Set up R and RStudio

Homework #1

Due Wednesday, Jan 07, 2026

Contents

Homework

Preliminary Information

Set up software: R, RStudio, R development environment, and R packages for Bayesian statistics.

Homework Exercises:

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   Install R   If you don't have R installed on your computer, download and install R. If you have a version of R older than 4.5, you should update it to 4.5 or higher.

   To install or upgrade R, download R version 4.5.2 from The Comprehensive R Archive Network

   – **Windows:**
       * Download and install the "base distribution" of R 4.5.2.
   – **MacOS:**
       * Download and install R version 4.5.2
   – **Linux:**
       * You should be able to install R from your Linux distribution's package manager:
           · `sudo apt-get install r-base r-base-dev` for Debian or Ubuntu
           · `sudo yum install R` or `sudo dnf install git` for Fedora, Red Hat, and related distributions.
           · If you are using Ubuntu, there are advanced instructions for configuring the package management system to use the very latest versions of R and its associated packages at https://cran.rstudio.org/bin/linux/ubuntu/fullREADME.html. This is optional and the default version of R should be fine for this class, as long as it is version 4.5 or higher.

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Install RStudio   RStudio is a free editing and software development environment that makes it much easier to work with R. I strongly recommend that you install RStudio for this course.

- Go to the download page for the free desktop edition of RStudio and download the installer for your operating system. Windows, MacOS, and the Debian, Ubuntu, Fedora, RedHat, and openSUSE editions of Linux are all supported.

  There are other versions of RStudio (an expensive professional edition and a server edition). You want the **free desktop edition**. As of January 2026, the latest version is RStudio Desktop version 2025.09.2+418 (Cucumberleaf Sunflower)

- Run the installer.

- After the installer finishes running, run RStudio.

  * When RStudio starts up, the lower left part of the screen should have a window that displays the R version, saying something like this:

    ```
    R version 4.5.2 (2025-10-31 ucrt) -- "[Not] Part in a Rumble"
    Copyright (C) 2025 The R Foundation for Statistical Computing
    Platform: x86_64-w64-mingw32

    R is free software and comes with ABSOLUTELY NO WARRANTY.
    You are welcome to redistribute it under certain conditions.
    Type 'license()' or 'licence()' for distribution details.

        Natural language support but running in an English locale

    R is a collaborative project with many contributors.
    Type 'contributors()' for more information and
    'citation()' on how to cite R or R packages in publications.

    Type 'demo()' for some demos, 'help()' for on-line help, or
    'help.start()' for an HTML browser interface to help.
    Type 'q()' to quit R.
    ```

    The details will be different depending on your operating system, but if you see something like this, RStudio correctly found R on your computer.

  * Configuring RStudio for additional optional software. There are a few other pieces of software that you may want to use this semester, but these are not required.

    If have installed the Git revision control system or the LaTeX typesetting software, you should configure RStudio to use them:

  * If you will use Git for software revision control with R, you should open the "Tools" menu, and click on the "Global Options" choice.

    · Go to the "Git/SVN" tab and click "enable version control interface for RStudio projects". If RStudio can find the git program on your computer, it will appear in the "git executable" field. If RStudio can't find it, you can help it by browsing to the git program.

  * If you have installed LaTeX on your computer, click on the SWeave tab, and select "knitr" for weaving `.Rnw` files, and choose `pdfLaTeX` for typesetting LaTeX files into PDF.

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Install the `cmdstanr` package for R   After you have installed R and RStudio, you will need to install a number of software packges that extend R for Bayesian data analysis.

The trickiest package to install is `cmdstanr`. I recommend that you follow the detailed installation instructions on the RStan web site.

After you install `cmdstanr`, you will need to use it to install the `cmdstan` software. For this, you will need to install a C++ compiler and related tools before you can install `cmdstan`.

(Don't worry, you won't need to do any programming in C++. Stan writes the C++ code for you, based on your description of the statistical problem.)

Follow the instructions at the `cmdstan` web page, https://mc-stan.org/docs/cmdstan-guide/installation.html. There are instructions for installing the C++ toolchain for Windows, MacOS, and Linux. If you are using Windows, the simplest thing to do is install the Rtools4.5 software from the same place you installed R, or from https://cran.rstudio.org/bin/windows/Rtools/rtools45/rtools.html

After you've done this, you can go to the main `cmdstanr` installation instructions and continue from there.

The basic steps are to do the following at the R console in RStudio:

1. First, check whether the C++ toolchain is set up correctly:

```r
library(cmdstanr)

check_cmdstan_toolchain()
```

2. If you get an error message, then run

```r
check_cmdstan_toolchain(fix = TRUE)
```

to fix the toolchain configuration

3. Next, install `cmdstan`

```r
options(mc.cores = parallel::detectCores() / 2 - 1)
install_cmdstan()
```

The line beginning `options(...` is optional. It tells R to use multiple processor cores to install `cmdstan`, which can speed up the installation considerably if you have a powerful processor in your computer.

If you run into difficulty, let me know and I will help you.

If you are having trouble installing `cmdstan`, don't worry. We won't use `cmdstan` until late in the semester, so go ahead and install the other things, and there will be plenty of time for me to help you get `cmdstan` installed and working on your computer.

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Install other R packages This will be a lot easier. Open RStudio, go to the "Console" window in RStudio, and type

```r
install.packages(c("devtools", "pacman"))
library(pacman)
for (p in c("tidyverse", "ape", "bayesplot", "brms",
            "broom", "coda", "dagitty", "flextable",
            "ggdag", "ggformula", "ggmcmc", "ggrepel",
            "ggthemes", "knitr", "loo", "mvtnorm",
            "patchwork", "posterior", "psych",
            "rcartocolor", "Rcpp", "rmarkdown",
            "rprojroot", "sf", "shiny", "shinystan",
            "statebins", "tidybayes", "viridis",
            "viridisLite", "wesanderson")) {
  p_install(p, character.only = TRUE, force = FALSE)
}
remotes::install_github("rmcelreath/rethinking")
remotes::install_github("mjskay/tidybayes.rethinking")
```

This may take some time to run, but when it is done, you should be good to go.

- You will also need to install the `cmdstanr` package to run the `rethinking` package.

  The first step is to start a fresh R session or in RStudio open the "Session" menu and choose "Restart R". Then type this in the console window:

  ```
  install.packages("cmdstanr", repos = c("https://mc-stan.org/r-packages/",
                    getOption("repos")))
  ```

  Next, type this:

  ```
  library(cmdstanr)
  check_cmdstan_toolchain(fix = TRUE, quiet = TRUE)
  ```

  If this works without error, you should finally type this:

  ```
  install_cmdstan(cores = 2)
  ```

  If you are having difficulty installing `cmdstanr`, check the documentation at the `cmdstanr` web site.

Notes on Homework:

This homework assignment is just to set up the software on your computer. There is nothing for you to turn in. Please ask me for help if you have trouble getting the software installed.