BST02: Using R for Statistics in Medical Research

Part A: Introduction

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What is this Course About

Statistics have flourished in the recent years mainly due to the possibility of doing complex analysis using computers

The **programming language R** is popular for Data Scientists

- ► The most valuable tool of a modern quantitative researcher is his/her personal computer
  - ► Many statistical software exist to do simple and specialized analysis
- ► Analysts must not only learn how to use the software but also the ideas behind it

What is this Course About (cont'd)

Therefore, the aim of this course is:

- ▶ **Aim A**: General Introduction
  - ▶ how does the programming language **R** work
- ▶ **Aim B**: Basic use of **R**
  - ▶ getting started with a data set, data visualizations
- ▶ **Aim C**: Programming
  - ▶ using and writing functions, popular functions which you will later need for the more advanced courses such as Repeated **Measurements (CE08)**, **Bayesian Statistics (CE09)**, etc.
- ▶ **Aim D**: Statistics with **R**
  - ▶ basic statistical tests, regression analysis
- ▶ **Aim E**: tools
  - ▶ some interesting tools for reporting data analyses in a reproducible manner

Agenda

- **Part A**:
  - What does R look like ?
  - What is R ?
  - A brief history of R
  - Why learn R ?
  - Where do I get R ?
  - How does R work ?
  - How to get help in R ?
  - Disadvantages of R

Agenda

- ► **Part B**:
  - ► Using R
  - ► In practice examples
  - ► Basics in R
  - ► Common R objects
  - ► Importing data and saving your work
  - ► Data transformation
  - ► Data exploration
  - ► Visualization of data
  - ► Indexing

Agenda

- **Part C**:
  - Merging data sets
  - Functions
  - Loops
  - The apply family
  - Combine everything we learned

Agenda

► **Part D**:
  ► Statistical tests
  ► Regression models
  ► Dummies, interaction and nonlinear effects
  ► Survival models
  ► Visualization of results

Agenda

- **Part E**
  - Markdown
  - Creating reports

Schedule

- ► February 24: 10h00 - 13h00, 14h00 - 17h00
- ► February 25: 10h00 - 13h00, 14h00 - 17h00
- ► February 26: 10h00 - 13h00, 14h00 - 17h00
- ► February 27: 10h00 - 13h00, 14h00 - 17h00

Exams

▶ Date: February 28: 14h15 - 17h00

▶ Format: Assignment

▶ Open-book

Structure & Material

- ► Lectures: slides interchanged with live **R** sessions
- ► Practicals in-between the lectures
    - ► you will be asked to perform small and big tasks
    - ► solutions of the practicals available beforehand
- ► Material
    - ► slides
    - ► **R** code with the output
    - ► **more than what we are going to cover!**

Structure & Material (cont'd)

- ► You are welcome to try along
- ► You are welcome to interrupt and ask questions

References

▶ More books that use R (or S) can be found at:

http://www.r-project.org/doc/bib/R-books.html, or
http://www.r-project.org/doc/bib/R-jabref.html

▶ R ships with a number of helpful manuals (illustrated later)

▶ Other manuals and helpful material are available on-line via CRAN:
http://cran.r-project.org/other-docs.html

What does R look like ?
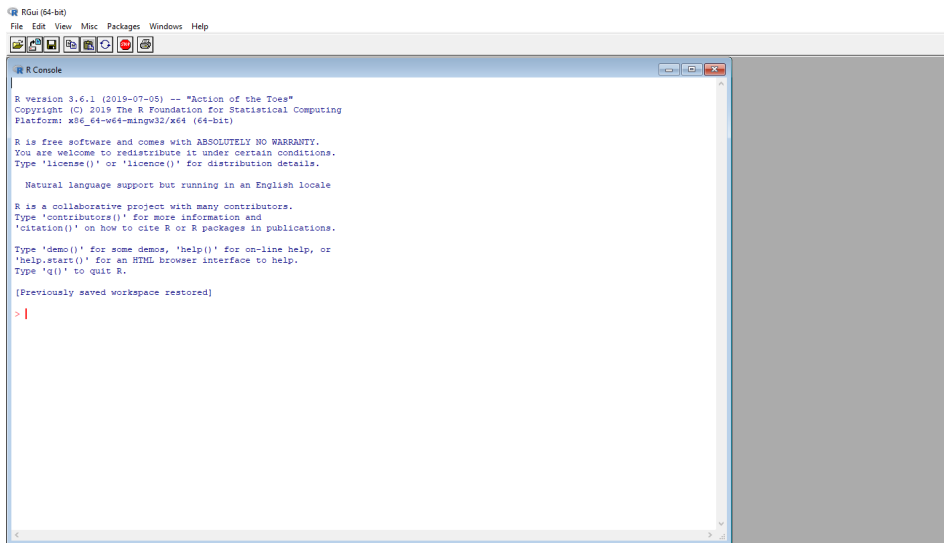
What is R

- ▶ is a software environment for statistical computing and graphics.
- ▶ Unlike SPSS, R is purely command driven

A brief history of R

- **1993**: University of Auckland, New Zealand by Ross Ihaka and Robert Gentleman
- **1997**: R core Team was formed (20 members)
- **2000**: R 1.0.0 released
- **2004**: First international user conference in Vienna
- **2013**: 5026 packages available
- **2017**: 10875 packages available
- **Now**: `nrow(available.packages())`

Why learn R ?

- ▶ R is a free software environment for statistical computing and graphics
- ▶ It compiles and runs on LINUX, Windows and MacOS
- ▶ Open source language
- ▶ Users are allowed to modify and redistribute the code
- ▶ Advanced statistical language
- ▶ Supports extensions
- ▶ Related to other languages
- ▶ **Flexible and fun!**

Where do I get R ?

- ► http://cran.r-project.org
- ► choose your platform, e.g., Windows, Linux
- ► e.g., for Windows: Windows → base → Download R 3.6.2 for Windows
- ► Install . . .

How does R work ?

- ▶ Packaged built for specific tasks
- ▶ Download R packages from the CRAN web site → within R
  - ▶ Packages
  - ▶ Install package(s) . . .
  - ▶ make you choice(s)
  - ▶ load the package using library() (note: install does not mean load)

How to get help in R

- ► Within R
  - ► help.search("topic") or ??"topic" (depends on the installed packages)
  - ► RSiteSearch("topic") (requires internet connection)
  - ► help() or ? invoke the on-line help file for the specified function
  - ► checking the FAQ
- ► Online
  - ► R-help (https://stat.ethz.ch/mailman/listinfo/r-help – mailing list)
  - ► R-seek (http://www.rseek.org – Google-like searched engine)
  - ► R-wiki (http://rwiki.sciviews.org/doku.php)
  - ► CRAN Task Views (http://cran.r-project.org/web/views/ – categorization of packages)
  - ► Crantastic (http://crantastic.org/ – categorization of packages + reviews)
  - ► Equalis (http://www.equalis.com/forums/ – R forum)
  - ► R4stats (http://www.r4stats.com/ – examples of basic R programs)
  - ► R related Blogs (http://www.r-bloggers.com/ – many useful illustrations of R and R packages)

Disadvantages of R

- ► appears intimidating to the first-time user
- ► output is not so nice looking (but there are some alternatives)
- ► exporting output is more difficult
- ► cannot easily handle very big data sets (depends on the installed RAM)
- ► a lot of things are available but it is sometimes hard to find your way
- ► the quality of the available packages is greatly varying