

noframenumbering,plain]



**University of
Zurich**^{UZH}



MAKERERE UNIVERSITY

Data Analysis with R: Lecture Slides (all)

Sonja Hartnack, Terence Odoch & Muriel Buri

October 2018

Goals of the course

To be able to...

- import data sets to R
- describe data with R
- apply basic statistical tests in R
- some ideas for more advanced statistical tools ...
- simulate a data set similar to own research

Course schedule:

- Starting at 9:00am / 9:30am (?)
- Tea breaks in between
- Lunch break
- Teaching until 4.30pm (~ 5pm)

Optaining a certificate is conditional on ...

- active participation in class
- attending at least 75 % of the course (lecture & exercises)
- short final exam (format to be defined)

Getting to know each other

- My name is ...
- I am doing a Master / a PhD in ...
- I hope to learn in this course how to
- My personal goal for this course is ...

How do we reach these goals

- hands on exercises with R:
 - chickwts
 - ToothGrowth
 - bacteria
 - perulung
 - ... and others.
- interactive discussions & presentations of student solutions
- asking a lot of questions: ask google!
- group work
- short motivational lectures

Get started with data set: chickwts

An experiment was conducted to measure and compare the effectiveness of various feed supplements on the growth rate of chickens.

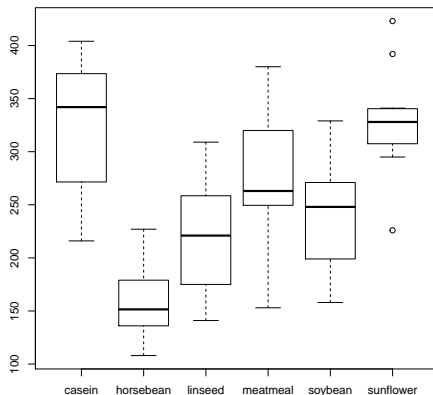
```
data(chickwts)
head(chickwts)
```

##	weight	feed
## 1	179	horsebean
## 2	160	horsebean
## 3	136	horsebean
## 4	227	horsebean
## 5	217	horsebean
## 6	168	horsebean

Ideas for plotting the data

Ideas for plotting the data

```
boxplot(weight ~ feed, data = chickwts)
```



Ideas for analysing the data

Ideas for analysing the data

```
summary(aov(weight ~ feed, data = chickwts))
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## feed           5 231129   46226   15.37 5.94e-10 ***
## Residuals     65 195556    3009
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Functionalities in R and RStudio

A hands on example

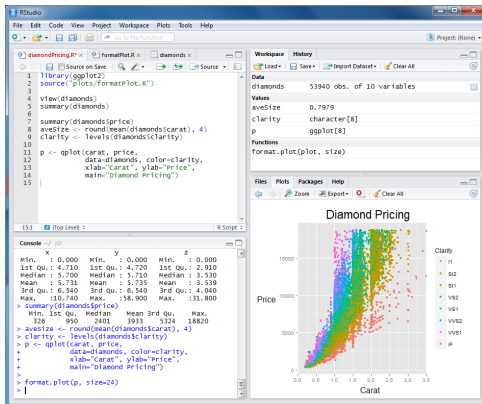


```
x <- c(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10)
y <- c(20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30)
plot(x, y)
```

Functionalities in R and RStudio



- Source
- Console
- Environment, History, Files
- Files, Plots, Packages, Help





- Define manually a new folder called **RCourse** in your personal documents on your personal computer
- Know in which directory you are

```
getwd()
```

```
## [1] "/home/mburi/ownCloud/git/DataAnalysisWithR/Lectures"
```

- Set directory path

```
# back- and forslash is dependent on the system
```

```
setwd("C:/Users/muriel/Documents/RCourse/")
```

```
setwd("C:\\Users\\muriel\\Documents\\RCourse\\")
```

- Always clean up before starting with new R-Script

```
rm(list=ls()) # empty workspace, delete previously saved variables
```



```
?chickwts
```

Also, have a look at the examples at the end of the help pages.

Exercise 1



A data frame in R: chickwts



chickwts[ROWS , COLUMNS]

	weight	feed
1	179	horsebean
2	160	horsebean
3	136	horsebean
4	227	horsebean
5	217	horsebean
6	168	horsebean
7	108	horsebean
8	124	horsebean
9	143	horsebean
10	140	horsebean
11	309	linseed
12	229	linseed
13	181	linseed

chickwts[6, 1]

	weight	feed
1	179	horsebean
2	160	horsebean
3	136	horsebean
4	227	horsebean
5	217	horsebean
6	168	horsebean
7	108	horsebean
8	124	horsebean
9	143	horsebean
10	140	horsebean
11	309	linseed
12	229	linseed
13	181	linseed

chickwts[11, 2]



Values of ...

```
# ... all columns of sixth observation:  
chickwts[6, ]  
  
# ... all columns of sixth to eleventh observation:  
chickwts[6:11, ]  
  
# ... all columns of sixth, eleventh and twentieth observation:  
chickwts[c(6, 11, 20), ]  
  
# ... all rows of first column (weight):  
chickwts[, 1]  
  
# ... all rows of second column (feed):  
chickwts[, 2]  
# or use the "$" sign as a reference to column "feed":  
chickwts$feed
```

What is a data frame in R?



A data frame is used for storing a list of vectors of equal length. For example, the following variable `df` is a data frame containing three vectors `n`, `s`, `b`.

```
n <- c(2, 3, 5)
s <- c("aa", "bb", "cc")
b <- c(TRUE, FALSE, TRUE)
df <- data.frame(n, s, b) # df is a data frame
```

Following are the characteristics of a data frame:

- The column names should be non-empty.
- The row names should be unique.
- Each column should contain same number of data items.



```
a <- c(1, 2, 3, 4)
```

```
a
```

```
## [1] 1 2 3 4
```

```
data.frame(a)
```

```
##      a
```

```
## 1 1
```

```
## 2 2
```

```
## 3 3
```

```
## 4 4
```

```
b <- c("d", "h", "h", "d")
```

```
dat <- data.frame(a, b)
```

```
dat
```

```
##      a b
```

```
## 1 1 d
```

```
## 2 2 h
```

```
## 3 3 h
```

```
## 4 4 d
```

Data frame in R: How to add a variable (var)



```
my.var <- c(1.3, 1.5, 1.8, 2.4)
# use "$" to refer to the additional vector variable
dat$my.var1 <- my.var
dat$my.var2 <- my.var
dat
```

```
##   a b my.var1 my.var2
## 1 1 d     1.3     1.3
## 2 2 h     1.5     1.5
## 3 3 h     1.8     1.8
## 4 4 d     2.4     2.4
```

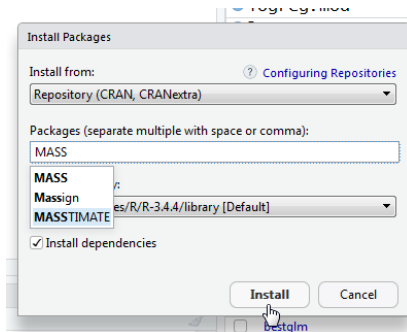
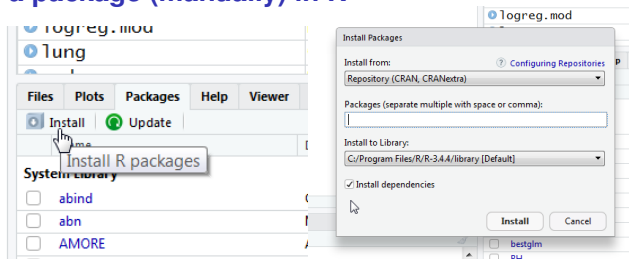
```
# What is the dimension (number of rows and columns) of our data frame?
dim(dat) # 4 rows and 3 columns
```

```
## [1] 4 4
```

Exercise 2



How to install a package (manually) in R



Using R is like cooking ...

Get into the kitchen	Change working directory
Get specialist electric tools into your kitchen (e.g. blender, ice-cream maker, etc.)	Install packages
Switch on your specialist electric tools	Load packages using the "library" function
Bring in your ingredients	Import data and save to R data frames
Check your ingredients	Use the function "summary" and basic tables to check your data for missing or implausible values (e.g. a number in a variable where "yes" or "no" are expected)
Chop things up (if required)	Split or filter data
Cook, using general and specialist tools	Carry out further descriptive and test statistics

How to install a package in R



```
# INSTALL package (only done ONCE!)  
install.packages("MASS")  
# LOAD package (whenever you use something from it!)  
library("MASS")  
data(bacteria)  
?bacteria
```

Exercise 3

