A gentle introduction to R and RStudio

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R is a programming language that is used by scientists in a wide variety of fields. It is open source (free to use and driven by community development) and installable on all major operating systems. RStudio is a separate installation from the R language, and is a desktop program that provides a graphical wrapper to the R language. The technical term for this type of program is *integrated development environment* (IDE), and it makes life much easier when using R. This document will get you up and running in R and RStudio on your personal machine. You will need installation permission on your computer (if installing on your home computer you will almost certainly have this).

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1 Installation

Depending on download and computer speed, you should plan to spend about 15 minutes installing both R and RStudio. The LaTeX download is much larger, and could take longer if you are not on fast internet. If on slow internet, I recommend connecting the power supply, making sure your computer is set to not go to sleep, and downloading the files overnight.

1.1 R

We will use R for calculations, statistical analyses, and plotting data. R is generally more powerful than Excel or other 'point-and-click' programs, and once you generate code to perform a certain calculation or generate a graph, you may quickly reuse that code throughout the semester.

There are numerous online resources (including YouTube videos) that outline how to install R. Below are general instructions for a normal installation in Windows 10.

1. Navigate to the R project homepage.
2. Click on the **CRAN** link under the **Download** header on the left side of the page. **CRAN** is an archival network that stores R and the majority of 3rd-party packages.
3. Choose your operating system, and then click through using either the **base** hyperlink or the **install R for the first time** hyperlink (they take you to the same place).
4. Click **Download R**, which will download an executable into your downloads folder.
5. Run this executable file, which will take you through the R installation process. Keep all defaults.

You now have the R language installed on your computer. If you were to open R, the base R terminal would appear (Fig. 1) At its simplest, R is run from this command line window. You could dive in and start scripting immediately, but there are programs that make navigating and writing in the R language a much more pleasant experience (i.e. R Markdown).

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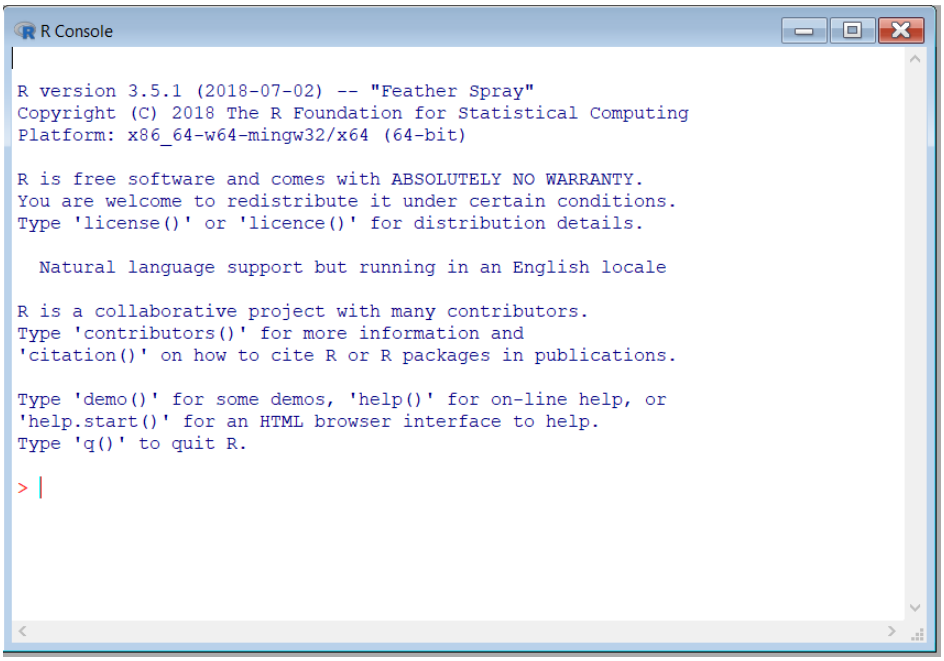

Figure 1: This is the R console, which you may open after installing R. The text that appears is non-editable, and includes some basic information about the current version of R you have installed (the R team gets creative with their version names). You may start scripting by typing next to the red greater-than sign. While completely functional, the R console lacks many 'bells-and-whistles' that a full IDE provides.

1.2 RStudio

RStudio is a free, open-source **integrated development environment** (IDE) that significantly improves the R experience. It is a excellent text-editor, provides ways to import data into the R environment without writing code, and exports figures and documents. And again, if you prefer a visual walkthrough, there are many good YouTube videos that cover this installation.

1. Navigate to the R Studio homepage.
2. Click **Download R Studio**.
3. **Download** the free RStudio open source license. The other options add functionality for large teams of researchers, which we do not need for this lab.
4. Choose your operating system under **Installers for Supported Platforms**, which will download an executable file to your downloads folder.
5. Run this executable file, which will take you through the RStudio installation. Keep all defaults.

1.3 LaTeX

LaTeX is a document preparation system for high-quality typesetting. Some people write in raw LaTeX, but RStudio provides a simpler Markdown language that is both easier to read and easier to learn. Below is a primarily windows-based walkthrough for installing a LaTeX distribution for use with RStudio.

RStudio recommends a complete installation of MiKTeX if you are a Windows user, and TexLive if you are Mac OS user. If you do not have a LaTeX distribution installed, Rstudio will throw an error when you try to *knit* your document and direct you toward the downloads page for your operating system. You will download a copy of the installer program from the distribution's website, and when you run that program it will download and install the actual LaTeX distribution. **CAUTION**: the LaTeX distribution is a rather large collection of files. Make sure you are on the fastest internet available to you, and that your roommate is not

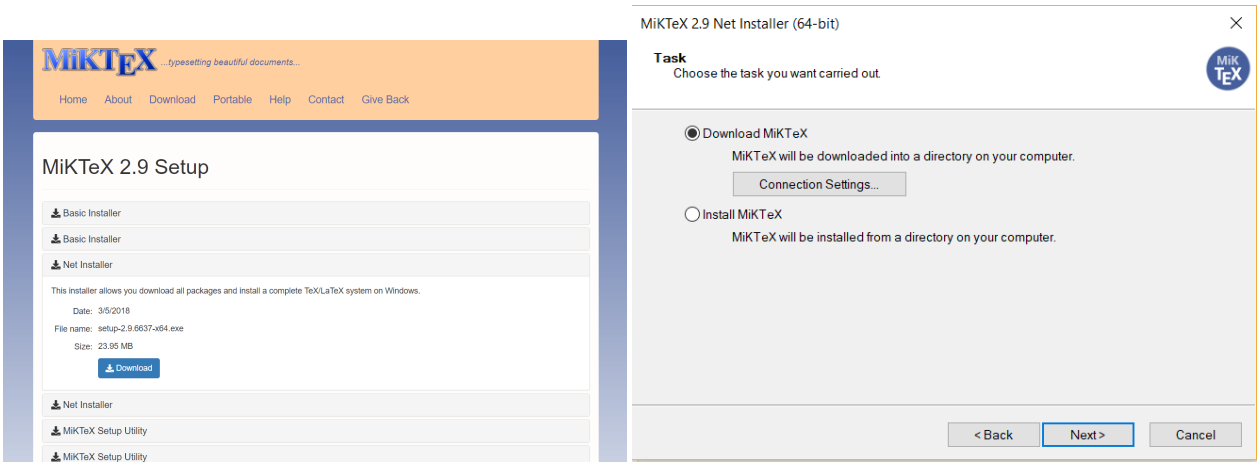

Figure 2: MiKTeX download page (left pane) and installation window (right pane) showing correct version and choice options.

in the middle of an online game. I will also have a USB thumb-drive with this download in lab that you can transfer to your personal computer.

1. Download the installer for Windows or Mac OS (Fig. 2, left panel).
2. Open the MiKTex installer.
3. Accept copying conditions.
4. Choose the **Download MiKTeX** option and click next. In lab, I will also have a USB thumb-drive with this download.
5. Choose **Complete MiKTeX** and click next (Fig. 2, right panel). This means you will not have to install different packages piecemeal every time you need a new function.
6. Choose a download mirror somewhere in the United States and click next. *http* vs *https* does not really matter.
7. Accept the default installation directory and click next.
8. Click **Start**, which will begin the download. This is a rather large series of files. So go take a coffee break.
9. Once downloaded, run the installer again and this time choose the **Install MiKTeX** option. Use default options throughout the installation process.