THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

ECON2300 - Introductory Econometrics

Tutorial 1: R and Basic Operations

Tutor: Francisco Tavares Garcia

ECON2300 – Tutorial 01

Install R – 4.3.1

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

Install RStudio – 2023.06.1+524

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

Update all packages –

In RStudio >>

Tools >>

Check for Package Updates >>

Select All >>

Install Updates

ECON2300 – Tutorial 01

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Install Updates

Who's your Tutor?

Francisco Tavares Garcia

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

ECON2300 – Tutorial 01

Install R – 4.3.1

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

Install RStudio – 2023.06.1+524

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

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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

ECON2333 – Big Data and Machine Learning for Economics and Finance

ECON3330 – Econometric Analysis

ECON3360 – Causal Inference for Microeconometrics

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
Quizzes Problem Solving Exercises	Online Periodic Assessments Throughout the Semester	30% 10% x best 3 out of 5	2
R-Exercises Analysis of Data and Short Report	Online Periodic Assessments Throughout the Semester	30% 10% x best 3 out of 5	1
Project Project I: Assignment and Brief Research Report	18 Sep 23 16:00	20%	1, 2, 3, 5
Project Project II: Assignment and Brief Research Report	06 Nov 23 16:00	20%	1, 2, 4, 5

Problem Solving Exercises

Type: Quizzes
Learning Objectives Assessed: 2
Due Date: Online Periodic Assessments Throughout the Semester
Weight: 30%
10% x best 3 out of 5
Task Description:
Online quizzes (via Blackboard) throughout the semester; mostly fortnightly, but exact dates will be announced on Blackboard. 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. Each quiz is worth 10%.
Due Date (TBC) -
Quiz 1: 18 August, 16:00
Quiz 2: 1 September, 16:00
Quiz 3: 15 September, 16:00
Quiz 4: 6 October, 16:00
Quiz 5: 20 October, 16:00
Criteria & Marking:
UQ Students: Please access the profile from Learn.UQ or mySI-net to access marking criteria held in this profile.
Submission:
Online via Blackboard. No late submission will be accepted (see Section 5.3)

Analysis of Data and Short Report

Type: R-Exercises
Learning Objectives Assessed: 1
Due Date: Online Periodic Assessments Throughout the Semester
Weight: 30%
10% x best 3 out of 5
Task Description:
R exercises (possibly via Blackboard) throughout the semester; mostly fortnightly, but exact dates will be announced on Blackboard. There will be in a total of five R exercises, each consisting of some questions that help students use R to analyse Data and report the estimation results using the material in lectures and tutorials. Each R-exercise is worth 10%.
Due Date (TBC) -
Quiz 1: 11 August, 16:00
Quiz 2: 25 August, 16:00
Quiz 3: 8 September, 16:00
Quiz 4: 22 September, 16:00
Quiz 5: 13 October, 16:00
Criteria & Marking:
UQ Students: Please access the profile from Learn.UQ or mySI-net to access marking criteria held in this profile.
Submission:
Online via Blackboard. No late submission will be accepted (see Section 5.3)

Project I: Assignment and Brief Research Report

Type: Project
Learning Objectives Assessed: 1, 2, 3, 5
Due Date: 18 Sep 23 16:00
Weight: 20%
Task Description:
You are expected to formulate hypothesis relevant to a research project. Analyse the data using techniques covered under the Learning Objectives as indicated above. Submit a research report summarising your findings and offering policy advice based on your findings.
Criteria & Marking:
UQ Students: Please access the profile from Learn.UQ or mySI-net to access marking criteria held in this profile.
Submission:
Students are required to submit an electronic copy to the Course Coordinator through the course webpage (Blackboard).

Project II: Assignment and Brief Research Report

Type: Project
Learning Objectives Assessed: 1, 2, 4, 5
Due Date: 06 Nov 23 16:00
Weight: 20%

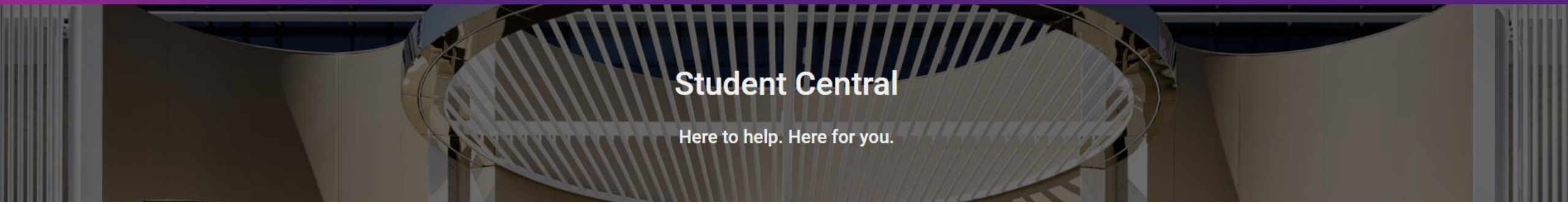
I need HELP!!!

- ECON2300@uq.edu.au – for general questions
- cml.2300@uq.edu.au – for CML/quizzes
- Discussion Board (Blackboard/Learn.UQ)
- Consultation every weekday!!

(Mostly afternoon)

- https://www.econometrics-with-r.org/

(good source for R codes – same book)



I really need HELP…

https://my.uq.edu.au/contact/student-central

Contact us

Monday-Friday, 8am-5pm:

Email
1300 275 870 (8.30am-5pm)
Building 42, St Lucia

Chat – unavailable

Emergency help

For immediate risk:

UQ Campus Security
07 3365 3333 (24/7)

Off-campus emergency
000 (24/7)

Crisis support

For urgent mental health support:

UQ Counselling and Crisis Line
1300 851 998 (24/7)

Text a Crisis Counsellor
0488 884 115 (4.30pm-8am)

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Installing R (not RStudio yet)

R base distribution – 4.3.1
https://cran.r-project.org/

R-4.3.1 for Windows

Download R-4.3.1 for Windows (79 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 the base distribution and of R and packages to run on macOS. R and package binaries for R versions older than 4.0.0 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.

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

R 4.3.1 "Beagle Scouts" released on 2023/06/16

Please check the integrity of the downloaded package by checking the signature:
`pkgutil --check-signature R-4.3.1.pkg`
in the *Terminal* application. If Apple tools are not avaiable you can check the SHA1 checksum of the downloaded image:
`openssl sha1 R-4.3.1.pkg`

Latest release:

For Apple silicon (M1/M2) Macs:
R-4.3.1-arm64.pkg
SHA1-hash: 14c018fff54f7f5bb37c1d96b33207343b83e9345
(ca. 90MB, notarized and signed)

For older Intel Macs:
R-4.3.1-x86_64.pkg
SHA1-hash: 1af8f055a601d5de5dfefdb3956ecc8f745c2401
(ca. 92MB, notarized and signed)

R 4.3.1 binary for macOS 11 (**Big Sur**) and higher, signed and notarized packages.

Contains R 4.3.1 framework, R.app GUI 1.79, Tcl/Tk 8.6.12 X11 libraries and Texinfo 6.8. 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` R package or build package documentation from sources.

macOS Ventura users: there is a known bug in Ventura preventing installations from some locations without a prompt. 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 2.8.5 or later). Always re-install XQuartz when upgrading your macOS to a new major version.

This release uses Xcode 14.2/14.3 and GNU Fortran 12.2. If you wish to compile R packages which contain Fortran code, you may need to download the corresponding GNU Fortran compiler from https://mac.R-project.org/tools. Any external libraries and tools are expected to live in `/opt/R/arm64` (Apple silicon) or `/opt/R/x86_64` (Intel).

Installing RStudio

Rstudio IDE – 2023.06.1+524
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

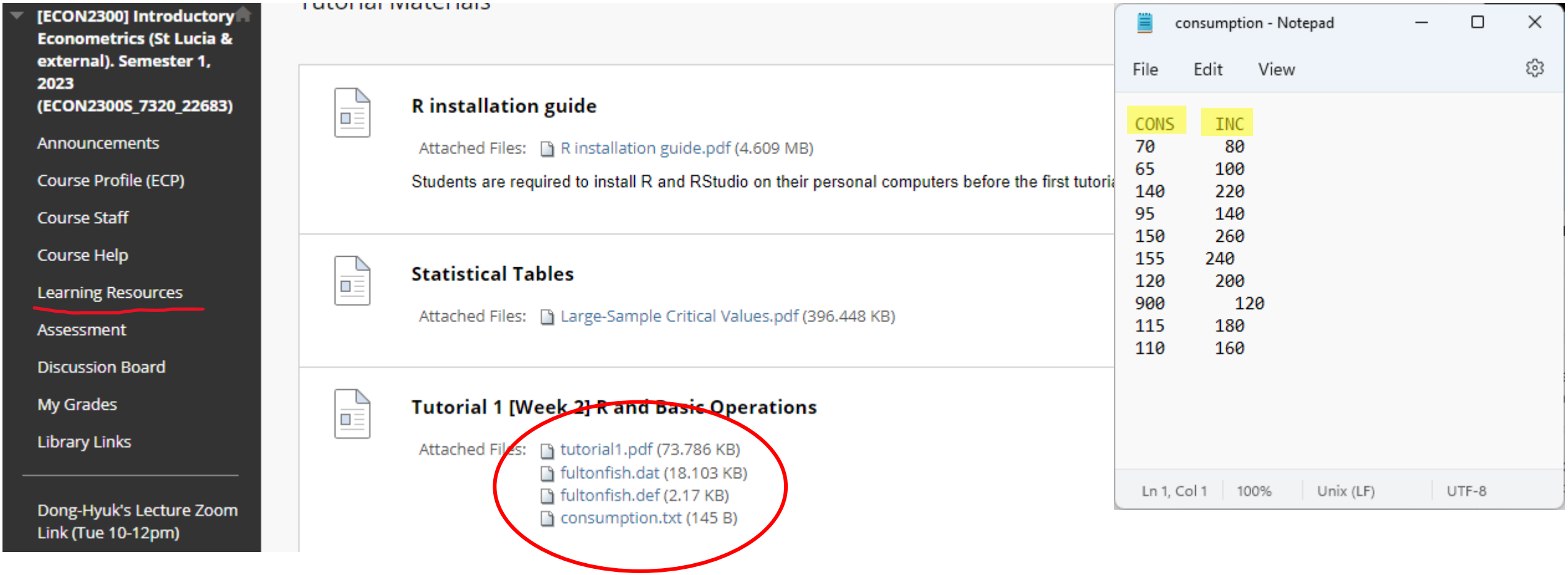
Find out more about RStudio Desktop and RStudio Desktop Pro below.

DOWNLOAD RSTUDIO

OS	Download	Size	SHA-256
Windows 10/11	RSTUDIO-2023.06.1-524.EXE	212.77 MB	A8325AD5
macOS 11+	RSTUDIO-2023.06.1-524.DMG	380.82 MB	184804EA
Ubuntu 20/Debian 11	RSTUDIO-2023.06.1-524-AMD64.DEB	145.85 MB	49E24A69
Ubuntu 22	RSTUDIO-2023.06.1-524-AMD64.DEB	146.82 MB	C030EC83
Fedora 19/Red Hat 7	RSTUDIO-2023.06.1-524-X86_64.RPM	162.31 MB	4C541A7F
OpenSUSE 15	RSTUDIO-2023.06.1-524-X86_64.RPM	146.70 MB	7CE6C080

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.

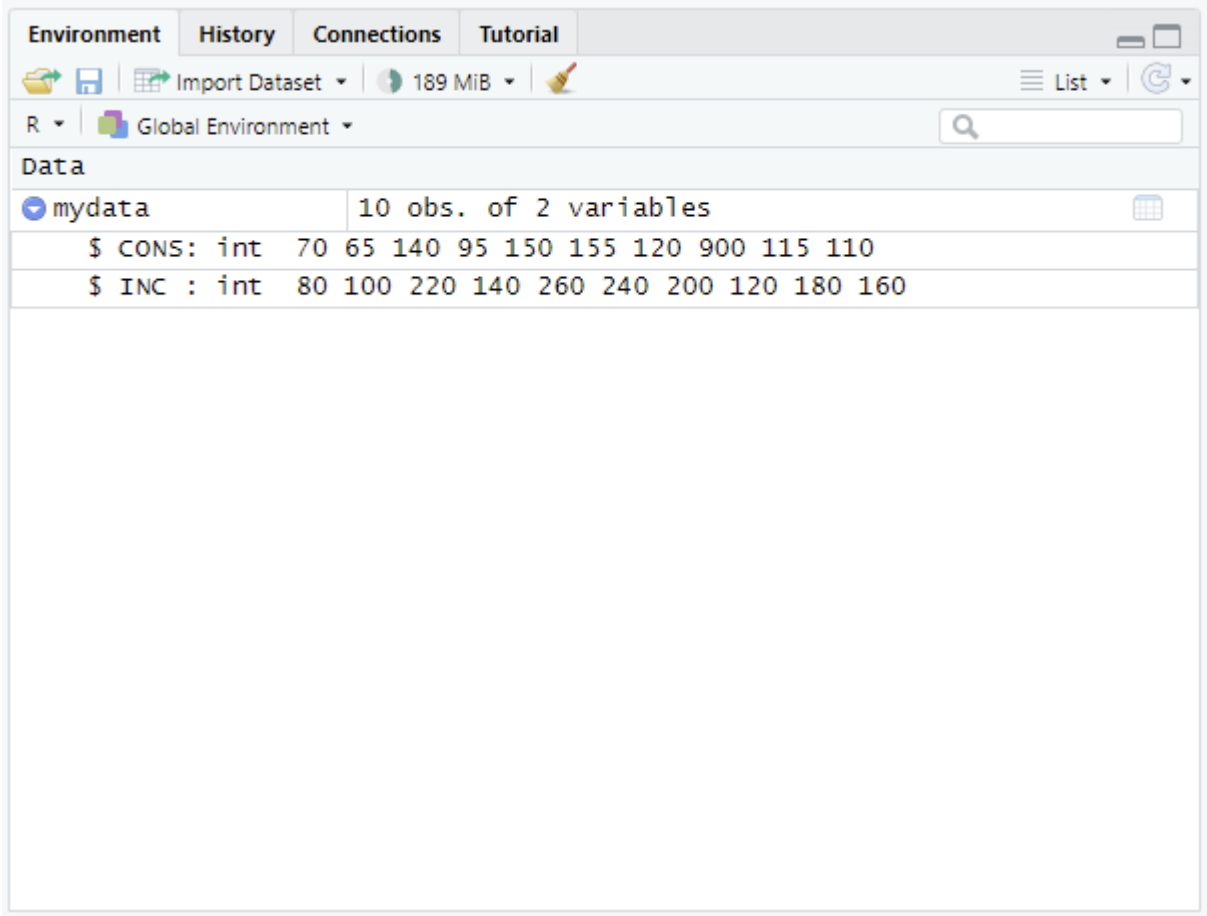
Set Work Directory

Session > Set Working Directory > To Source File Location

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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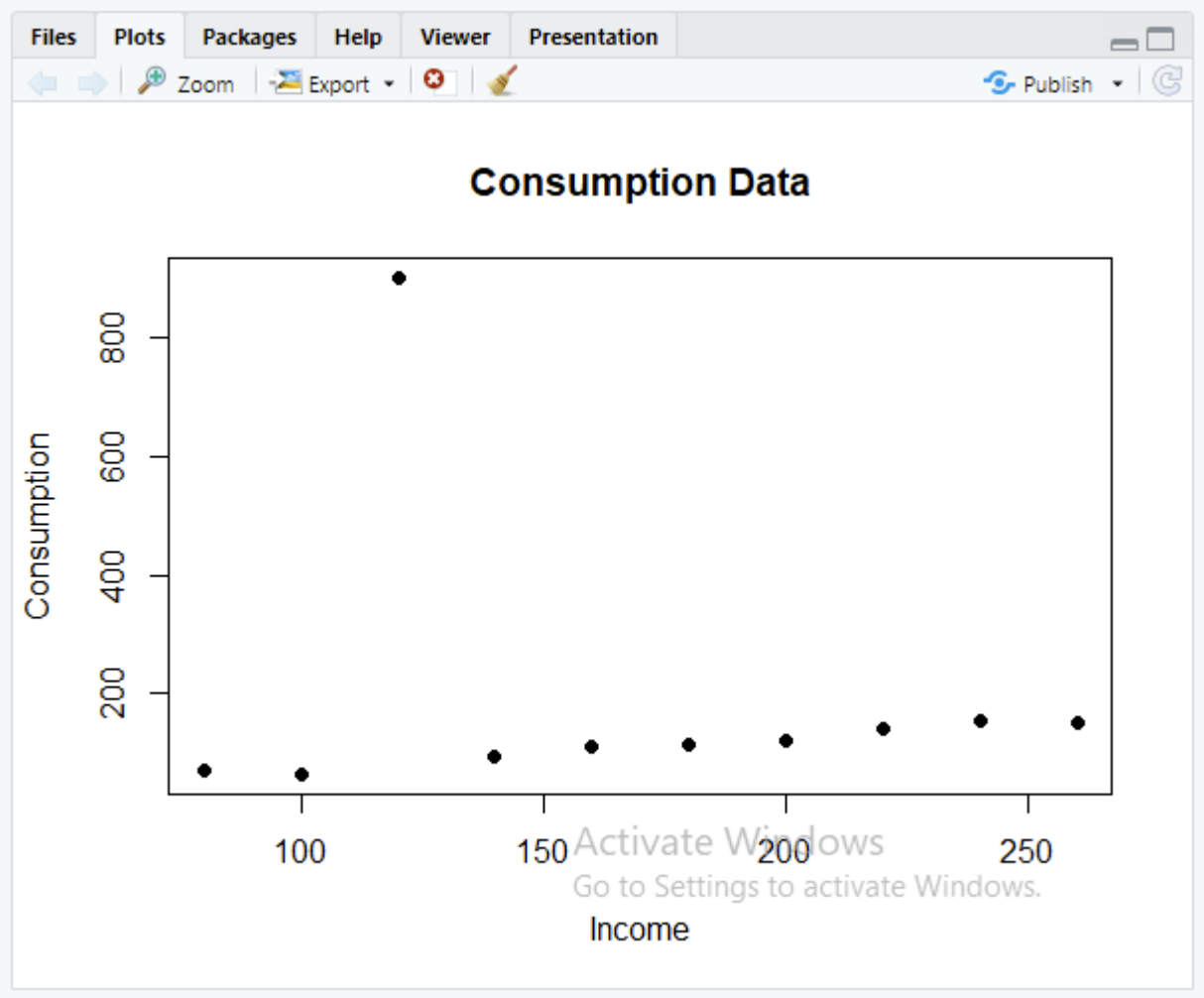
   (a) Read the data into R.

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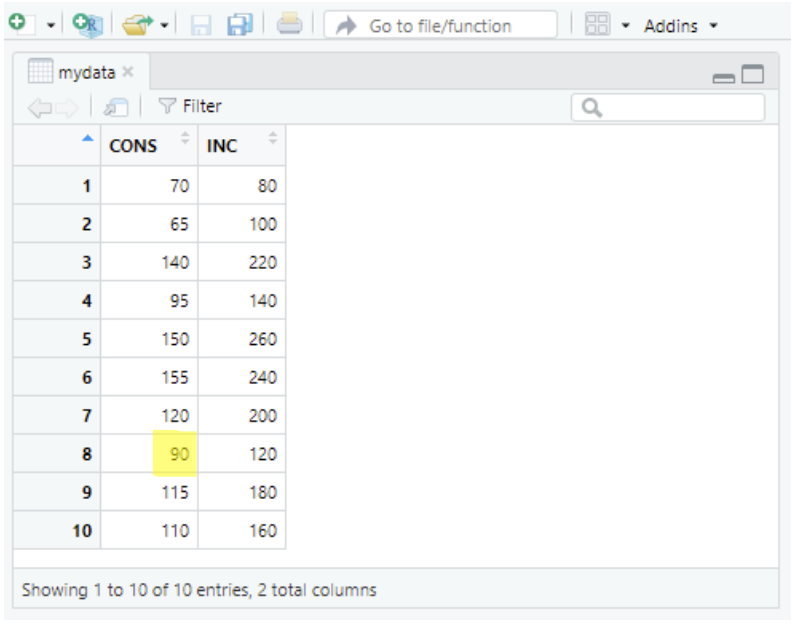
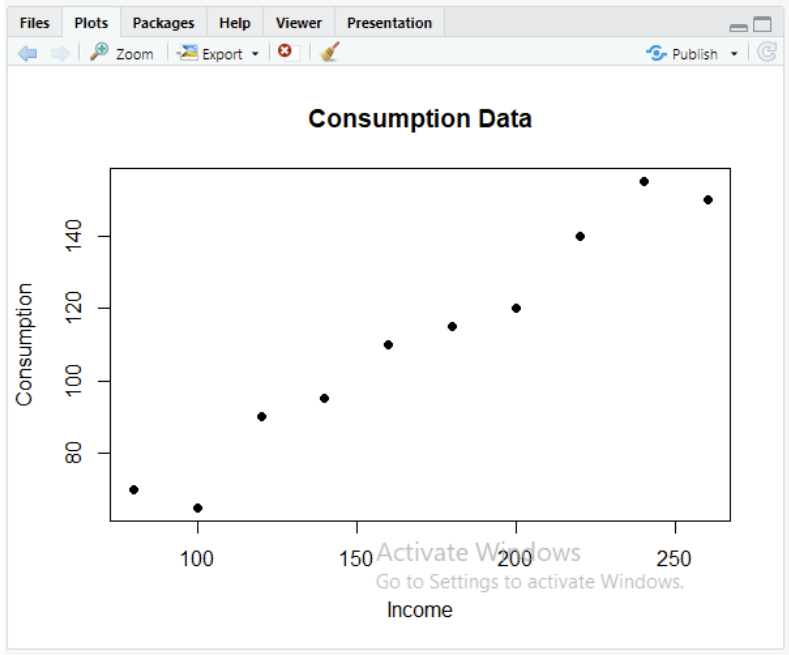
Solution The data are in the form of a matrix whose (8,1) element has the error, so we assign the correct value to it. Next, we need to "refresh" the data in memory by "detaching" and "attaching" `mydata` again. Once done, redraw the scatter diagram by repeating the command in part (b).

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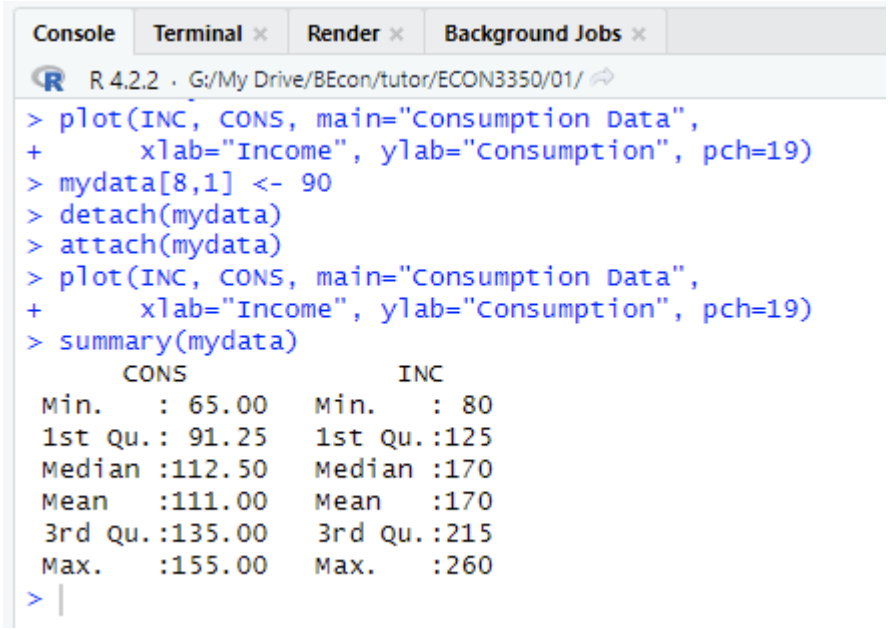
Solution All these statistics are neatly summarised by the `summary` command.

```
summary(mydata)
```



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Intro · RStudio · consumption.txt · fultonfish.def

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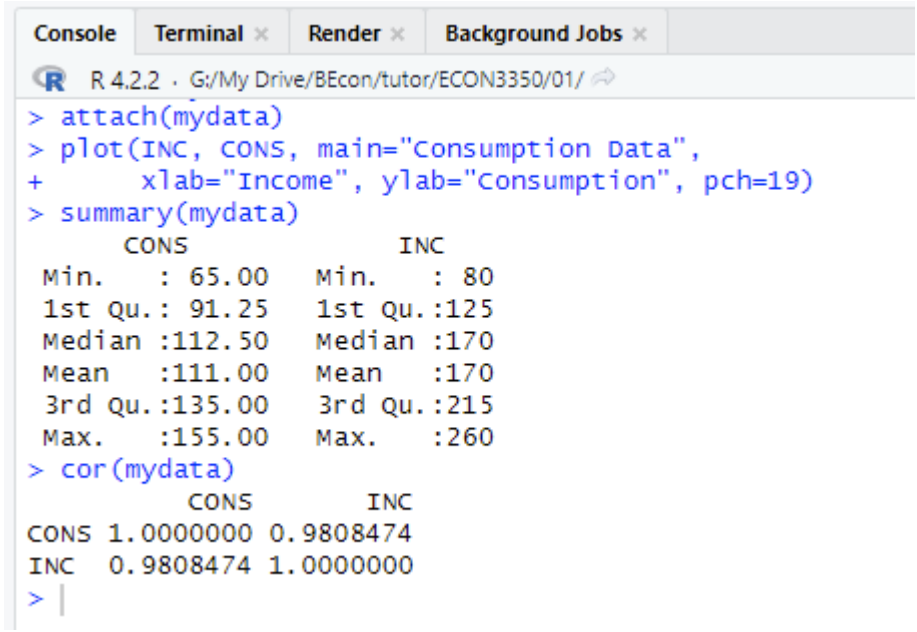
   (e) Compute the correlation coefficient between `CONS` and `INC`. Comment on the result.

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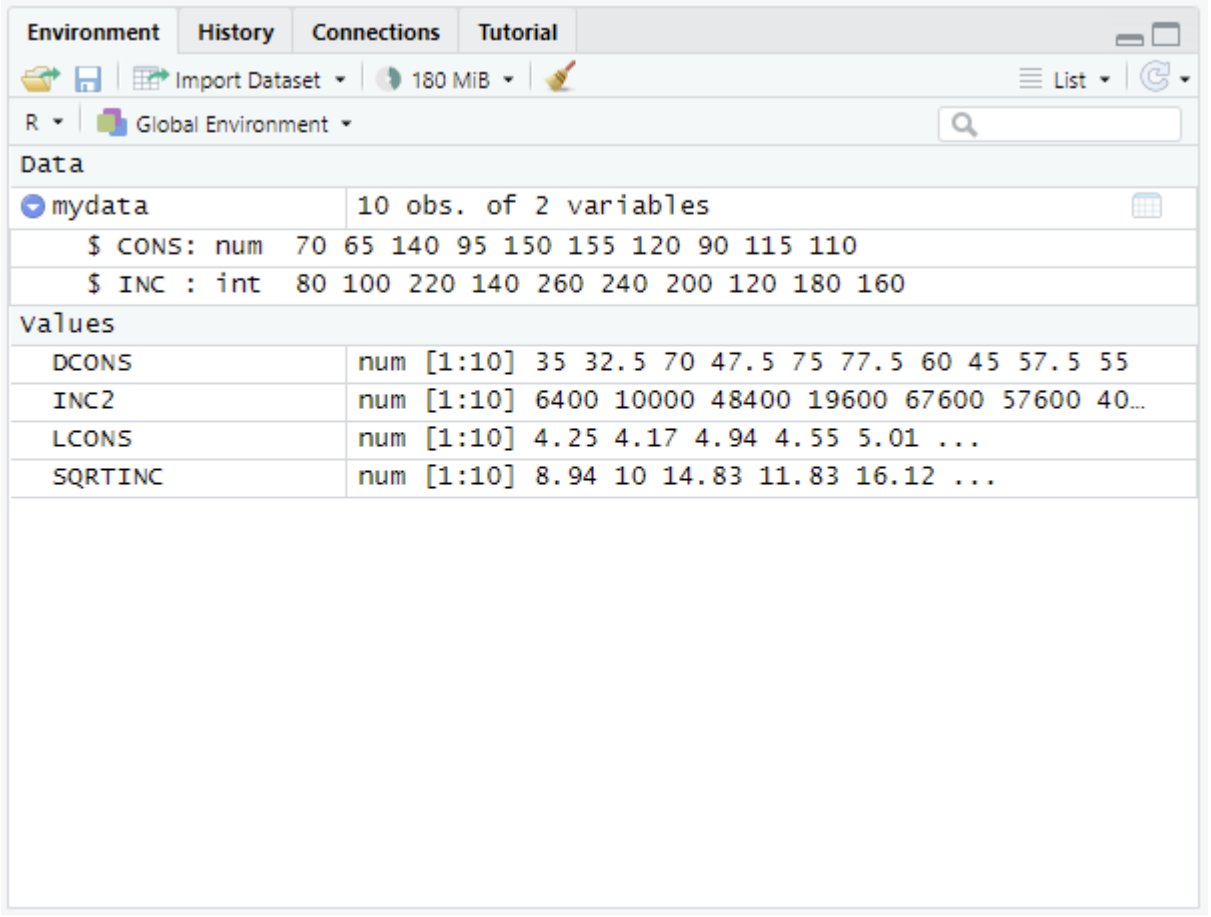
Solution Variables are created using either <- or =. The function log applied the "natural logarithm'' transformation.

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



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

   (h) Delete everything.

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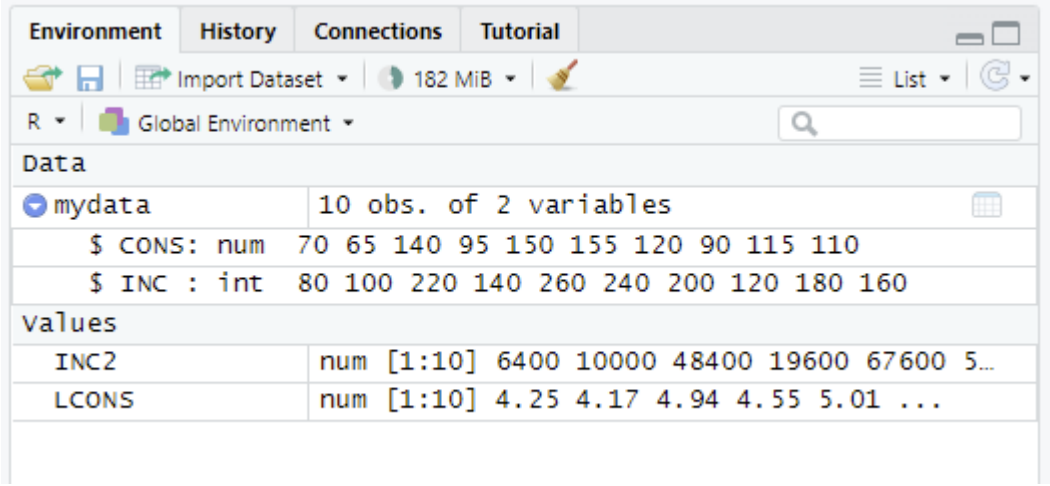
   (g) Delete the variables `DCONS` and `SQRTINC`.

   (h) Delete everything.

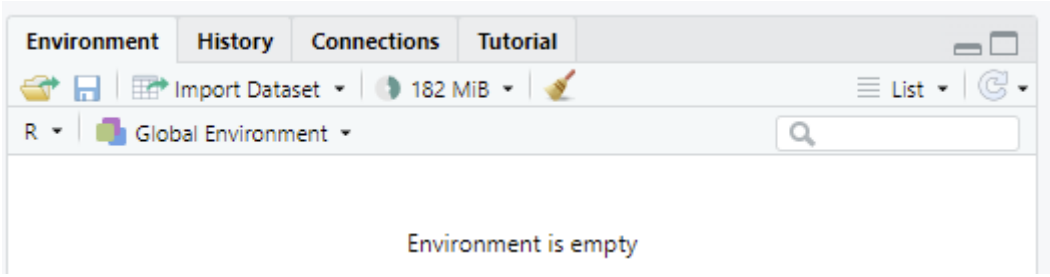
Solution Use the `rm` command to delete variables.

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



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

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



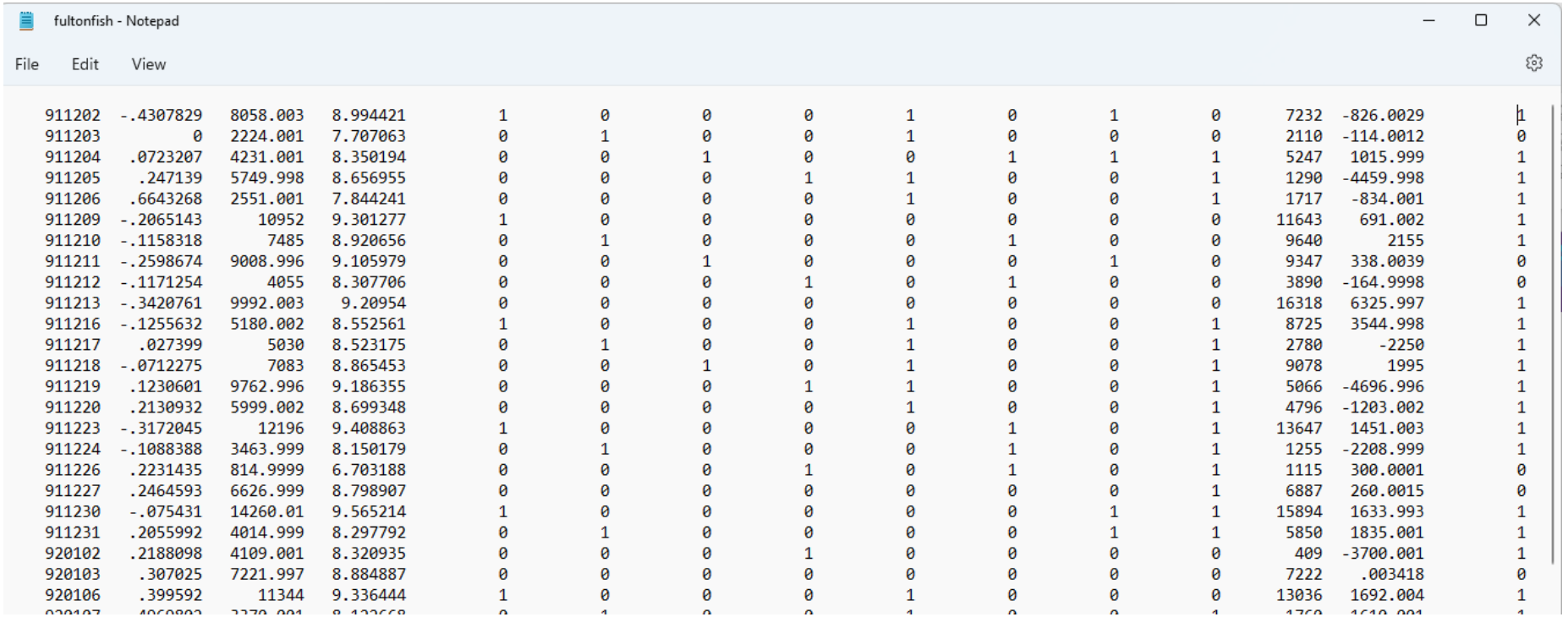
2. At the Famous Fulton Fish Market in New York city, sales of whiting (a type of fish) vary from day to day. Over a period of several months, daily quantities sold (in pounds) were observed. These data are in the file `fultonfish.dat`. Description of the data is in the file `fultonfish.def`. Describe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

fultonfish.dat

Whiting

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.

fultonfish.dat




```
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
```

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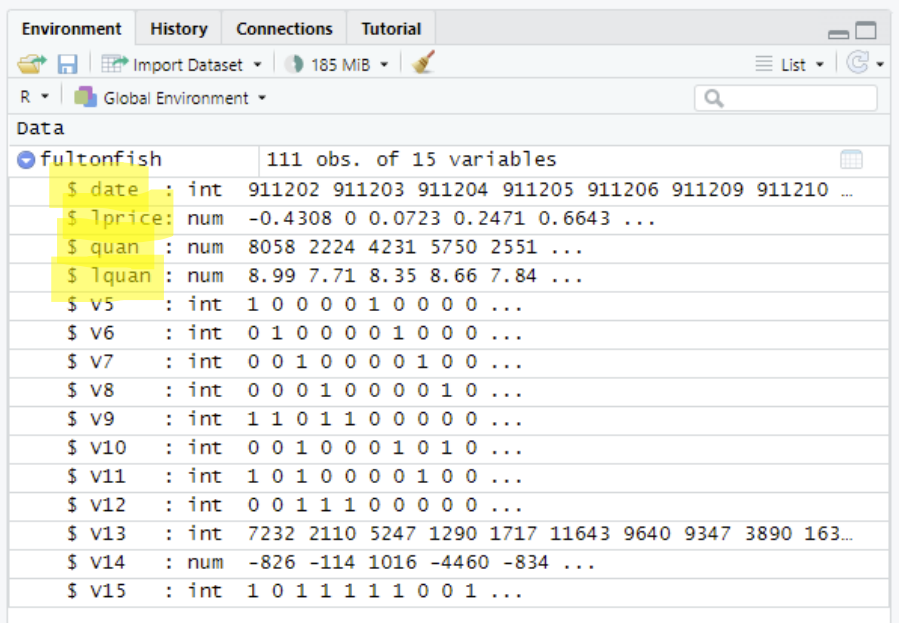
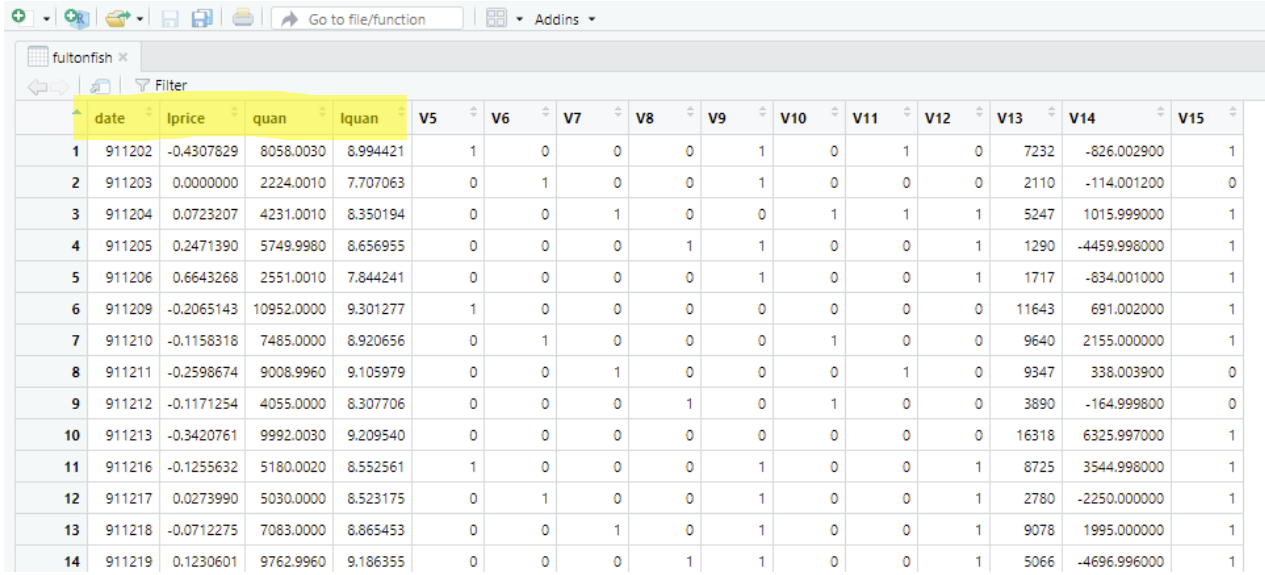
   (a) Use R to open the data file and name the series in the first four columns as `date`, `lprice`, `quan` and `lquan`.

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
5	911206	0.6643268	2551.0010	7.844241	0	0	0	0	1	0	0	1	1717	-834.001000	1
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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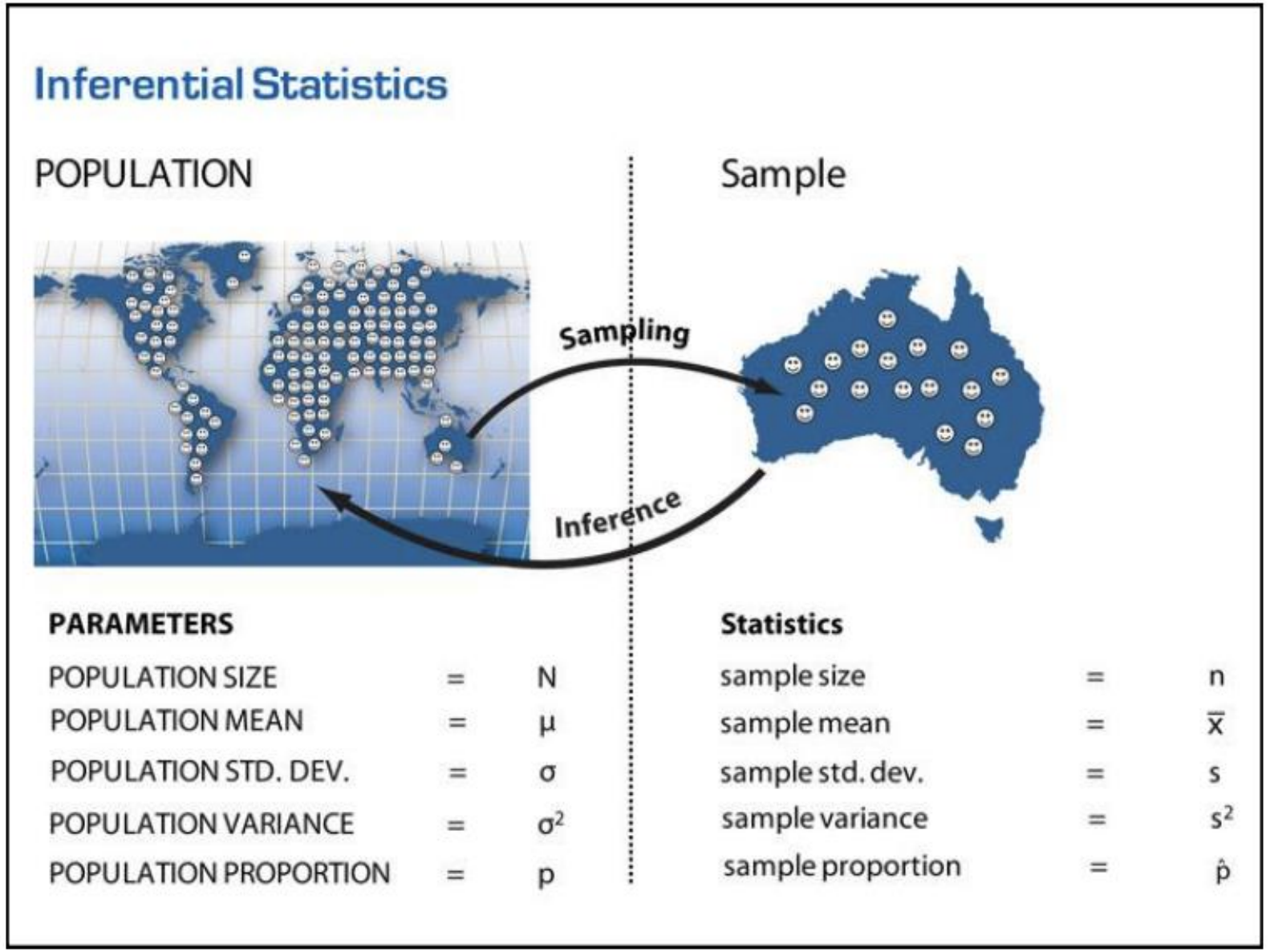
Inferential Statistics
POPULATION
Sample
Sampling
Inference
PARAMETERS
POPULATION SIZE = N
POPULATION MEAN = μ
POPULATION STD. DEV. = σ
POPULATION VARIANCE = σ²
POPULATION PROPORTION = p
Statistics
sample size = n
sample mean = x̄
sample std. dev. = s
sample variance = s²
sample proportion = p̂

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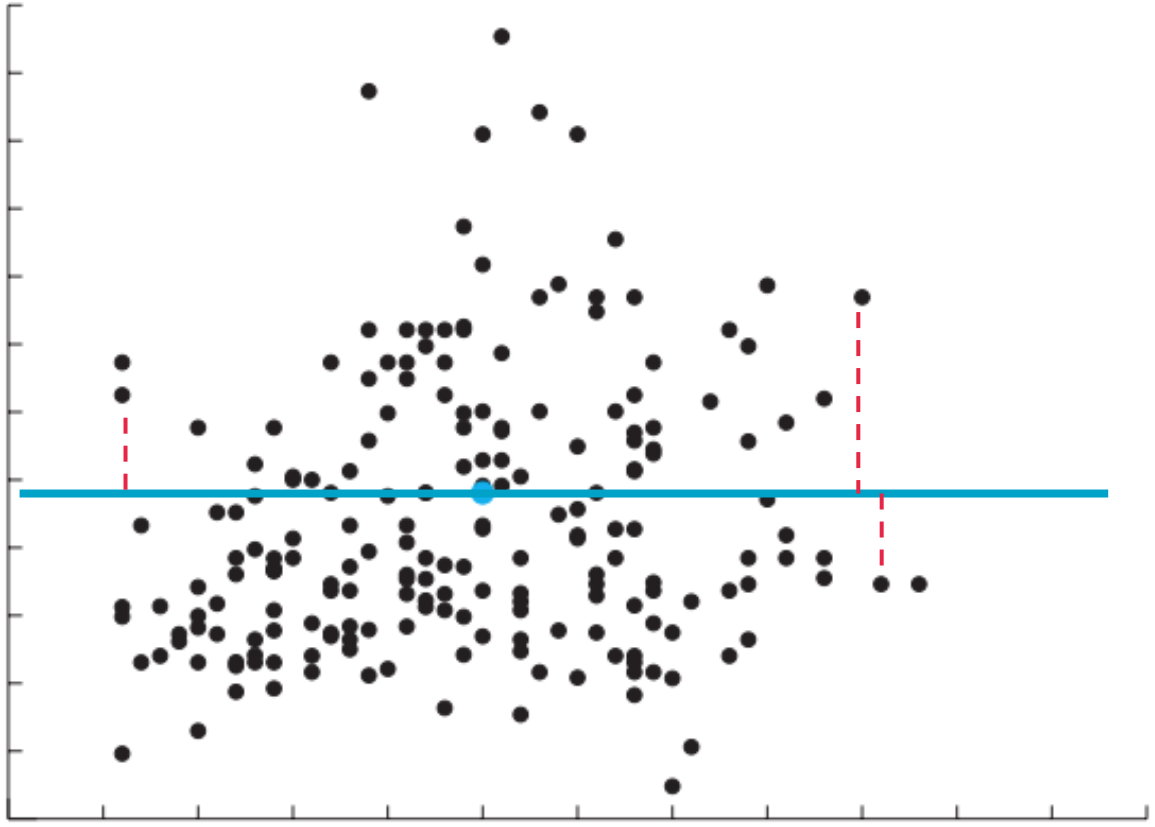

What is the sample mean?
Should I add every observation and divide by the number of observations?

YES!

The bar represents mean →

$$\overline{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i = \frac{1}{n}(Y_1 + Y_2 + \cdots + Y_n)$$

$$\overline{Y} \xrightarrow{p} \mu_Y.$$

What is the standard deviation?
From ECON1310, you might remember that standard deviation = σ and σ^2 = variance. So $\sigma = \sqrt{variance}$.

$$\text{Var}(Y) = \frac{1}{N}\sum_{i=1}^{N}(y_i - \mu_Y)^2$$

$$s_Y^2 = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})^2$$

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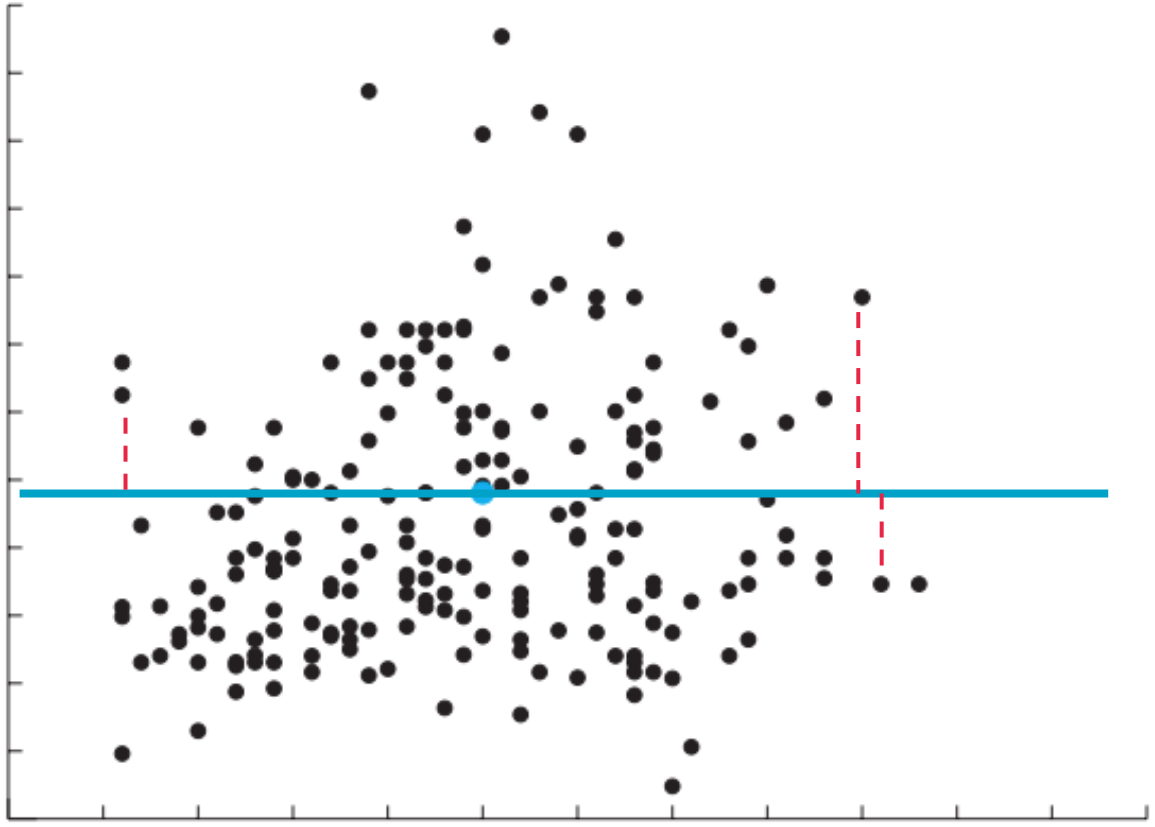


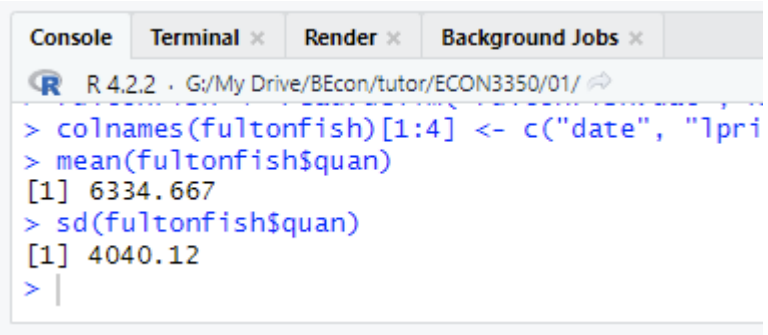
Solution This is straightforward using commands `mean` and `sd`.

```
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.

Five Steps for Hypothesis Testing.

1. State H_0 and H_1
2. State the decision rule for the appropriate test statistic and sampling distribution
3. Calculate the test statistic
4. Make a decision (reject H_0 or do not reject H_0)
5. State a conclusion

Note:
steps 1 and 2 are prior to any sample information.

26

Step 1: State H_0 and H_1

H_0: μ = 7,200

H_1: μ ≠ 7,200

Step 2: Decision rule

Reject H_0 if $|t_{calc}| > t_{crit} = t_{\alpha/2,n-1} = t_{0.025,110} = 1.98$

Step 3: Calculate t_{calc}

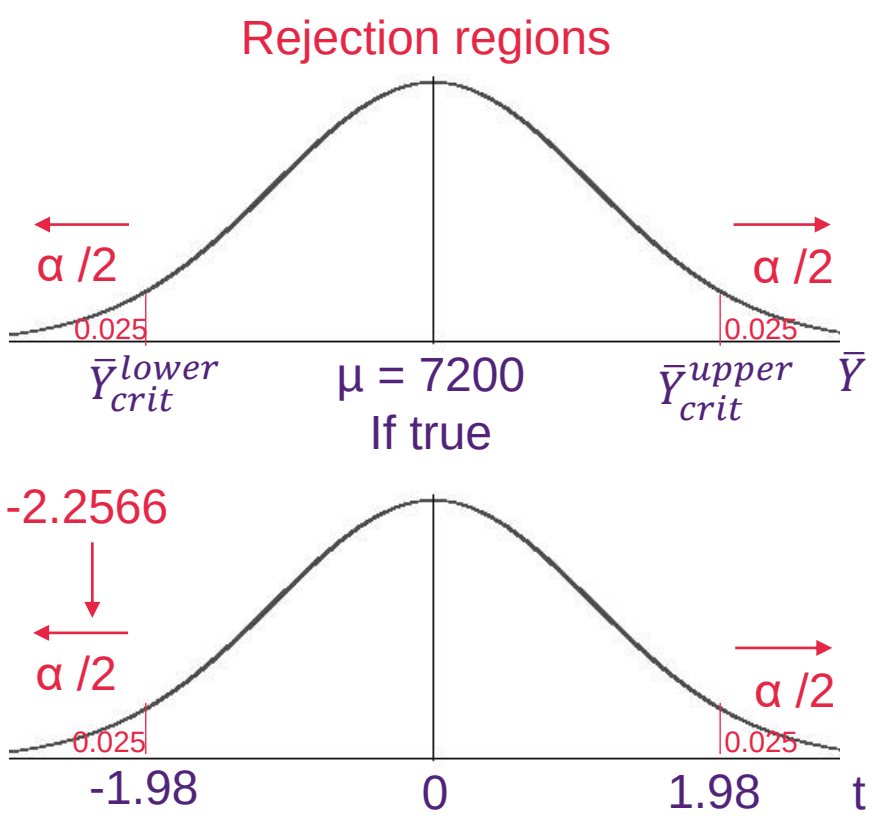
$$t_{calc} = \frac{\bar{Y} - \mu}{s_{\bar{Y}}} = \frac{\bar{Y} - \mu}{\frac{s}{\sqrt{n}}} = \frac{6334.67 - 7200}{\frac{4040.12}{\sqrt{111}}} = -2.2566$$

Step 4: Make a decision

$|t_{calc}| > t_{crit}$ → |-2.26| > 1.98 → Reject H_0.

Step 5: Conclusion

There is sufficient evidence to suggest that the mean quantity sold is not equal to 7,200 pounds a day at the 5% level of significance.



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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
```

Five Steps for Hypothesis Testing.

1. State H_0 and H_1
2. State the decision rule for the appropriate test statistic and sampling distribution
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4. Make a decision (reject H_0 or do not reject H_0)
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$|t_{calc}| > t_{crit}$ → |-2.26| > 1.98 → Reject H_0.

Step 5: Conclusion

There is sufficient evidence to suggest that the mean quantity sold is not equal to 7,200 pounds a day at the 5% level of significance.

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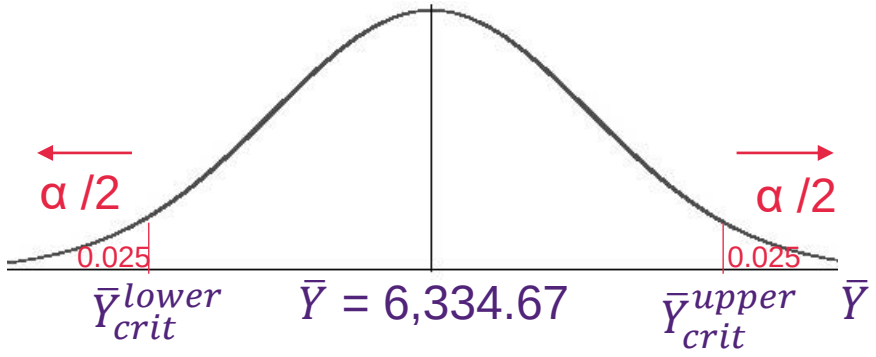
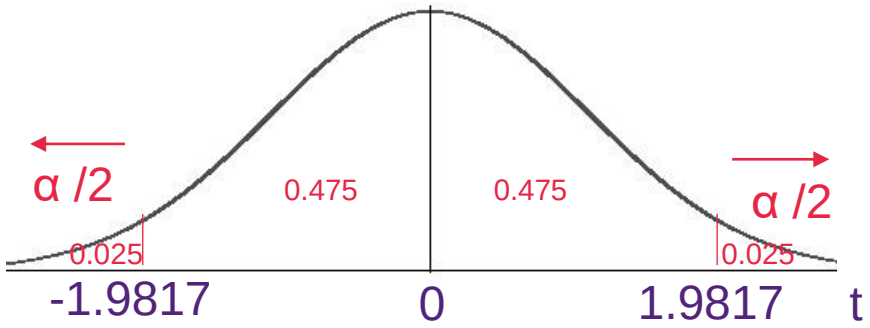
   (d) Construct the 95% confidence interval for part (c).

Confidence interval



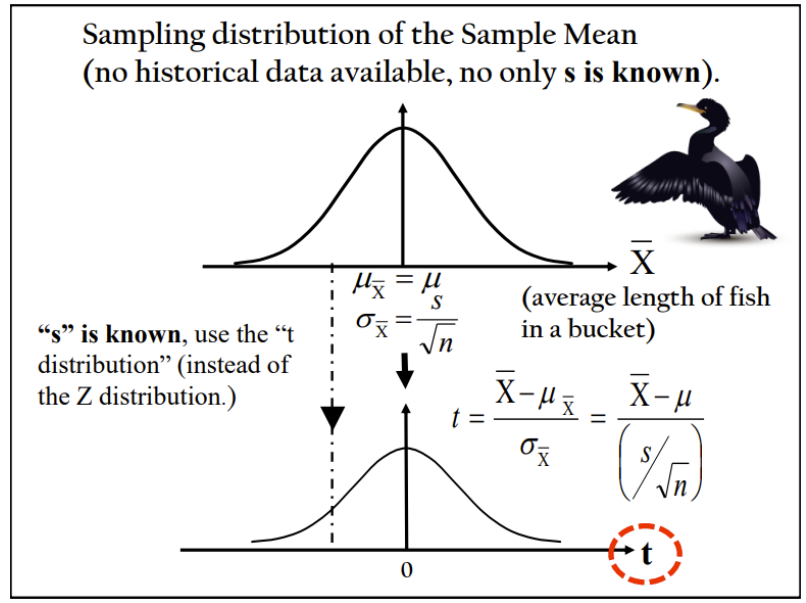


$$\bar{Y} \pm t_{\alpha/2,\,df} * s_{\bar{Y}} =$$

$$\bar{Y} \pm t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} =$$

$$6{,}334.67 \pm 1.9817 * \frac{4040.12}{\sqrt{111}} =$$

$$5{,}574.72 < \mu < 7{,}094.62$$



Confidence Interval Estimate for μ, (σ unknown, and only have s).

Lower limit: $\bar{X} - t_{\alpha/2,\,n-1}\frac{s}{\sqrt{n}}$

Upper limit: $\bar{X} + t_{\alpha/2,\,n-1}\frac{s}{\sqrt{n}}$

where $t_{\alpha/2,\,n-1}$ is the critical value t_{crit} of the t distribution with:

- n -1 degrees of freedom
- an area of α/2 in **each** tail
- t distribution assumptions must be satisfied

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Console | Terminal | Render | Background Jobs

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

```
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        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:
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sample estimates:
mean of x
 6334.667

>
```

$$\bar{Y} \pm t_{\alpha/2,\,df} * s_{\bar{Y}} =$$

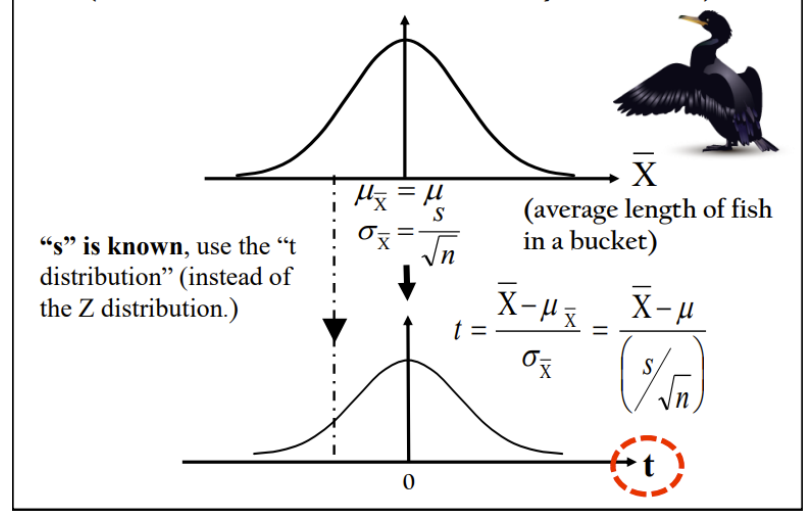
$$\bar{Y} \pm t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} =$$

$$6{,}334.67 \pm 1.9817 * \frac{4040.12}{\sqrt{111}} =$$

$$5{,}574.72 < \mu < 7{,}094.62$$

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

Sampling distribution of the Sample Mean
(no historical data available, no only **s is known**).



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   (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.

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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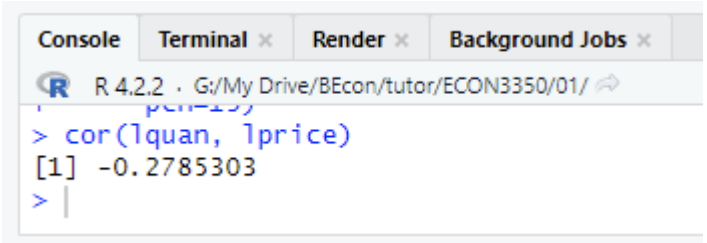

Conceptually, we expect price and quantity to be negatively related, but there does not to appear to be a clear relationship between price and quantity in this data. We can investigate it further by computing the sample correlation.

```
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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   (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.

   (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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CREATE CHANGE

Thank you

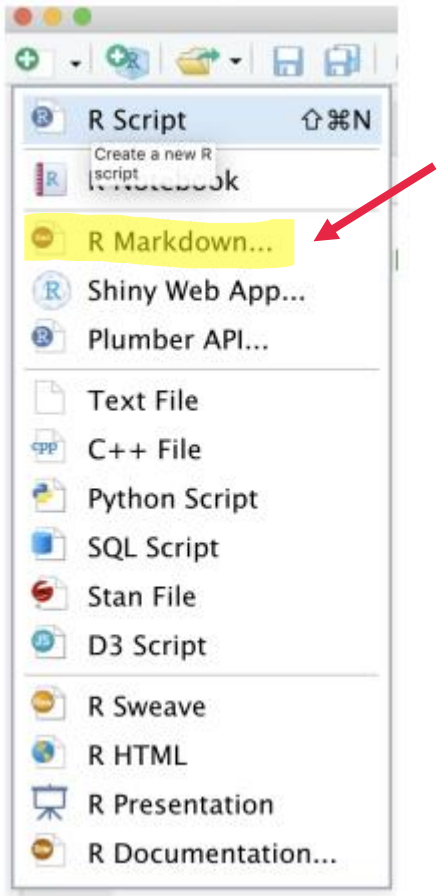
Francisco Tavares Garcia

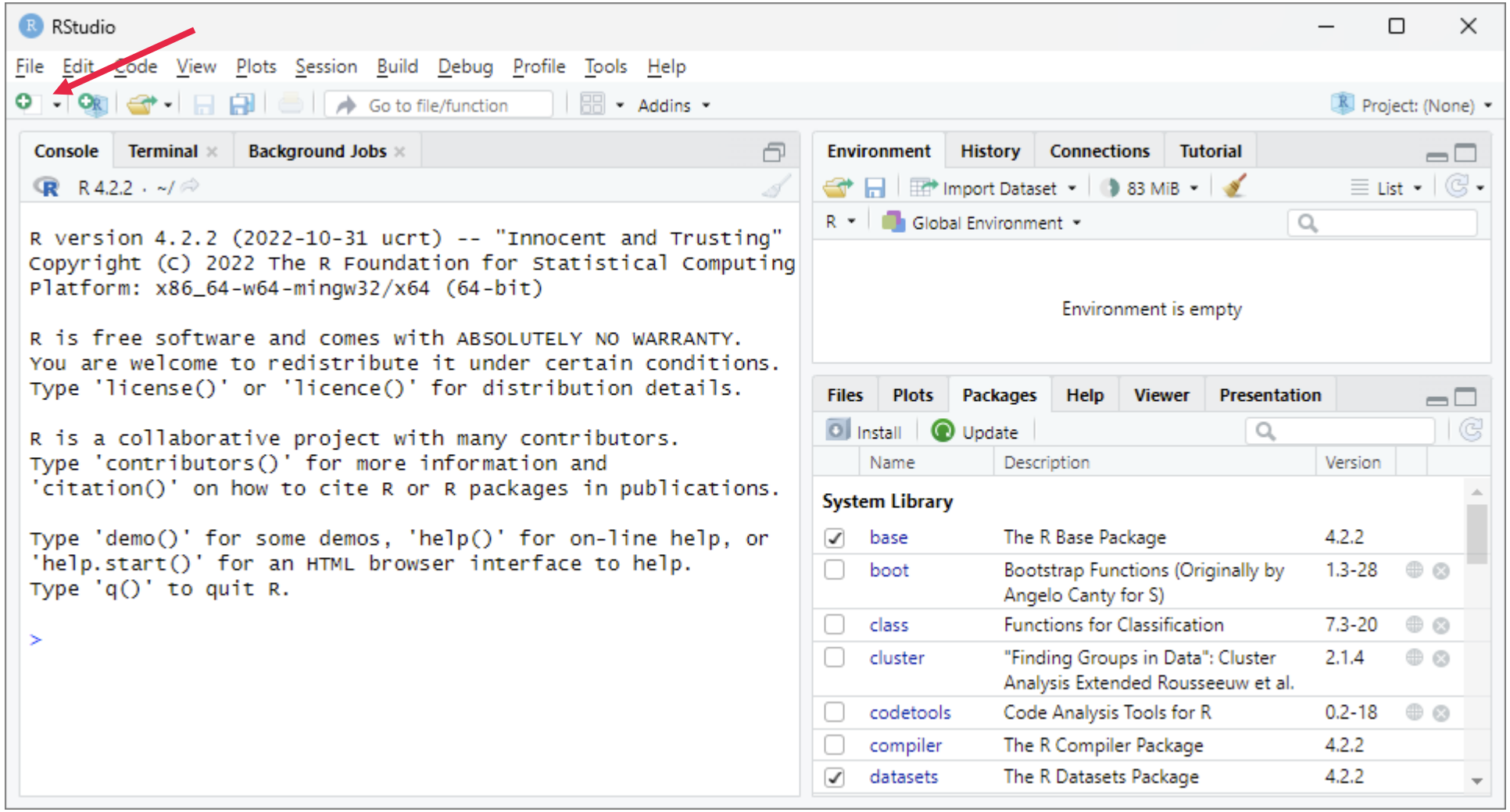
Academic Tutor | School of Economics

Reference

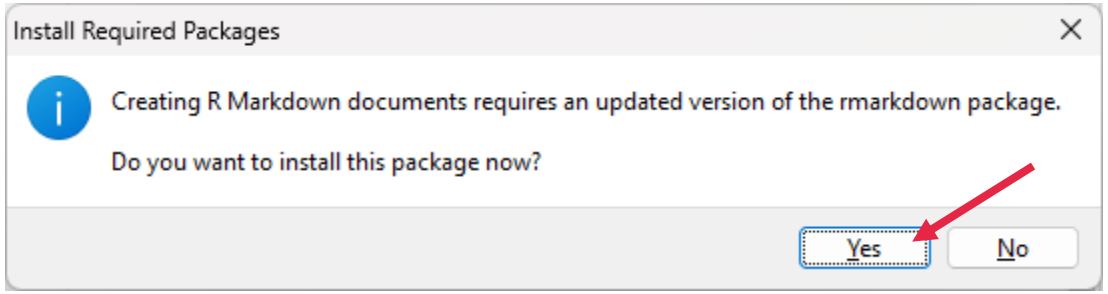
Stock, J. H., & Watson, M. W. (2019). Introduction to Econometrics, Global Edition, 4th edition. Pearson Education Limited.

Bonus – R Markdown



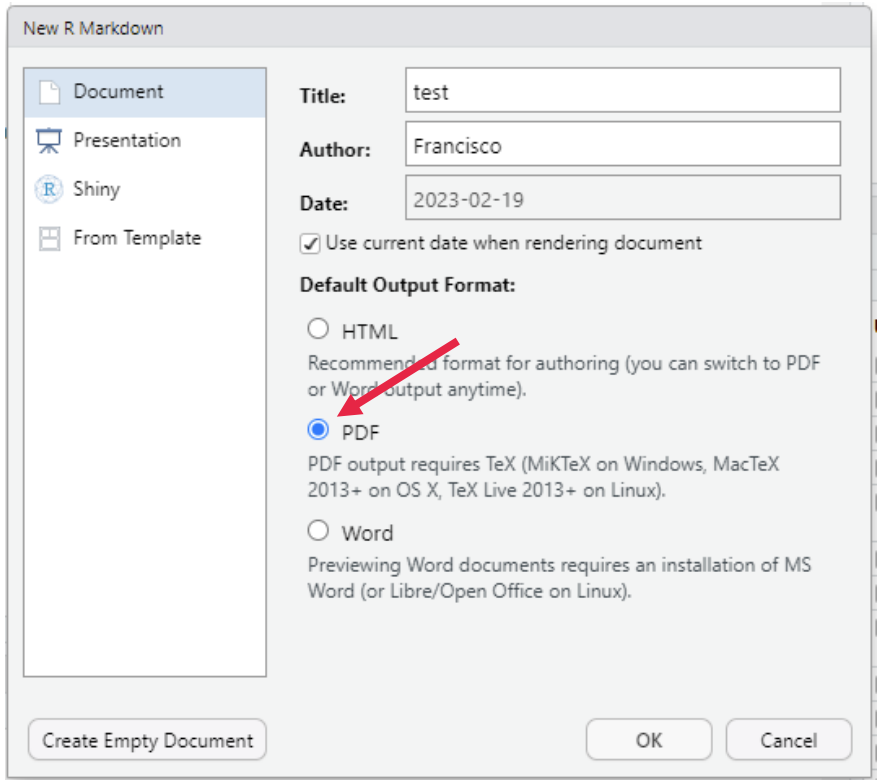


R Markdown - installation



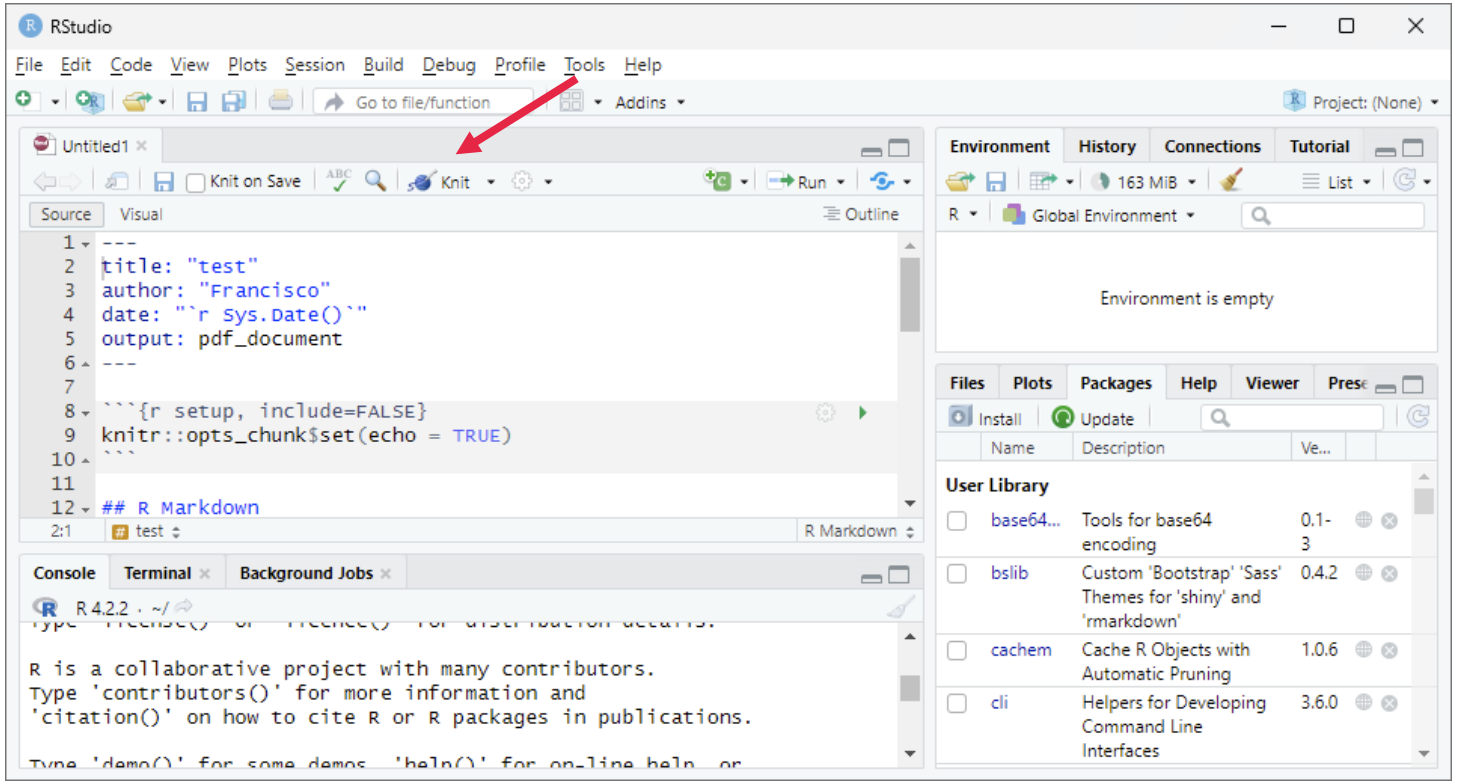
It will install 20+ packages to run R Markdown.

R Markdown - new document and Knit



Choose pdf to create documents using LaTeX.

Save your file, then Knit to PDF.

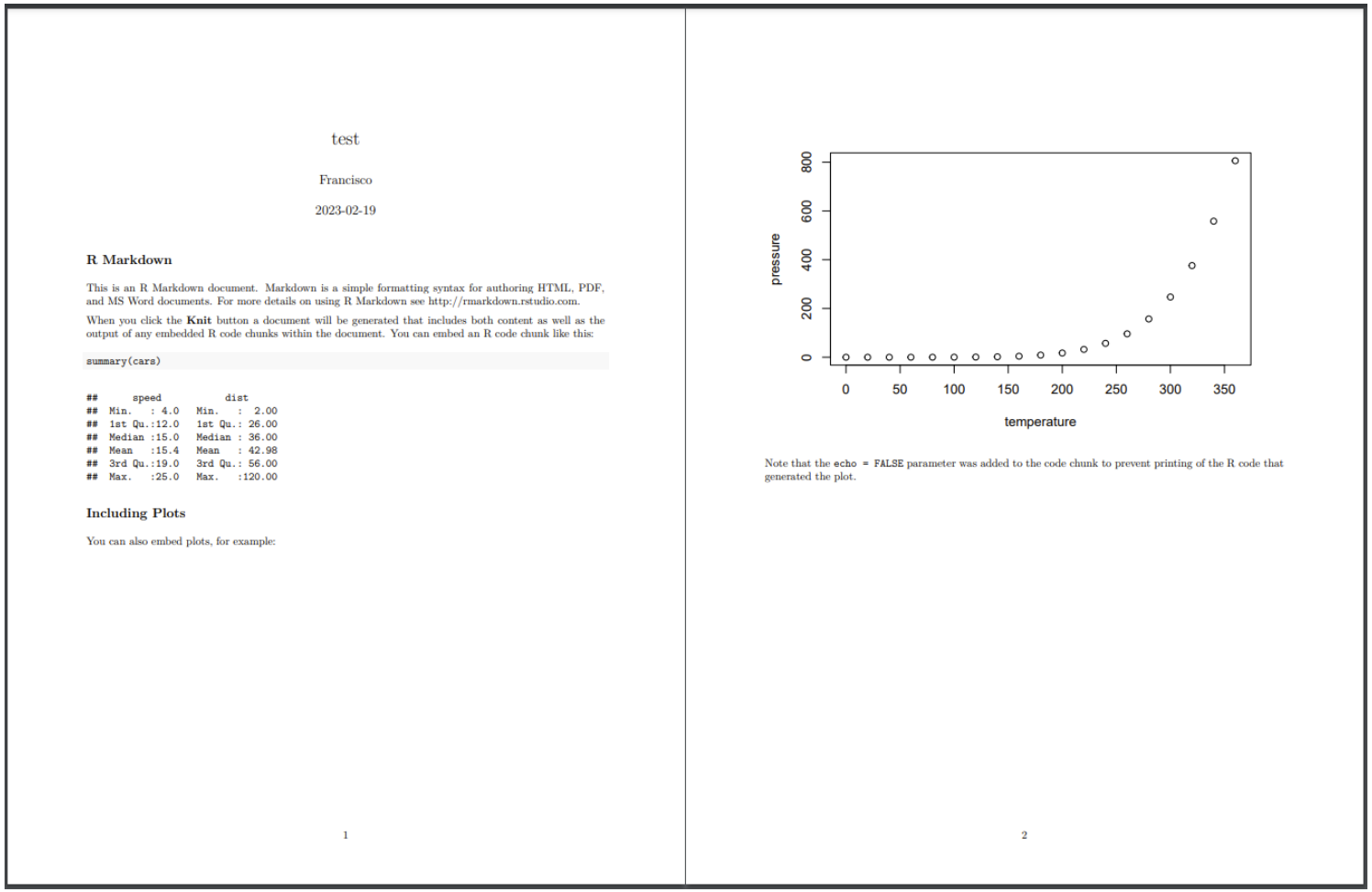


R Markdown - PDF

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

You need to install the package tinytex.
To do so, 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