CHAPTER 2

Overview of R and RStudio

OBJECTIVE
This chapter shows you how to set up RStudio and use it to run R scripts. You will learn about RStudio Cloud and RStudio Desktop, the 2 important and user-friendly R editors that are used throughout this book to run R scripts. After showing how you can set up these 2 platforms, I will cover the basics of the R language as well. After reading this chapter, you will be able to write and successfully run R scripts that implement simple data analyses.

Contents

2.1   Introduction

In this chapter, you will learn how to set up the R environment that you need to start doing some data analysis. I mentioned in chapter 1 that the use of R in this book will be done through the user-friendly interface RStudio. Given the growing popularity of R in the past several years, many alternative R editors were developed. However, RStudio is widely recognized as being one of the best R interfaces being used today. Moreover, it comes with a free version that has all the features that you will ever need.

As a beginner, you have 2 options for using RStudio. One option is *RStudio Cloud* (renamed as "Posit Cloud" since 2022)[1] and the second option is *RStudio Desktop*. RStudio Cloud requires that you remain connected to the Internet at all times as it is a managed cloud instance of the RStudio Integrated Development Environment (IDE). *RStudio Desktop* on the other hand, is a standalone desktop application used as interface to the version of R installed at your local Windows, Mac OS X, or Linux workstation. Once installed, RStudio Desktop does not require the Internet nor any other software to work.

> *If you are an absolute beginner and have a reliable Internet service each time you want to work, then I would recommend RStudio Cloud. Otherwise, I recommend that you use RStudio Desktop.*

I will review RStudio Cloud in section 2.2, and RStudio Desktop in section 2.3.

2.2   RStudio Cloud

As a tool for learning to use R, I do believe that *RStudio Cloud* would be hard to beat for those with continuous Internet access, and will likely remain unbeatable in a foreseeable future. I like this product very much even though I am an experienced R user. RStudio Cloud requires no installation. As soon as you sign up, you will only need your log-in information to start working.

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[1]Throughout this chapter, I will still use the term "RStudio Cloud" to refer to RStudio in the cloud through "Posit Cloud". In fact, Posit Cloud offers more than RStudio in the cloud.

- Before you can use *RStudio Cloud* you need to register with the following web address:

<div align="center">

https://posit.cloud/

</div>

Although you have the *Free*, *Basic*, *Standard*, *Instructor* and *Student* plans, you need to start with the *Free* plan as a beginner. The registration process is intuitive and self-explanatory, and requires only to fill out the simple form showed in Figure 2.1.
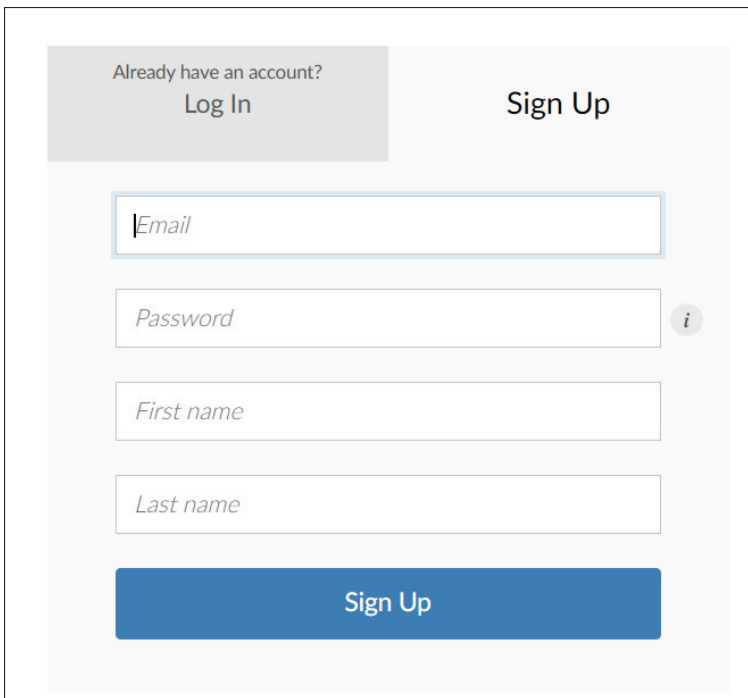

Figure 2.1: Signing Up to RStudio Cloud

After completing this form and clicking on the `Sign Up` button, an email will be sent to the address you provided. Upon receiving that email, you will need to click on the "verify your email" action link within 72 hours. You can then go back to the registration page to click on the "Continue" button. That is it. You are now ready to start using the cloud version of RStudio.

- Once the RStudio Cloud dashboard opens, you need to know one fundamental thing about this new environment. A **project** is the fundamental

unit of work in RStudio Cloud. That is, you will start any task in RStudio by first creating a project. This is done by clicking on the `New Project` button on the right-hand side of the screen as shown in Figure 2.2. You will select the first option "New RStudio Project." *Do not get distracted by the many options offered by this dashboard.* You will have time to become familiar with them at a later time. You cannot be a beginner and an experienced R user at the same time.
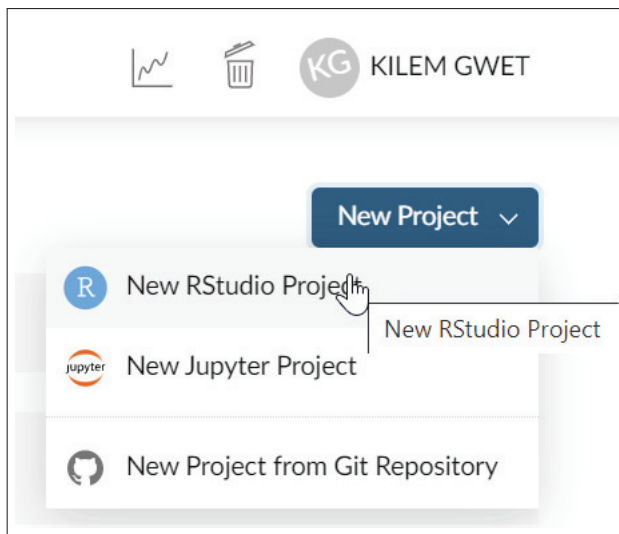

Figure 2.2: Creating a New Project in RStudio Cloud

- When you launch RStudio Cloud for the first time, its dashboard will have 2 sides. The left side is the "navigation sidebar," whereas the right side is your workspace. The navigation sidebar is where you will find a lot of resources for learning about the RStudio platform. Do not hesitate to explore it at length whenever you can.

  The initial workspace you will see after launching RStudio Cloud for the first time will look like the picture in Figure 2.3. This appearance may change by the time you experiment with RStudio Cloud, due to new updates to the platform. The current guidelines provided here will still be useful, although some objects may have been relocated.

  The first thing to do is to name your project by clicking on "Untitled Project" and by typing your project's name. The "RStudio Console" pane is where you would type R commands to create R objects, which

will appears in the "Environment" pane. The "Project Directory" is where the different data files of your project are stored.

Before, you begin working, I strongly recommend adding the "Scripts" pane to your Workspace of Figure 2.3, so that your new Workspace looks like Figure 2.5. The "Scripts" pane is a place where you type a series of R commands prior to executing them. *You would add the Script pane to your workspace by going to the main horizontal menu and by selecting* `File > New File > R Script` *as shown in Figure 2.4*. From now on, I will always assume that your workspace is similar to what you see in Figure 2.5.
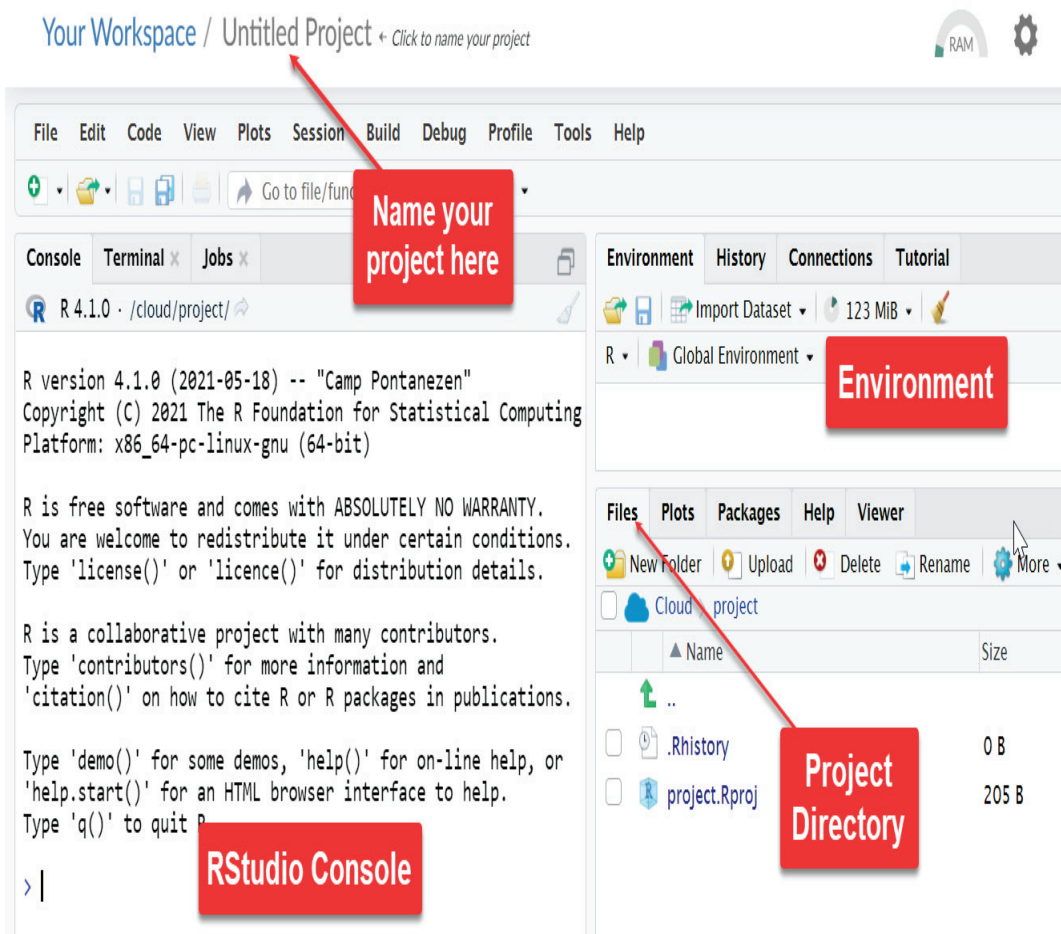

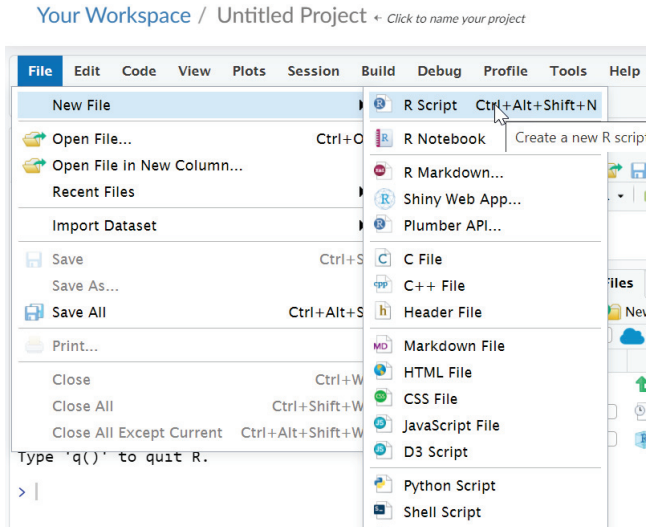Figure 2.3: Initial Workspace in RStudio Cloud
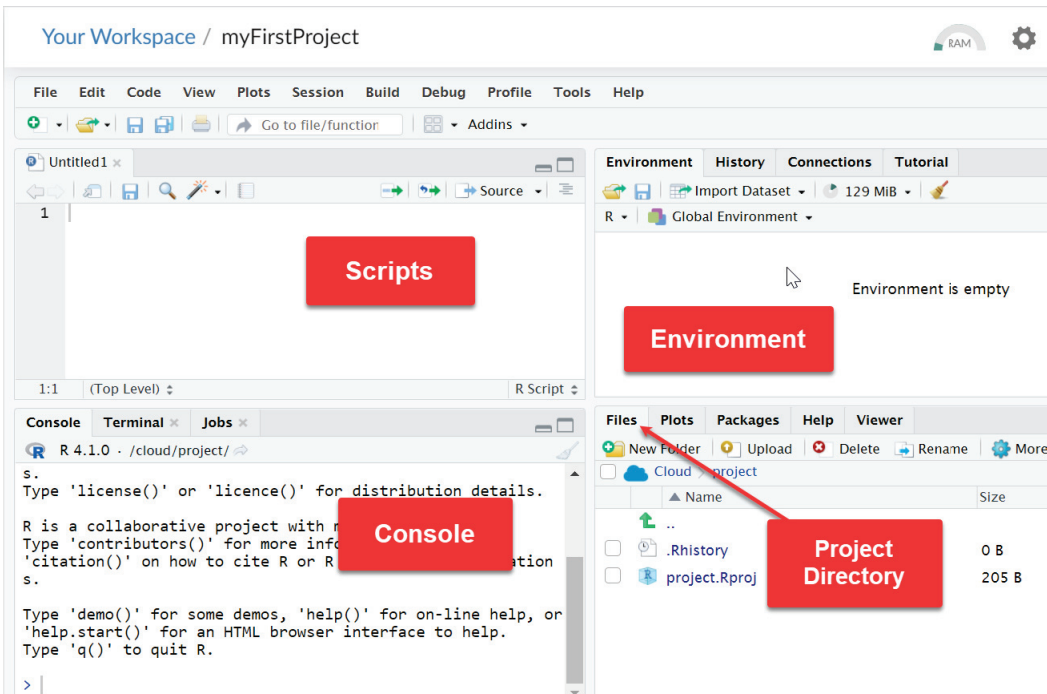
Figure 2.4: Creating the "Scripts" Window

Figure 2.5: Recommended Workspace in RStudio Cloud

2.3   RStudio Desktop

If you want to use RStudio with or without Internet, then you need to install it locally on your machine. The process is still simple, and both R and RStudio have free versions. Even experienced individual users like myself still use these free versions, which are likely to satisfy all of your needs.

You need to install 2 programs. The first program you need is R, and the second is RStudio. R is the language in which the commands will be issued, and RStudio the interface that you will use to interact with the R language. Since RStudio does not come with R, both products must be installed separately.

- **Installing R**

  To start, go to the website **https://cloud.r-project.org/**. It is *The Comprehensive R Archive Network*, best known in the R world by the acronym CRAN. The appearance of the main part of this webpage is shown in Figure 2.6. Click on the appropriate link and follow the instructions to download and install R. Do not get distracted by the plethora of information presented on this page. R is a system that aims at offering many different ways for resolving the same problem. The challenge is not to find the best option. Instead, it is to focus on one option that works well.
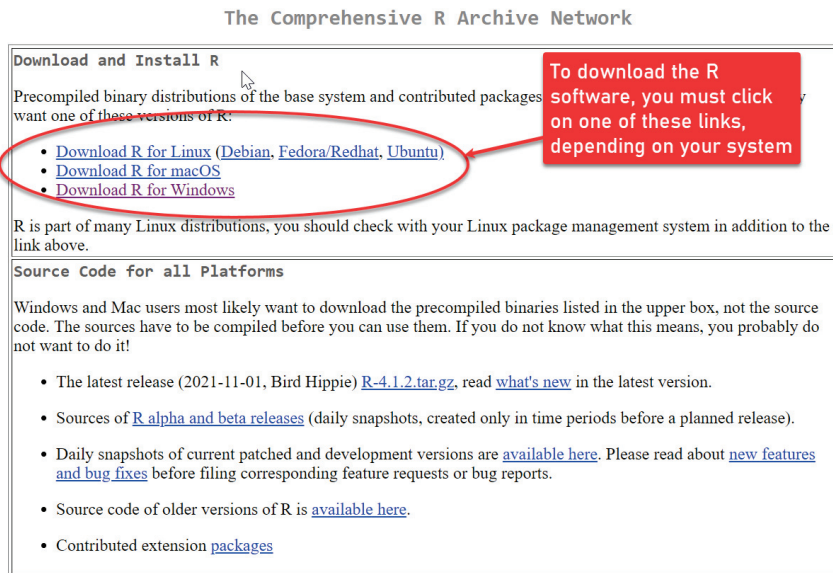
Figure 2.6: The Comprehensive R Archive Network's Webpage

- **Installing RStudio Desktop**
  To install RStudio, first visit the following webpage:

  ## https://posit.co/download/rstudio-desktop/

  Depending on the operating system you are using (e.g. Windows, macOS, Ubuntu,...) you need to download the appropriate installation file. Then double-click on the downloaded file and follow the instructions for installing RStudio Desktop.

Organizing the Workspace

The first time you open RStudio Desktop after installation, you will see a window with 3 panes as shown in Figure 2.7. Let us review each of these panes and their respective roles in a typical RStudio session.
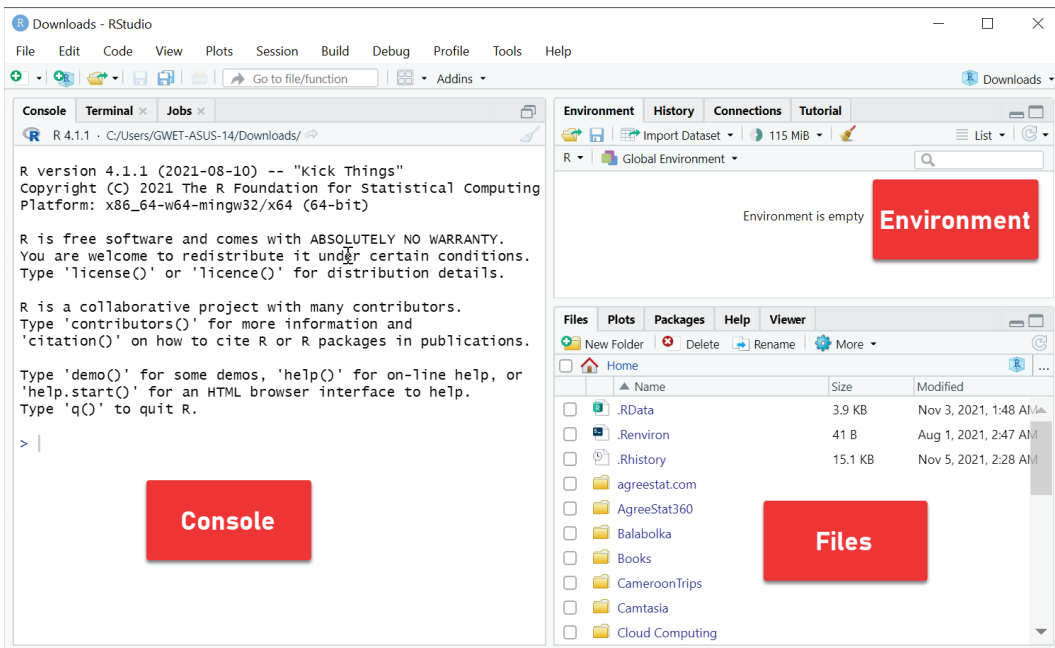

Figure 2.7: Initial RStudio Desktop Workspace

The first and largest pane on the left-hand side is the RStudio *Console* where you can type R commands at the prompt. Its appearance is similar to

that of RStudio Cloud. The *Environment* pane displays among other things all R objects that you create, whereas the *Files* pane shows various directories, files and more. I suggest you also add another useful window for Scripts so that your R workspace's appearance is as shown in Figure 2.9. This is done by going to the main horizontal menu and selecting `File > New File > R Script` as shown in Figure 2.8.
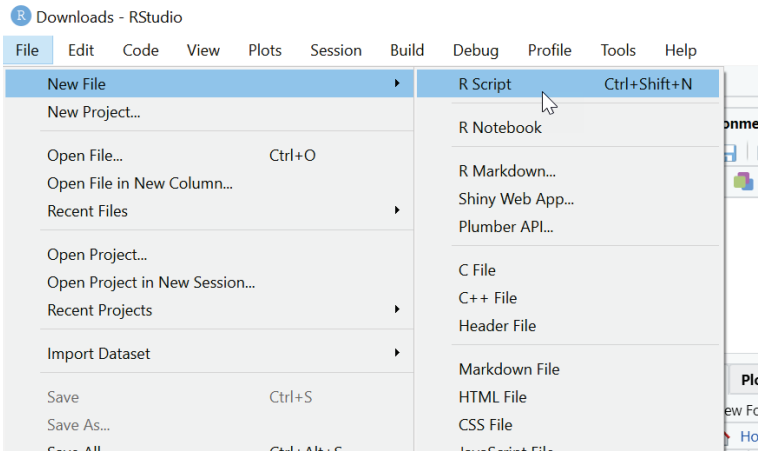

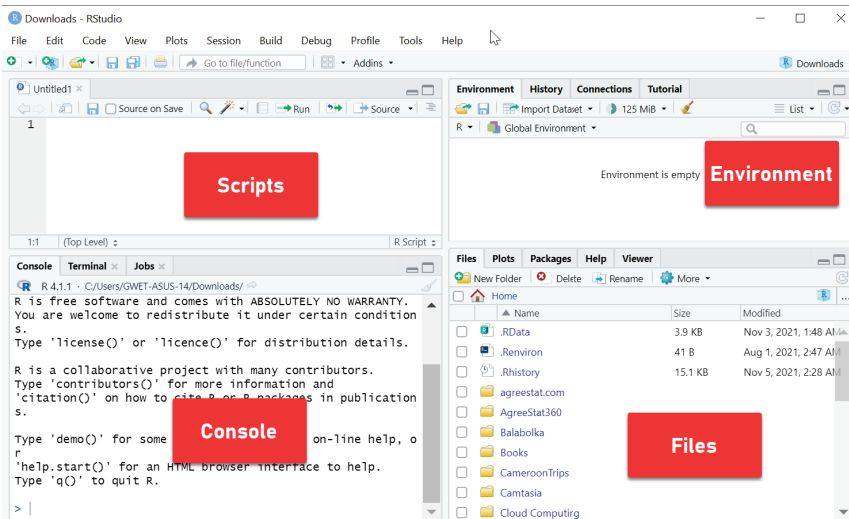Figure 2.8: Creating the Scripts Window in RStudio Desktop

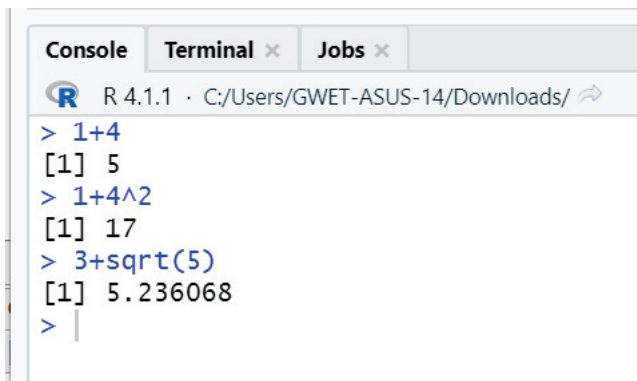Figure 2.9: RStudio Desktop Workspace with Scripts Pane

2.4   Using RStudio

In this section, you will learn how to write and execute basic R commands in RStudio. You will also see what a typical RStudio workflow looks like, from the creation of a script file, to its execution in batch mode.

2.4.1   R Commands in RStudio

Let us now see a few things that you can do in this new platform, by crunching some numbers:

- You can always clean the *Console* any time by selecting it and typing `CTRL+L`. It is a tip that you will use very often in RStudio.

- Within the console, you can perform all the basic arithmetic operations. At the prompt, you can type `> 1+4` then press `ENTER` to see the answer "5" as shown in Figure 2.10. Next, type `> 1+4^2` and press `ENTER` to obtain "17," which represents $1+4^2 = 17$. Finally, you can compute $3+\sqrt{5}$ by typing the R command `> 3+sqrt(5)` to get the answer "5.236068." Note that R commands are case sensitive. That is executing the command `SQRT(5)` as opposed to `sqrt(5)` will produce an error message.

Figure 2.10: Basic Arithmetics on RStudio Console

You may want to know why the R console always displays `[1]` right before the result. Because RStudio console often prints multiple-element