


Running R


# Running R online, 2024/2025 version

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



UNIVERSITY OF  
**TORONTO**


**2i2c JupyterHub**



jupyter

Classic Jupyter Notebook


LOG IN



Studio

RStudio

LOG IN




jupyterlab

JupyterLab

LOG IN

**Welcome to U of T's JupyterHub for education**

The University's 2i2c JupyterHub is an open source, web-based platform that offers a standardized computing environment. It can be accessed via your browser. To get started, select one of the above services: Jupyter Notebook, RStudio or JupyterLab.



Click Log In (the blue button) 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



weblogin idpz

UTORid / JOINid

Password

log in ➔

The CILogon logo, which consists of a green square containing a white circular arrow pointing up and to the right, followed by the text "CILogon" in a large, bold, green, sans-serif font.

CILogon facilitates secure access to Cyberinfrastructure

Protect Your Account

Login Problem

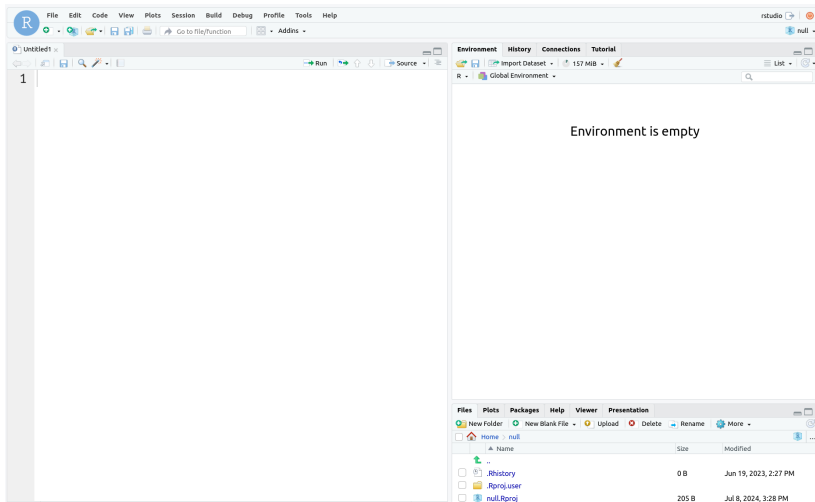
## Steps you should take to

- ✓ Before you begin, make sure to
  - ✓ When using a public computer
  - ✓ Keep your password a secret a
- Tip: U of T will **never** ask for yo

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

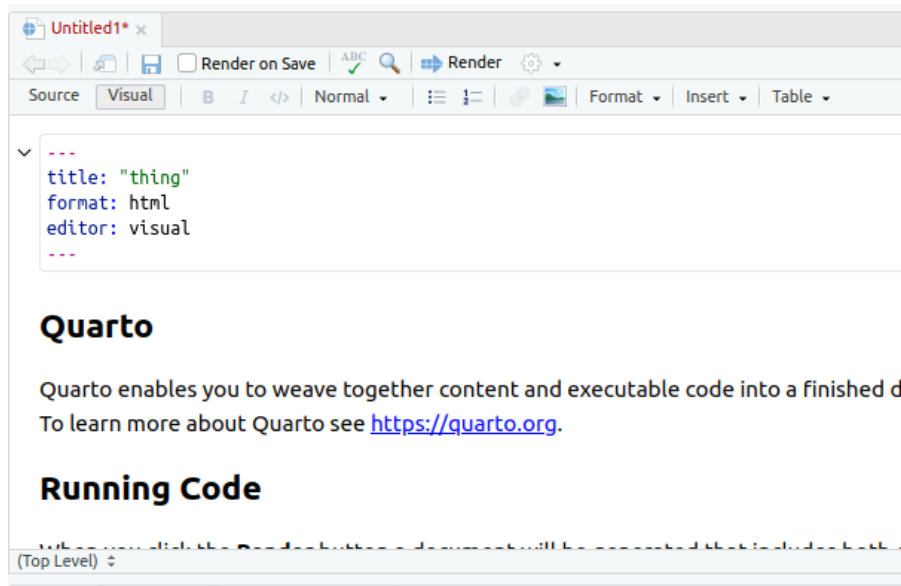
- ▶ Call it what you like. Mine is called thing:
- ▶ Select:
  - ▶ File,
  - ▶ New Project,
  - ▶ New Directory,
  - ▶ New Project (again),
  - ▶ give it a name and click Create Project.
- ▶ You see the name of your new project top right.

# 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}`, with grey background, 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 “Chicken weights by diet”, and click Create. When the document opens, delete the template that it gives you (leaving only the six lines that begin and end with ---).
- ▶ Move the cursor to the next line below those top six lines.
- ▶ Type a / (slash). This allows you to insert something.
- ▶ Start typing “heading”. When you see “Heading 2” in the list, select that.
- ▶ 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, you should now see Normal ( normal text).

## Making our own document 2/2

- ▶ Make a new code chunk: type a slash, then select the top option “R Code Chunk”.
- ▶ Inside that cell, type `library(tidyverse)`.
- ▶ Below that, make another “Heading 2” and put “Weights of chickens” on that line.
- ▶ Make another new code cell below that, and insert the line of code: `chickwts`
- ▶ Below that, make another Heading 2, “A boxplot”, and another code cell containing `ggplot(chickwts, aes(x = feed, y = weight)) + geom_boxplot()`.

# My document

```
---  
title: "Chicken weights"  
author: "me"  
format: html  
editor: visual  
---
```

## Packages

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

## Weights of chickens

```
{r}  
chickwts
```

## A boxplot

```
{r}  
ggplot(chickwts, aes(x = feed, y = weight)) +  
  geom_boxplot()
```

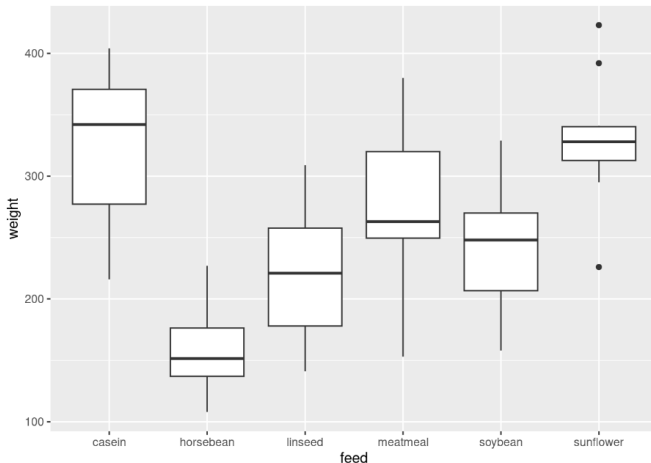
## Run the chunks

- ▶ Now run each of the three chunks in order. You'll see output below each one, including a boxplot 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

## A boxplot

```
ggplot(chickwts, aes(x = feed, y = weight)) + geom_boxplot()
```



The weights of the chickens vary considerably by feed, with the chickens fed on horsebean weighing the least on average



# 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/>.

## The R Project for Statistical Computing

### Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To **download R**, please choose your preferred [CRAN mirror](#).

- ▶ 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.

### CRAN Mirrors

The Comprehensive R Archive Network is available at the following URLs, please choose a location close to you. Some 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/>

<http://cloud.r-project.org/>

Algeria

Automatic redirection to servers worldwide, cur

Automatic redirection to servers worldwide, cur

## Click your mirror

- ▶ Click 0-Cloud (or other mirror), get:

### Download and Install R

Precompiled binary distributions of the base system and core

- [Download R for Linux](#)
- [Download R for \(Mac\) OS X](#)
- [Download R for Windows](#)

- ▶ Click on your operating system, eg. Windows.

Click on Base

## R for Windows

Subdirectories:

[base](#)

Binaries for base distribution (managed by Duncan M. Miller). If you want to **install R for the first time**.

[contrib](#)

Binaries of contributed CRAN packages (for R  $\geq$  2.1.0; managed by Uwe Ligges). There is also information on [third party software](#) and Windows services and corresponding environment and path variables.

[old contrib](#)

Binaries of contributed CRAN packages for outdated versions of R (2.10.x; managed by Uwe Ligges).

[Rtools](#)

Tools to build R and R packages (managed by Duncan M. Miller). If you want to build your own packages on Windows, or if you want to build R packages for Windows.

► 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:

[Download R-4.4.1 for Windows](#) (82 megabytes, 64 bit)

[README on the Windows binary distribution](#)

[New features in this version](#)

... continued

[Download R-4.4.1 for Windows](#) (82 megabytes, 64 bit)

[README on the Windows binary distribution](#)

[New features in this version](#)

- ▶ 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](https://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. See over.



# Choose the right one

## 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	<a href="#">RSTUDIO-2024.04.2-764.EXE <sup>↓</sup></a>	262.79 MB	<a href="#">09E1E38A</a>
macOS 12+	<a href="#">RSTUDIO-2024.04.2-764.DMG <sup>↓</sup></a>	664.40 MB	<a href="#">D0DD0395</a>
Ubuntu 20/Debian 11	<a href="#">RSTUDIO-2024.04.2-764-AMD64.DEB <sup>↓</sup></a>	194.73 MB	<a href="#">87B20155</a>
Ubuntu 22/Debian 12	<a href="#">RSTUDIO-2024.04.2-764-AMD64.DEB <sup>↓</sup></a>	196.64 MB	<a href="#">1D0BD2F5</a>
OpenSUSE 15	<a href="#">RSTUDIO-2024.04.2-764-X86_64.RPM <sup>↓</sup></a>	196.89 MB	<a href="#">CC0E1D88</a>

# 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 (over):

# Quarto 2/2

## Step 1

Install Quarto

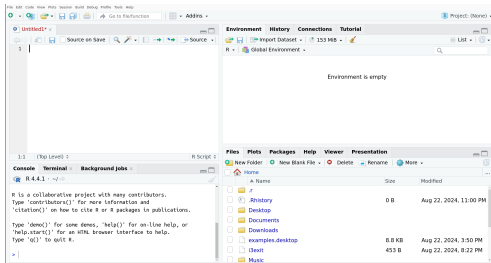
Find your operating system in the table below

Platform	Download
Ubuntu 18+/Debian 10+	<a href="#"><u>quarto-1.5.54-linux-amd64.deb</u></a>
Linux x86 Tarball	<a href="#"><u>quarto-1.5.54-linux-amd64.tar.gz</u></a>
Linux Arm64	<a href="#"><u>quarto-1.5.54-linux-arm64.deb</u></a>
Linux Arm64 Tarball	<a href="#"><u>quarto-1.5.54-linux-arm64.tar.gz</u></a>
RHEL 7 Tarball	<a href="#"><u>quarto-1.5.54-linux-rhel7-amd64.tar.gz</u></a>
Mac OS	<a href="#"><u>quarto-1.5.54-macos.pkg</u></a>
Windows	<a href="#"><u>quarto-1.5.54-win.msi</u></a>
	<a href="#"><u>Release notes and more downloads...</u></a>

# 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.

# Install Tidyverse

- ▶ 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.