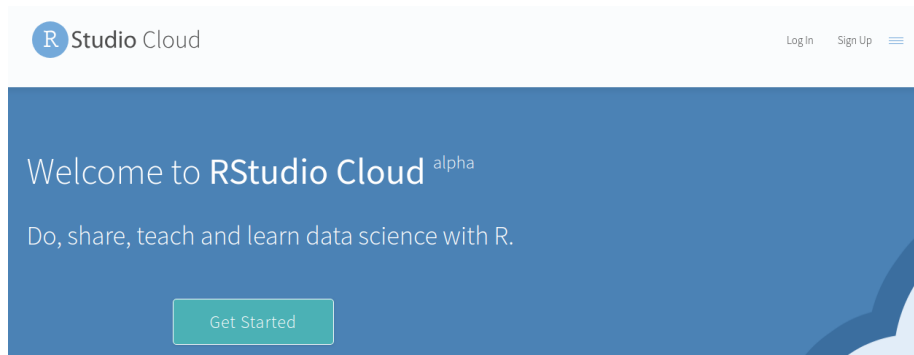


Running R

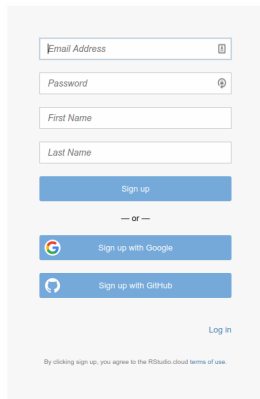
Running R online

Go to rstudio.cloud.



- Click Get Started (or Sign Up top right).

Signing up



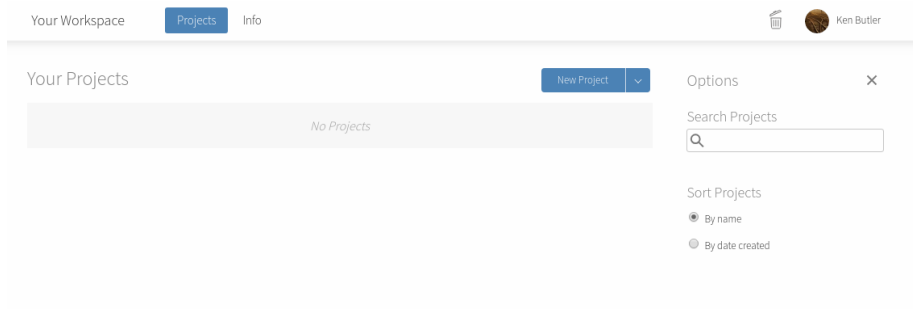
A screenshot of the RSudio cloud sign-up form. It features four input fields: 'Email Address' with a calendar icon, 'Password' with a key icon, 'First Name', and 'Last Name'. Below these is a blue 'Sign up' button. A separator '— or —' follows. Then are two blue buttons: 'Sign up with Google' with the Google logo and 'Sign up with Github' with the Github logo. At the bottom is a 'Log in' link and a small text line: 'By clicking sign up, you agree to the RSudio.cloud terms of use.'

- Fill out the top 4 boxes and click Sign Up. Or, log in with your Google or Github accounts, if you have either of those. (If you have GMail, that's a Google account.)

Logging in

- After you have signed up, you will be logged in.
- If you close the rstudio.cloud browser tab and open it up again, you will probably get automatically logged in.
- If not, you can click Log In on the opening screen, or click Get Started and pretend to sign up again, and you'll get logged in.
- You can explicitly log out, in which case you'll need to log in again.
- Use one of these ways to get back into R Studio Cloud next time.

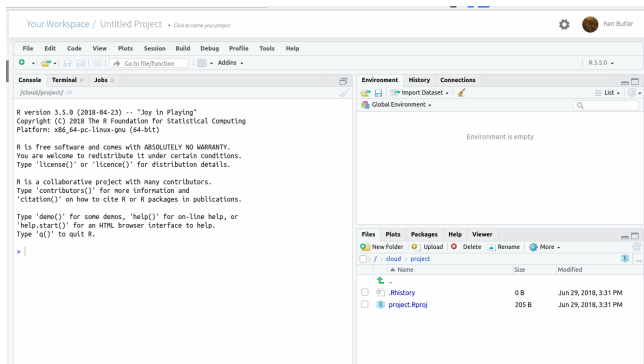
R Studio Cloud



- 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*.

In a new project

- R Studio starts a new (untitled) project:



- In left-hand Console can type stuff and see output.
- Click on Console, type `install.packages("tidyverse")` and let it do what it will. (This takes a few minutes.)

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 “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 first time, you will probably be asked to “install some packages”. Click Yes to let it do that.

The template R Notebook

The screenshot displays the RStudio IDE interface. The main editor window shows an R Markdown document titled "Untitled1". The document content includes a title, output format, and introductory text about R Markdown notebooks, followed by a small R code chunk plotting cars data.

```
1 ---
2 title: "R Notebook"
3 output: html_notebook
4 |---
5
6 This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute
7 code within the notebook, the results appear beneath the code.
8
9 Try executing this chunk by clicking the "Run" button within the chunk or by
10 placing your cursor inside it and pressing "Ctrl+Shift+Enter".
11
12 ```{r}
13 plot(cars)
14 ```
15
16 Add a new chunk by clicking the "Insert Chunk" button on the toolbar or by
17 pressing "Ctrl+Alt+I".
18
19 When you save the notebook, an HTML file containing the code and output will be
20 saved alongside it (click the "Preview" button or press "Ctrl+Shift+K" to preview
21 the HTML file).

The environment pane on the right shows the "Global Environment" is empty. The file explorer at the bottom shows the project files: .Rhistory (0 B) and project.Rproj (205 B).


```

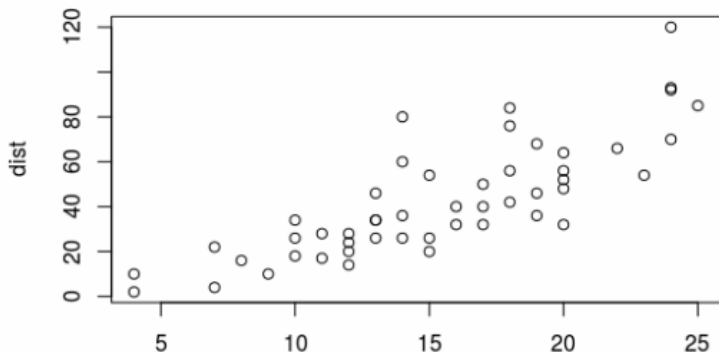

About this notebook

- 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
9 placing your cursor inside it and pressing **Ctrl+Shift+Enter**.

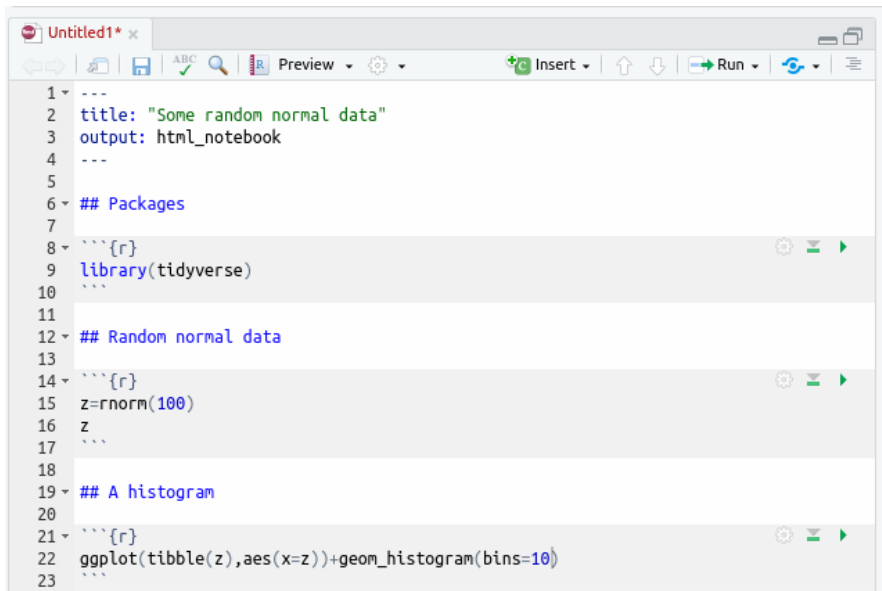
```
10 ```{r}  
11 plot(cars)  
12 ```
```



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



The screenshot shows an R notebook window titled "Untitled1* x". The interface includes a toolbar with icons for navigation, saving, and running code. The script content is as follows:

```
1 ---  
2 title: "Some random normal data"  
3 output: html_notebook  
4 ---  
5  
6 ## Packages  
7  
8 ```{r}  
9 library(tidyverse)  
10 ```  
11  
12 ## Random normal data  
13  
14 ```{r}  
15 z=rnorm(100)  
16 z  
17 ```  
18  
19 ## A histogram  
20  
21 ```{r}  
22 ggplot(tibble(z),aes(x=z))+geom_histogram(bins=10)  
23 ```
```

Run the chunks

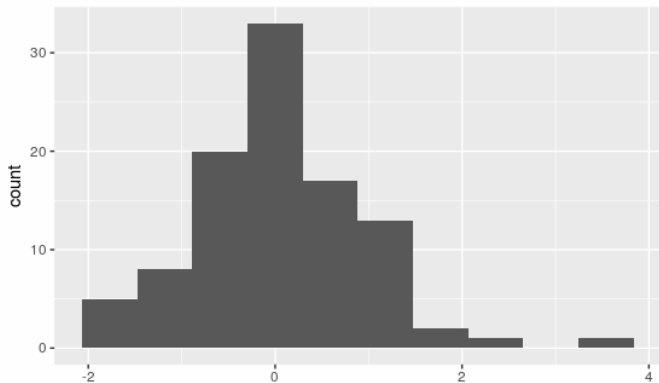
- Now run each of the three chunks in order. You'll see output below each one, including a histogram below the last one.
- When it works, add some narrative text before the code chunks explaining what is going to be done, and some text after describing what you see.
- Save the notebook (File, Save As). 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/>:

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 on Download

- 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/>

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

Automatic redirection to servers worldwide, currently sponsored by Rstudio

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.nuc.cl/>

Pontificia Universidad Catolica de Chile, Santiago

Click your mirror

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

Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows**

- [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:

<u>base</u>	Binaries for base distribution (managed by Duncan Murdoch). This is what you want to <u>install R for the first time</u> .
<u>contrib</u>	Binaries of contributed CRAN packages (for R \geq 2.11.x; managed by Uwe Ligges). There is also information on <u>third party software</u> available for CRAN Windows services and corresponding environment and make variables.
<u>old contrib</u>	Binaries of contributed CRAN packages for outdated versions of R (for R $<$ 2.11.x; managed by Uwe Ligges).
<u>Rtools</u>	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, here 3.5.3, will be different for you.
- Click something like the top link below:

[Download R 3.5.3 for Windows](#) (79 megabytes, 32/64 bit)

[Installation and other instructions](#)

[New features in this version](#)

If you want to double-check that the package you have downloaded matches the package distributed b windows: both [graphical](#) and [command line versions](#) are available.

- Then install usual way.
- Or, for Mac, download and install R-3-5-1.pkg.
- Or, for Linux, click your distribution (eg. Ubuntu), then one of the cran35 links according to your version, then eg. r-base-core_3.5.1-1bionic_amd64.deb.

Now, R Studio

- Go [here](#). (The word “here” is clickable link.)
- Find this, and click Download:



RStudio

RStudio makes R easier to use. It includes a code editor, debugging & visualization tools.

 [Download](#)  [Learn More](#)

Scroll down...

- to this:

RStudio Desktop
Open Source License

FREE

DOWNLOAD

RStudio Desktop
Commercial License

\$995 per year

BUY

RStudio Server
Open Source License

FREE

DOWNLOAD

RStudio Server Pro
Commercial License

\$9,995 per year

DOWNLOAD

RStudio Server Pro +
RStudio Connect
Commercial License

\$29,995 per
year

TALK

- Click left-side Download.

Find the one for you

- Scroll down, 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](#).

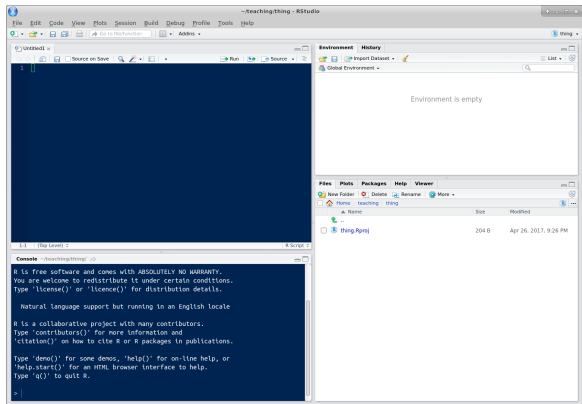
Installers for Supported Platforms

Installers	Size	Date	
RStudio 0.99.902 - Windows Vista/7/8/10	77.1 MB	2016-05-14	1
RStudio 0.99.902 - Mac OS X 10.6+ (64-bit)	60 MB	2016-05-14	1
RStudio 0.99.902 - Ubuntu 12.04+/Debian 8+ (32-bit)	81.6 MB	2016-05-14	1
RStudio 0.99.902 - Ubuntu 12.04+/Debian 8+ (64-bit)	88.3 MB	2016-05-14	1
RStudio 0.99.902 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (32-bit)	81 MB	2016-05-14	1
RStudio 0.99.902 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (64-bit)	81.9 MB	2016-05-14	1

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.

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.