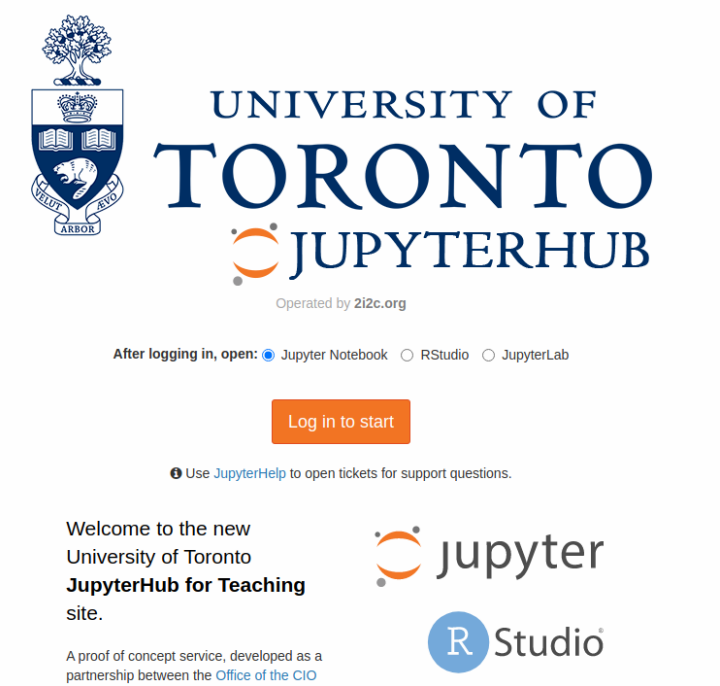
Running R

Running R online

Go to https://jupyter.utoronto.ca.

You want to see this:



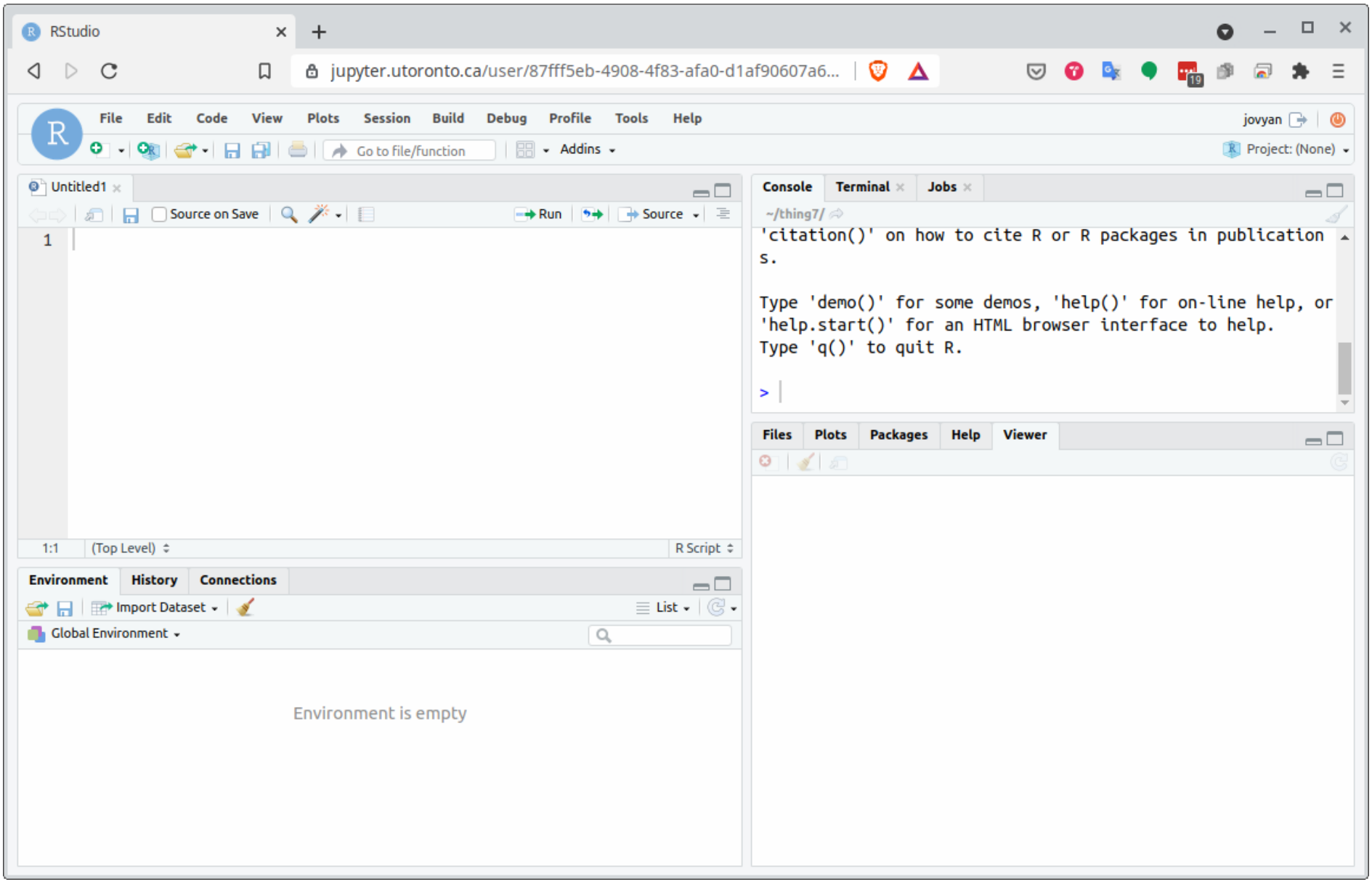
If you do, find the line that says "after logging in, open" and click the button next to R Studio to make it blue. Then click the orange Log In to Start, and log in with UTorID and password.

Next

You'll see something that looks like this, with some files (maybe):

Click on New, on the right. From the dropdown, select R Studio (near the bottom).

How R Studio looks



Projects

- Each user has a "workspace", a place where all your work is stored.
- Within that workspace, you can have as many Projects as you like.
- To create a new Project, click on the blue New Project button.
- I recommend having one project per *course*.
- R Studio restarts where you left off.

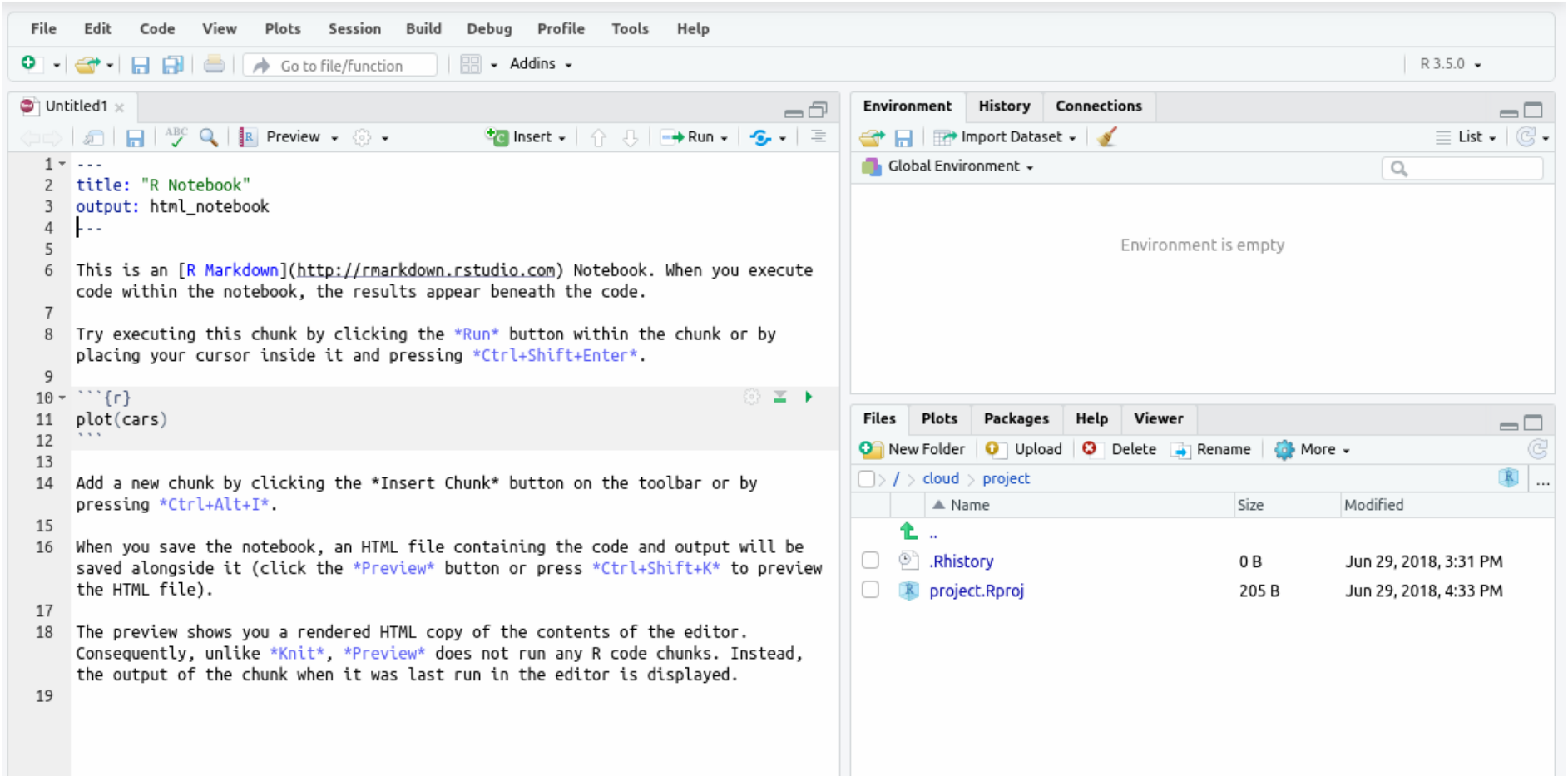
Make a new project

- Call it what you like. Mine is called `thing7`:
- Select:
  - File,
  - New Project,
  - New Directory,
  - New Project (again),
  - give it a name and click Create Project.
- You see the name of your new project top right.

R Notebooks

- At top right of previous view is Console, where you can enter R commands and see output.
- A better way to work is via "R Notebooks". These allow you to combine narrative, code and output in one document.
- Data analysis is always a story: not only what you did, but why you did it, with the "why" being more important.
- To create a new notebook, select File, New File, R Notebook. This brings up an example notebook as over.
- The next example was done in another online environment, so looks (slightly) different, but will still work for you.

The template R Notebook

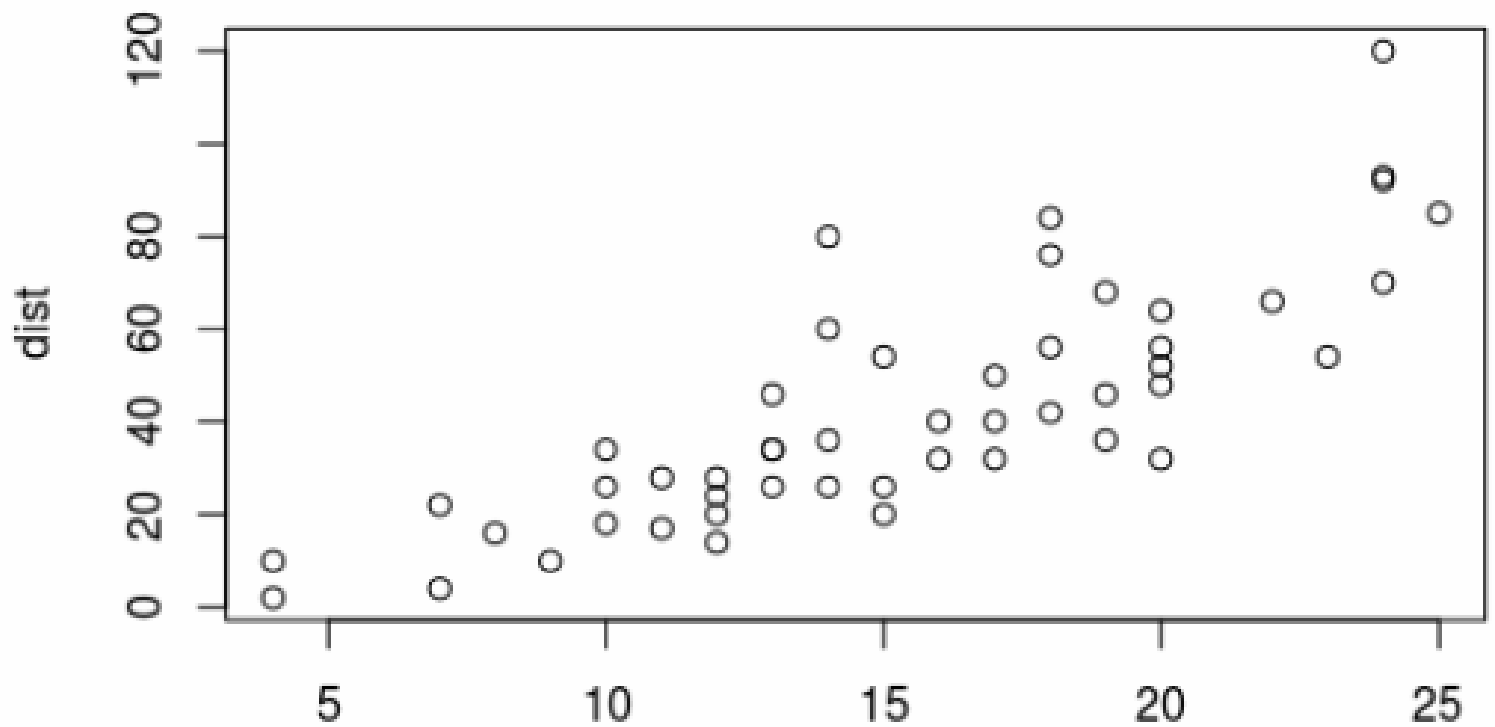


About this notebook

- The notebook begins with a title (that you can change).
- Most of this notebook is text (narrative). The stuff with `*asterisks*` around it will come out in italics in the final document.
- Pieces beginning with three "backticks" and `{r}`, in grey, are called code chunks. They contain R code. Three more backticks marks the end of a code chunk.
- Run code chunks by clicking on the green "play button" at the top right of the chunk. This one makes a scatterplot. If you click the play button, the plot is made and placed under the code, as over.

After running the code chunk

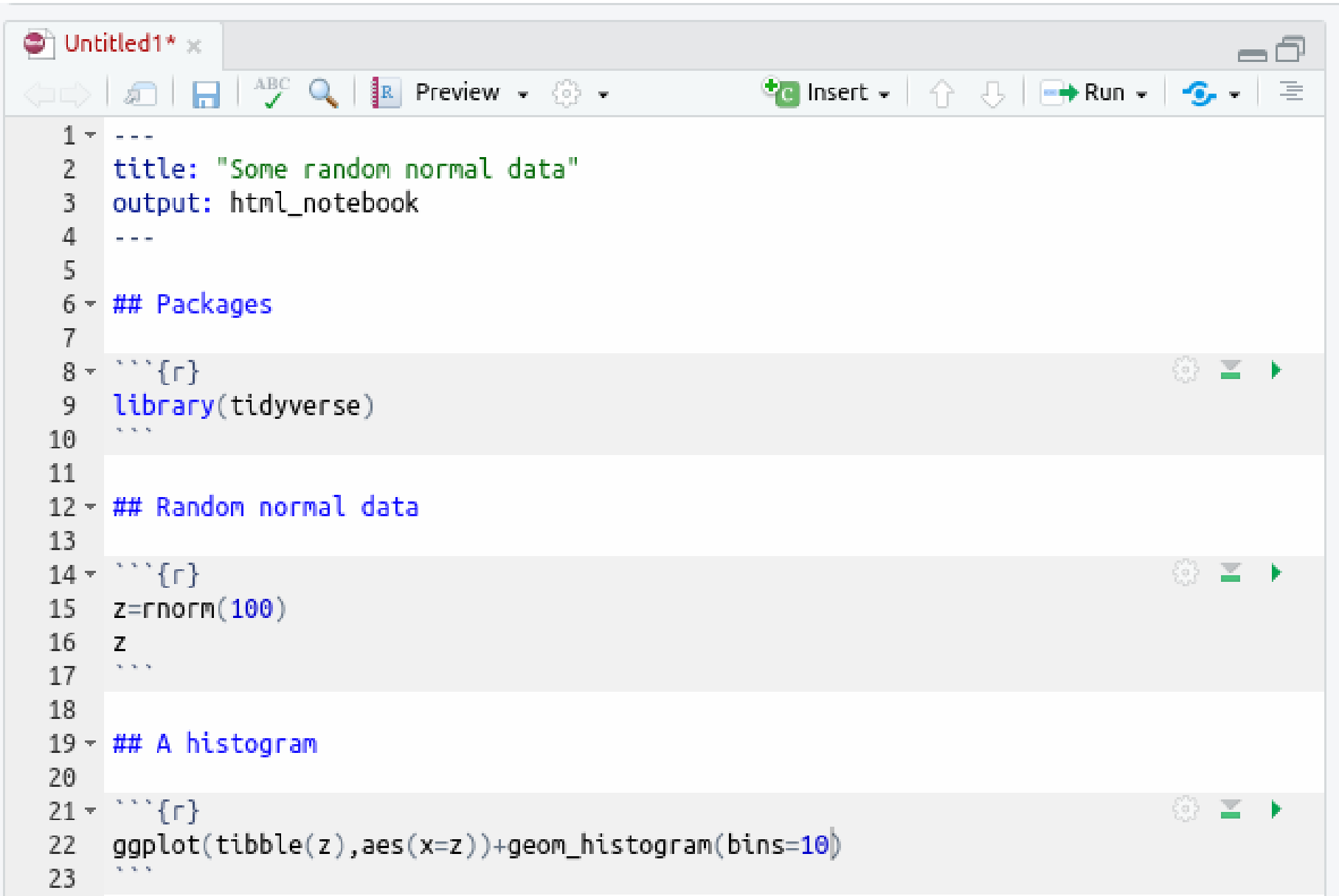
```
8  Try executing this chunk by clicking the *Run* button within the chunk or by
   placing your cursor inside it and pressing *Ctrl+Shift+Enter*.
9
10 ```{r}
11 plot(cars)
12 ```
```



Making our own notebook

- Create another new notebook. Delete the template text and change the title to "Some random normal data".
- Type `## Packages` and go down a couple of lines.
- Make a new code chunk by clicking Insert (at the top of the notebook window) and selecting R. Inside that chunk, type `library(tidyverse)`.
- Below that, type `## Random normal data`.
- Make another new code chunk below that, and insert two lines of code: `z=rnorm(100)` and then `z`.
- Below that, type text `## A histogram` and a code chunk containing `ggplot(tibble(z),aes(x=z))+geom_histogram(bins=10)`.

My R notebook



Run the chunks

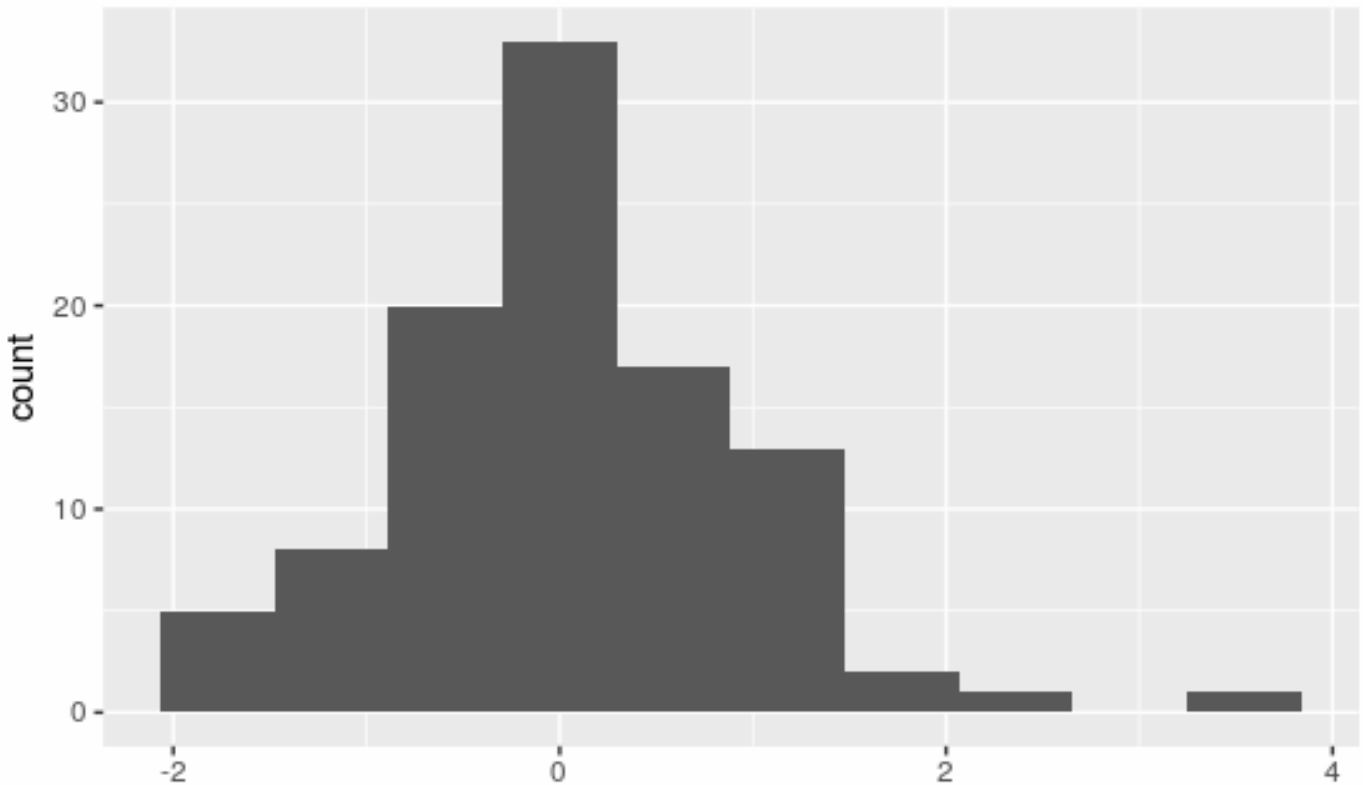
- Now run each of the three chunks in order. You'll see output below each one, including a histogram below the last one.
- When it works, add some narrative text before the code chunks explaining what is going to be done, and some text after describing what you see.
- Save the notebook (File, Save As). You don't need a file extension.
- Click Preview. This makes an HTML-formatted report. (The first may be gibberish: ignore that). Note what happened to the text.
- If you want to edit anything, go back to the R Notebook, change it, save it, and run Preview again.

The end of my (formatted) report

A histogram

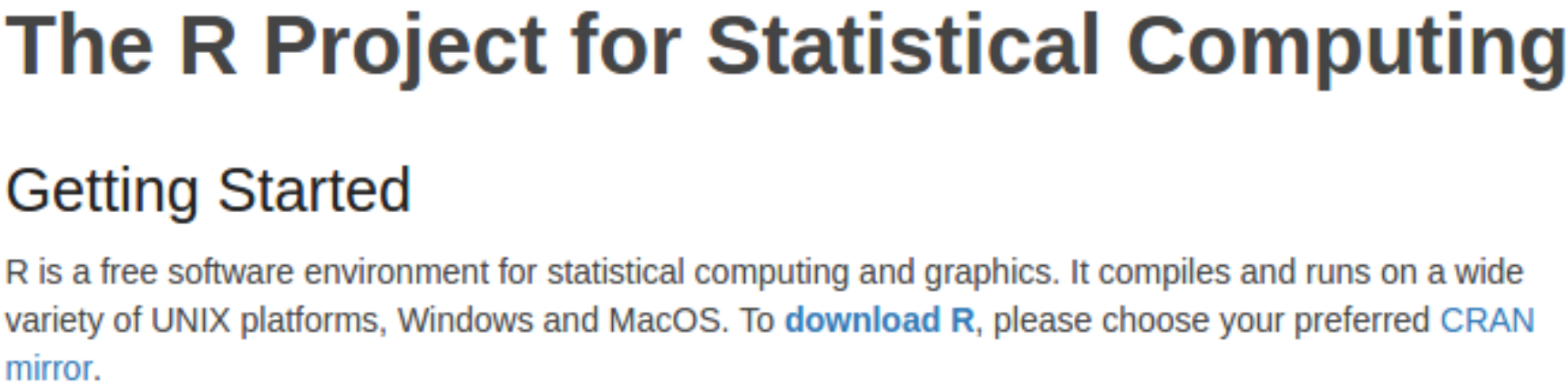
To see whether we got a rough bell shape, we can draw a histogram:

```
ggplot(tibble(z),aes(x=z))+geom_histogram(bins=10)
```



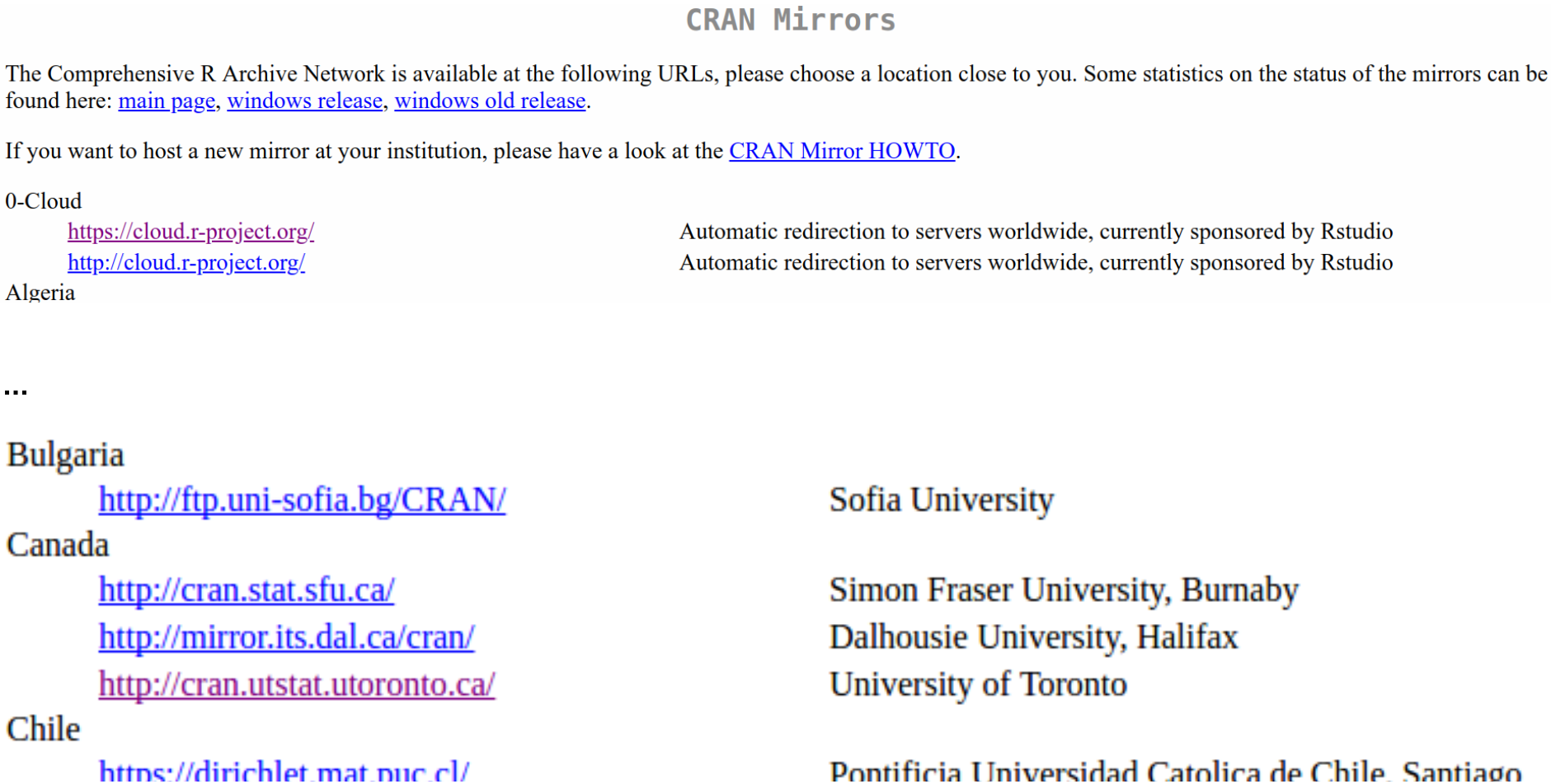
Installing R on your own computer

- Free, open-source. Download and run on own computer.
- Two things: R itself (install first) and R Studio (front end).
- Go to https://www.r-project.org/:



Click on Download R

- R is stored on numerous "mirrors", sites around the world. The top one, "0-Cloud", picks one for you. Or you can choose one close to you (might be faster), eg. U of T:



CRAN Mirrors

The Comprehensive R Archive Network is available at the following URLs, please choose a location close to you. Some statistics on the status of the mirrors can be found here: main page, windows release, windows old release.

If you want to host a new mirror at your institution, please have a look at the CRAN Mirror HOWTO.

0-Cloud

https://cloud.r-project.org/	Automatic redirection to servers worldwide, currently sponsored by Rstudio
http://cloud.r-project.org/	Automatic redirection to servers worldwide, currently sponsored by Rstudio

Algeria

...

Bulgaria

http://ftp.uni-sofia.bg/CRAN/	Sofia University

Canada

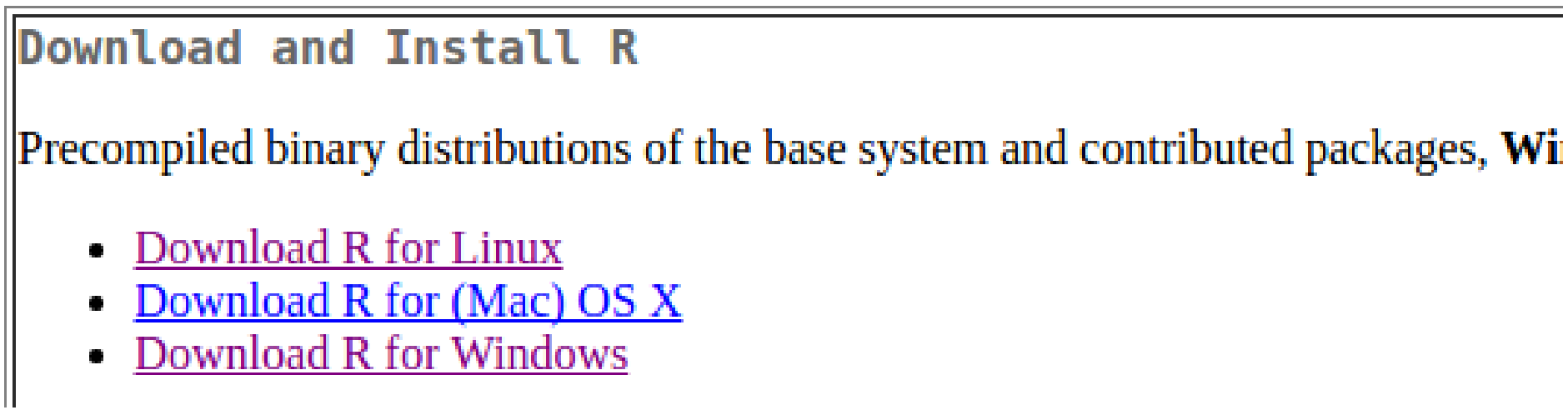
http://cran.stat.sfu.ca/	Simon Fraser University, Burnaby
http://mirror.its.dal.ca/cran/	Dalhousie University, Halifax
http://cran.utstat.utoronto.ca/	University of Toronto

Chile

https://dirichlet.mat.puc.cl/	Pontificia Universidad Catolica de Chile, Santiago

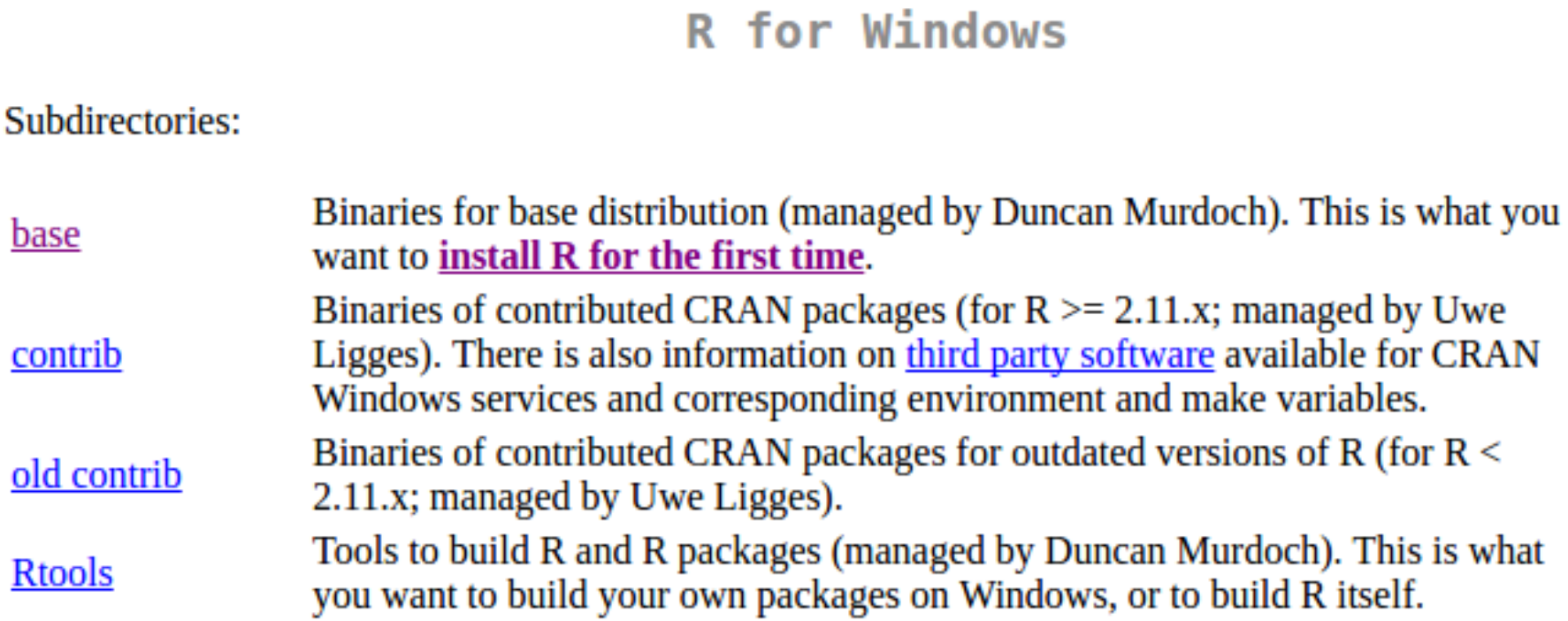
Click your mirror

- Click 0-Cloud or U of T (or other mirror), get:



- Click on your operating system, eg. Windows.

Click on Base



R for Windows

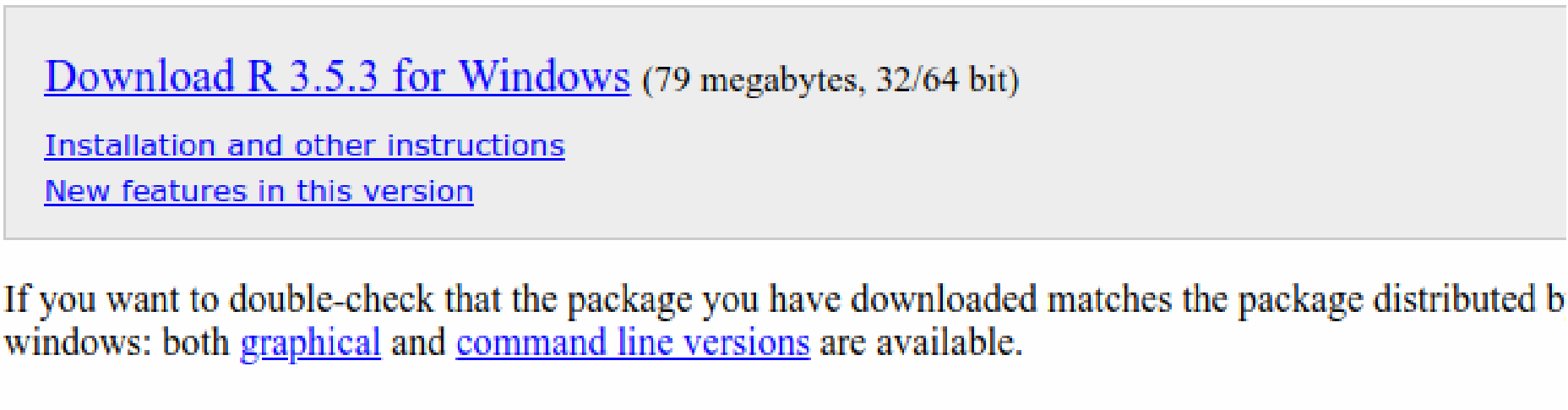
Subdirectories:

base	Binaries for base distribution (managed by Duncan Murdoch). This is what you want to **install R for the first time**.
contrib	Binaries of contributed CRAN packages (for R >= 2.11.x; managed by Uwe Ligges). There is also information on third party software available for CRAN Windows services and corresponding environment and make variables.
old contrib	Binaries of contributed CRAN packages for outdated versions of R (for R < 2.11.x; managed by Uwe Ligges).
Rtools	Tools to build R and R packages (managed by Duncan Murdoch). This is what you want to build your own packages on Windows, or to build R itself.

- Click on “base” here.

The actual download

- The version number is, as I write this, 4.2.1, but the layout is the same.
- Click something like the top link below:



- Then install usual way.
- Or, for Mac, download and install `R-4-2-1.pkg` (High Sierra) or `R-4.2.1-arm64.pkg` (Big Sur).
- Or, for Linux, click your distribution (eg. Ubuntu), then follow the instructions.

Now, R Studio

- Go here. (The word "here" is clickable link.)
- Scroll right down to the bottom, find Products, and click R Studio Desktop.

Scroll down...

- There are two choices. You want the free one on the left.
- Click left-side Download.

Find the one for you

- Scroll down to All Installers, and click the installer for your machine (Windows, Mac, several flavours of Linux). Install as usual.

RStudio requires R 2.11.1 (or higher). If you don't already have R, you can download it here.

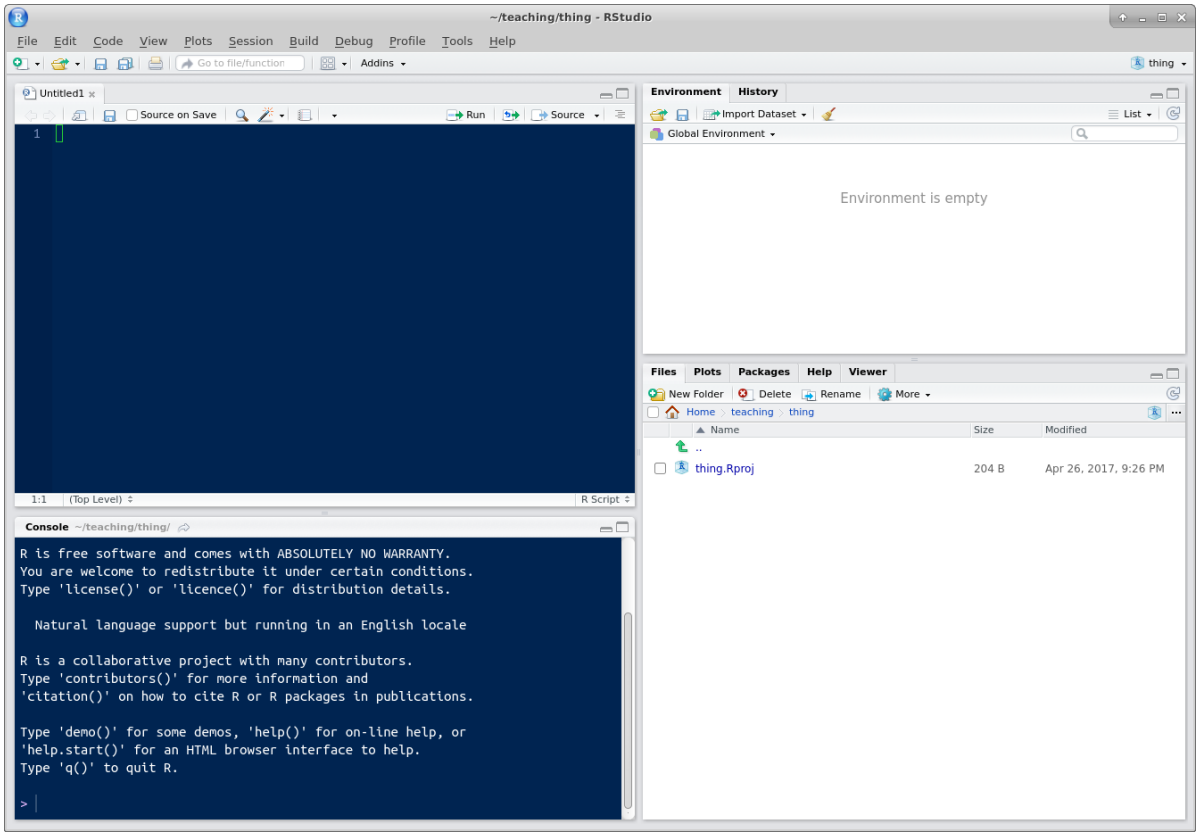
Installers for Supported Platforms

Installers	Size	Date
RStudio 0.99.902 - Windows Vista/7/8/10	77.1 MB	2016-05-14
RStudio 0.99.902 - Mac OS X 10.6+ (64-bit)	60 MB	2016-05-14
RStudio 0.99.902 - Ubuntu 12.04+/Debian 8+ (32-bit)	81.6 MB	2016-05-14
RStudio 0.99.902 - Ubuntu 12.04+/Debian 8+ (64-bit)	88.3 MB	2016-05-14
RStudio 0.99.902 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (32-bit)	81 MB	2016-05-14
RStudio 0.99.902 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (64-bit)	81.9 MB	2016-05-14

Running R

- All of above only done once.
- To run R, run R Studio, which itself runs R.

How R Studio looks when you run it



- First time you run R Studio, click on Console window, and, next to the >, type `install.packages("tidyverse")`. Let it do what it needs to. (You need to do this on your machine. On `jupyter.utoronto.ca`, it's already been done.)

Projects

- A project is a "container" for code and data that belong together.
- Goes with a folder on some computer.
- File, New Project. You have option to create the new project in a new folder, or in a folder that already exists.
- Use a project for a collection of work that belongs together, eg. data files and notebooks for assignments. Putting everything in a project folder makes it easier to find.
- Example: use a project for (all) assignments, a different notebook within that project for each one.