R bootcamp for Engineering - September 2019: Syllabus/schedule

September 3, 2019

The bootcamp will be held September 7-8, so Day 1 is September 7 and Day 2 is September 8.

Unless otherwise noted, modules are about 75 minutes long: 45 minutes for presentation, 20 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? why not 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 (Chris) (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 (Chris) (40 minutes)
    - more on reading data
    - breakout problems
  - Module 4: Calculations (Simal)
    - vectorized calculations and efficiency
    - apply, lapply
    - tabulation, stratified analyses, aggregation, merging data
    - breakout problems
  - Break (15 minutes)
  - Module 5: Programming in R (Emily)
    - loops, if-else
    - writing your own functions, function arguments, functions as objects
    - basic scoping and environments
    - breakout problems
- Day 2 afternoon (1-5) (programming, data analysis, and advanced topics)
  - Module 6: Data manipulation using the tidyverse (Chris)
    - stratified analyses: groupwise operations and split-apply-combine using dplyr
    - reshaping and tidying data

    - breakout problems/homework
- Break (15 minutes)
- Module 7: Graphics (Chris)
    - overview of graphics in R
    - ggplot2
    - exporting graphics (vector/raster formats)
    - breakout problems
- Break (fill out feedback forms) (15 minutes)
- Module 8: Advanced topics morsels (Chris)
    - timing, memory use
    - object-oriented programming (S3, R6)
    - errors and try-catch
    - working with databases
    - parallel processing: future, future.apply, foreach
- Module 9: Wrapping up (Chris) (15 minutes)
    - R inconsistencies and different ways to do things
    - Where to learn more (campus and non-campus resources)