrices.
The shorter of two vectors is recycled to the length
of the longer. A warning is printed if lengths are not
even multiples. Use `options(warn=2)` to make this
an error.

`^` exponents, `sqrt()` square root

`%/%` integer divide: `27 %/% 4 = 6`

`%%` modulus or remainder: `27 %% 4 = 3`.

Statistics

`max()`, `min()`, `mean()`, `median()`, `sum()`, `var()`
as named

`cor(m1)`, `cor(x1,y1)` show correlations within matrix
`m1` or between `x1` and `y1`

`summary(x1)` prints quartiles, mean, min, and max

`summary(data.frame)` prints summary of each column

`sort()` sort, also see help for `order()`

`quantiles(x1, .9)` find the 90th percentile

`rnorm(n1, mean,sd)` generate `n1` random normals

`rchisq()`, `rf()`, `runif()`, `rbinom()` generate ran-
dom variates

`pnorm()`, `pchisq()`, `pf()` (CDF) Statistical tables
for p-values. Use 1 - these to get upper tail probs.

`qnorm()`, `qchisq()`, `qf()` quantiles, inverse CDF.

`by()` apply function to data frame by factor
e.g. `by(x1, g1, mean)`

`apply(x1,n1,function1)` apply `function1` (e.g.
`mean`) to `x1` by rows (`n1=1`) or columns (`n1=2`)

`tapply(x1,list1,function1)` apply `function` to `x1`
split by `list1`

`table(f1, f2)` make a table of occurrence counts

Data Frames

`read.table("file1")` read data from `file1` into a
dataframe, which is a special type of list.

`data.frame(x=x1, y=y1)` creates a dataframe with 2
columns, x and y

`m1$a1` variable `a1` in data frame `m1`

`NA` missing data (use in a data file)

`is.na(x1)` returns true if `x1 == NA`, i.e.`x1` is missing

Input and Output

`source("file1")` run the commands in `file1`.

`data.entry(x1,y1)` pops up a primitive spreadsheet
allowing modification to `x1` or `y1`.

`scan("file1")` read a file (or keyboard input if "file"
is omitted) into a single vector

`sink("file1")` output to `file1`, until `sink()`

`write(object, "file1")` writes an object to `file1`

`write.table(dataframe1,"file1")` writes a table or
matrix see its options for quotes, format, and labels

Managing Variables and Objects

`ls()` lists all objects in workspace.

`rm(object1)` removes `object1` from workspace

`search()` view your search path

`attach(x1)` put variables in dataframe `x1` into search
path so that `a1` can be used for `x1$a1`.

`detach(x1)` remove from search path

`library(nlme)` load (e.g.) the `nlme` package

`as.matrix()`, `as.numeric()` conversions

`factor(x1)`, `ordered(x1)` convert numeric `x1` to a
factor or ordered factor

`is.factor()`, `is.matrix()`, `is.numeric()` look for
attributes

`which(x1==a1)` returns indices of `x1` where `x1==a1`

Basic Statistical Analysis

`t.test(x1,y1)` t test (1 or 2 samples)

`wilcox.test(x1)` Wilcoxson's median test

`lm()` linear models: regression, anova, ancova

`aov(formula)` specialized anova function

`anova()` compares two or more linear models (LRT).

`kruskal.test(x1,g1)` Kruskal-Wallis test for equal medians in `x1` over groups `g1`.

Programming

`function(x1,v1)` build a function with 2 args
   e.g. `sd <- function(x1){ sqrt(var(x1)) }`

`for (i1 in 1:n1) { stuff }` repeat "stuff" n1 times

Logical Comparisons: `==`, `<=`, `>=` Note 2 ='s. Usage:

`if (condition1) {somestuff} else`
   `{otherstuff}`

`while (condition1) {stuff}` repeat "stuff" until condition1 is false

`break` jumps out of a loop

`switch` avoids several `if` statements

`next` jumps to end of a loop

`ifelse` applies condition to every element of a vector

Graphics

`plot(x1,y1)` scatterplot, alternatively:
   `plot(y1 ~ x1, data = df1)`

Options within `plot()`: (separate with commas)
   `type="p"` for points, "l" for lines, or "b" for both
   `xaxt="n"` omit x axis, `yaxt="n"` omit y axis
   `lty = 2` dashed lines use integers > 1
   `pch = 15` set plotting character to letter or integer
   `main = "String")` add a main title
   `xlab = "Lab1", ylab="Lab2"` set axis labels

`abline(int1, slope1)` add a line to plot
   `abline(h=0)`, `abline(v=22)` horiz. or vert. line

`points(x1,y1)` add more points to a plot

`lines(x1,y1)` add lines to an existing plot
   add smoother: `lines(loess(x1, y1))`

`text(x1,y1, text1)` add text to plot

`axis()` or `mtext()` to create an axis

`legend(x1, y1, labels1, lty=lty1, pch = pch1)`
   add a legend at coordinates `x1, y1`.

`stem(x1)`, `hist(x1)` stem-and-leaf and histogram

`boxplot(x1)` box-whisker plot (single)
   `boxplot(x1 ~ g1)` box-whisker plot by group

`pairs(m1)` matrix of scatterplots

`qqnorm(x1)`, `qqline(x1)` compare `x1` to normal dist'n

`interaction.plot(Xfactor1, TraceFactor2, y1)`
   plot means for 2-way anova

Plotting Devices

`x11()` open a plot window on Unix system

`windows()` same for MSWindows. Note different menus when plotting window is active.

`postscript("file1.ps", horiz=F, height=6,`
   `width=6, paper="special")` open a device to save plots to `file1.ps`

`dev.off()` to finish the file

Jpeg, png, and other formats available, see `?Devices`.

Lattice Graphics

`library(lattice)` load the library

`xyplot(y1 ~ x1|g1)` scatterplot of y1 over x1 separated by group `g1`

`bwplot(y1 ~ g1)` box-whisker plot

`barchart() dotplot() stripplot()` and others

`trellis.par.set(theme = col.whitebg())`   set white background

Linear Models

`lm(y1 ~ x1, data = df1)`
   If `x1` is quantitative, a regression of `y1` on `x1`.
   If x1 is a factor, the analysis of variance.

Formula: the first argument of `lm()` can have the form

`y ~ x1 + x2 + x3` main effects for 3 predictors

`y ~ x1 + x2 + x1:x2` main effects and interactions shorthand versions:
   `y ~ x1 * x2` or
   `y ~ (x1 + x2)^2`

To enforce arithmetic within a formula use `I()` as in
   `y ~ x1 + I(x1^2)` (quadratic in x1)

`lm1 <- lm(formula1)` a linear models object

`summary(lm1)` prints coefficient estimates and F test for $H_0 : \boldsymbol{\beta} = \mathbf{0}$

`update(lm1, formula2)` shortcut to modify `lm1`

`anova(lm1, lm2)` gives LRT for nested models

`predict(lm1, newdata = df2)` prediction and confidence intervals for new x values

`par(mfrow=c(2,2)); plot(lm1)` plots 4 plots:
   Residuals vs Fitted to look for curvature
   Normal Q-Q plot to examine normality assumptions
   Scale-Location plot to look for non-constant variance
   Cook's distance plot to look for influential points

Mixed Models

`lme(fixed=formula1, data=df1,`
   `random=formula2, corr = structure, weights`
   `= variance.structure)` linear mixed effects
   Example formulae:
   `random = ~ 1| g1` random intercept for each group
   `random = ~ x1 | g1` random intercept & slope (over x1) for each group
   `corr= corCompSymm(form = ~ 1| g1)` same correlation within group
   `corr = corAR1(form = ~ 1| Subj)` AR1 correlations w/in Subject
   `weights= varIdent(form = ~ 1|Year)` variance changes with year
   `weights= varPower(form = ~ fitted(.) |`
   `g1)` variance increases as power of $E(Y)$, powers vary with group.

`gls(formula1, data=df1, corr = structure,`
   `weights = variance.structure)` generalized least squares. Use `corr` and `weights` as with lme.

`nlme()` nonlinear mixed models

Setting Options

`par(mfrow = c(2,3))` 6 plots/page (2 rows, 3 cols)

`options(contrasts = c("contr.treatment",`
   `"contr.poly" ))` set treatment contrast option

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