R Basics and Examples - A short introduction

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The R Project for Statistical Computing

The R project `http://www.r-project.org` develops a free software environment for statistical computing and graphics. R compiles and runs on a wide variety of UNIX platforms, Windows and MacOS, is mostly used for statistics but can also be used as a programming (script) language alone.

R is organized as a core distribution of base packages which can be extended by further packages loaded into the a user workspace (or interpreter global environment). Some useful links are

- ▶ Tutorials on using R can be found at `http://www.r-tutor.com/`
- ▶ Meta search and package documentation `https://www.rdocumentation.org/`
- ▶ R CRAN repository for contributed packages: `https://cran.r-project.org/`
- ▶ A short reference card `https://cran.r-project.org/doc/contrib/Short-refcard.pdf`

R Basics

```
R> PATH <- getwd()          # get working directory
R> INFO <- Sys.info()       # get system info
R> objects()                # show all loaded variables
 [1] "a"    "b"    "d"    "d0"   "d.0"  "d00"  "dd"   "fac"  "g"
[11] "L3"   "PATH" "x"    "XYZ"  "y"    "z"
R> ls()                     # objects in your workspace
 [1] "a"    "b"    "d"    "d0"   "d.0"  "d00"  "dd"   "fac"  "g"
[11] "L3"   "PATH" "x"    "XYZ"  "y"    "z"
```

Whats is in these objects?

```
R> PATH

[1] "/home/baaske/workspace/RIntro/doc"

R> INFO[c("sysname","nodename","user")]

          sysname          nodename              user
          "Linux" "baaskelap.rdm.de"          "baaske"
```

Important: On quitting, R offers the option of saving the workspace image, by default in the file "*.RData". Use before ending the R session:

```
R> rm(list=ls())
R> q()
```

R Help and vectors

Getting help:

```
R> help()               # general help
R> ?length              # help for `length`
R> help.search(lapply)  # help for function `lapply`
R> help.start()         # start html help system
```

Vectors:

```
R> 2+2

[1] 4

R> round(pi,3)

[1] 3.142

R> sqrt(10)

[1] 3.162

R> 1000*(1+0.075)^5-1000

[1] 435.6

R> sin(c(30,60,90)*pi/180)

[1] 0.500 0.866 1.000
```

R variables and subsetting

```
R> a <- 2*3
R> a
[1] 6
R> a^2
[1] 36
R> b <- a^2
R> a <- c(17,1,3,9)
R> a
[1] 17  1  3  9
R> a[2]
[1] 1
R> a[c(1,3)]
[1] 17  3
R> a[-2]
[1] 17  3  9
R> a[2] <- 1
R> a
[1] 17  1  3  9
```

Characters and categories

```
R> (x <- "Hallo")                        # character vector
[1] "Hallo"
R> (y <- factor(c("C","A","C","B")))     # characters as categories
[1] C A C B
Levels: A B C
R> (z <- factor(c(1,1,2)))               # numbers as factors
[1] 1 1 2
Levels: 1 2
R> (x <- c(1,2,3))                       # distroy x and overwrite
[1] 1 2 3
R> x[4]                                  # NA = Not Available
[1] NA
R> try(x[4])                             # catch error
[1] NA
```

R object classes

```
R>                    class(1.7) # "numeric"
[1] "numeric"
R> class(x)   # "character" = character vector
[1] "numeric"
R> class(y)   # "factor" categories
[1] "factor"
R> class(z)
[1] "factor"
R> mode(1.7)
[1] "numeric"
R> x <- as.integer(x)
R> class(x)
[1] "integer"
R> z <- as.character(z)
R> class(z)
[1] "character"
```

Characters and categories

```
R> # Save contents of workspace, into the file .RData
R>                 save.image()
R> # Save into the file archive.RData
R> save.image(file="archive.RData")
R> # save single objects
R> save(x, y,z, file="tmpobj.RData")
R> # save as RDS (could be big data)
R> saveRDS(list(x,y,z),file="myfile.rds")
R> # read as RDS
R> XYZ <- readRDS(file="myfile.rds")

R> # attach (reload) to current workspace
R>                 attach("tmpobj.RData")
R> ls()
 [1] "a"    "b"    "d"    "d0"   "d.0"  "d00"  "dd"   "fac"  "g"
[11] "L3"   "PATH" "x"    "XYZ"  "y"    "z"
```

R data frame object

```
R> ?data.frame     # help on data frames
R> example(data.frame)   # some examples
Construct a data frame of study courses
R> g <- data.frame(StG=c("GTB","MPV","BGM"),Anz=c(75,11,62))
R> g
  StG Anz
1 GTB  75
2 MPV  11
3 BGM  62
R> class(g)    # "data.frame" = Datenmatrix
[1] "data.frame"
R> names(g)   # categories in g
[1] "StG" "Anz"
R> g[,2]          # 2nd column
[1] 75 11 62
R> g[3,]          # 3rd row
  StG Anz
3 BGM  62
R> g[3,2]              # single element
```

R data frame object

```
R> g[c(2,3),]  # select 2nd and 3rd row

  StG Anz
2 MPV  11
3 BGM  62
R> g$Anz       # select category `Anz`

[1] 75 11 62
R> g$Anz[1]    # select first element of `Anz`

[1] 75
R> # Extending the  data frame
R> (g <- rbind(g,c("GTB",26)))

  StG Anz
1 GTB  75
2 MPV  11
3 BGM  62
4 GTB  26
```

R data frame object

```
R> g <- cbind(g,Sem=c(3,1,3,5))
```