A

Work with R

A.1 Installation of R and RStudio

This appendix provides instructions for installation of R and its graphical user interface (gui) Rstudio. Instructions are provided for Windows and for Mac OS X.

A.1.1 Windows

1. **Download R.** Go to

   ```
   https://cran.r-project.org/bin/windows/base/
   ```

   and click on **Download R 4.x.x for Windows** (Figure A.1). This will

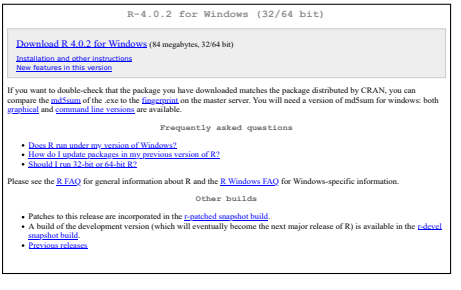

   FIGURE A.1: Download site for R in Windows.

   download the executable installer `R-4.X.X-win.exe`.

2. **Install R.** Open the downloaded installer by double-clicking on the `.exe` file, and follow the instructions to install R. Proceed with leaving all the installation options as they are by default.

3. **Download RStudio.** Navigate to

   ```
   https://www.rstudio.com/products/rstudio/download/
   ```

and choose the free version by clicking on the respective Download button. Finally, download `Rstudio` with the blue button labelled **"DOWNLOAD RSTUDIO FOR WINDOWS"** (Figure A.2). This will download the installer `RStudio-1.X.XXX.exe`.

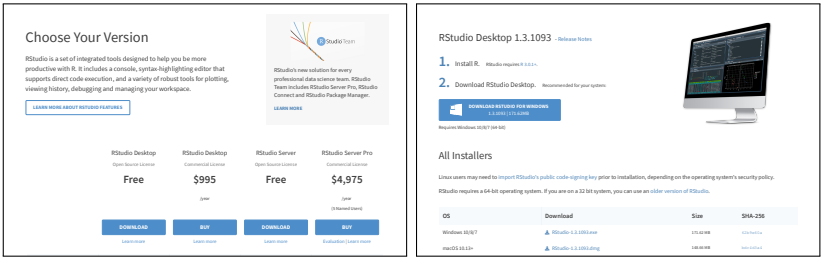

FIGURE A.2: Choose the free plan and download RStudio for Windows.

4. **Install RStudio.** Open downloaded installer and follow instructions to install the RStudio. Leave all default settings of the installation options.

A.1.2 Mac OS X

1. **Download `R`.** Go to

```
https://cloud.r-project.org/bin/macosx/
```

and click on **Download `R-4.x.x.pkg`** in the bottom left-hand corner.

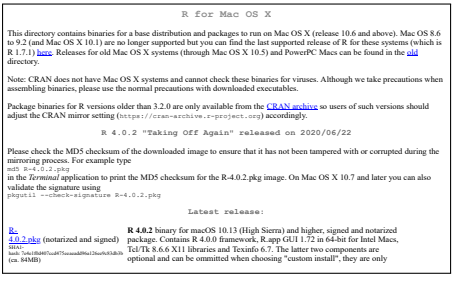

FIGURE A.3: Download site for `R` in Mac OS X.

2. **Install `R`** by double-clicking on the `.pkg` file. Leave all default settings in the installation options.

3. **Download RStudio.** Go to

```
https://www.rstudio.com/products/rstudio/download/
```

and choose the free version by clicking on the respective Download button. Finally, download Rstudio with the blue button labelled **"DOWNLOAD RSTUDIO FOR MAC"**.

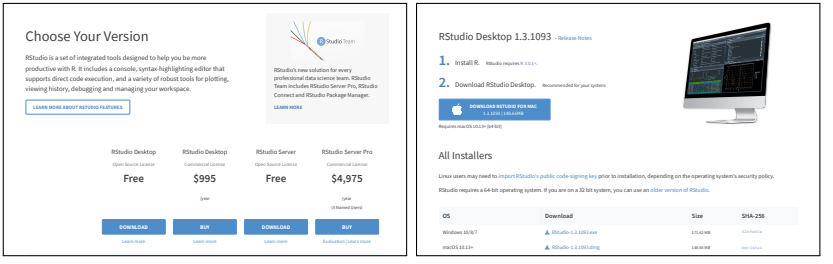

FIGURE A.4: Choose the free plan and download RStudio for Mac.

4. **Install RStudio** by either double-clicking or dragging the application icon onto your Applications folder.

A.2 Basic work with R in RStudio

Once both R and RStudio are installed, you may start working either in bare R console or in a so-called *Integrated Development Environment* (IDE) of RStudio, which is recommended. New file may be open by clicking on the RStudio icon. Alternatively, you may open an existing and previously saved R file with script/source code, R environment (including all objects and history), or an existing R project composed of multiple files or directories. As mentioned in the Preface of the book, source files for each chapter are included in a GitHub repository

```
https://github.com/patriciamar/psychometrics_intro/
```

We recommend downloading files of this repository into a local folder of your choice and clicking on the chapter source (.R) files to start RStudio. Alternatively, you may type or copy-paste the code provided in the book directly into the console.

The RStudio is typically divided into four sections (panes), see Figure A.5 One section (the upper-left part in Figure A.5) is devoted to R script. The R script includes lines of code run in the analysis. It can be saved and

later uploaded to allow for reproducibility and further extensions of the analysis. Another section (the lower-left part in Figure A.5) is the console, which displays the results of the analysis. One can either type into the console directly, or can run lines or parts of the code from the R script pane. In the next pane (the upper-right part in Figure A.5), the RStudio typically offers list of objects created in the analysis. The last pane (the lower-right part in Figure A.5) displays generated plots and figures, provides list of installed and attached packages, and offers help pages for description of functions.

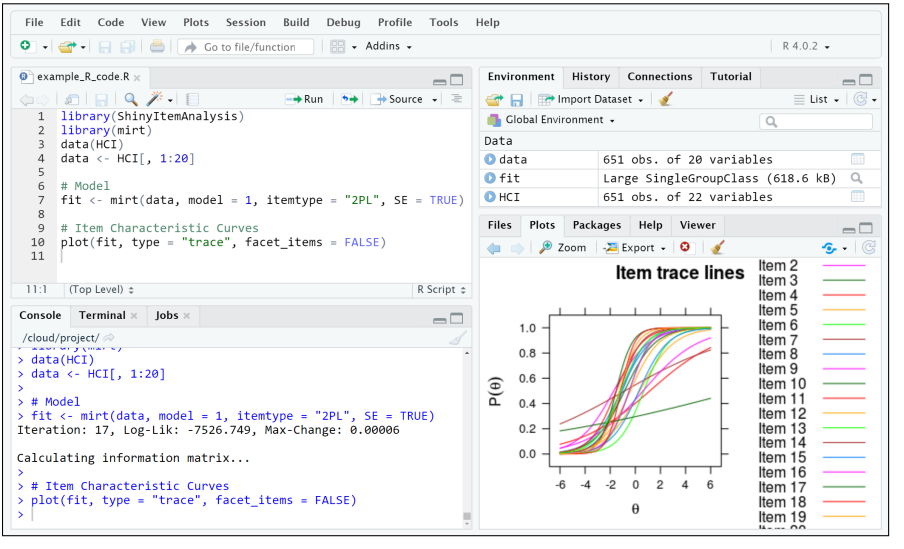

FIGURE A.5: Screenshot of the RStudio environment.

Before turning to sample R code for individual chapters, you may try to use R as a fancy calculator:

```
1 + 2
## [1] 3
sqrt(25)
## [1] 5
(v <-  c(1:10))  # define v as a vector of numbers 1 to 10
## [1] 1 2 3 4 5 6 7 8 9 10
v * 3
## [1] 3 6 9 12 15 18  21 24 27 30
```

But R can do much more: define different types of objects including functions, simulate and upload external data, perform complex analysis and provide fancy graphics. For deeper introduction to R, see for example (Paradis, 2002).

A.3 Installation of the R packages

Besides base functions, R offers many contributed packages. These packages need to be downloaded and installed before they can be used. This needs to be done only once. To download an R package from the CRAN repository, one needs to run the following command, e.g. by typing in directly into the console:

```
install.packages("MISSING-PACKAGE")
```

where MISSING-PACKAGE is replaced by the name of needed package. To install packages, one can use also a clickable environment of RStudio (Figure A.6).

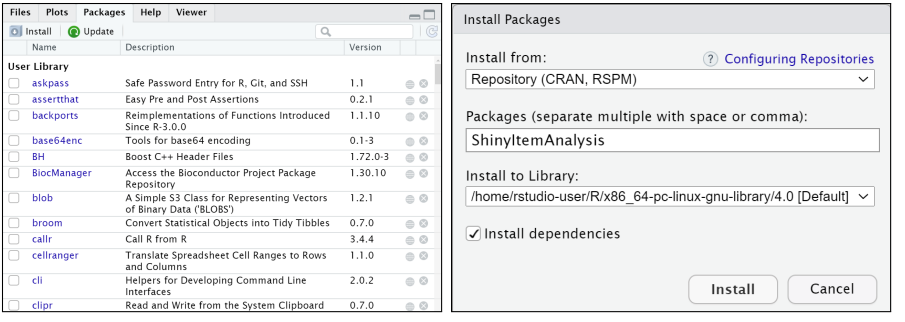

FIGURE A.6: Clickable environment of the RStudio to install missing packages.

Packages can be installed from CRAN (internet connection is needed), or from a local folder. Another possibility is to download and install packages from a GitHub repository. This can be done with the `install_github()` function of the `devtools` package by typing

```
devtools::install_github("USER_NAME"/"PACKAGE_NAME")
```

where `USER_NAME` is replaced by the name of the GitHub user who hosts the package repository and `PACKAGE_NAME` is the name of the package to be downloaded and installed.

The following R source file on GitHub includes code lines for installation of all packages used in this book.

```
https://github.com/patriciamar/psychometrics_intro/
        blob/master/Installing_packages.R
```

Download the file, open it in R or RStudio and run all lines of the code.

Once the needed R packages are installed, they have to be loaded and attached. This needs to be done in each new R session, for example whenever R or RStudio are started or when R session is restarted. Packages can be loaded and attached with the `library()` function:

```
library("MISSING-PACKAGE")
```

where MISSING-PACKAGE is replaced by name of the package needed to be uploaded and attached. For this book, each chapter source code file includes lines for loading and attaching the packages needed in that chapter.

A.4 Installation of the ShinyItemAnalysis package

The ShinyItemAnalysis can be standardly downloaded and installed from the CRAN repository as was shown in Appendix A.3 using the clickable environment of RStudio (Figure A.6) or by typing

```
install.packages("ShinyItemAnalysis")
```

Alternatively, one can download the last development version of the ShinyItemAnalysis package, which is available on GitHub, by typing

```
devtools::install_github("patriciamar/ShinyItemAnalysis")
```

Once the ShinyItemAnalysis package is installed, it needs to be loaded as a standard R package:

```
library(ShinyItemAnalysis)
```

Now, the ShinyItemAnalysis is ready to run. To launch the interactive application, type the following line into the console

```
startShinyItemAnalysis()
```

This opens an interactive application, see Figure A.7 while keeping the console available for further calculations. Click on **Open in browser** button to open application in your default browser.

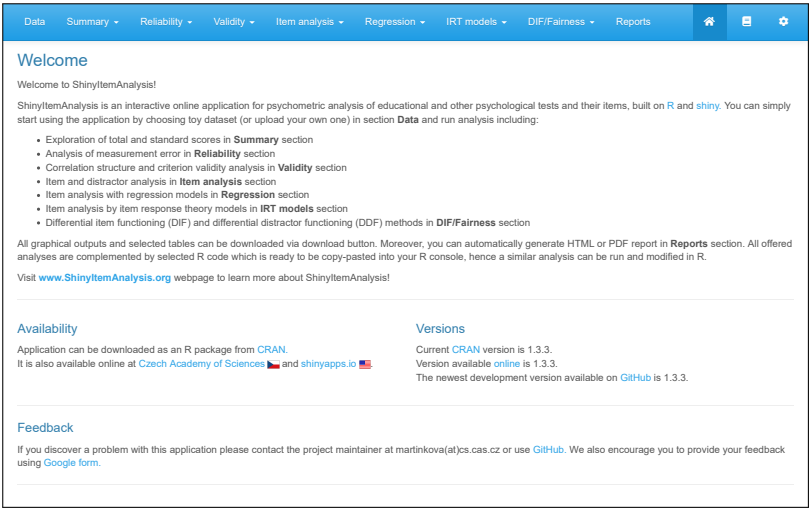

FIGURE A.7: Intro page of the `ShinyItemAnalysis` application.