Getting started with `R`

FOR 128: Lab 1

Solutions

2024-08-29

Welcome

Welcome to Lab 1! Today, we'll get started with a few data science tools (`R`, RStudio, and Quarto), learn to use `R` as a calculator, and get a glimpse into graphics with `R`.

Learning objectives

- Make sure `R` and RStudio are set up correctly.
- Set up folders on your computer for saving your work.
- Begin working with Quarto (.qmd) documents.
- Learn to save and render your work with Quarto.
- Start using `R` as a calculator.
- Gain familiarity with graphics in `R`

Deliverables (i.e., what to put in the lab drop box)

Upload your rendered PDF (`lab_01.pdf`) **and** Quarto (`lab_01.qmd`) document to the lab drop box. Make sure the Quarto document properly renders to PDF.

Collaborator(s)

List any collaborators you worked with in the space below.

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Part 1: Setting up your workspace

Exercise 1

Create a folder on your computer where you'll store all your work for this course. We do not suggest putting this on your Desktop. A better place would be your Documents folder or your home directory. Make sure to give the folder an informative name like `for128` or `for128_f24` or something else. Put this file (`lab_01.qmd`) in your new folder.

Now, run the following code chunk (press the green arrow on the far right of the code chunk). The output should include this file. What do you think the `list.files()` function does in this case? For all lab exercises in this course, please answer between the rows of dashed lines.

```
list.files()
```

```
 [1] "data_lab9"                   "data_lab9.zip"
 [3] "datasets"                    "FEF_trees.csv"
 [5] "lab_01_solutions.qmd"        "lab_01_solutions.rmarkdown"
 [7] "lab_01.qmd"                  "lab_02.qmd"
 [9] "lab_03_example.R"            "lab_03.html"
[11] "lab_03.qmd"                  "lab_04.qmd"
[13] "lab_05.qmd"                  "lab_06.qmd"
[15] "lab_07_web.qmd"              "lab_07.qmd"
[17] "lab_08_web.qmd"              "lab_08.qmd"
[19] "lab_09_web.qmd"              "lab_09.qmd"
[21] "lab_10_web.qmd"              "lab_10.qmd"
```

Shows the files in the current directory.

Exercise 2

Go to D2L and download the `datasets.zip` file. This file contains datasets needed to work with our textbook. Use your computer to "unzip" the file (a folder called "datasets" should appear). Move this folder into the folder you just created in Exercise 1. For now, we'll leave this directory alone, but we will use it for future labs.

Now, run the following code chunk. What do you think specifying the `path` argument in the `list.files()` function did?

```r
list.files()
```

```
 [1] "data_lab9"                   "data_lab9.zip"
 [3] "datasets"                    "FEF_trees.csv"
 [5] "lab_01_solutions.qmd"        "lab_01_solutions.rmarkdown"
 [7] "lab_01.qmd"                  "lab_02.qmd"
 [9] "lab_03_example.R"            "lab_03.html"
[11] "lab_03.qmd"                  "lab_04.qmd"
[13] "lab_05.qmd"                  "lab_06.qmd"
[15] "lab_07_web.qmd"              "lab_07.qmd"
[17] "lab_08_web.qmd"              "lab_08.qmd"
[19] "lab_09_web.qmd"              "lab_09.qmd"
[21] "lab_10_web.qmd"              "lab_10.qmd"
```

```r
list.files(path = "datasets/")
```

```
 [1] "BoundaryExamples"            "city_block_survey.csv"
 [3] "doubleSamplingData.csv"      "dplyrJoinAllometric"
 [5] "FACE"                        "FACE_aspen_core_growth.csv"
 [7] "FEF_species_summary.csv"     "FEF_trees_missing.csv"
 [9] "FEF_trees.csv"               "FEF_trees.tsv"
[11] "FEF_trees.txt"               "FVS_NE_coefficients.csv"
[13] "HF"                          "Honer_coefficients.csv"
[15] "Jenkins_coefficients.csv"    "loblolly_trees.csv"
[17] "Loblolly.csv"                "mn_trees_subset.csv"
[19] "mn_trees.csv"                "mnf-plot-55.csv"
[21] "neighborhood_survey.csv"     "PA"
[23] "PEF"                         "plotSamplingExample"
[25] "RDS-2013-0015"               "RDS-2016-0016"
[27] "samplingWithCovs.csv"        "tidyPlotSummaryExample"
[29] "tidyPlotSummaryExample.zip" "TODO"
[31] "TODO~"                       "tree_list_2_plots.csv"
[33] "tree_list_2_plots.csv~"      "trees_1_tidyverse.csv"
[35] "twin-lakes.csv"              "two_stands_wo_ht_vol.csv"
[37] "USFS_species_codes.csv"      "WeatherKLAN2014.csv"
[39] "WeatherKLAN2014Full.csv"
```

Now, the files in the `data` subdirectory are listed.

Exercise 3

Render this document by clicking "Render" towards the top of the RStudio window. What does it look like? Does the output of your code from Exercises 1 and 2 look the same? If it doesn't, why do you think that is the case?

Note: You can answer this Exercise just with words, so there is no need for a code chunk for this Exercise.

Here, we see a .rmarkdown temporary file appear. The student need not have great intuition about this, just observe that it appears and attempt to explain why it might be there.

Part 2: `R` as a calculator

Exercise 4

Do Exercise 2.1 from IFDAR in the following code chunk.

```r
# put your code on the following line
4 + sqrt(5)
```

```
[1] 6.236068
```

Exercise 5

Do Exercise 2.2 from IFDAR in the following code chunk.

```r
exp(10)
```

```
[1] 22026.47
```

Exercise 6

Do Exercise 2.3 from IFDAR. Note, you'll have to make your own code chunk.

Hint: on Windows and Linux you can create a new code chunk with control + alt + I and on macOS you can make a new code chunk with command + alt + I. Otherwise, you can create a new code chunk by clicking the code dropdown menu in RStudio and then clicking Insert Chunk.

```r
5^5 - 10^10
```

```
[1] -9999996875
```

Exercise 7

Do Exercise 2.4 from IFDAR. Note, you'll have to make your own code chunk.

```r
(5 + 5) / (3 * 4)
```

```
[1] 0.8333333
```

Part 3: A glimpse into graphics

Exercise 8

Part (a)

Run the following code to install the `ggplot2` package. Note the `eval: false` setting. This means this code will not run when you render the document (we don't want to install `ggplot2` every time we render the document, rather we'd like to install it just once when we run the chunk by hand). Do not change the `eval` setting for this code chunk.

```r
install.packages("ggplot2")
```

If everything has gone correctly, the following chunk should return `TRUE`:

```r
"ggplot2" %in% installed.packages()
```

```
[1] TRUE
```

Part (b)

Use the `rnorm()` function to generate 100 random numbers with a `mean` of 0 and a `sd` of 1. Save these numbers to an `R` object called `draws`.

```r
draws <- rnorm(n = 100, mean = 0, sd = 1)
```

Part (c)

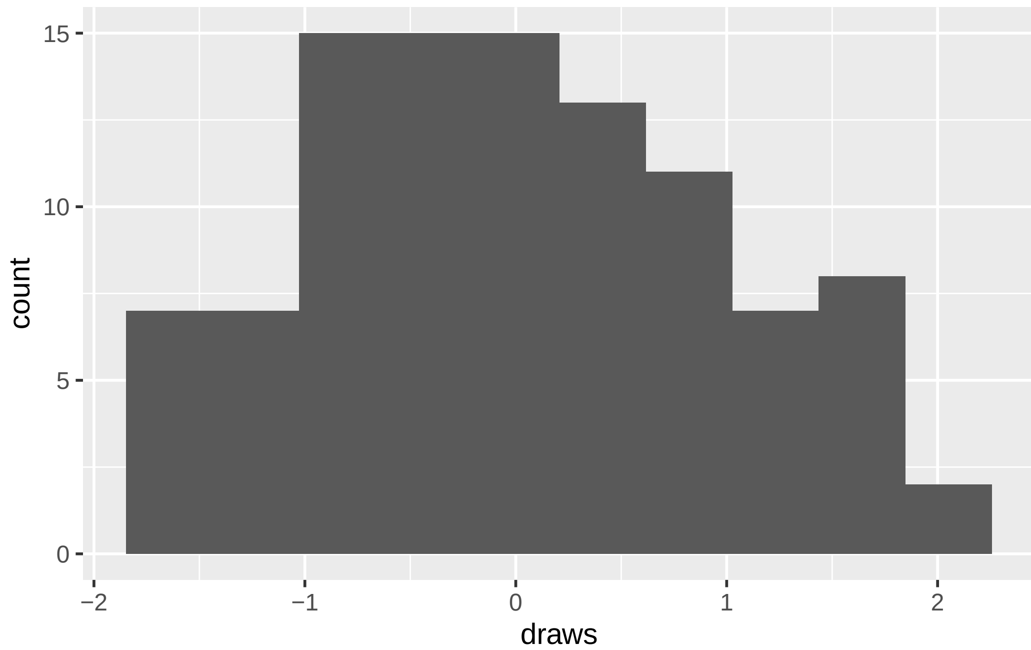
Once you have completed parts (a) and (b), set the `eval` option from `false` to `true` in the following chunk. Then run the following code and comment on what you see. What happens if you change the number of `bins` from 10 to 20? to 50? to 100? to 1?

Note: You are not expected to understand the following code at this stage of the course, but it is a good glimpse into what we'll do as the course progresses.

```r
library(ggplot2)

dat <- data.frame(draws = draws)

ggplot(data = dat, mapping = aes(x = draws)) +
  geom_histogram(bins = 10)
```



The students should notice that the number of bins increases as bins increases.

Wrap up

Congratulations! You've made it to the end of Lab 1. Make sure to render your final document and submit both the .pdf and .qmd file to D2L.