

# R bootcamp - August 2022: Syllabus/schedule

July 12, 2022

The bootcamp will be held August 20-21, so Day 1 is August 20 and Day 2 is August 21.

Unless otherwise noted, modules are about 75 minutes long: 40 minutes for presentation, 25 minutes for breakout and 10 minutes for discussion of solutions.

- Day 1 morning (8:30-12:15) (learning R)
  - Module 0: Introduction, what is R, starting R, why R? (Chris) (15 minutes)
  - Module 1: Basics of R, with RStudio (Chris)
    - \* R as a calculator
    - \* helpful shortcuts: tab-complete, up arrow, Ctrl-{up arrow}
    - \* vectors and indexing and subset assignment
    - \* some basic functions; help()
    - \* vectorized calculations, comparisons
    - \* basic R objects: vectors, matrices, dataframes, lists
    - \* basic graphics
    - \* breakout problems
  - Break (15 minutes)
  - Module 2: Managing R and your analyses (Chris) (45 minutes)
    - \* managing R objects, the R workspace
    - \* using packages (installing, loading, namespaces)
    - \* the working directory and basic file reading/writing
    - \* Git, GitHub and version control
    - \* getting R help online

- \* breakout problems
- Module 3: Working with data (TBD) (45 minutes)
  - \* dataframes/matrices
  - \* attributes, missing values and factors
  - \* subsetting
  - \* strings
- Lunch (on your own) (12:00-1:30)
- Day 1 afternoon (1:30-5:00) (data processing and manipulation)
  - Module 3: Working with data, continued (TBD) (40 minutes)
    - \* more on reading data
    - \* breakout problems
  - Module 4: Calculations (TBD)
    - \* vectorized calculations and efficiency
    - \* apply, lapply
    - \* tabulation, stratified analyses, aggregation, merging data
    - \* breakout problems
  - Break (15 minutes)
  - Module 5: Programming in R (TBD)
    - \* loops, if-else
    - \* writing your own functions, function arguments, functions as objects
    - \* basic scoping and environments
    - \* breakout problems/homework
- Day 2 morning (9-12:45) (programming and data analysis)
  - Module 6: Data manipulation using the tidyverse (TBD)
    - \* stratified analyses: groupwise operations and split-apply-combine using dplyr
    - \* reshaping and tidying data
    - \* breakout problems
  - Break (15 minutes)

- Module 7: Graphics (TBD)
  - \* ggplot2 basics
  - \* using aesthetics to control plotting
  - \* exporting graphics (vector/raster formats)
  - \* breakout problems
- Module 8: Data analysis (TBD)
  - \* regression, GLMs
  - \* smoothing
  - \* optimization
  - \* simulation, sample()
  - \* dates and times
  - \* breakout problems
- Lunch (on your own) (12:45-2:00)
- Day 2 afternoon (2:00-4:30) (more advanced topics)
  - Module 9: Workflows, coding practices, and project management (Chris) (60 minutes)
    - \* debugging, timing, memory use
    - \* scripting, source(), batch jobs
    - \* good coding practices
    - \* reproducible research
  - Break (fill out feedback forms) (20 minutes)
  - Module 10: Advanced topics morsels (Chris) (60 minutes)
    - \* object-oriented programming (S3, S4, R6)
    - \* computing on the language (using R to write and evaluate R code)
    - \* errors and try-catch
    - \* encodings
    - \* working with databases
    - \* parallel processing: foreach, par\_lapply, RNG issues
  - Module 11: Wrapping up (Chris) (15 minutes)
    - \* R inconsistencies and different ways to do things
    - \* Where to learn more (campus and non-campus resources)