Getting Started with R and RStudio

Statistics 109

Spring 2020

Topics

- *RStudio Cloud*
- Installing R, *RStudio*, and LaTeX (Optional!)
- R and *RStudio* Tutorial

RStudio Cloud

Rstudio.cloud is a cloud-based service that runs R and *RStudio*; conveniently, it is also equipped with the necessary packages for knitting R Markdown scripts into PDF files. Create an account by signing up at https://rstudio.cloud/. To join the class workspace, click here. The workspace is hosted at https://rstudio.cloud/spaces/44458/projects.

The class workspace contains RStudio Projects for each assignment; a project is a self-contained directory structure that contains the files (e.g., datasets) needed for an assignment.

Installing R, *RStudio*, and LaTeX (Optional!)

Note: The instructions in this section are only recommended if you anticipate needing to work on assignments while without internet access.

First, download R from http://cran.us.r-project.org/. Versions are available for Windows, Mac OS X, and Linux. Follow the instructions when running the installation program, selecting the default options when prompted.

RStudio can be downloaded from https://www.rstudio.com/products/rstudio/download/. Scroll down to "Installers for Supported Platforms" and select the appropriate version for your system. Leave all default settings in the installation options.

The easiest way to install LaTeX for use with R Markdown is to install the TinyTex R package. Instructions are available at https://yihui.name/tinytex/.

The *RStudio* Console

The *RStudio* environment is organized by panes, with the default layout shown below; the script editor and console are on the top and bottom left, and there are additional panes on the right. The script editor is used to create and edit files. Multiple files can be open at once, and will appear as separate tabs. If the script editor is not visible, open a new file via *File* > *New File* > *R Script* to make the script editor reappear. When commands are run in the script editor, the commands and the corresponding output appear in the console.

RStudio can be used to create several types of files; the major two types are R Script files (`.R`) and R Markdown files (`.Rmd`). An R Script file contains code that can be executed in the script editor. Saving code in a script file makes it easy to reuse or modify code at a later time. An R Markdown

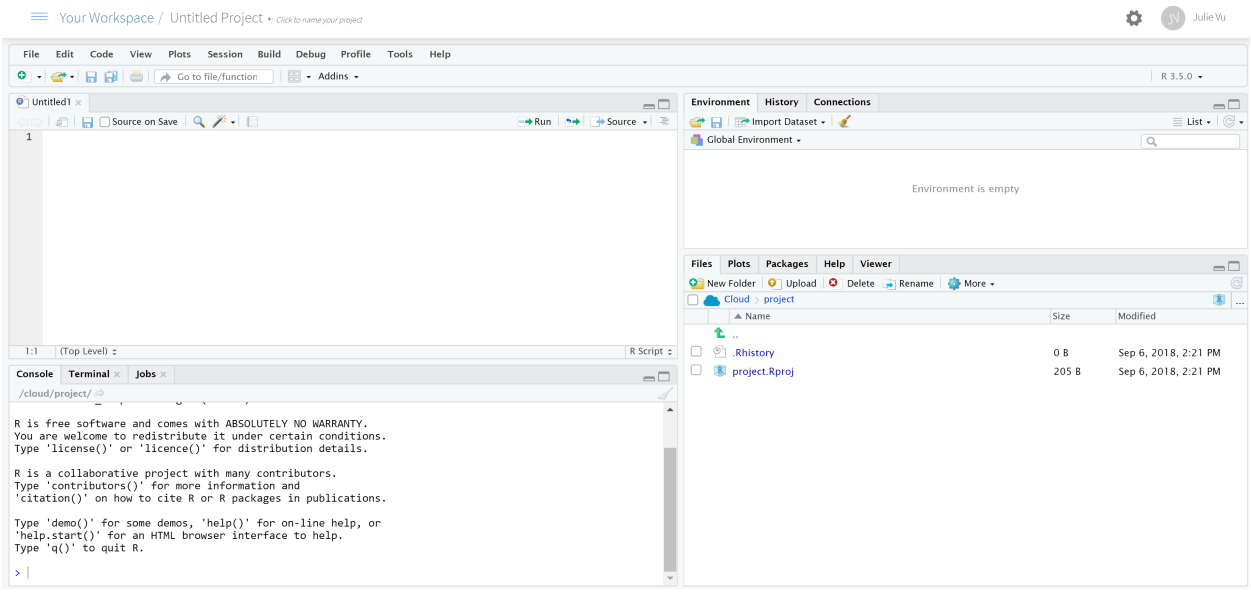

Figure 1: The default layout of the *RStudio* console

file contains both code and plain text, and can be used to generate a PDF document that contains output (including figures or calculations) along with the text.

R and *RStudio* Tutorial

This file is an R Markdown file. While R commands can be entered in either a code chunk or the console, it is recommended to always use a code chunk; code entered in a chunk can be easily edited and re-run, as well as saved.

1. Below is an example of a code chunk. A code chunk can be inserted by either 1) choosing *Insert* > *R* from the menu on the right of the toolbar on top of the script editor, 2) the keyboard shortcut Ctrl/Alt/I on the PC and Cmd/Option/I on the Mac, or 3) typing out the three apostrophes followed by an `r` enclosed in braces, then the additional three ending apostrophes.

   To run the code in the chunk, click the green 'play' symbol at the upper right of the chunk. To run a specific line, place the cursor on the line and use the keyboard shortuct Ctrl/Cmd + Enter.

   In order for the output to appear in the PDF, change eval = FALSE to eval = TRUE.

```
#some arithmetic expressions
8 + 3
log(2)
((121/3) * (6^3))/(pi)
```

2. The previous calculations only produce output in the console. To save a value, assign it a name by using "=". Entering the name of a value will return the value. For example, run:

```
#create x and y
x = 8 + 3
```

```
y = log(2)

#calculation
x + y

#define and return z
z = x * y
z
```

3. Take a look at the Environment tab in the top right pane—the values of `x`, `y`, and `z` are displayed. Any created data structures or loaded datasets will appear in this tab. All objects can be cleared by selecting the broom icon.

4. Note that R is case-sensitive; `x` and `X` are not the same. If you try to run `X`, an error will be returned since no value has been named `X`. If the same name is used again to define a new value, `R` will overwrite the previous information. For example, redefine `x`:

```
#a semicolon (;) can be used to separate commands
x = 8 + 3; x
x = 21; x
```

5. Variables can not only contain single values, but also vectors or matrices of values. One simple way to create a vector is to use the `c()` command:

```
#define and return vectors a and b
a = c(4.1, 6.7, 8.2, 1.8); a
b = 2*a; b
```

6. Use `mean()` and `sd()` to find the mean and standard deviation of the numbers in `a`:

```
#calculate mean and standard deviation
mean(a)
sd(a)
```

7. Plots appear in the Plots tab in the upper right. Plot the values of `a` against the values of `b`:

```
#plot a against b
plot(a, b)
```

8. R has help pages that can sometimes be useful; they typically contain a basic description and include syntax information. To look up what a certain function does, use `?`; for example, run `?mean` and the help page for the `mean` will appear in the Help tab on the bottom right. Often, the most helpful part of a help page is the Examples section, which appears at the end.

9. The Files tab shows all the files on the cloud (or the local computer); the "..." icon in the upper right corner opens up the directory in a separate window, which makes it easier to browse for a particular location.

10. The plain text sections of a R Markdown file can be formatted according to Markdown (more details in Homework 0) or to LaTeX. LaTeX is perhaps best learned through practice and modifying examples, so an in-depth explanation is not provided here.

11. To compile an R Markdown file into a PDF, click *Knit PDF* on the toolbar of the script editor.

12. Bonus: the *RStudio* workspace can be customized easily. The panels can be rearranged by going to *Tools* > *Global Options* > *Pane Layout*. Other customization options (e.g., font size, themes, etc.) are available under *Global Options* > *Appearance*.