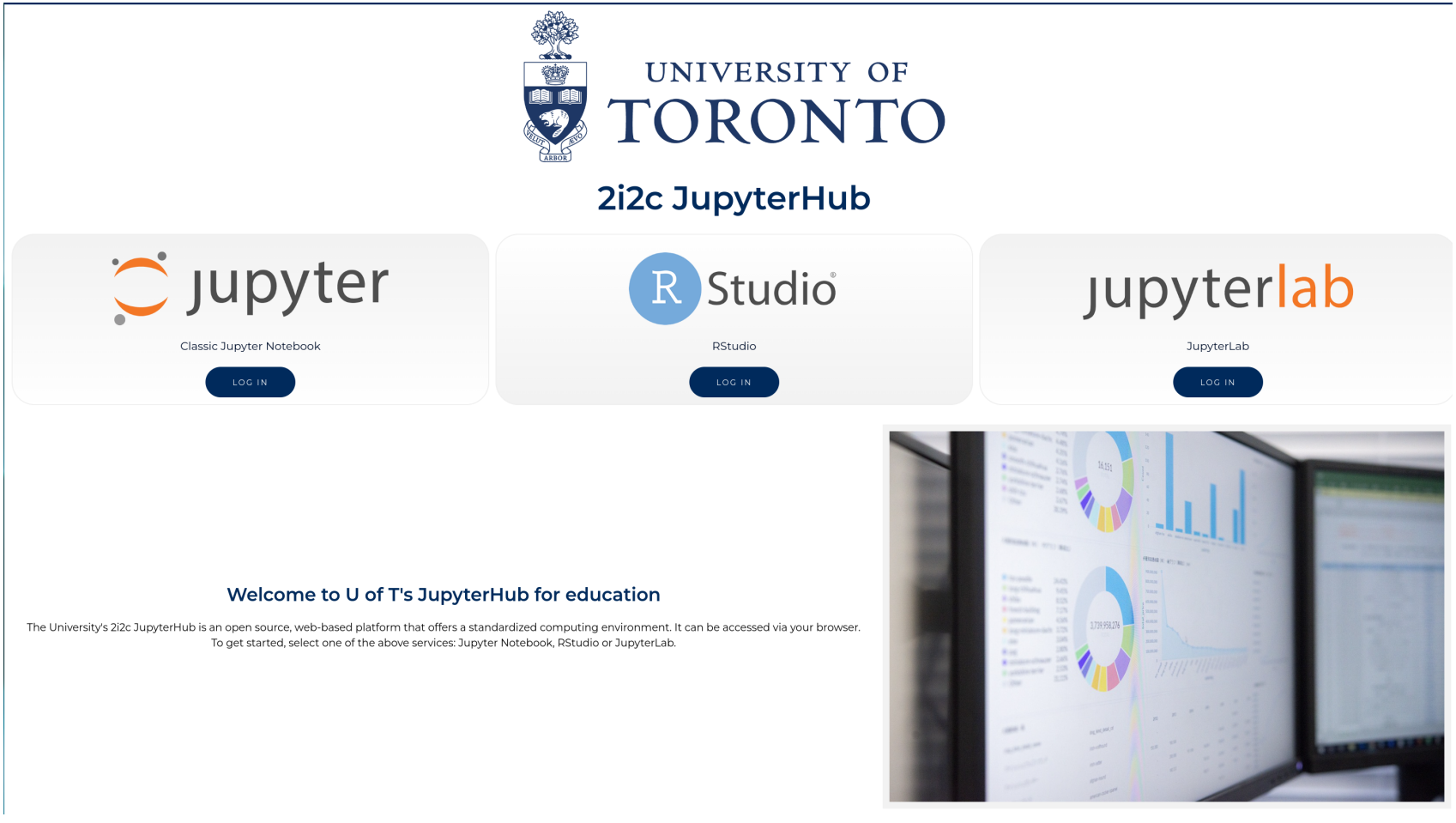
Running R

Running R online, 2024/2025 version

Go to https://r.datatools.utoronto.ca:



Click Log In under R Studio.

Log in

Selected Identity Provider

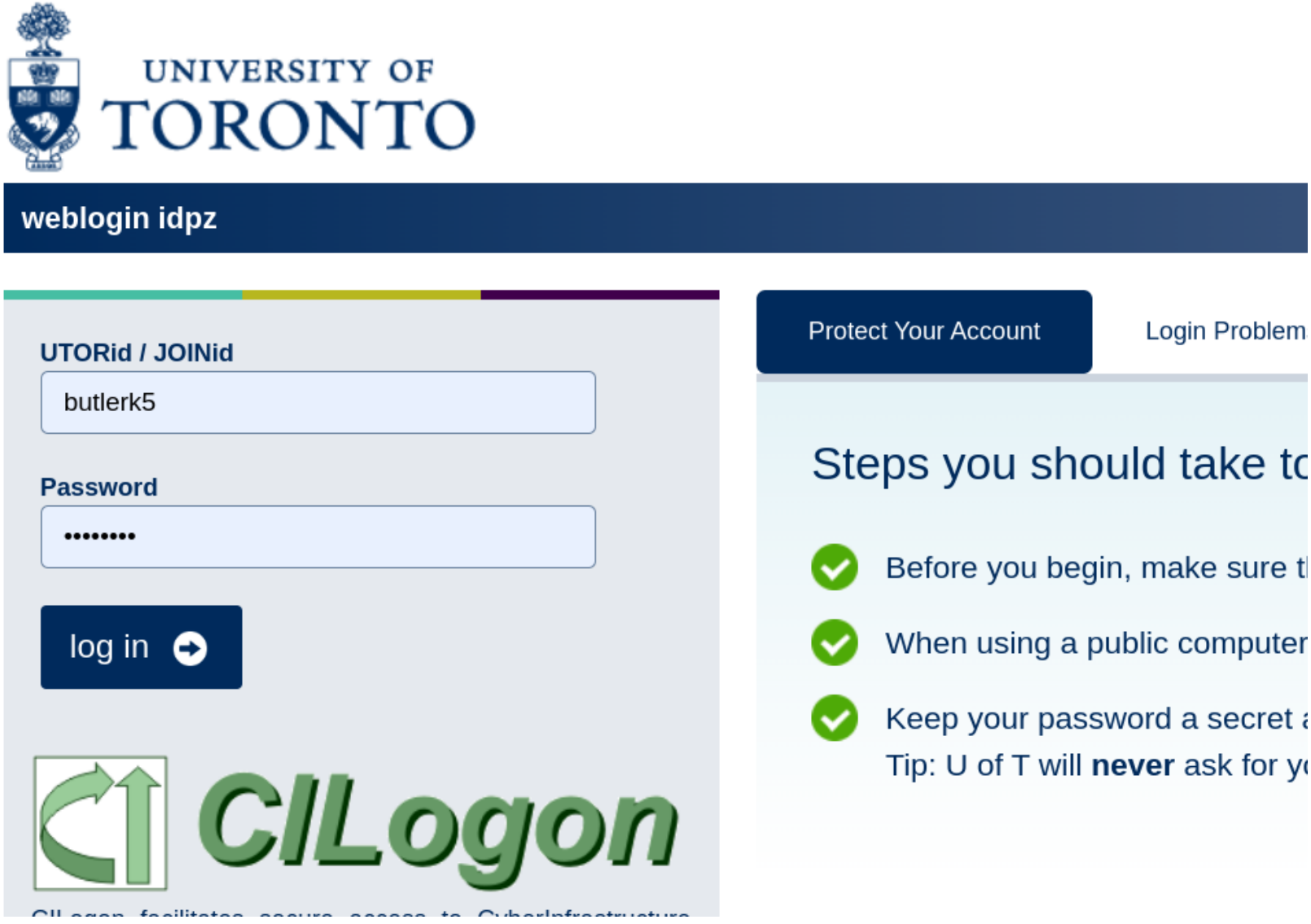
University of Toronto

Remember this selection

Log On

By selecting "Log On", you agree to the privacy policy.

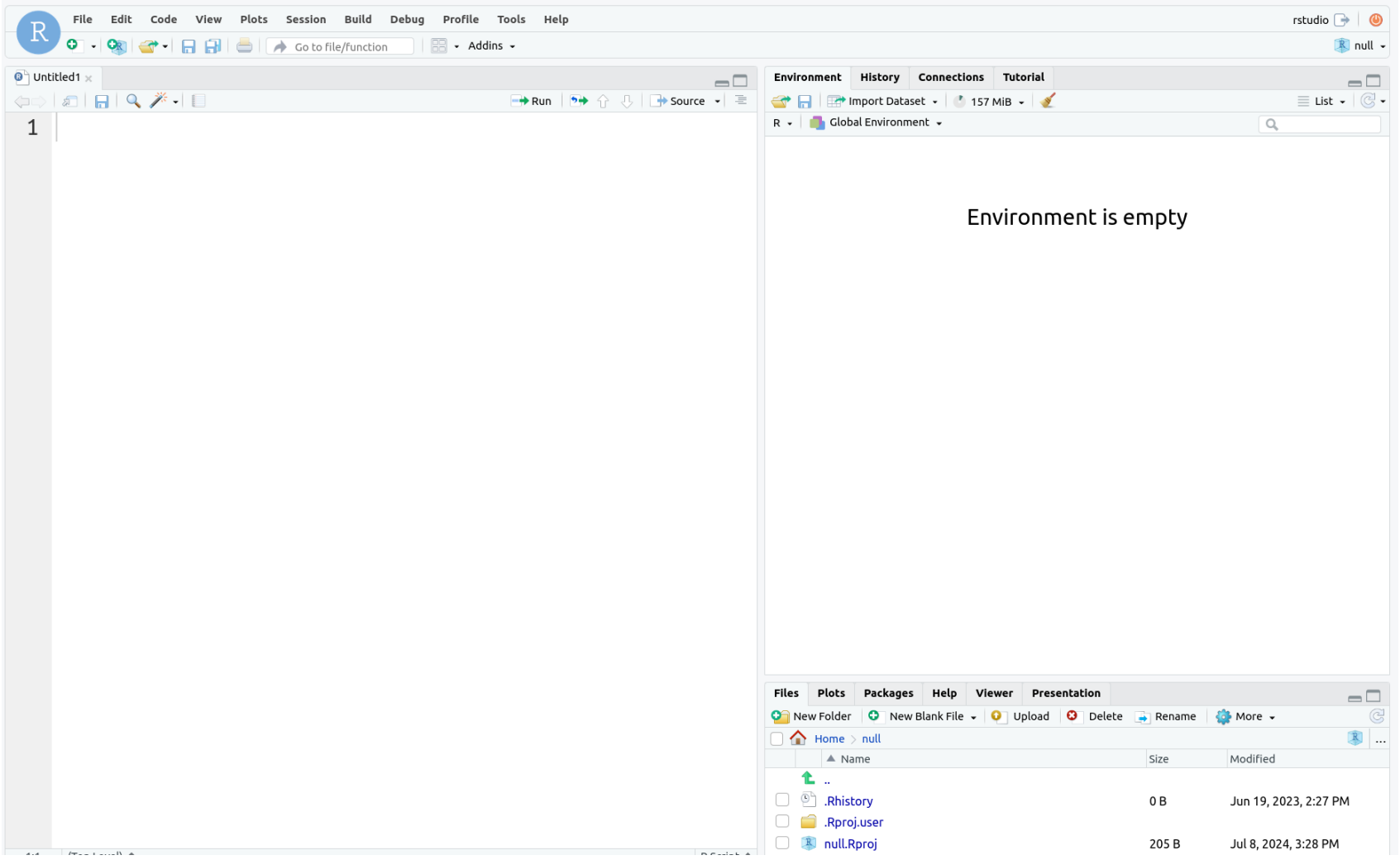
UTorID and password



as usual, but with *your* UTorID and password, not mine!

After a moment...

... gets you to R Studio:



If already signed in with UTorID and password, you may get to skip some steps.

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 in project where you left off.

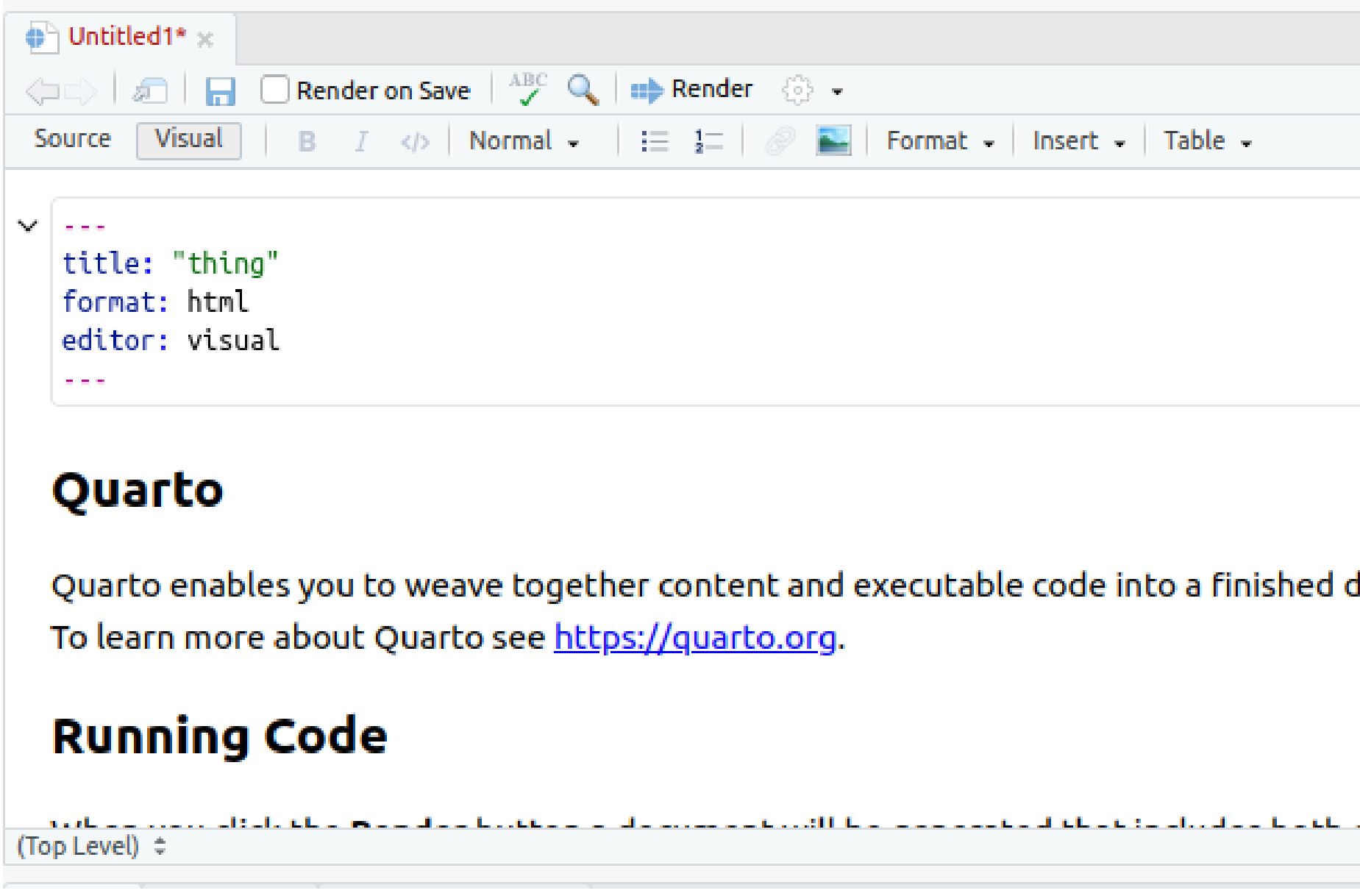
Make a new project

- Call it what you like. Mine is called `thing`:
- 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 left of previous view is Console, where you can enter R commands and see output.
- A better way to work is via "Quarto Documents". 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 Quarto Document, select File, New File, Quarto Document. Give it a title. This brings up an example document as over.

The template document



About this document

- It begins with a title (that you can change).
- Most of the document is text (narrative).
- Pieces beginning with `{r}`, in grey, are called code cells (code chunks). They contain R code.
- Run code cells by clicking on the green "play button" at the top right of the first cell. This one does some very exciting arithmetic.

After running the code chunk

```{r}
1 + 1
```

```
[1] 2
```

Making our own document 1/2

- Create another new document. Give it a title of "Some random normal data", and click Create. When the document opens, delete the template that it gives you (leaving only the five or so lines that begin and end with ---).
- You will probably be sitting on a line that says (greyed out) Heading 2. On this line, type **Packages** (which you'll see big and bold like a title) and hit Enter a couple of times. At the top of the window, on the line with Visual, Format, Insert, and Table, it should now say Normal (which is normal text). If you want a heading, click the arrow to the right of Normal and select one. Header 2 is a good one for section titles in your document.

Making our own document 2/2

- Make a new code chunk by clicking Insert (at the top of the notebook window) and selecting Code Cell and R. Inside that cell, type `library(tidyverse)`.
- Below that, make another "Header 2" and put "Random normal data" on that line.
- Make another new code cell below that, and insert two lines of code: `z <- rnorm(100)` and then `z`.
- Below that, make another Header 2, "A histogram", and a code cell containing `ggplot(tibble(z), aes(x=z)) + geom_histogram(bins = 10)`.

My document

```
---
title: "Some random normal data"
format: html
editor: visual
---
```

Packages

```
{r}
library(tidyverse)
```

Random normal data

```
{r}
z <- rnorm(100)
z
```

A histogram

```
{r}
```

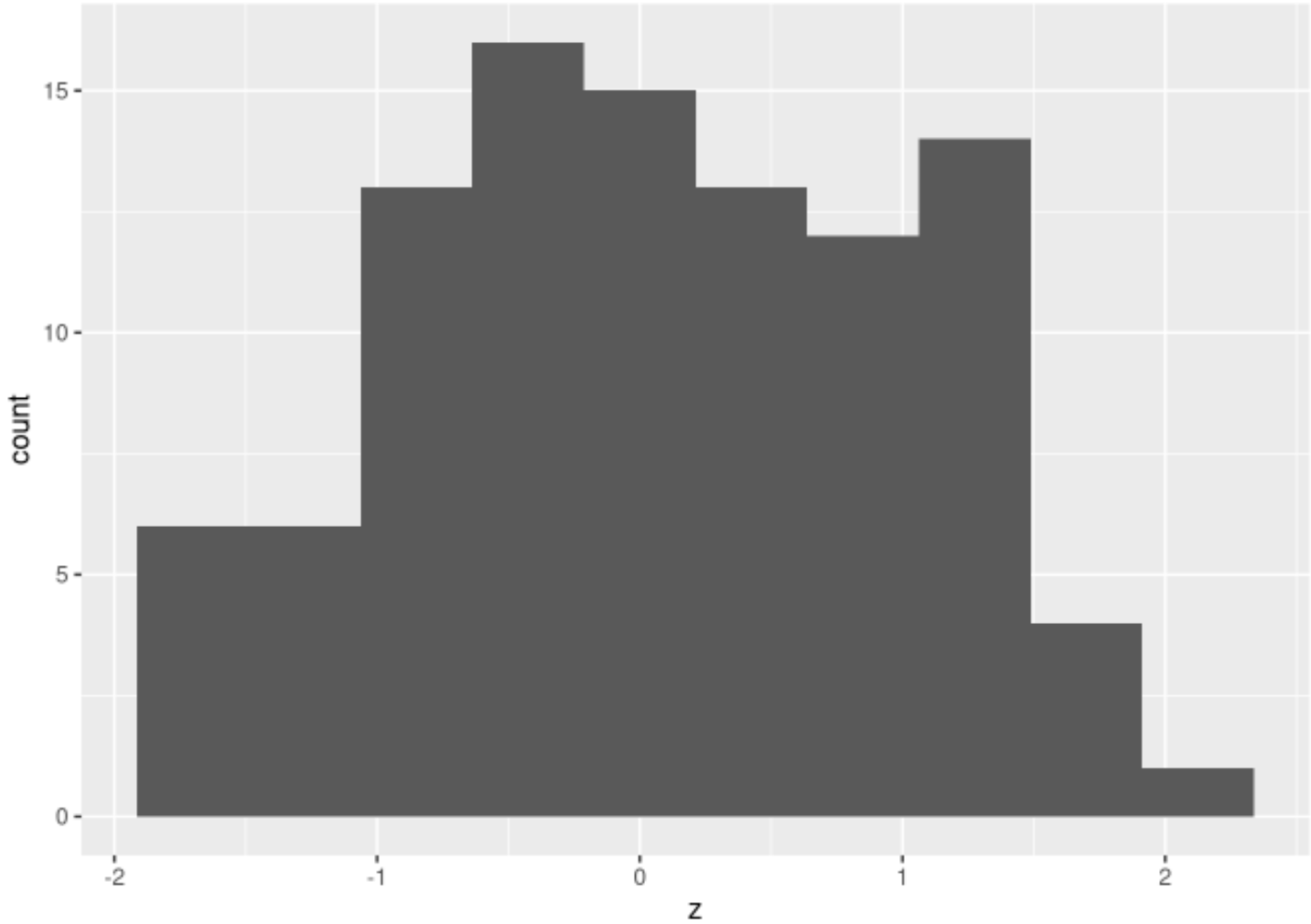
Run the chunks

- 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 document (File, Save As). You don't need a file extension.
- Click Render (at the top). This makes an HTML-formatted report, which may appear in another tab of your web browser.
- If you want to edit anything, go back to the Quarto document, change it, save it, and run Render again. For example, you can try putting some of the text in *italics* or **bold**. (See Format.)

The end of my (rendered) report

Then, we draw a histogram of the random normal values we generated:

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



Even though we know the data to come from a normal distribution, the histogram may not

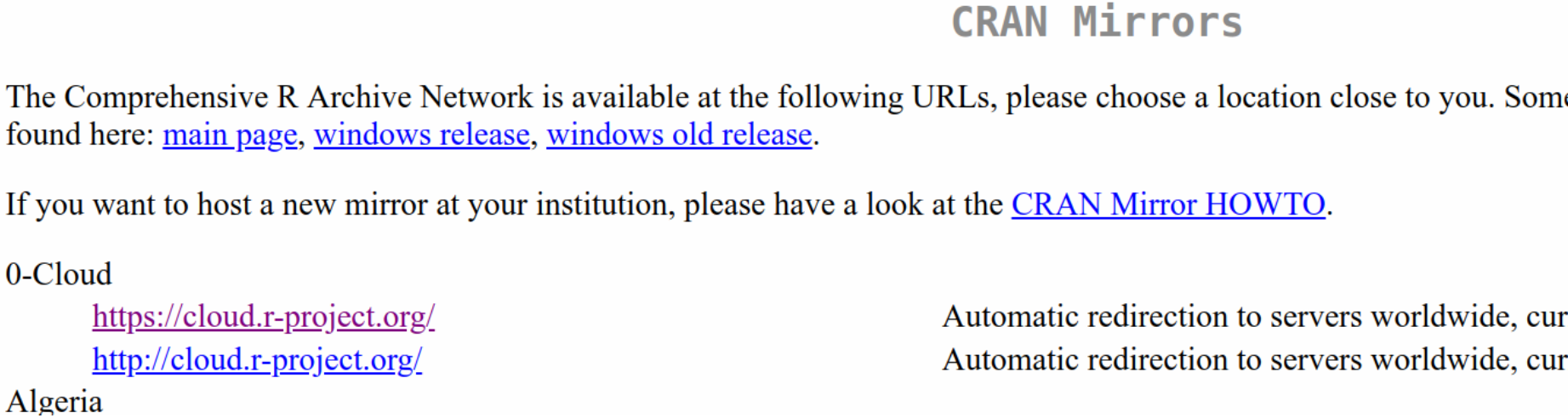
Installing R on your own computer

- Free, open-source. Download and run on own computer.
- Three things:
  - R itself (install first)
  - R Studio (front end)
  - Quarto (for writing reports).

Downloading R

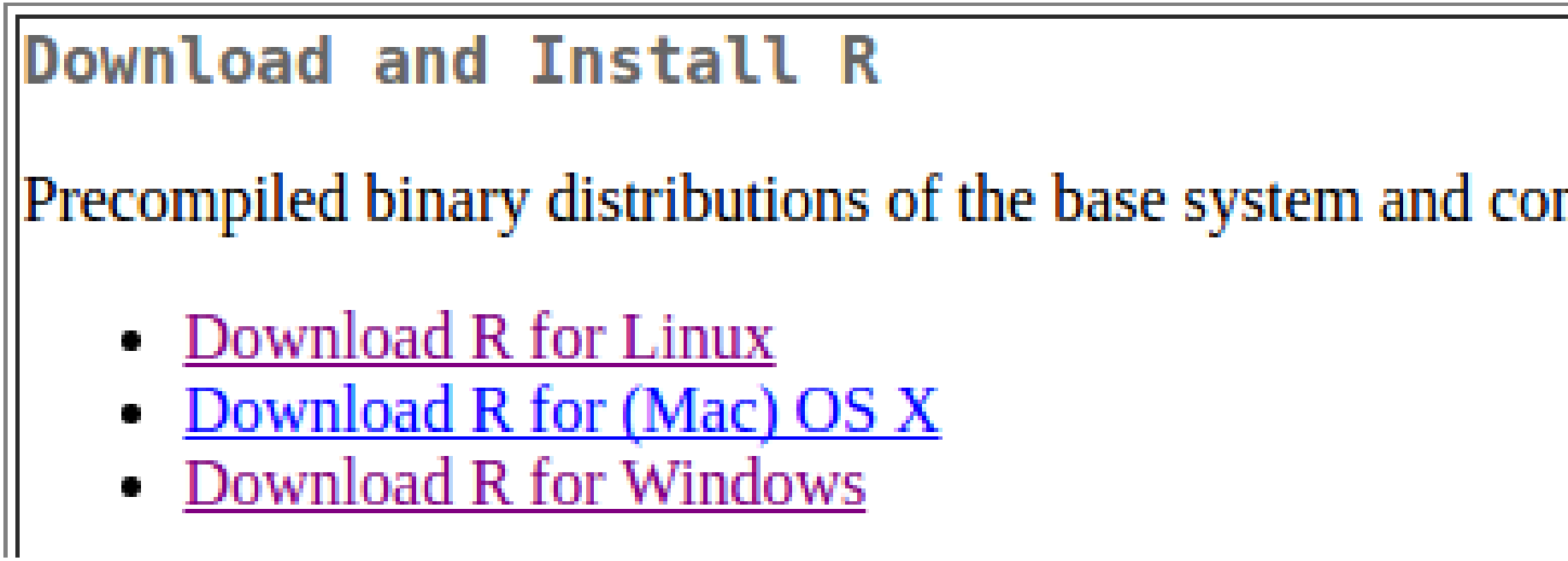
- Go to https://www.r-project.org/.

- Click Download R (the link in the first paragraph) .
- R is stored on numerous "mirrors", sites around the world. The top one, "0-Cloud", picks one for you.



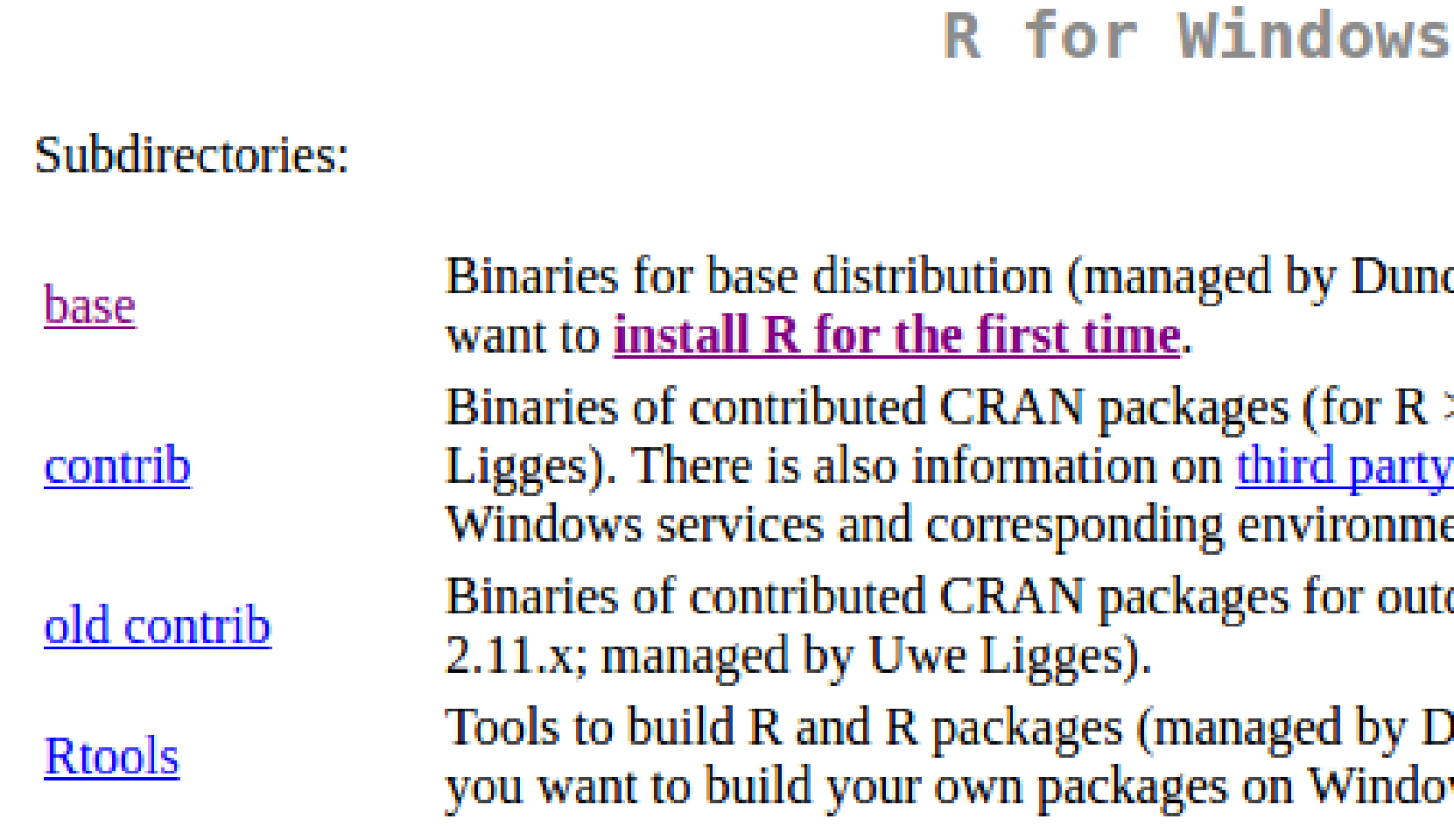
Click your mirror

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



- Click on your operating system, eg. Windows.

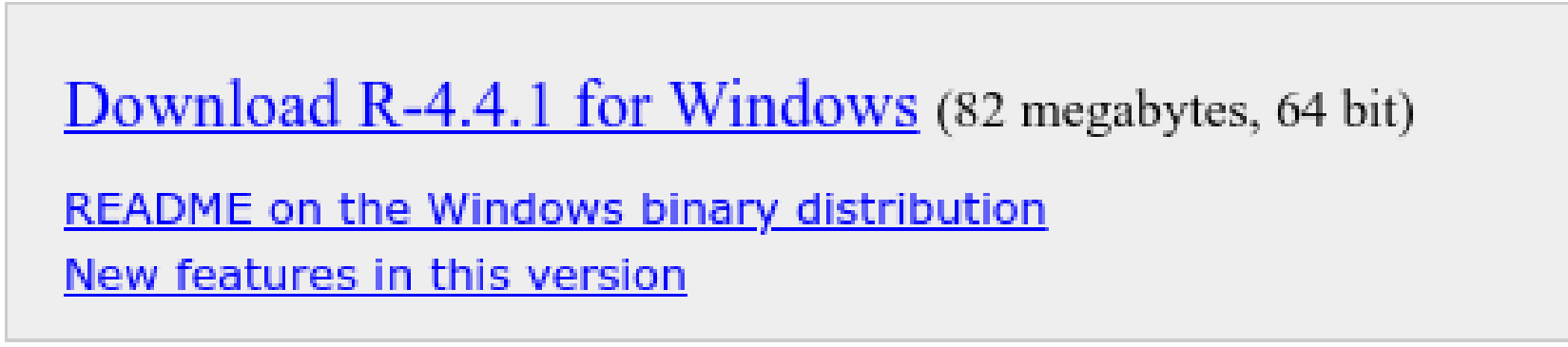
Click on Base



- Click on “base” here.

The actual download

- The version number is, as I write this, 4.4.1, but there may be an update between me writing this and you reading it.
- For Windows, click something like the top link below:



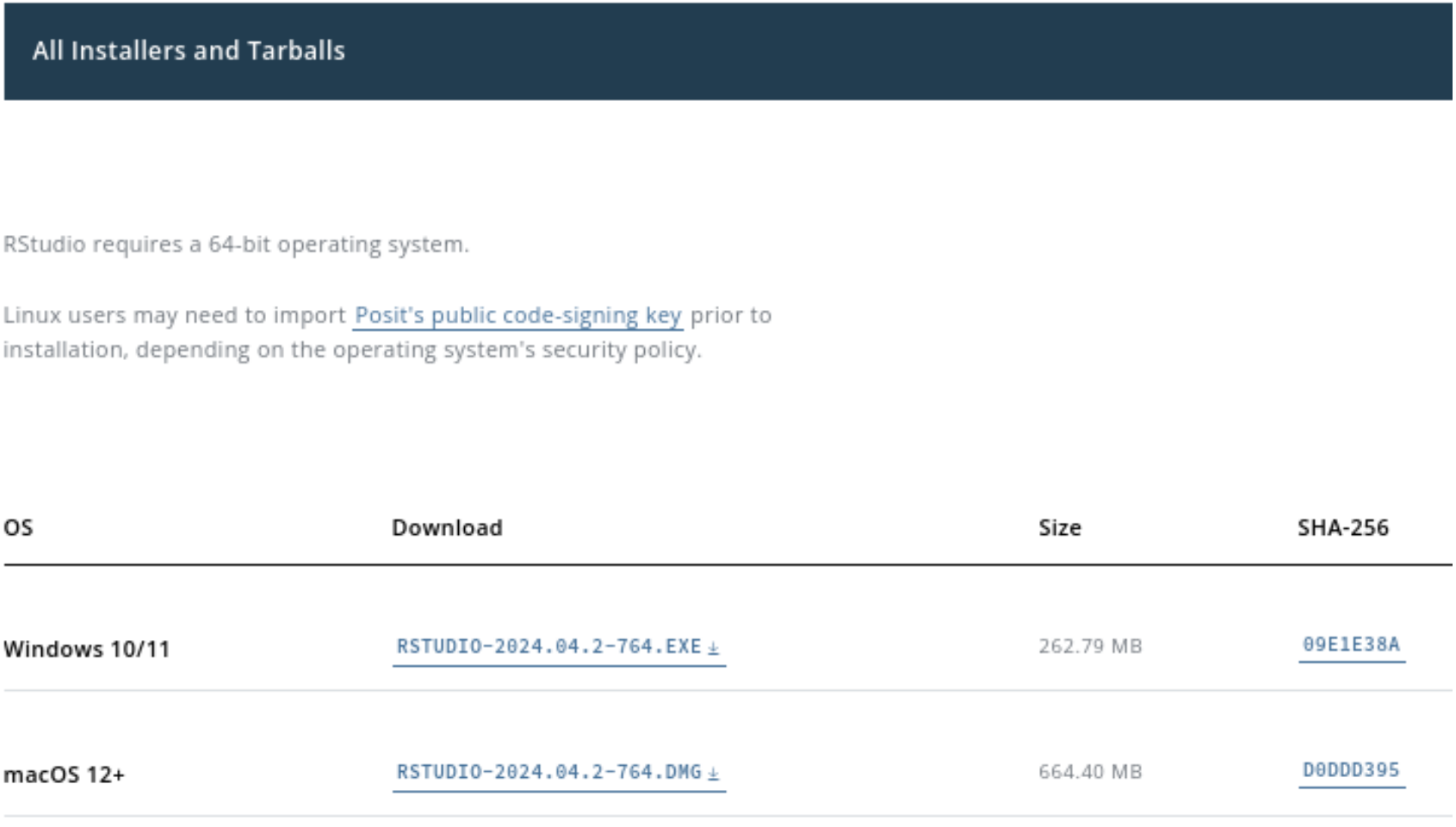
- Then install usual way.
- For Mac, install `R-4.4.1-arm64.pkg` (Big Sur with Apple Silicon M1-3), `R-4.4.1-x86_64.pkg` (Intel), or a newer version if available.
- Or, for Linux, click your distribution (eg. Ubuntu), then follow the instructions.

Now, R Studio

- Go to https://www.rstudio.com/. You will be redirected to `posit.co`, which is the new name of the company that makes R Studio.
- Top right, click Download R Studio (the blue link).
- Scroll down to where it says R Studio Desktop, Free, and a blue Download button underneath. Click Download.

Find the one for you

- We already installed R, so no need to do that.
- Scroll down to All Installers, and click the installer for your machine (Windows, Mac, several flavours of Linux). Install as usual.



All Installers and Tarballs

RStudio requires a 64-bit operating system.

Linux users may need to import Posit's public code-signing key prior to installation, depending on the operating system's security policy.

OS	Download	Size	SHA-256
Windows 10/11	RSTUDIO-2024.04.2-764.EXE	262.79 MB	09E1E38A
macOS 12+	RSTUDIO-2024.04.2-764.DMG	664.40 MB	D0DDD395

Quarto

The last thing we need is Quarto, so that we can render documents (and thus hand in assignments).

- Go to https://quarto.org/.
- Click on one of the Get Started links (blue).
- Find your operating system and install as usual:

Step 1

Install Quarto

Find your operating system in the table below

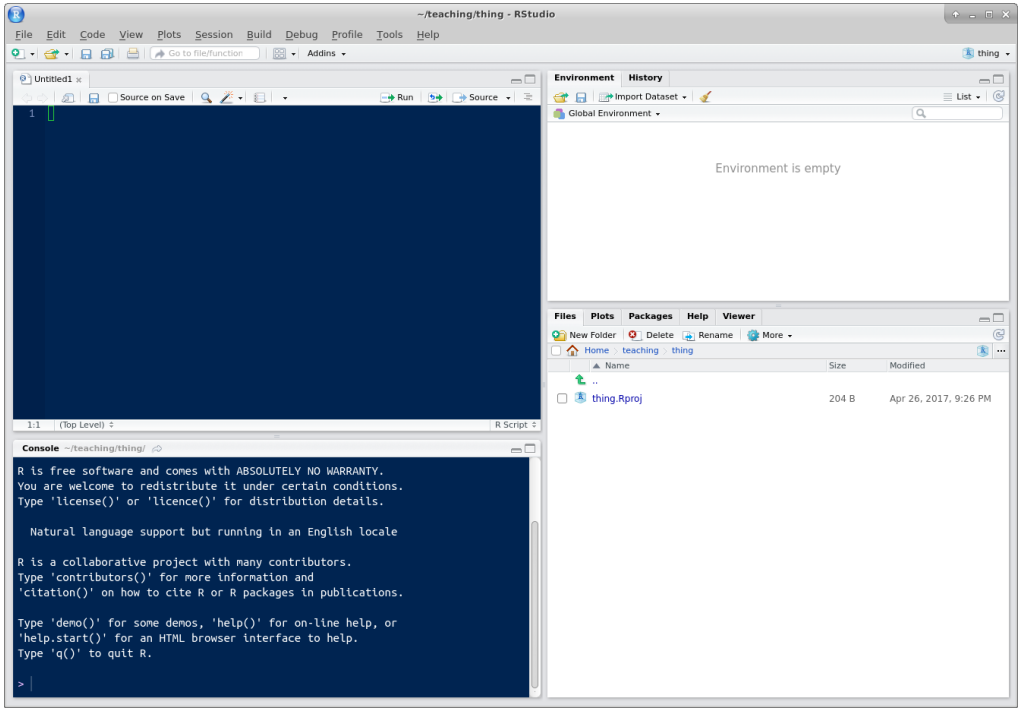
Platform	Download
Ubuntu 18+/Debian 10+	quarto-1.5.54-linux-amd64.deb
Linux x86 Tarball	quarto-1.5.54-linux-amd64.tar.gz
Linux Arm64	quarto-1.5.54-linux-arm64.deb
Linux Arm64 Tarball	quarto-1.5.54-linux-arm64.tar.gz
RHEL 7 Tarball	quarto-1.5.54-linux-rhel7-amd64.tar.gz
Mac OS	quarto-1.5.54-macos.pkg
Windows	quarto-1.5.54-win.msi

Release notes and more downloads…

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



- that is, just the same as the online one.
- First time you run R Studio on your machine, 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 `r.datatools.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 Quarto documents for assignments. Putting everything in a project folder makes it easier to find.
- Example: use a project for (all) assignments in a course, a different document within that project for each one.