THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

ECON3350 - Applied Econometrics for Macroeconomics and Finance

Tutorial 1: R and Basic Operations

Tutor: Francisco Tavares Garcia

ECON3350 – Tutorial 01

Install R – 4.2.2

https://cran.r-project.org/

Install RStudio – 2022.12.0+353

https://posit.co/download/rstudio-desktop/

Update all packages –

In RStudio >>

Tools >>

Check for Package Updates >>

Select All >>

Install Updates

ECON3350 – Tutorial 01

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Tools >>

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Select All >>

Install Updates

Who's your Tutor?

Born in 1986 in Ourinhos,
São Paulo state, Brazil

2004 – 2008
Bachelor of Computer Science
2008 – 2012
Supervisor at Procter & Gamble
2009 – 2011
MBA - FGV
2012 – 2018
Built and ran a Hostel
2021 – current
Bachelor of Economics - UQ

ECON3350 – Tutorial 01

Install R – 4.2.2

https://cran.r-project.org/

Install RStudio – 2022.12.0+353

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Select All >>

Install Updates

Who's your Tutor?

Econometrics/Statistics

ECON1310 - Introductory Statistics for Social Sciences

ECON2300 - Introductory Econometrics

ECON2105 - Statistical Theory for Economists

ECON3350 - Applied Econometrics for Macroeconomics and Finance

STAT2003 - Mathematical Probability

STAT2004 - Statistical Modelling & Analysis

STAT3001 – Mathematical Statistics

STAT3004 - Probability Models & Stochastic Processes

Assessments

Assessment Task	Due Date	Weighting	Learning Objectives
Online Quiz Online Periodic Assessments	Throughout the Semester	30% (5 @ 6%)	1, 2, 3, 4, 5, 6
Report Research Report 1	28 Apr 23 15:59	35%	1, 2, 3
Report Research Report 2	02 Jun 23 15:59	35%	2, 3, 5, 6

Online Periodic Assessments

Type: Online Quiz
Learning Objectives Assessed: 1, 2, 3, 4, 5, 6
Due Date: Throughout the Semester
Weight: 30%
(5 @ 6%)
Reading: 0 minutes
Duration: 10 minutes
Format: Multiple-choice, Short answer
Task Description:
Online quizzes (via course website) throughout the semester; approximately fortnightly, but exact dates will be announced on the course website with at least two weeks advance notice. There will be in total five quizzes, each consisting of multiple-choice and short-answer questions related to the material covered in lectures and tutorials.
Criteria & Marking:
UQ Students: Please access the profile from Learn.UQ or mySI-net to access marking criteria held in this profile.

No time limit, available for a few days

Research Report 1

Type: Report
Learning Objectives Assessed: 1, 2, 3
Due Date: 28 Apr 23 15:59
Weight: 35%
Task Description:
The report is a research-oriented tasks involving real-world data. You will be given a data set and asked to provide policy guidance using the empirical tools learned in the course. This is designed to be an authentic assessment that better reflects the skills needed to apply the methods taught in practice. As such, there will be minimal guidance provided; instead, students will have the freedom to make their own decisions in overcoming real-world challenges.
Topics covered:

- forecasting univariate processes I and II;
- dynamic relationships;
- cointegration I and II.

Further details about the report will be provided on our course website.
Criteria & Marking:
Students will be required to analyse a data set provided and report on a set of required tasks. Each part will have clearly indicated marks.

Submission:
Online via course website. No late submission will be accepted (see Section 5.3).

Research Report 2

Type: Report
Learning Objectives Assessed: 2, 3, 5, 6
Due Date: 02 Jun 23 15:59
Weight: 35%
Task Description:
The second report is a continuation of the research-oriented tasks involving real-world data and is similar in design to Research Report 1. Again, students should expect minimal guidance to be provided; instead, students will have the freedom to make their own decisions in overcoming real-world challenges.
Topics covered:

- forecasting univariate processes I and II;
- dynamic relationships;
- cointegration I and II;
- multivariate processes I, II and III

Further details about the report will be provided on our course website.
Criteria & Marking:
Students will be required to analyse a data set provided and report on a set of required tasks. Each part will have clearly indicated marks.

Submission:
Online via course website. No late submission will be accepted (see Section 5.3).

I need HELP!!!

- Consultation almost every weekday!!

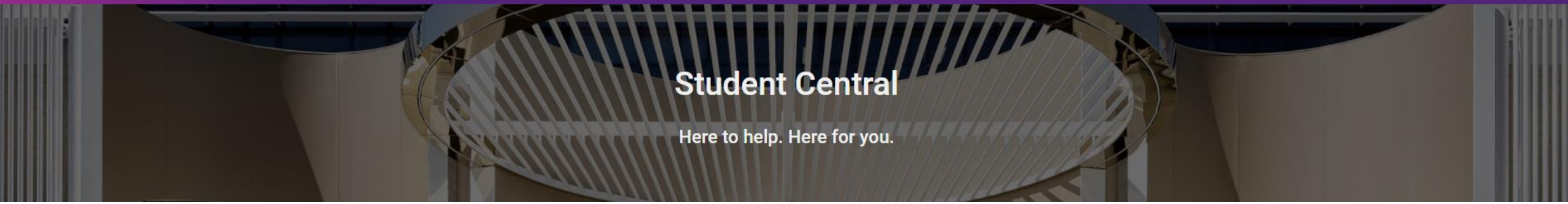
(both tutors and Eric)

- Ed Discussion Board (Blackboard/Learn.UQ)

- e.eisenstat@uq.edu.au – for academic questions
- econ_admin@uq.edu.au – for admin questions

Online free R books:

- https://bookdown.org/ndphillips/YaRrr/ (Intro R)
- https://www.econometrics-with-r.org/
- https://otexts.com/fpp3/ (Forecasting in R)



I really need HELP… https://my.uq.edu.au/contact/student-central

Contact us

We're here to help from Monday to Friday.

Email Student Services

1300 275 870 (Option 2)
8.30am–5pm

Live chat (8.30am–4.30pm)

Chat – unavailable

Counselling

Looking for ways to build strategies and help you overcome challenges in your life? Some areas we can provide support with, include:

- Stress
- Depression
- Anxiety
- Relationships
- Wellbeing

Book an appointment

Wellbeing

We are here for you. Take advantage of our support and maximise your university experience. Some areas we can provide guidance on include:

- Accommodation
- Crisis support
- Financial hardship assistance
- International student support
- Health and wellbeing advice
- Academic accommodations
- Support with Disability and Inclusion

Find out more

Study skills

Set yourself up for academic success with the right tools, advice and support from our experts. Some of the areas we can support you in include:

- Academic writing
- Time management
- Learning and exam preparation
- Learning Adviser Appointments

Book an appointment

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Installing R (not RStudio yet)

R base distribution – 4.2.2
https://cran.r-project.org/

R-4.2.2 for Windows

Download R-4.2.2 for Windows (76 megabytes, 64 bit)

README on the Windows binary distribution
New features in this version

This build requires UCRT, which is part of Windows since Windows 10 and Windows Server 2016. On older systems, UCRT has to be installed manually from here.

If you want to double-check that the package you have downloaded matches the package distributed by CRAN, you can compare the md5sum of the .exe to the fingerprint on the master server.

Frequently asked questions

- Does R run under my version of Windows?
- How do I update packages in my previous version of R?

Please see the R FAQ for general information about R and the R Windows FAQ for Windows-specific information.

R for macOS

This directory contains binaries for a base distribution and packages to run on macOS. Releases for old Mac OS X systems (through Mac OS X 10.5) and PowerPC Macs can be found in the old directory.

Note: Although we take precautions when assembling binaries, please use the normal precautions with downloaded executables.

Package binaries for R versions older than 3.2.0 are only available from the CRAN archive so users of such versions should adjust the CRAN mirror setting (`https://cran-archive.r-project.org`) accordingly.

R 4.2.2 "Innocent and Trusting" released on 2022/10/31

Please check the integrity of the downloaded package by checking the signature:
`pkgutil --check-signature R-4.2.2.pkg`
in the *Terminal* application. If Apple tools are not avaiable you can check the SHA1 checksum of the downloaded image:
`openssl sha1 R-4.2.2.pkg`

Latest release:

R-4.2.2-arm64.pkg (notarized and signed) SHA1-hash: c3bb657ca6912b9b98e254f63434a365da26848f (ca. 86MB) for M1 and higher Macs only!	**R 4.2.2** binary for macOS 11 (**Big Sur**) and higher, **Apple silicon arm64** build, signed and notarized package. Contains R 4.2.2 framework, R.app GUI 1.79 for Apple silicon Macs (M1 and higher), Tcl/Tk 8.6.12 X11 libraries and Texinfo 6.8. **Important: this version does NOT work on older Intel-based Macs** - see below for Intel version. macOS Ventura users: there is a known bug in Ventura, if the installation fails, move the downloaded file away from the *Downloads* folder (e.g., to your home or Desktop) Note: the use of X11 (including `tcltk`) requires XQuartz (version 2.8.1 or later). Always re-install XQuartz when upgrading your macOS to a new major version. This release uses Xcode 13.1 and experimental GNU Fortran 12 arm64 fork. If you wish to compile R packages which contain Fortran code, you may need to download GNU Fortran for arm64 from https://mac.R-project.org/tools. Any external libraries and tools are expected to live in `/opt/R/arm64` to not conflict with Intel-based software and this build will not use `/usr/local` to avoid such conflicts (see the tools page for more details).
R-4.2.2.pkg (notarized and signed) SHA1-hash: 99b8d184f855e630ac950ca4e62cb7fc9a1f7b2e (ca. 87MB) for Intel Macs	**R 4.2.2** binary for macOS 10.13 (**High Sierra**) and higher, **Intel 64-bit** (older Macs) build, signed and notarized package. Contains R 4.2.2 framework, R.app GUI 1.79 in 64-bit for Intel Macs, Tcl/Tk 8.6.6 X11 libraries and Texinfo 6.7. The latter two components are optional and can be ommitted when choosing "custom install", they are only needed if you want to use the `tcltk`

Installing RStudio

Rstudio IDE – 2022.12.0+353
https://posit.co/download/rstudio-desktop/

DOWNLOAD

RStudio IDE

The most popular coding environment for R, built with love by Posit.

Used by millions of people weekly, the RStudio integrated development environment (IDE) is a set of tools built to help you be more productive with R and Python. It includes a console, syntax-highlighting editor that supports direct code execution. It also features tools for plotting, viewing history, debugging and managing your workspace.

RStudio Desktop | RStudio Server

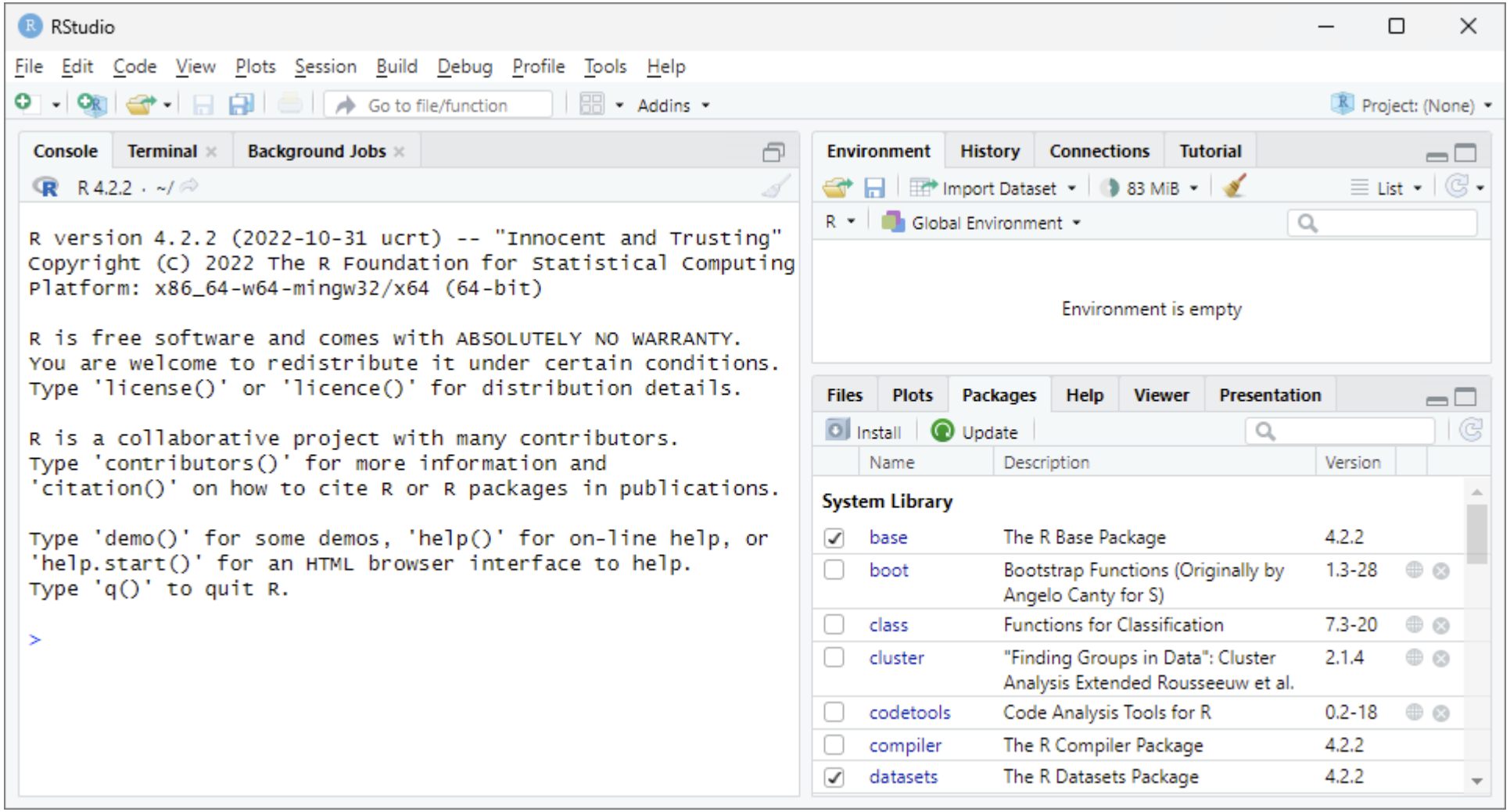
RStudio Desktop

Find out more about RStudio Desktop and RStudio Desktop Pro below.

DOWNLOAD RSTUDIO

OS	Download	Size	SHA-256
Windows 10/11	RSTUDIO-2022.12.0-353.EXE	202.77 MB	FD8EA4B4
macOS 11+	RSTUDIO-2022.12.0-353.DMG	365.71 MB	FD4BEBB5
Ubuntu 18+/Debian 10+	RSTUDIO-2022.12.0-353-AMD64.DEB	131.20 MB	23CAE58F
Ubuntu 22	RSTUDIO-2022.12.0-353-AMD64.DEB	131.95 MB	8BC3F84D
Fedora 19/Red Hat 7	RSTUDIO-2022.12.0-353-X86_64.RPM	145.99 MB	A717CDAD
OpenSUSE 15	RSTUDIO-2022.12.0-353-X86_64.RPM	131.50 MB	983E7D0C

RStudio IDE


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
Console
Terminal
Background Jobs
R 4.2.2 · ~/
R version 4.2.2 (2022-10-31 ucrt) -- "Innocent and Trusting"
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Platform: x86_64-w64-mingw32/x64 (64-bit)
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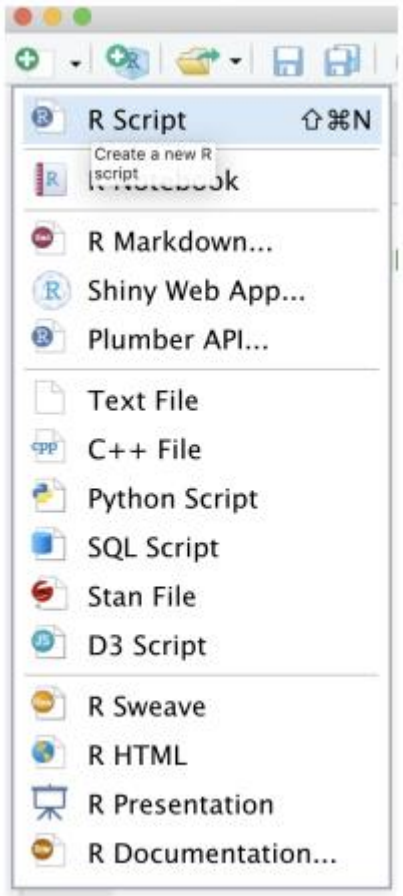
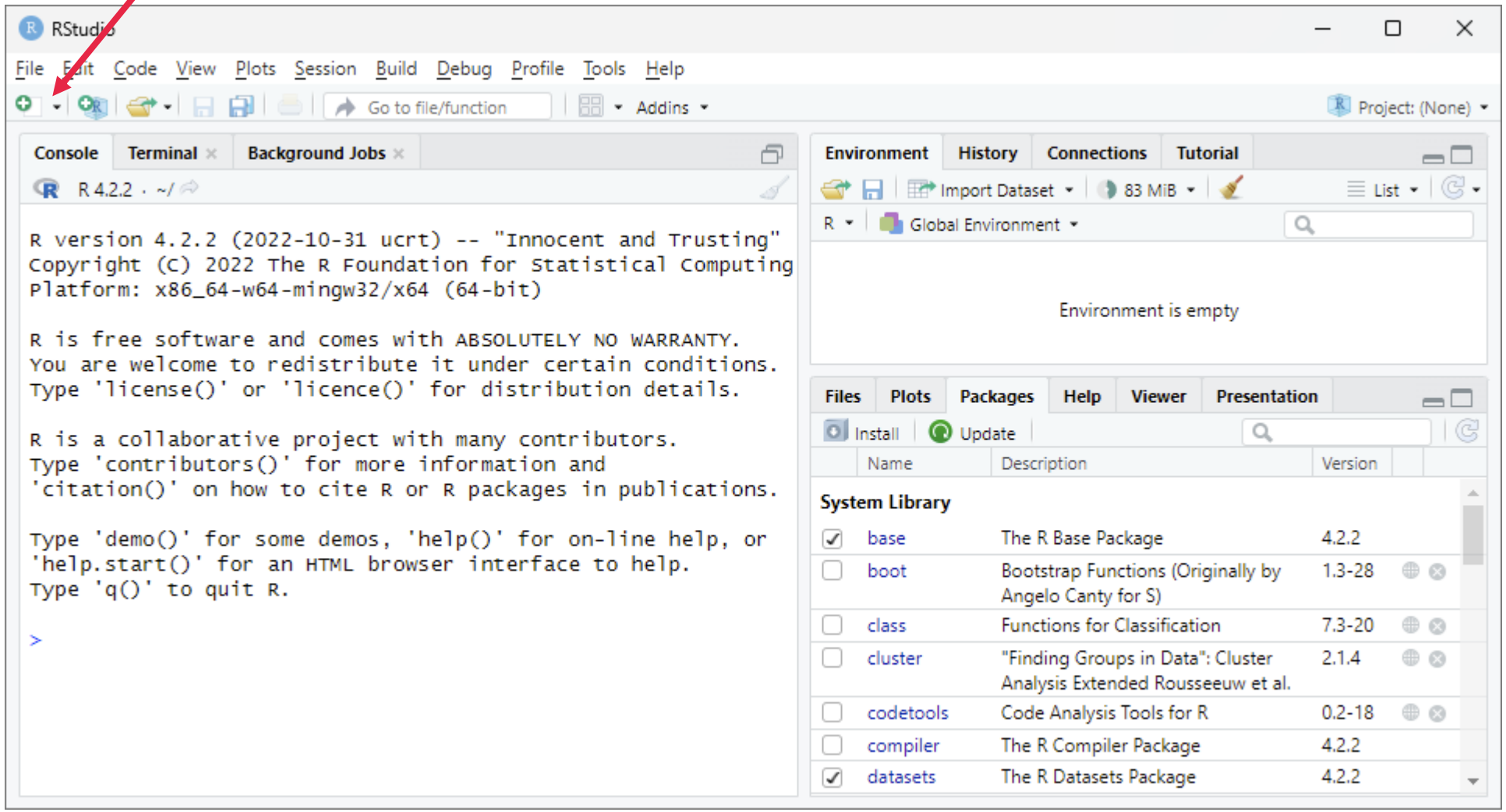
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
>
Environment
History
Connections
Tutorial
Import Dataset
83 MiB
List
R
Global Environment
Environment is empty
Files
Plots
Packages
Help
Viewer
Presentation
Install
Update
Name
Description
Version
System Library
base
The R Base Package
4.2.2
boot
Bootstrap Functions (Originally by Angelo Canty for S)
1.3-28
class
Functions for Classification
7.3-20
cluster
"Finding Groups in Data": Cluster Analysis Extended Rousseeuw et al.
2.1.4
codetools
Code Analysis Tools for R
0.2-18
compiler
The R Compiler Package
4.2.2
datasets
The R Datasets Package
4.2.2

New script


R Script ⇧⌘N
Create a new R script
R Markdown...
Shiny Web App...
Plumber API...
Text File
C++ File
Python Script
SQL Script
Stan File
D3 Script
R Sweave
R HTML
R Presentation
R Documentation...


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
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R 4.2.2 · ~/
R version 4.2.2 (2022-10-31 ucrt) -- "Innocent and Trusting"
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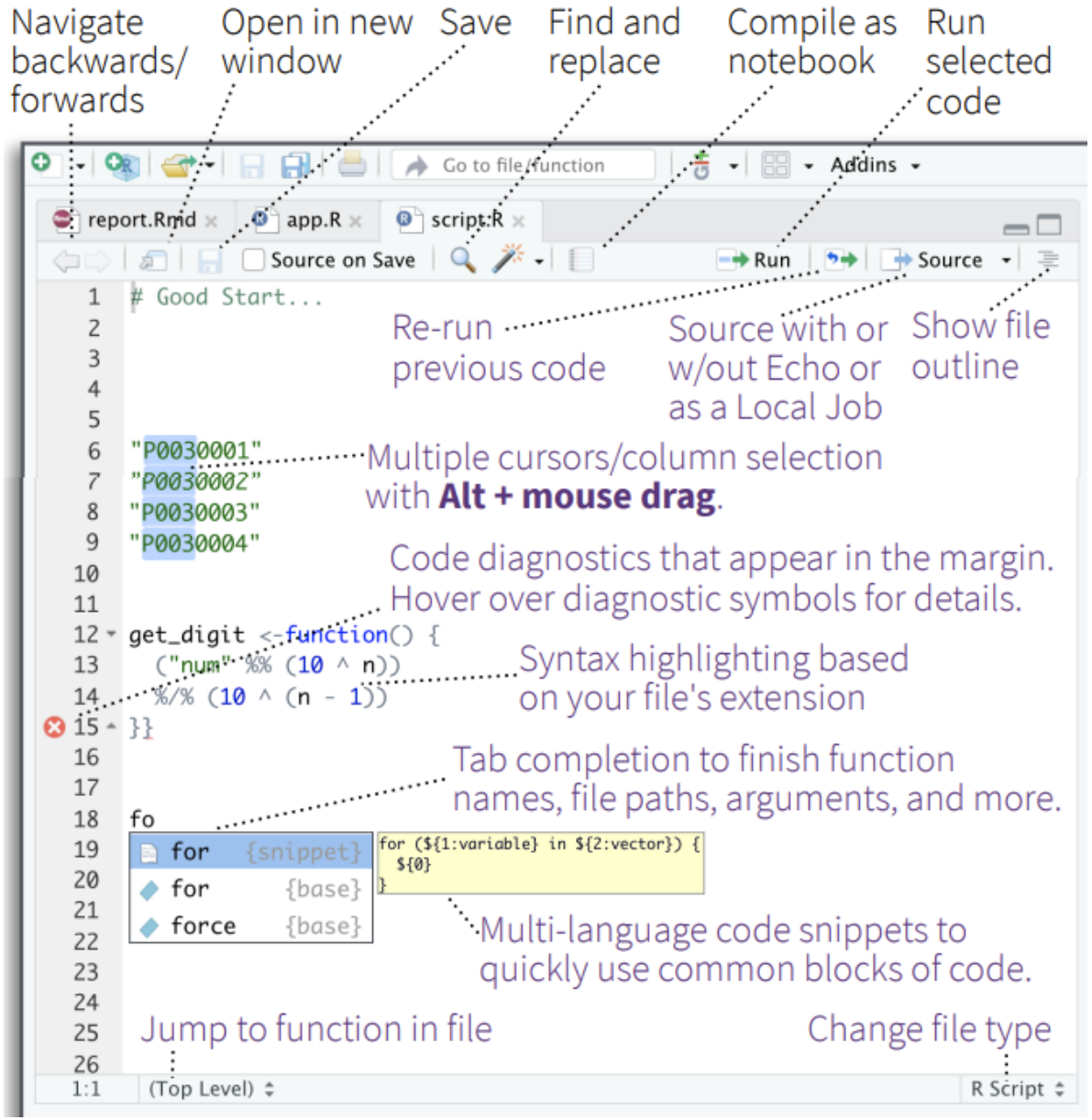
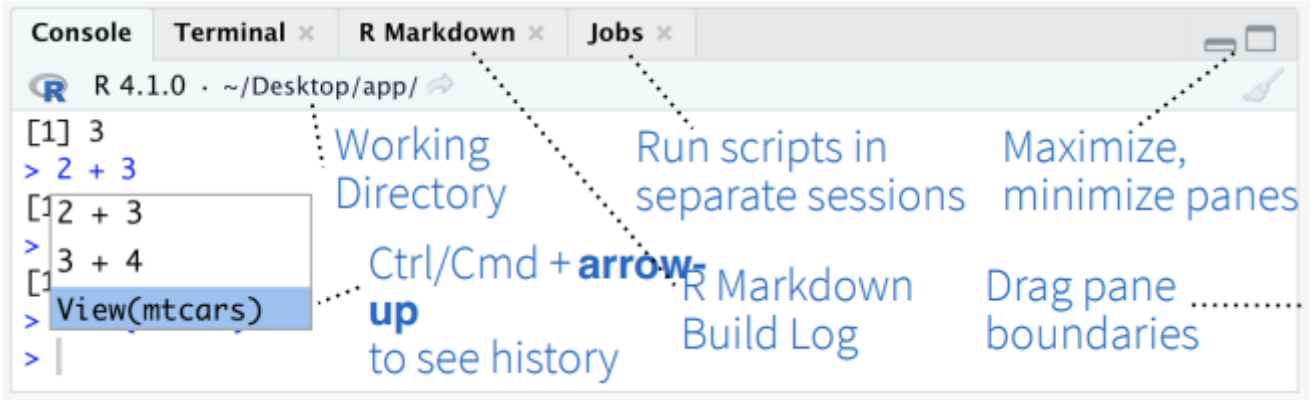
codetools Code Analysis Tools for R 0.2-18
compiler The R Compiler Package 4.2.2
datasets The R Datasets Package 4.2.2

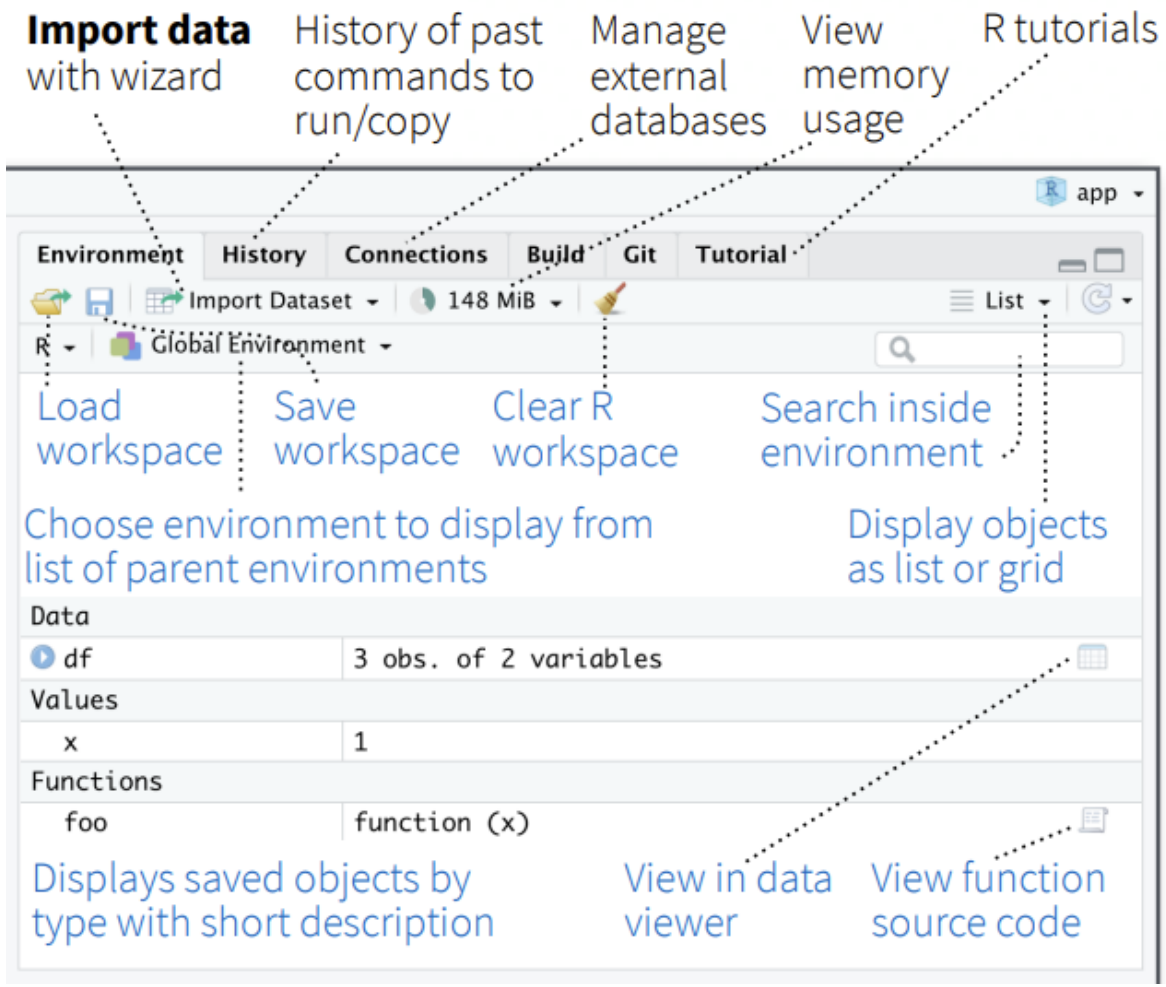
Source Editor top left panel

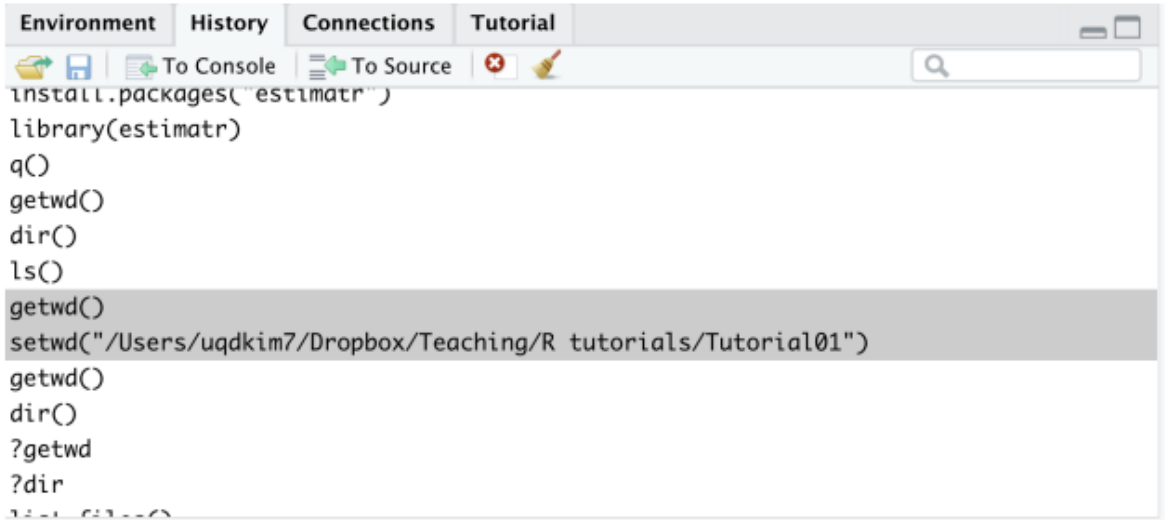


Console – bottom left panel

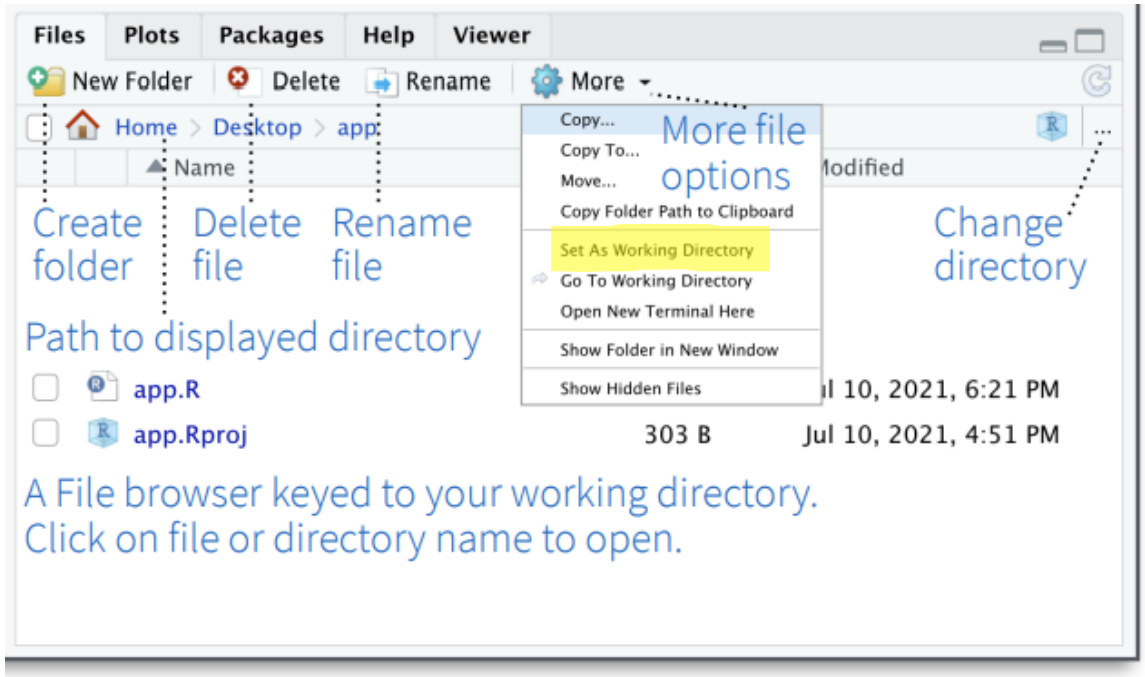


Tab Panes - top right panel

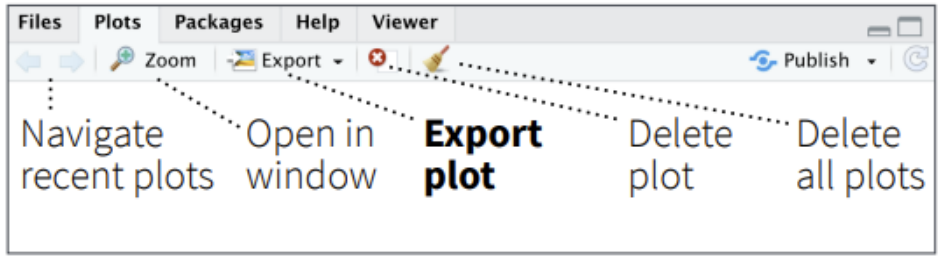




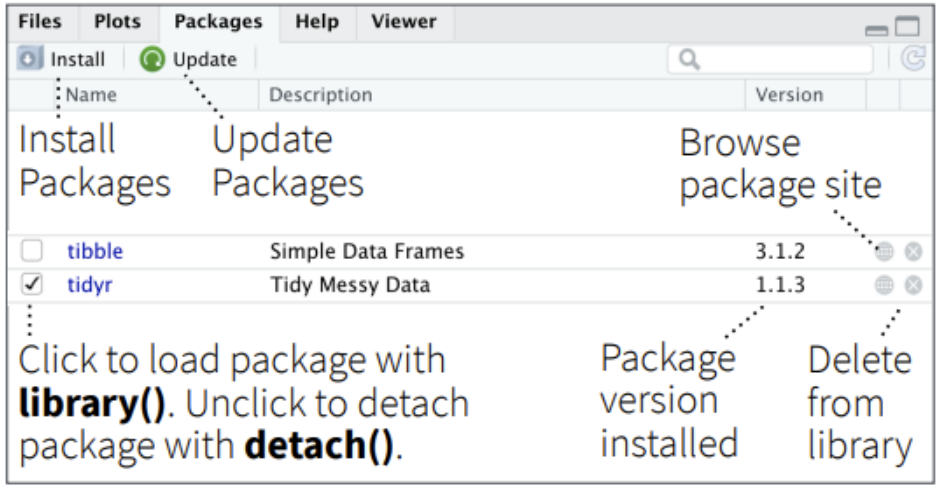
Tab Panes - bottom right panel



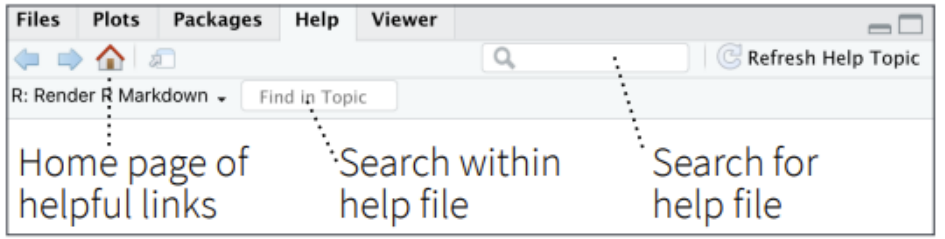
RStudio opens plots in a dedicated **Plots** pane



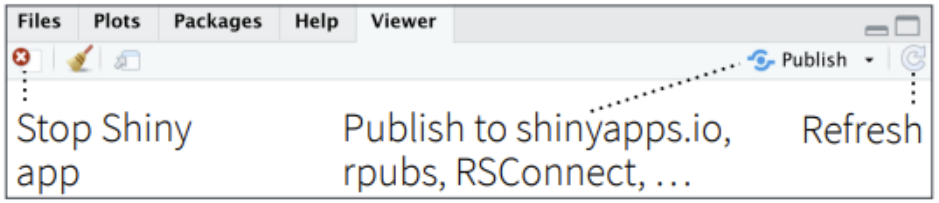
GUI **Package** manager lists every installed package



RStudio opens documentation in a dedicated **Help** pane

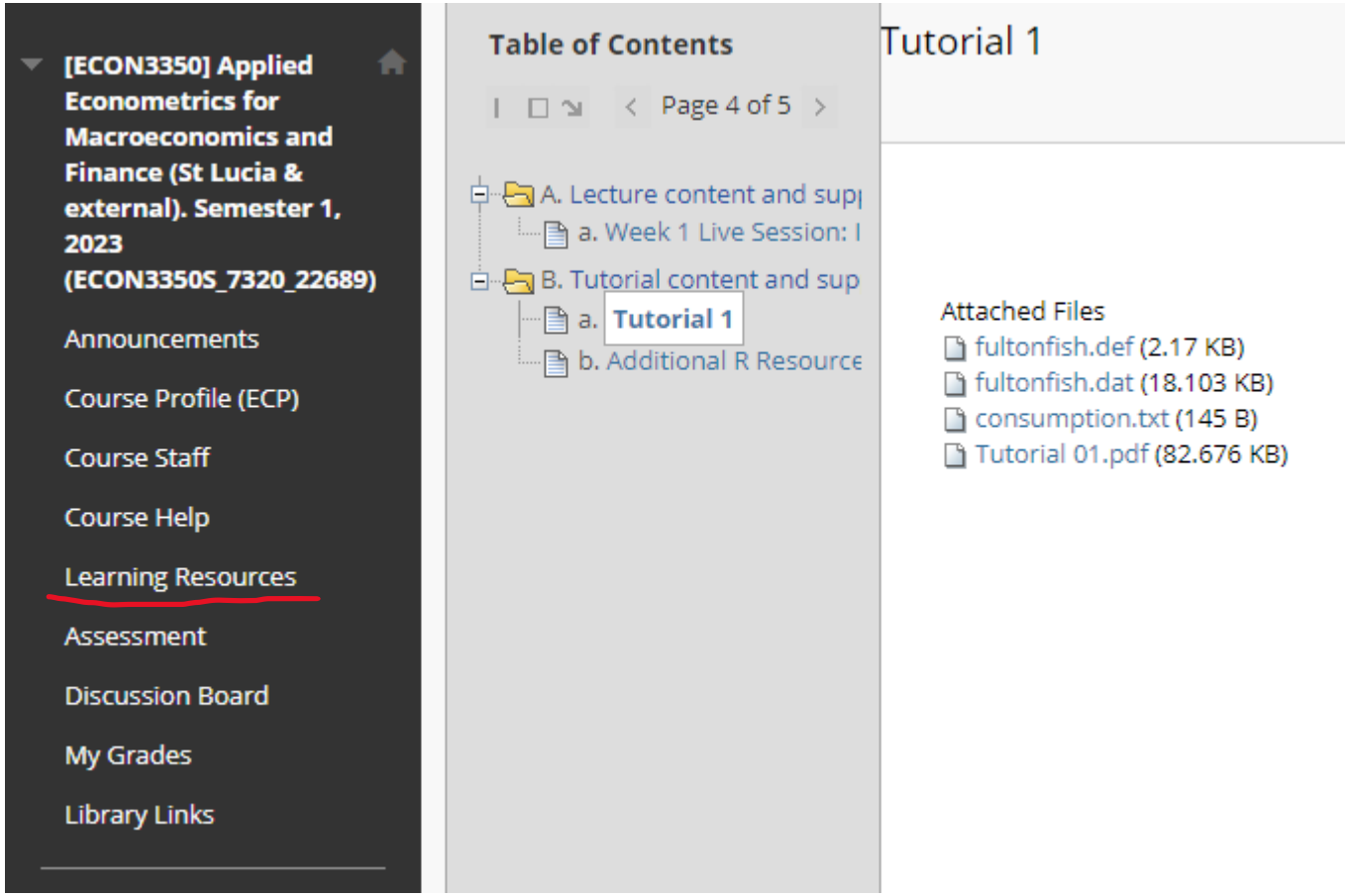


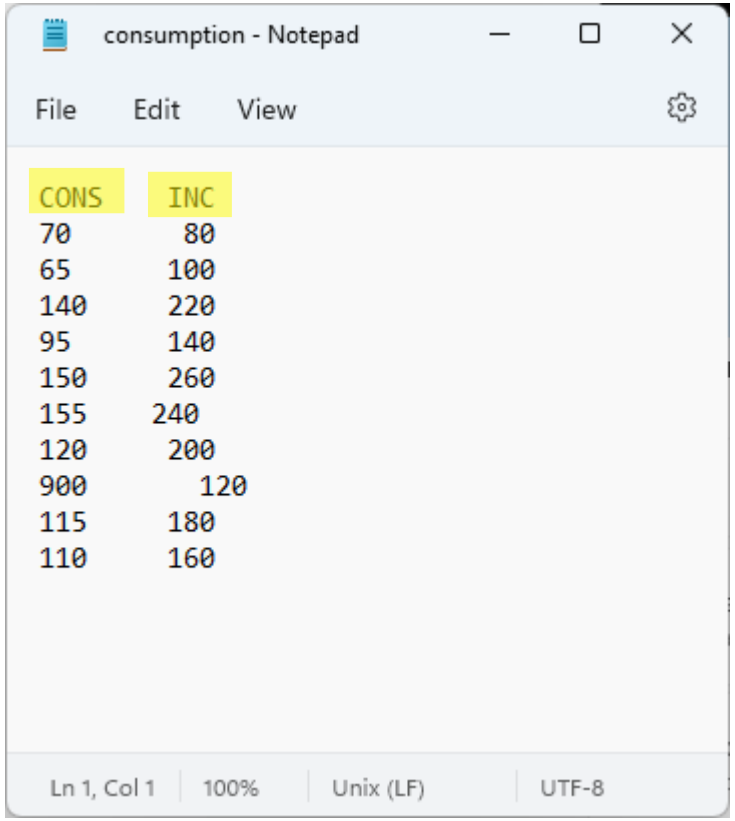
Viewer pane displays HTML content, such as Shiny apps, RMarkdown reports, and interactive visualizations



1. The text file `consumption.txt` contains observations on the weekly family consumption expenditure (`CONS`) and income (`INC`) for a sample of 10 families.

consumption.txt





1. The text file `consumption.txt` contains observations on the weekly family consumption expenditure (`CONS`) and income (`INC`) for a sample of 10 families.

   (a) Read the data into R.

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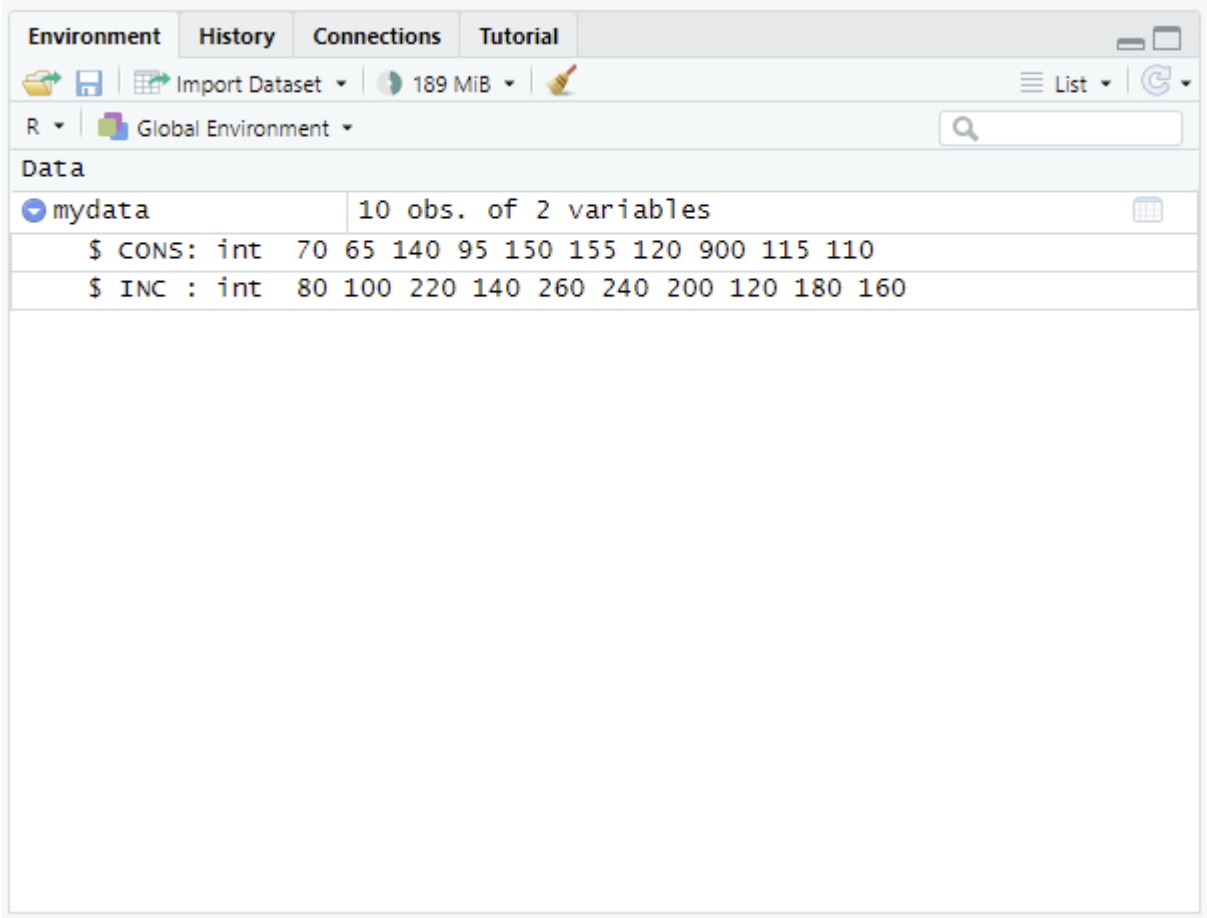
   (a) Read the data into R.

Solution The data is loaded using the R command `read.delim`.

```
mydata <- read.delim("consumption.txt", header = TRUE,  sep = "")
```

We use the option `header = TRUE` to inform R that the first line contains variable names, and the option `sep = ""` to indicate that the variables are separated by a space. At the same, we create an R variable `mydata` to store the data.



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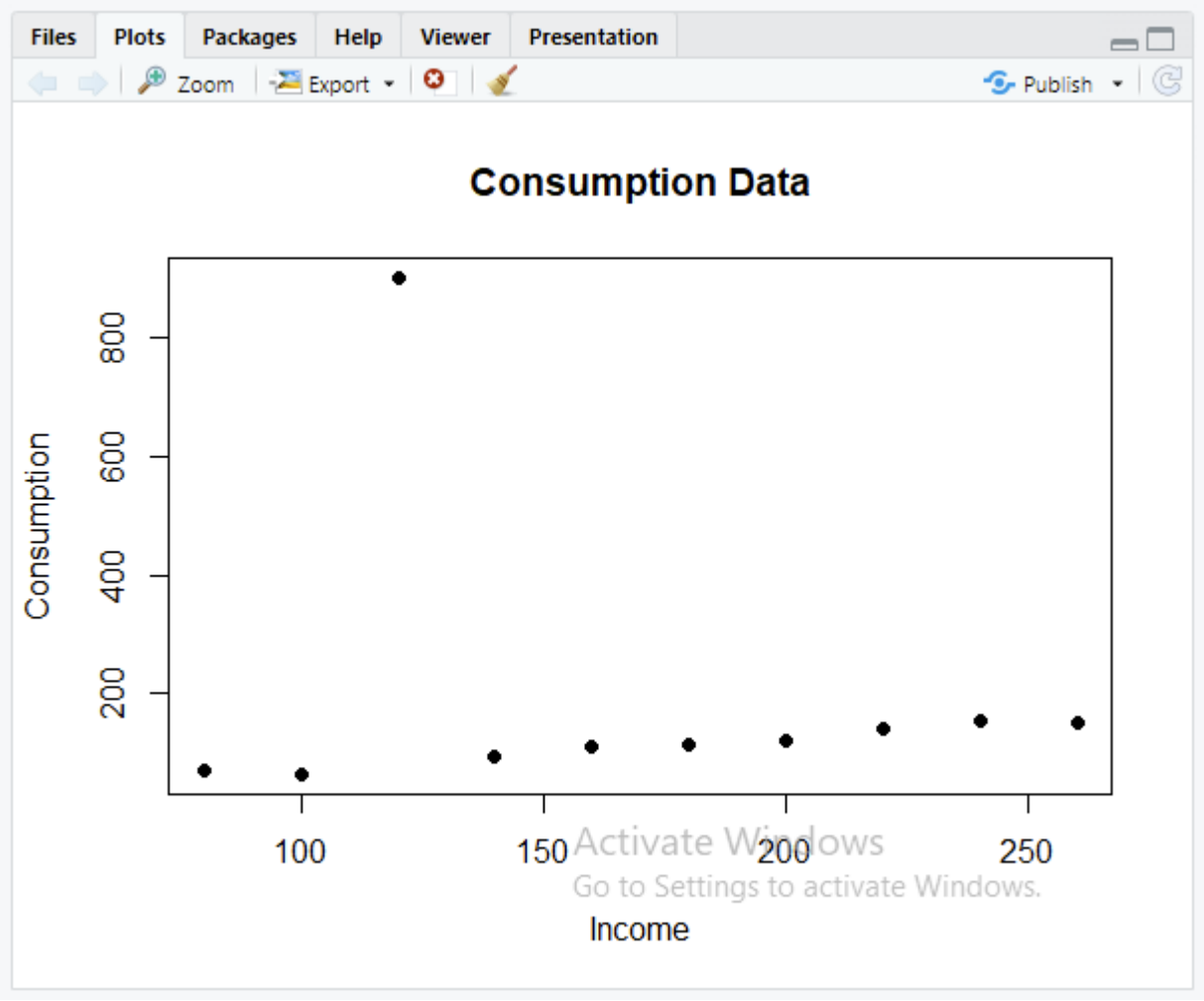
   (b) Draw a scatter diagram of `CONS` against `INC`.

Solution The simplest way to draw a scatter gram is to `attach` the data and use the `plot` command.

```
attach(mydata)
plot(INC, CONS, main="Consumption Data",
     xlab="Income", ylab="Consumption", pch=19)
```

The command `plot` has several arguments. The first two are the X and Y variables. In addition, it has options to choose a title (`main`) and labels (`xlab` and `ylab`), as well as the point style (`pch`).



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   (a) Read the data into R.

   (b) Draw a scatter diagram of `CONS` against `INC`.

   (c) On checking the data, you find that your assistant has recorded the weekly consumption expenditure for Family 8 as \$900 instead of \$90. Correct this error and redraw the scatter diagram.

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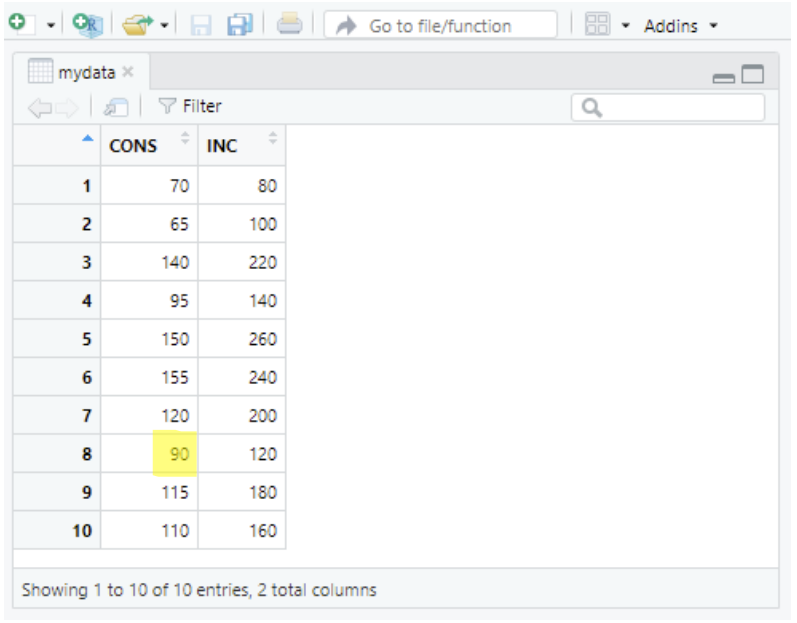
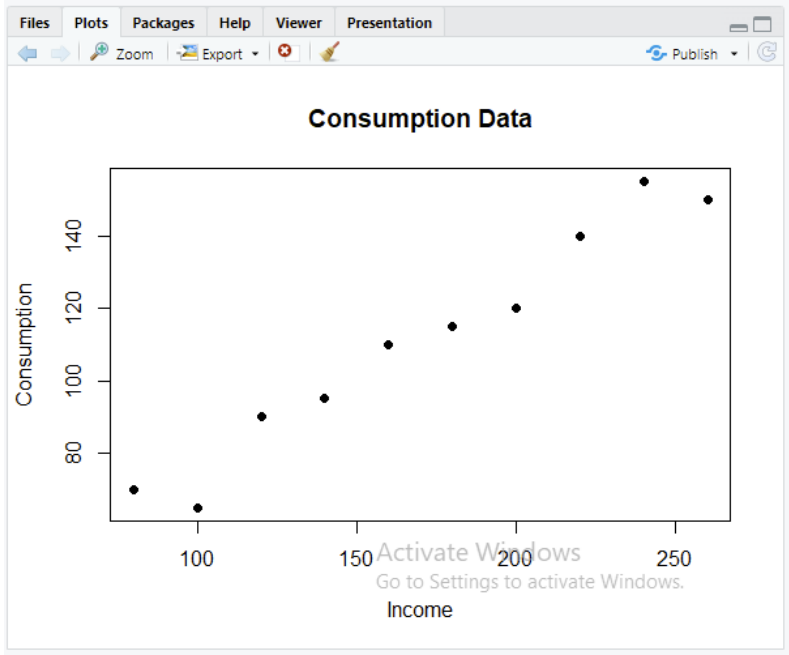
Solution The data are in the form of a matrix whose (8,1) element has the error, so we assign the correct value to it. Next, we need to "refresh" the data in memory by "detaching" and "attaching" `mydata` again. Once done, redraw the scatter diagram by repeating the command in part (b).

```
mydata[8,1] <- 90

detach(mydata)
attach(mydata)

plot(INC, CONS, main="Consumption Data",
     xlab="Income", ylab="Consumption", pch=19)
```





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   (d) Compute the mean, median, maximum and minimum values of `INC` and `CONS`.

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   (a) Read the data into R.

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   (c) On checking the data, you find that your assistant has recorded the weekly consumption expenditure for Family 8 as \$900 instead of \$90. Correct this error and redraw the scatter diagram.

   (d) Compute the mean, median, maximum and minimum values of `INC` and `CONS`.

Solution All these statistics are neatly summarised by the `summary` command.

```
summary(mydata)
```

Console | Terminal | Render | Background Jobs

R 4.2.2 · G:/My Drive/BEcon/tutor/ECON3350/01/

```
> plot(INC, CONS, main="Consumption Data",
+      xlab="Income", ylab="Consumption", pch=19)
> mydata[8,1] <- 90
> detach(mydata)
> attach(mydata)
> plot(INC, CONS, main="Consumption Data",
+      xlab="Income", ylab="Consumption", pch=19)
> summary(mydata)
      CONS             INC
 Min.   : 65.00   Min.   : 80
 1st Qu.: 91.25   1st Qu.:125
 Median :112.50   Median :170
 Mean   :111.00   Mean   :170
 3rd Qu.:135.00   3rd Qu.:215
 Max.   :155.00   Max.   :260
>
```

1. The text file `consumption.txt` contains observations on the weekly family consumption expenditure (`CONS`) and income (`INC`) for a sample of 10 families.

   (a) Read the data into R.

   (b) Draw a scatter diagram of `CONS` against `INC`.

   (c) On checking the data, you find that your assistant has recorded the weekly consumption expenditure for Family 8 as \$900 instead of \$90. Correct this error and redraw the scatter diagram.

   (d) Compute the mean, median, maximum and minimum values of `INC` and `CONS`.

   (e) Compute the correlation coefficient between `CONS` and `INC`. Comment on the result.

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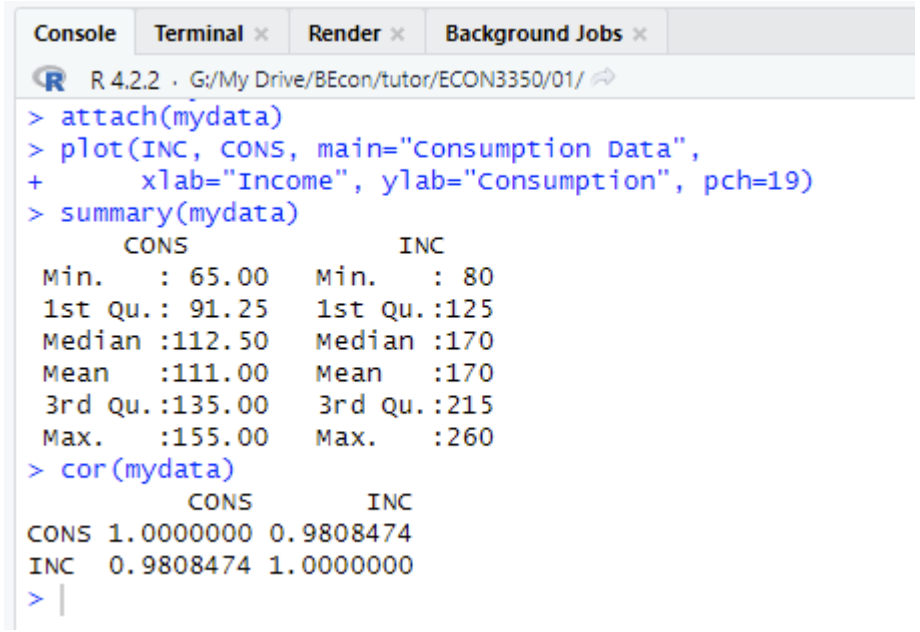
Solution The command `cor` gives a correlation matrix. The off-diagonal elements are correlation coefficients between the variables indicated in the rows and columns.

```
cor(mydata)
```

```
##             CONS       INC
## CONS 1.0000000 0.9808474
## INC  0.9808474 1.0000000
```

In this example, we have only two variables, which gives only one correlation coefficient (0.981). Since the correlation coefficient is close to (positive) one, consumption and income are moving in the same direction and they are closely related.



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   (f) Create the following new variables:

$$\begin{aligned} \texttt{DCONS} &= 0.5\texttt{CONS}, \\ \texttt{LCONS} &= \log(\texttt{CONS}), \\ \texttt{INC2} &= \texttt{INC}^2, \\ \texttt{SQRTINC} &= \sqrt{\texttt{INC}}. \end{aligned}$$

Intro · RStudio · consumption.txt · fultonfish.def

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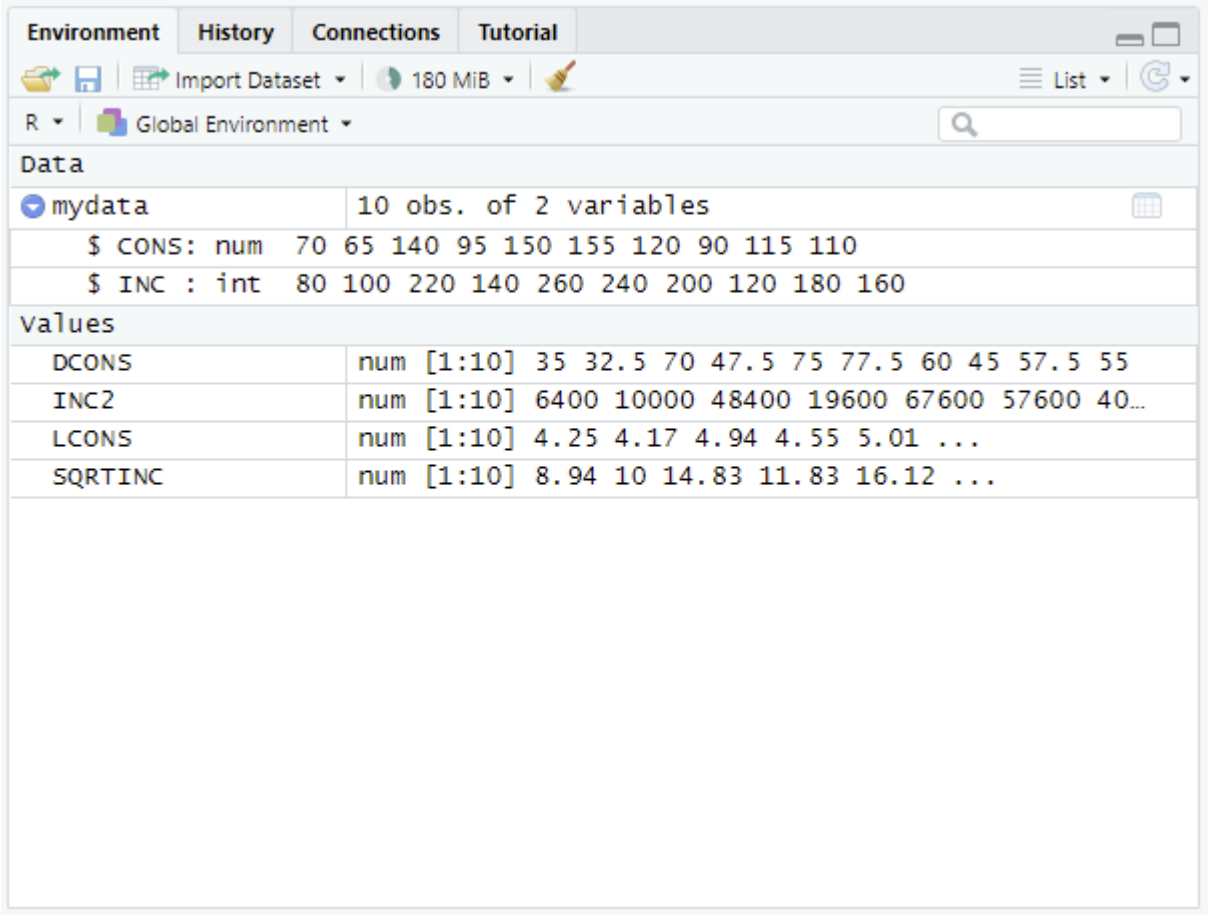
Solution Variables are created using either <- or =. The function log applied the "natural logarithm'' transformation.

```
DCONS <- 0.5 * CONS
LCONS <- log(CONS)
INC2 = INC^2
SQRTINC = sqrt(INC)
```



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   (g) Delete the variables `DCONS` and `SQRTINC`.

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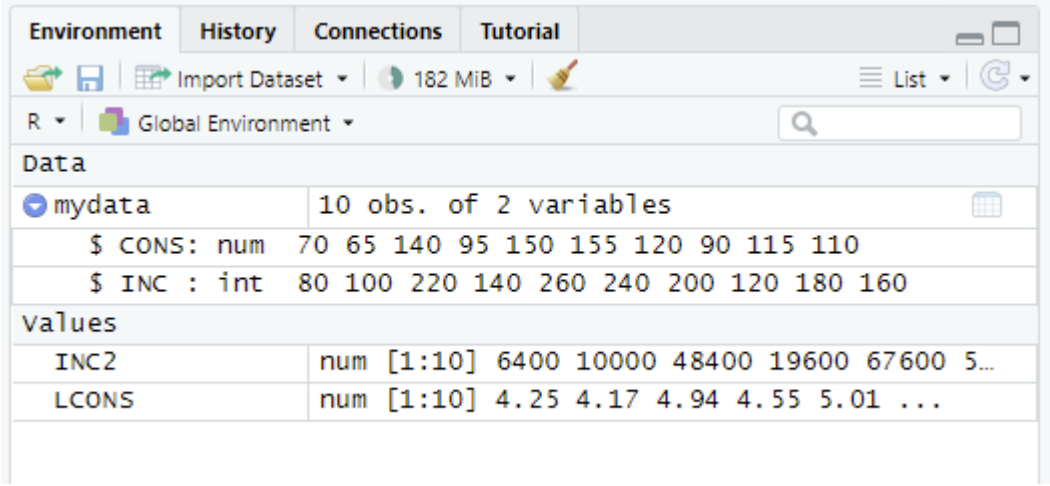
   (g) Delete the variables DCONS and SQRTINC.

   (h) Delete everything.

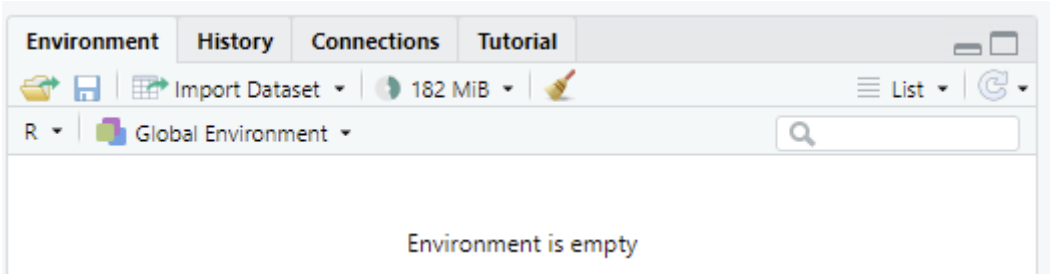
Solution Use the `rm` command to delete variables.

```
rm(DCONS, SQRTINC)
```



Solution Delete all the variables by passing the output of the `ls` command to `rm`.

```
rm(list = ls())
```



2. At the Famous Fulton Fish Market in New York city, sales of whiting (a type of fish) vary from day to day. Over a period of several months, daily quantities sold (in pounds) were observed. These data are in the file `fultonfish.dat`. Description of the data is in the file `fultonfish.def`. Describe the first four columns.

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fultonfish.dat

Whiting

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fultonfish.dat

fultonfish - Notepad

File Edit View

```
911202  -.4307829   8058.003   8.994421        1       0       0       0       1       0       1       0      7232  -826.0029       1
911203          0   2224.001   7.707063        0       1       0       0       1       0       0       0      2110  -114.0012       0
911204   .0723207   4231.001   8.350194        0       0       1       0       0       1       1       1      5247   1015.999       1
911205    .247139   5749.998   8.656955        0       0       0       1       1       0       0       1      1290  -4459.998       1
911206   .6643268   2551.001   7.844241        0       0       0       0       1       0       0       1      1717   -834.001       1
911209  -.2065143      10952   9.301277        1       0       0       0       0       0       0       0     11643   691.002       1
911210  -.1158318       7485   8.920656        0       1       0       0       0       1       0       0      9640      2155       1
911211  -.2598674   9008.996   9.105979        0       0       1       0       0       0       1       0      9347   338.0039       0
911212  -.1171254       4055   8.307706        0       0       0       1       0       1       0       0      3890  -164.9998       0
911213  -.3420761   9992.003    9.20954        0       0       0       0       0       0       0       0     16318   6325.997       1
911216  -.1255632   5180.002   8.552561        1       0       0       0       1       0       0       1      8725   3544.998       1
911217    .027399       5030   8.523175        0       1       0       0       1       0       0       1      2780      -2250       1
911218  -.0712275       7083   8.865453        0       0       1       0       1       0       0       1      9078      1995       1
911219   .1230601   9762.996   9.186355        0       0       0       1       1       0       0       1      5066  -4696.996       1
911220   .2130932   5999.002   8.699348        0       0       0       0       1       0       0       1      4796  -1203.002       1
911223  -.3172045      12196   9.408863        1       0       0       0       0       1       0       1     13647   1451.003       1
911224  -.1088388   3463.999   8.150179        0       1       0       0       0       1       0       1      1255  -2208.999       1
911226   .2231435   814.9999   6.703188        0       0       0       1       0       1       0       1      1115   300.0001       0
911227   .2464593   6626.999   8.798907        0       0       0       0       0       0       0       1      6887   260.0015       0
911230   -.075431   14260.01   9.565214        1       0       0       0       0       0       1       1     15894   1633.993       1
911231   .2055992   4014.999   8.297792        0       1       0       0       0       0       1       1      5850   1835.001       1
920102   .2188098   4109.001   8.320935        0       0       0       1       0       0       0       0       409  -3700.001       1
920103    .307025   7221.997   8.884887        0       0       0       0       0       0       0       0      7222    .003418       0
920106    .399592      11344   9.336444        1       0       0       0       1       0       0       0     13036   1692.004       1
920107   .4969802   3370.001   8.122668        0       1       0       0       1       0       0       1      1760  -1610.001       1
920108   .3968258       3470    8.15191        0       0       1       0       1       0       0       1      4824       1354       1
920109   .2830518   13607.01    9.51834        0       0       0       1       0       1       0       1     16489   2881.994       1
920110   .2263384       5260   8.567886        0       0       0       0       0       1       1       0      4842  -418.0005       0
920113  -.0723207      11930   9.386811        1       0       0       0       0       1       0       0     12732   802.0029       1
920114  -.1545295       5590   8.628735        0       1       0       0       0       1       0       0      7070       1480       1
920115   .2363888   2269.999   7.727535        0       0       1       0       1       0       1       1      2873   603.0007       0
920116   .1718503       4690   8.453188        0       0       0       1       1       0       0       1      1915      -2775       1
920117   .1541506       1283   7.156956        0       0       0       0       1       0       1       1       240      -1043       1
920120   .0350913    579.9999   6.363028        1       0       0       0       1       0       0       1       300  -279.9999       0
920121    .218131   1500.001   7.313221        0       1       0       0       0       1       1       1      1960   459.9991       0
920122  -.0624355   4410.001    8.39163        0       0       1       0       0       0       0       1      5408    997.999       1
920123  -.4418328   9783.996   9.188503        0       0       0       1       0       0       0       0     10130   346.0039       0
920124  -.7699343      11140   9.318297        0       0       0       0       0       0       1       0     12943   1803.001       1
920127  -.7391911   4288.999   8.363809        1       0       0       0       1       0       1       1      2766  -1522.999       1
920128  -.7230001   5548.001   8.621193        0       1       0       0       0       1       0       1      4050  -1498.001       1
920129  -.5184302       3445   8.144679        0       0       1       0       0       0       0       1      6208       2763       1
920130  -.5533853   6067.998   8.710784        0       0       0       1       0       0       0       1      7539   1471.002       1
920131  -.5590724       4525   8.417373        0       0       0       0       0       0       0       0      6250       1725       1
920203  -.4238143   8249.997   9.017968        1       0       0       0       1       0       0       1      8620   370.0029       0
920204  -.7731899   1860.001   7.528332        0       1       0       0       1       0       0       1       300  -1560.001       1
920205  -.2040953   1279.999   7.154615        0       0       1       0       1       0       0       1       360  -919.9994       1
920206   .3841877       4855   8.487764        0       0       0       1       1       0       0       1      5680       825       1
920207   .3479887   7939.001   8.979543        0       0       0       0       0       1       0       1      7484   -455.001       0
920210   .3229889   6274.992   8.744328        1       0       0       0       1       0       0       1      6960   685.0078       1
920211   .4345259       2680   7.893572        0       1       0       0       1       0       0       1      2460  -219.9995       0
```

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2. At the Famous Fulton Fish Market in New York city, sales of whiting (a type of fish) vary from day to day. Over a period of several months, daily quantities sold (in pounds) were observed. These data are in the file `fultonfish.dat`. Description of the data is in the file `fultonfish.def`. Describe the first four columns.

   (a) Use R to open the data file and name the series in the first four columns as `date`, `lprice`, `quan` and `lquan`.

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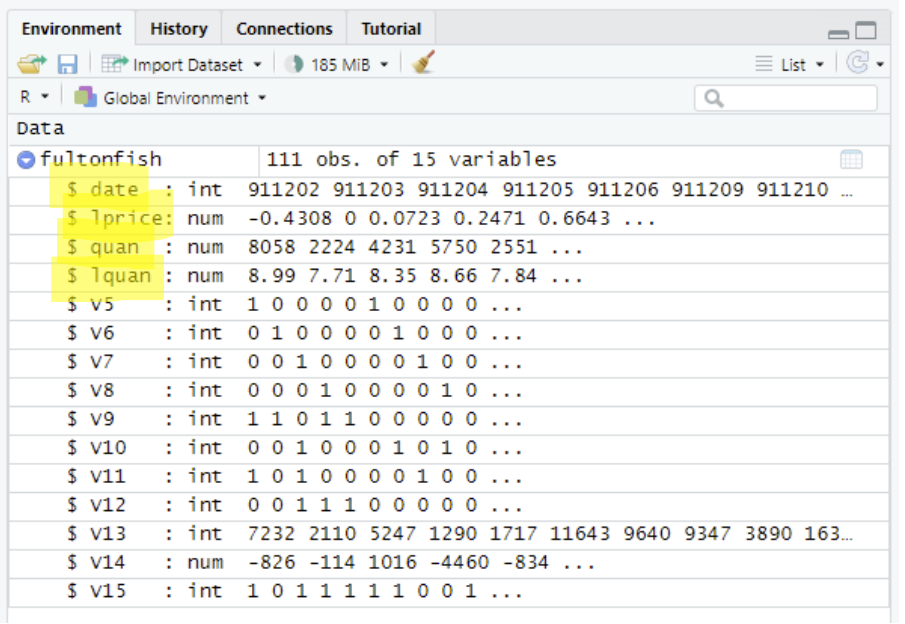
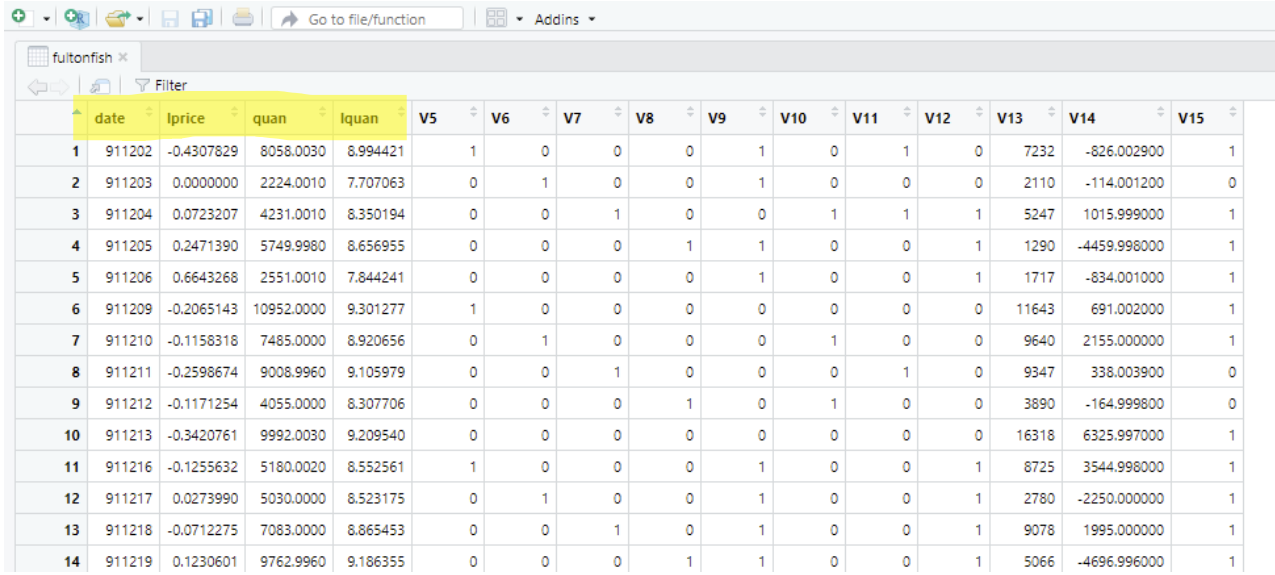
Solution R assigns variable names `V1`, `V2`, ... when the variables do not have a name. Assign proper names to the first four variables using the command `colnames`.

```
fultonfish <- read.delim("fultonfish.dat", header = FALSE,  sep = "")
colnames(fultonfish)[1:4] <- c("date", "lprice", "quan", "lquan")
```

The command `colnames` takes an R object as an argument—in this case `fultonfish`. The range in brackets, [1:4], chooses the columns (from the first to the fourth). The command `c` "concatenates" a list of variables.





	date	lprice	quan	lquan	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15
1	911202	-0.4307829	8058.0030	8.994421	1	0	0	0	1	0	1	0	7232	-826.002900	1
2	911203	0.0000000	2224.0010	7.707063	0	1	0	0	1	0	0	0	2110	-114.001200	0
3	911204	0.0723207	4231.0010	8.350194	0	0	1	0	0	1	1	1	5247	1015.999000	1
4	911205	0.2471390	5749.9980	8.656955	0	0	0	1	1	0	0	1	1290	-4459.998000	1
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6	911209	-0.2065143	10952.0000	9.301277	1	0	0	0	0	0	0	0	11643	691.002000	1
7	911210	-0.1158318	7485.0000	8.920656	0	1	0	0	0	1	0	0	9640	2155.000000	1
8	911211	-0.2598674	9008.9960	9.105979	0	0	1	0	0	0	1	0	9347	338.003900	0
9	911212	-0.1171254	4055.0000	8.307706	0	0	0	1	0	1	0	0	3890	-164.999800	0
10	911213	-0.3420761	9992.0030	9.209540	0	0	0	0	0	0	0	0	16318	6325.997000	1
11	911216	-0.1255632	5180.0020	8.552561	1	0	0	0	1	0	0	1	8725	3544.998000	1
12	911217	0.0273990	5030.0000	8.523175	0	1	0	0	1	0	0	1	2780	-2250.000000	1
13	911218	-0.0712275	7083.0000	8.865453	0	0	1	0	1	0	0	1	9078	1995.000000	1
14	911219	0.1230601	9762.9960	9.186355	0	0	0	1	1	0	0	1	5066	-4696.996000	1

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   (a) Use R to open the data file and name the series in the first four columns as `date`, `lprice`, `quan` and `lquan`.

   (b) Compute the sample mean and standard deviation of the quantity sold (`quan`).

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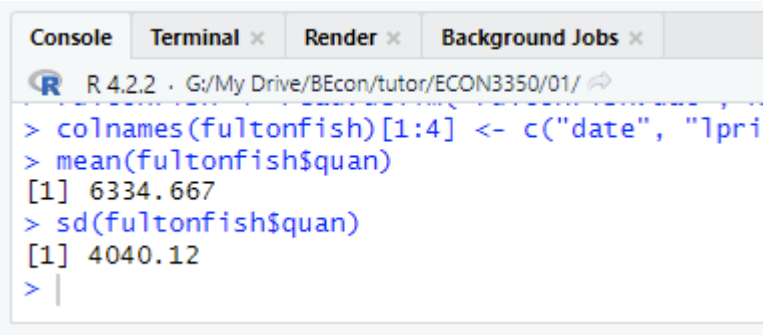
Solution This is straightforward using commands `mean` and `sd`.

```
mean(fultonfish$quan)
```

```
## [1] 6334.667
```

```
sd(fultonfish$quan)
```

```
## [1] 4040.12
```



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   (c) Test the null hypothesis that the mean quantity sold is equal to 7,200 pounds a day at the 5% level of significance.

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HYPOTHESES:

$$H_0 : \mu = 7,200$$
$$H_1 : \mu \neq 7,200.$$

Two-sided test

DECISION RULE: Reject H_0 if $|t_{calc}| > t_{crit} = 1.96$

Absolute value operators on the calculated t-statistic because of the two-sided test

TEST STATISTIC:

$$\left|\frac{\overline{X}_n - \mu_0}{\hat{\sigma}/\sqrt{n}}\right| = \left|\frac{6,334.67 - 7,200}{4,040.12/\sqrt{111}}\right| \approx 2.26 > 1.96,$$

Sample mean

Hypothesised value

Sample standard deviation

Number of observations

Except for our hypothesized value (7,200), all of these inputs come from RStudio

DECISION: Reject H_0 (because 2.26 > 1.96)

CONCLUSION: At the 5% level of significance (LOS), there is sufficient evidence to conclude that the mean quantity sold is not equal to 7,200 pounds per day.

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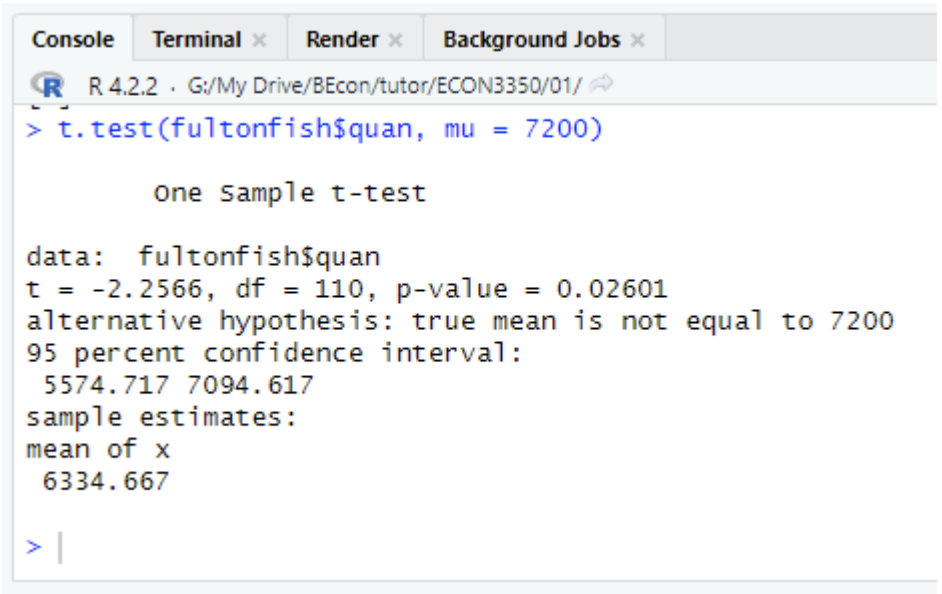
   (b) Compute the sample mean and standard deviation of the quantity sold (`quan`).

   (c) Test the null hypothesis that the mean quantity sold is equal to 7,200 pounds a day at the 5% level of significance.

Solution This is straightforward using the command `t.test`.

```
t.test(fultonfish$quan, mu = 7200)

##
##  One Sample t-test
##
## data:  fultonfish$quan
## t = -2.2566, df = 110, p-value = 0.02601
## alternative hypothesis: true mean is not equal to 7200
## 95 percent confidence interval:
##  5574.717 7094.617
## sample estimates:
## mean of x
##  6334.667
```



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   (d) Construct the 95% confidence interval for part (c).

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   (c) Test the null hypothesis that the mean quantity sold is equal to 7,200 pounds a day at the 5% level of significance.

   (d) Construct the 95% confidence interval for part (c).

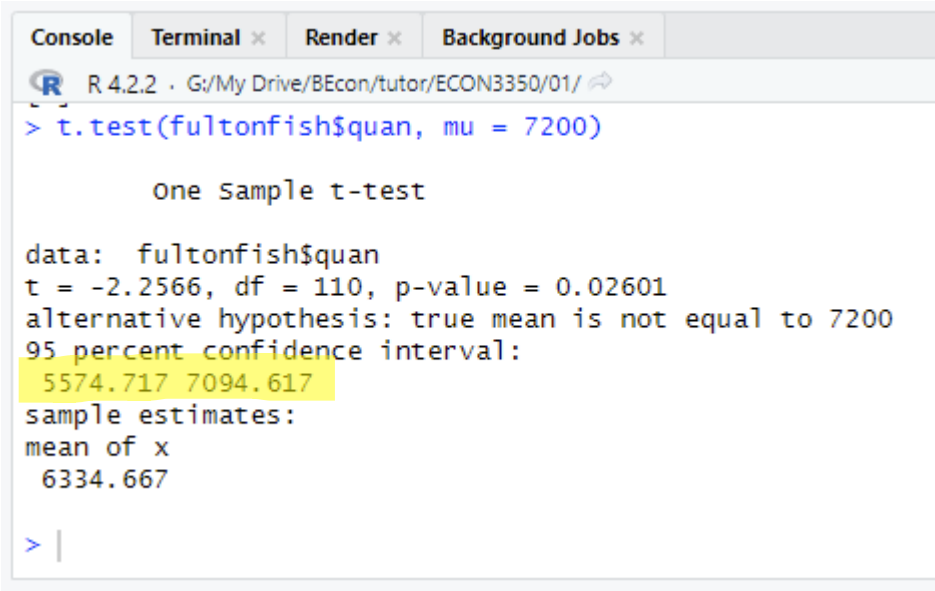
95% Confidence Interval

$$\overline{X}_n \pm t_{crit} \times \hat{\sigma}/\sqrt{n}$$

Solution The confidence interval is:

$$6,334.67 \pm 1.96 \times 4040.12/\sqrt{111} = 6,334.67 \pm 751.58.$$

All the necessary information is available form the output of the `t.test` command. Indeed, the confidence interval itself is included in the output!



2. At the Famous Fulton Fish Market in New York city, sales of whiting (a type of fish) vary from day to day. Over a period of several months, daily quantities sold (in pounds) were observed. These data are in the file `fultonfish.dat`. Description of the data is in the file `fultonfish.def`. Describe the first four columns.

   (a) Use R to open the data file and name the series in the first four columns as `date`, `lprice`, `quan` and `lquan`.

   (b) Compute the sample mean and standard deviation of the quantity sold (`quan`).

   (c) Test the null hypothesis that the mean quantity sold is equal to 7,200 pounds a day at the 5% level of significance.

   (d) Construct the 95% confidence interval for part (c).

   (e) Plot `lprice` against `lquan` and label the variable `lprice` as "log(Price) of whiting per pound" and `lquan` as "log(Quantity)". Then, comment on the nature of the relationship between these two variables.

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Solution Generate the plot the same way as in Question 1, part (b).

```
attach(fultonfish)
plot(lquan, lprice,
     main = "Log Price and Log Quantity",
     xlab="log(Quantity)",
     ylab="log(Price) of whiting per pound",
     pch=19)
```

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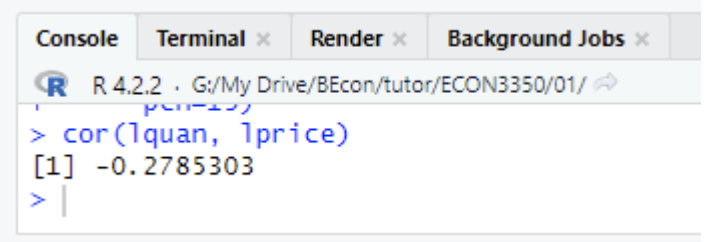
Conceptually, we expect price and quantity to be negatively related, but there does not to appear to be a clear relationship between price and quantity in this data. We can investigate it further by computing the sample correlation.

```
cor(lquan, lprice)
```

```
## [1] -0.2785303
```

The correlation coefficient is slightly negative but not particularly strong. Does this mean demand for whiting is not very affected by prices?



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   (f) Save this workfile to any folder on any drive.

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   (f) Save this workfile to any folder on any drive.

Solution Save the entire workspace in `RData` format using the `save` command in combination with the `ls` command.

```
save(list = ls(all = TRUE), file = "tuturial01.RData")
```

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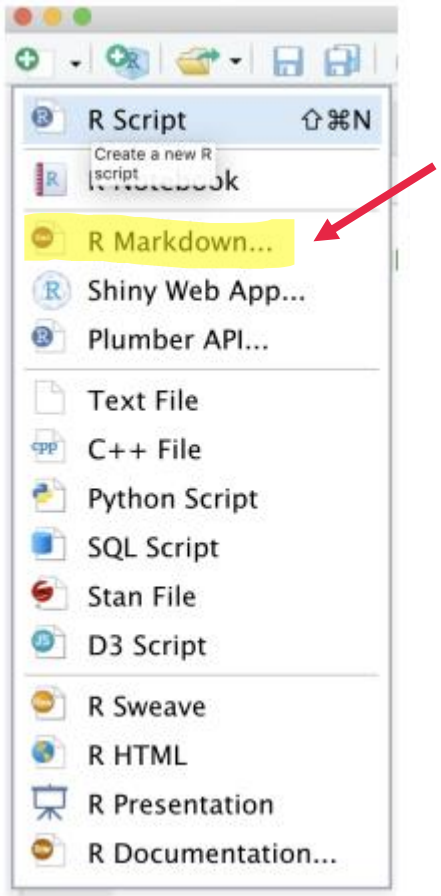
Thank you

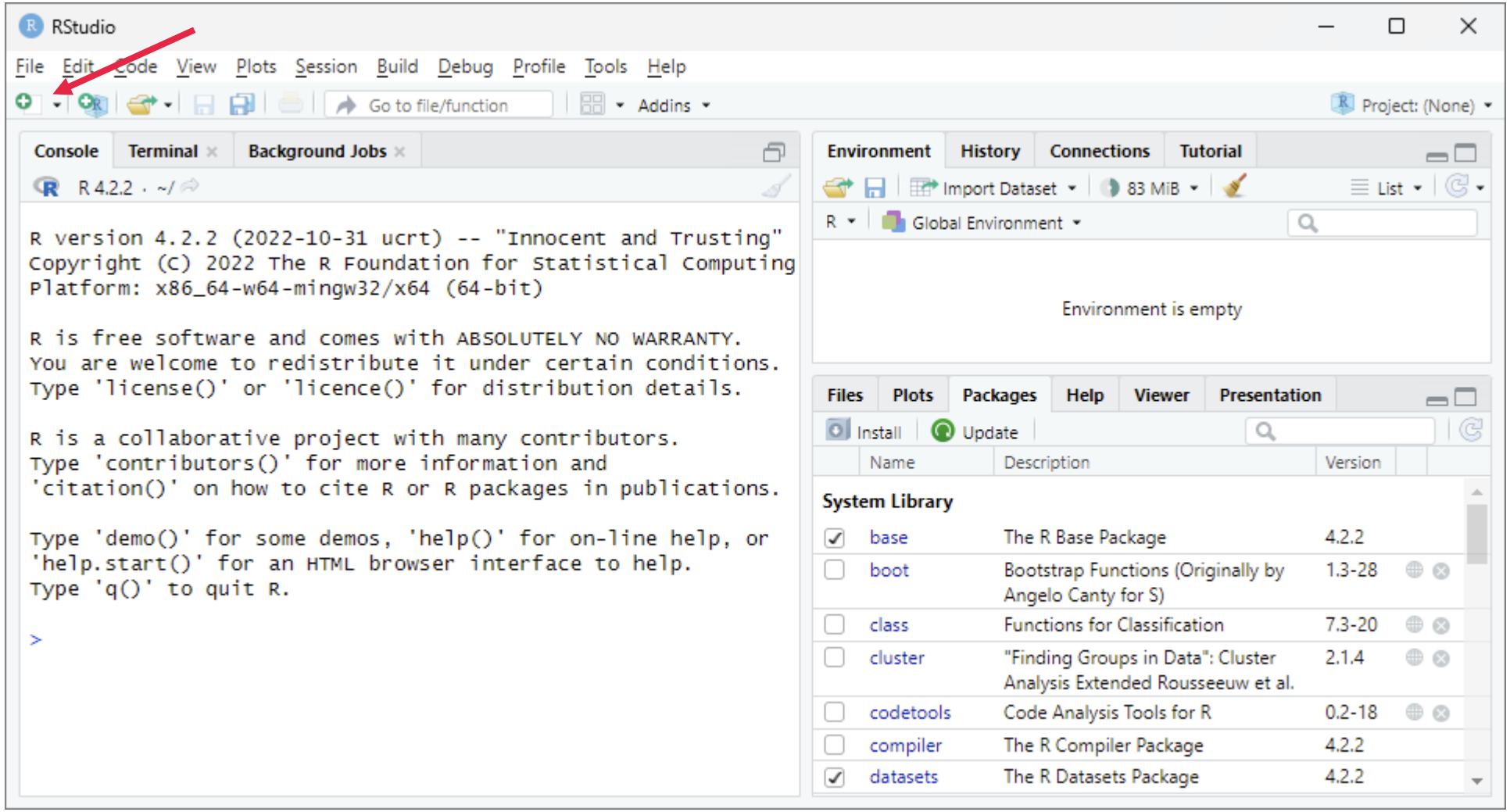
Francisco Tavares Garcia | Tutor
School of Economics

Reference

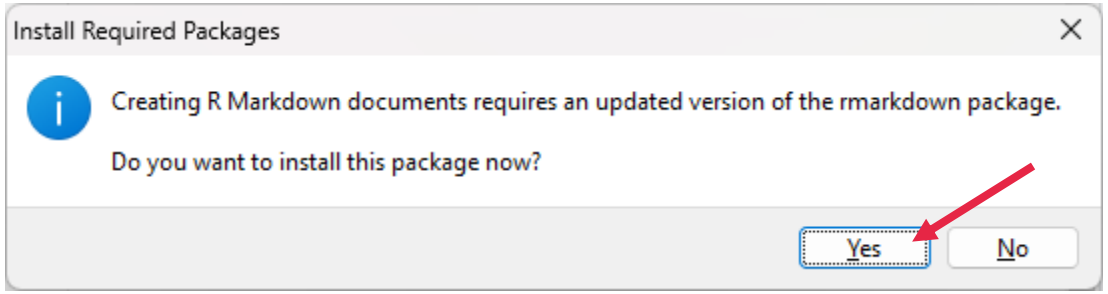
Enders, W. (2015). Applied econometric time series fourth edition. New York (US): University of Alabama.

Bonus – R Markdown



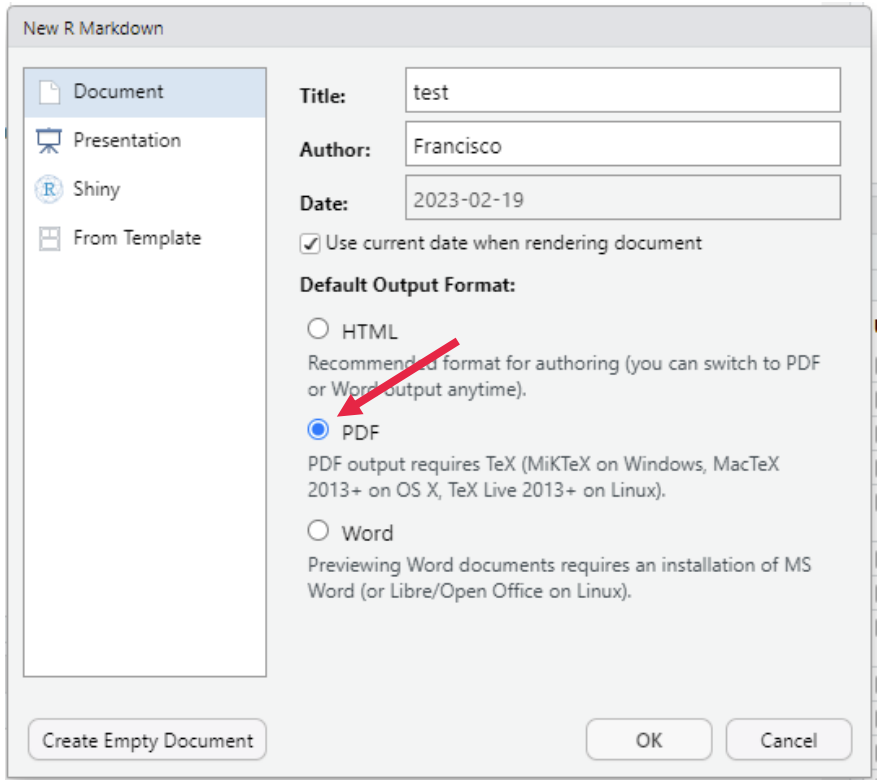


R Markdown - installation



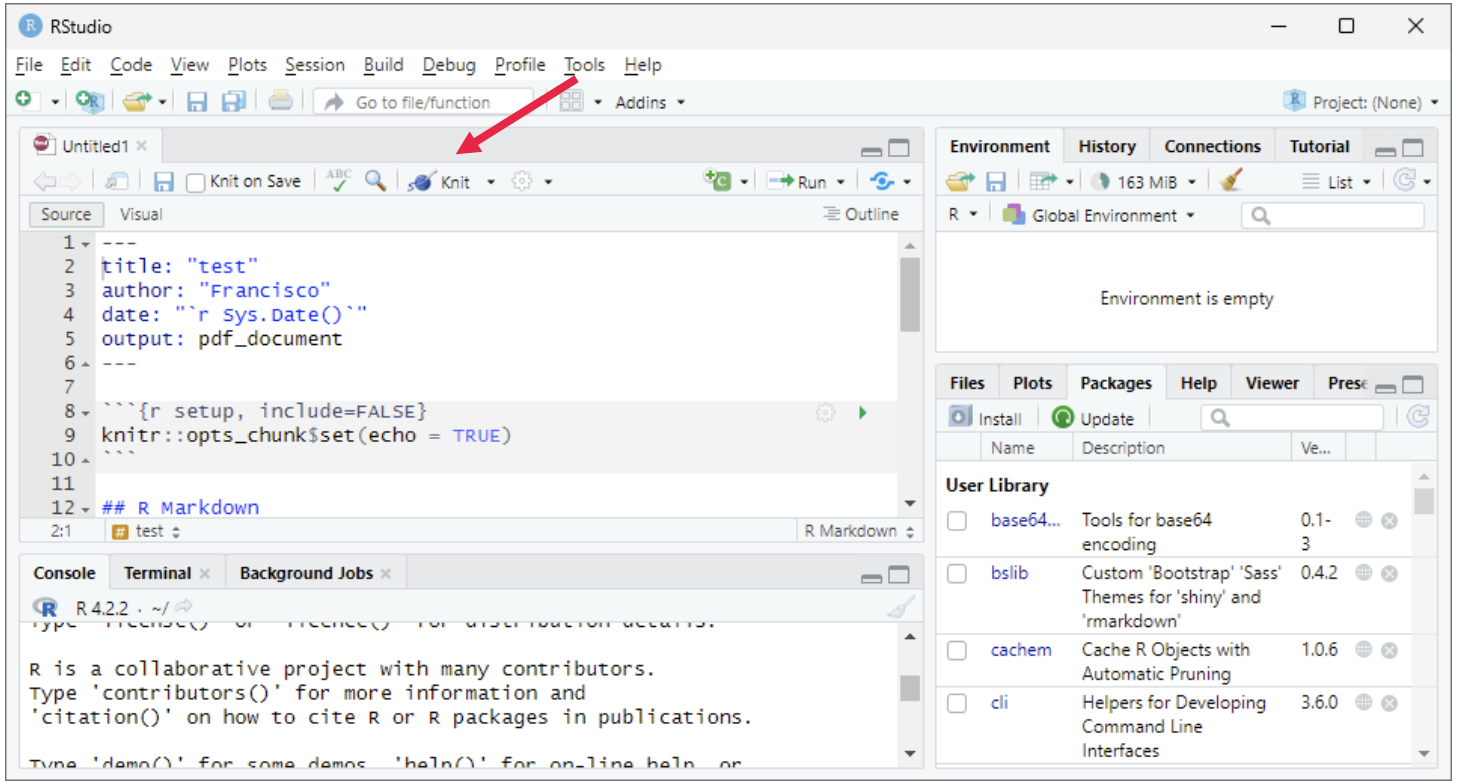
It will install 20+ packages to run R Markdown.

R Markdown - new document and Knit



Choose pdf to create documents using LaTeX.

Save your file, then Knit to PDF.

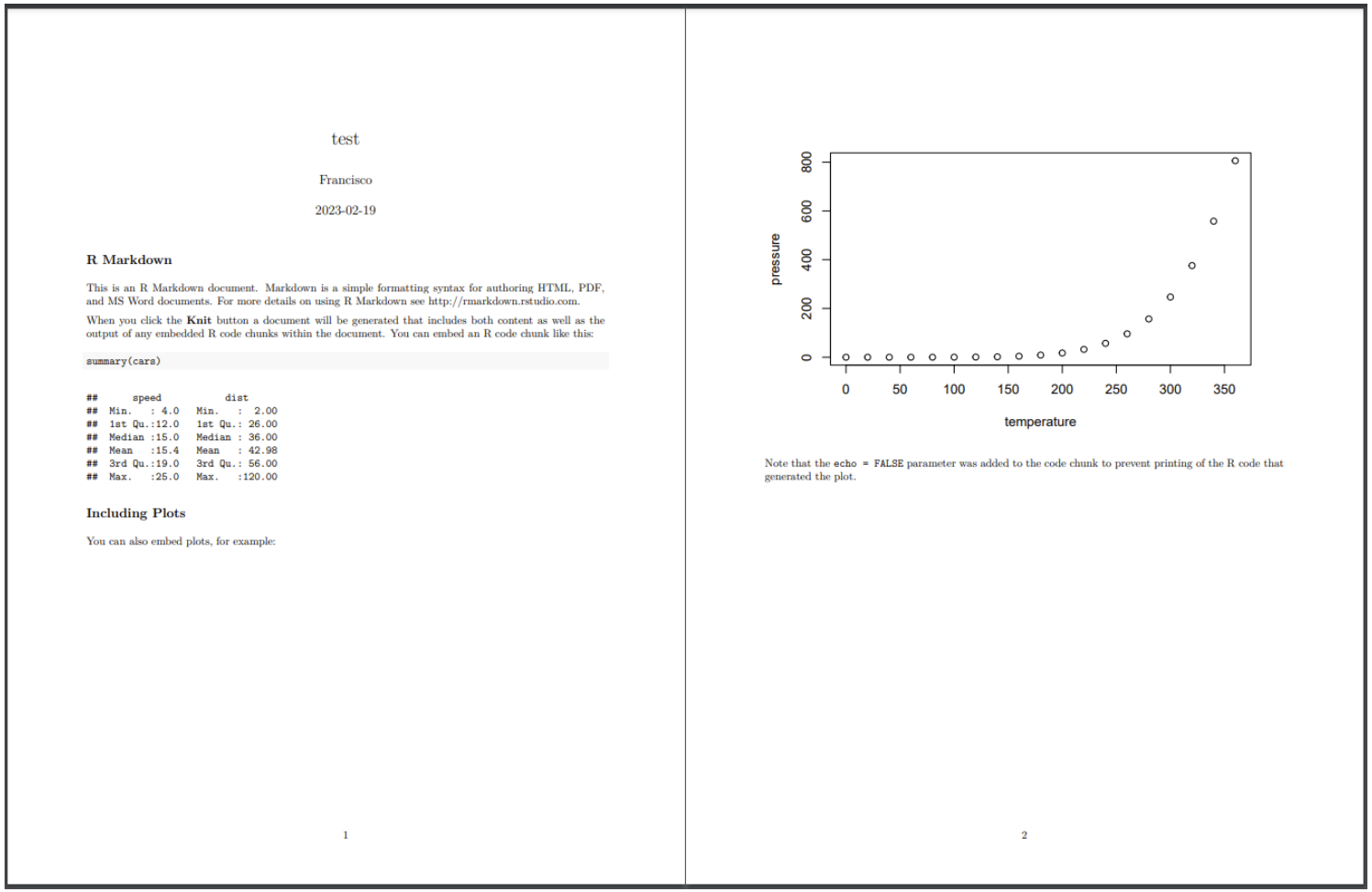


R Markdown - PDF

Go to the same folder you saved your .rmd file.
There you will find the PDF generated

You might need to install the package tinytex, but in my recent attempts it is already installed with rmarkdown packages. If you do, run the following code:

```
tinytex::install_tinytex()
# to uninstall TinyTeX, run
# tinytex::uninstall_tinytex()
```



test

Francisco

2023-02-19

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:

1

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

2