Statistical Computing
R Programming

Course for non-student learners
(Full course, 11 weeks)
Course information sheet 2019-20

The course introduces learners to data visualisation, data management and programming in the statistical software environment R.

Prerequisite Knowledge

The course requires no prerequisite knowledge. However, some of the examples require a basic understanding of matrix algebra.

The course is suitable for learners with no prior experience of programming, however learners with no prior experience in programming should expect a larger time commitment in order to fully benefit from the course.

Intended Learning Outcomes

By the end of this course learners will be able to:

- recognise and make appropriate use of different types of data structures;
- manipulate data sets in R;
- use R to create figures and graphs;
- identify and implement appropriate control structures to solve a particular programming problem;
- design and write functions in R and implement simple iterative algorithms;
- structure complex programming problems into functional units and implement these;
- carry out extended programming tasks and produce clearly annotated listing of their code;
- author reports with embedded code using technologies such as Sweave or knitr; and
- develop and deploy R Shiny apps.

Syllabus

Week 1
- Installing R and RStudio
- Accessing R in the cloud
- Basics of scientific computing
- Variables and R as a calculator

Week 2
- Logical operators
- Vectors, lists and matrices
- Other common data types

Week 3
- Data frames
- Transforming, subsetting and merging data frames
- Reading/writing data from/to files

Week 4
- Efficient data management using `tidyverse`
- `tibbles`
- Transforming, subsetting and merging data frames using `dplyr`
- Reshaping data using `tidyr`

Week 5
- R graphics
- Data visualisation in R

Week 6
- Advanced graphics using `ggplot2`

Week 7
- `if` statements and `ifelse`
- Using loops (`for` and `while`) for iterative and repeated computations

Week 8
- Writing R functions
- Structuring your code efficiently using functions
- Debugging

Week 9
- Authoring data-driven interactive webapps using `shiny`

Week 10
- Authoring automatic reports using `knitr` and `rmarkdown`
- Reproducible data science

Week 11
- Basics of object-oriented programming
- Creating classes ("S3") in R
- Creating R6 classes

Online Learning

The course is delivered by online distance learning and consists of
- Weekly live sessions with tutor(s)
- Weekly learning material (reading material, videos, exercises with model answers)
- Bookable one-to-one sessions with tutor(s)

Textbooks

G. Grolemund, H. Wickham. R for Data Science. O'Reilly Media.
https://r4ds.had.co.nz/
H. Wickham. Advanced R. CRC Press.
httpd://adv-r.had.co.nz/
W. J. Brown, D. J. Murdoch. A First Course in Statistical Programming with R. Cambridge University Press.
P. Daalgard. Introductory Statistics with R. Springer.

Assessment

Courses for non-student learners have quizzes which allow you to check your progress. You need to attempt at least one quiz to obtain a certificate of attendance.

Hardware and Software Requirements

To take our courses all you need is a computer with an internet connection, an up-to-date version of a standard browser (such as Google Chrome, Firefox, Safari, Internet Explorer or Microsoft Edge) and a PDF reader (such as Acrobat Reader).
We encourage learners to install R and RStudio and provide detailed installation instructions, but learners can also use free cloud-based services (RStudio Cloud) if they prefer not to install software on their computer.
Learners need to install Zoom for participating in videoconferencing sessions. We recommend the use of a headset for videoconferencing sessions.

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