

Introduction to R/RStudio

Outline

What is R and why do we use it?

Downloading R and RStudio

Basics of using R

Objects, assigning, and functions

Summary

Outline

What is R and why do we use it?

Downloading R and RStudio

- EX: download and start using

Basics of using R

- EX: Trying out commands

Objects, assigning, and functions

- EX: Using objects and functions in R

Summary

What is R and why do we use it?



What is R and why do we use it?



**Who has heard of
R before?**



<https://www.menti.com/28mosciyxe>

What is R and why do we use it?



Open-source (FREE)

Statistical programming language

Widely used (popular) and cross platform

Flexible

Interpreted language (no need to compile)

What is R and why do we use it?



Open-source (FREE)

Statistical programming language

Widely used (popular) and cross platform

Flexible

Interpreted language (no need to compile)

Object orientated

What is R and why do we use it?



Language – so we have some new words:

Script

Comment

Assign

Function

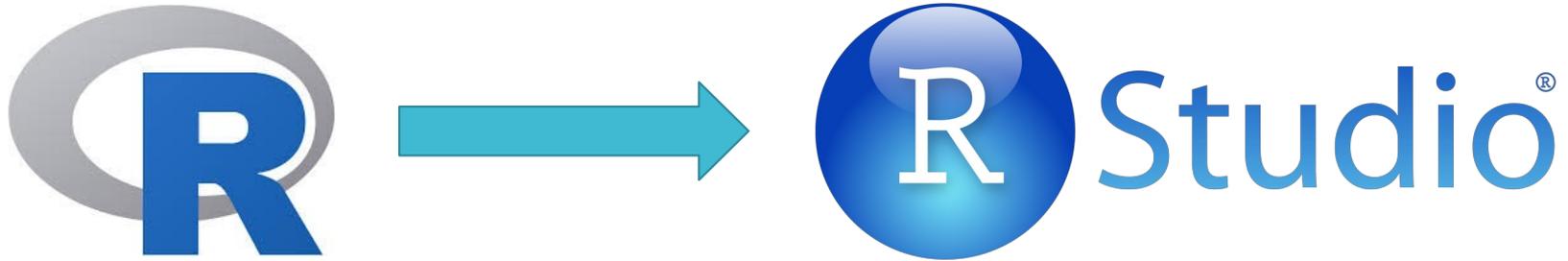
Argument

Object

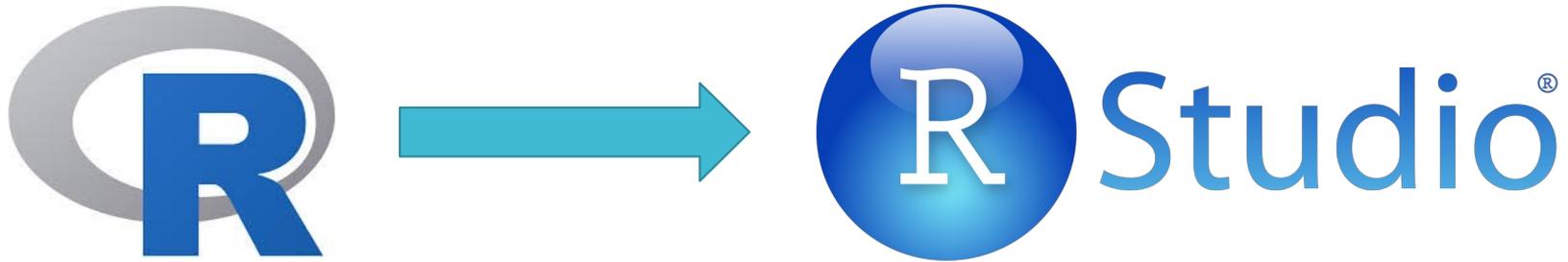
How to use R



How to use R



How to use R



RStudio is an integrated development environment
(makes R pretty and has everything in one place)

It runs R

Also free and cross platform

Downloading R and RStudio

Exercise 1: Downloading R and Rstudio and getting started

Go to:

<https://www.math.ntnu.no/emner/ST2304/2021v/Week01/R-tutorial.html>

Open the file.

Work through Part A.

Ask if you need help! That's what we are here for ☺



Recap

Using RStudio

The screenshot displays the RStudio IDE interface. The top-left pane shows a script editor with a single line of code: `1`. The top-right pane is the Environment pane, which is currently empty, displaying the text "Environment is empty". The bottom-left pane is the Console, showing the R version information and help text:

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

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.

[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData]
> |
```

The bottom-right pane is the Help Viewer, displaying the R Resources page. It includes sections for R Resources, RStudio, Manuals, and Reference, with links to various resources such as Learning R Online, CRAN Task Views, R on StackOverflow, Getting Help with R, RStudio IDE Support, RStudio Community Forum, RStudio Cheat Sheets, RStudio Tip of the Day, RStudio Packages, RStudio Products, An Introduction to R, Writing R Extensions, R Data Import/Export, The R Language Definition, R Installation and Administration, and R Internals.

Using RStudio

The screenshot displays the RStudio interface with four main panes:

- Source Editor (Top Left):** Shows a file named `my_script_demo.R` with a single line of code: `1`. The status bar at the bottom indicates `1:1 (Top Level) R Script`.
- Environment Pane (Top Right):** Titled "Teaching code", it shows the "Global Environment" and states "Environment is empty".
- Console (Bottom Left):** Displays the R version information and help text:

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData]
> |
```
- Help Viewer (Bottom Right):** Shows the "R Resources" and "RStudio" sections with various links for learning and support.

Using RStudio

The image displays four panels of the RStudio interface:

- Script window:** Shows a file named `my_script_demo.R` with a single line of code containing the number `1`. The status bar at the bottom indicates `1:1 (Top Level) R Script`.
- Environment:** Shows the `Global Environment` with a search bar and a `List` button.
- Console:** Displays the R version `3.5.1 (2018-07-02)` and various help messages, including the license and instructions for using `demo()`, `help()`, and `q()`. The workspace is loaded from `~/Dropbox/Teaching ntnu/Teaching code/.RData`.
- Files/plots/packages/help/viewer:** Shows a search bar and a list of resources, including [R Resources](#), [RStudio](#), [Learning R Online](#), [CRAN Task Views](#), [R on StackOverflow](#), [Getting Help with R](#), [RStudio IDE Support](#), [RStudio Community Forum](#), [RStudio Cheat Sheets](#), [RStudio Tip of the Day](#), [RStudio Products](#), [Manuals](#), [An Introduction to R](#), [Writing R Extensions](#), [R Data Import/Export](#), [The R Language Definition](#), [R Installation and Administration](#), [R Internals](#), and [Reference](#).

Using RStudio

The image displays the RStudio IDE interface, divided into four main panes:

- Script Editor (Top Left):** Shows a file named `my_script_demo.R` with a single line of code containing the number `1`. The status bar at the bottom indicates `1:1 (Top Level) R Script`.
- Environment Pane (Top Right):** Displays the current environment, which is empty. The text "Environment is empty" is centered in the pane.
- Console (Bottom Left):** Shows the output of the R session. The text includes the R version (3.5.1), copyright information, and instructions for using the console. A large, semi-transparent watermark with the word "Console" is overlaid on this pane.
- Help Viewer (Bottom Right):** Displays a list of resources and manuals. The "R Resources" section includes links for Learning R Online, CRAN Task Views, R on StackOverflow, and Getting Help with R. The "RStudio" section includes links for RStudio IDE Support, RStudio Community Forum, RStudio Cheat Sheets, RStudio Tip of the Day, RStudio Packages, and RStudio Products. The "Manuals" section includes links for An Introduction to R, Writing R Extensions, R Data Import/Export, The R Language Definition, R Installation and Administration, and R Internals. A "Reference" section is also visible at the bottom.

Using RStudio

Console ~/Dropbox/Teaching ntnu/Teaching code/ 



R version 3.5.1 (2018-07-02) -- "Feather Spray"

Copyright (C) 2018 The R Foundation for Statistical Computing

Platform: x86_64-apple-darwin15.6.0 (64-bit)

> 2+2

[1] 4

> |

Using RStudio

Console ~/Dropbox/Teaching ntnu/Teaching code/   

R version 3.5.1 (2018-07-02) -- "Feather Spray"

Copyright (C) 2018 The R Foundation for Statistical Computing

Platform: x86_64-apple-darwin15.6.0 (64-bit)

> 2+2

[1] 4

> |

Using scripts in RStudio

The image shows a screenshot of the RStudio interface, divided into four main panes:

- Script window (top-left):** Displays a file named `my_script_demo.R` with the text `1` on the first line. The title bar indicates the file path is `~/Dropbox/Teaching code/`. The status bar at the bottom shows `1:1 (Top Level) R Script`.
- Environment pane (top-right):** Shows the current environment, which is empty. The title bar says `Teaching code - RStudio`. Below the title bar are tabs for `Environment`, `History`, `Connections`, and `Git`. There are icons for `Import Dataset` and `Global Environment`. The text `Environment is empty` is displayed in the center.
- Console (bottom-left):** Shows the R version and system information:

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

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'citation()' on how to cite R or R packages in publications.

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.

[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData]
> |
```
- Viewer pane (bottom-right):** Displays a help page with a search bar and navigation icons. The content is organized into sections:
 - R Resources:**
 - [Learning R Online](#)
 - [CRAN Task Views](#)
 - [R on StackOverflow](#)
 - [Getting Help with R](#)
 - RStudio:**
 - [RStudio IDE Support](#)
 - [RStudio Community Forum](#)
 - [RStudio Cheat Sheets](#)
 - [RStudio Tip of the Day](#)
 - [RStudio Packages](#)
 - [RStudio Products](#)
 - Manuals:**
 - [An Introduction to R](#)
 - [Writing R Extensions](#)
 - [R Data Import/Export](#)
 - [The R Language Definition](#)
 - [R Installation and Administration](#)
 - [R Internals](#)
 - Reference:**

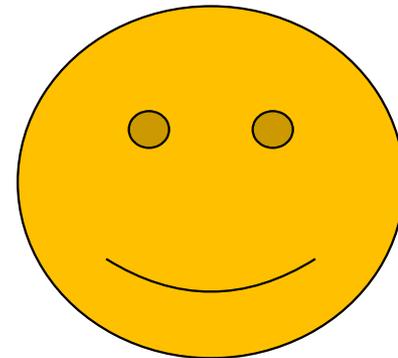
Why use scripts?

You can save your code

Easier to change the code

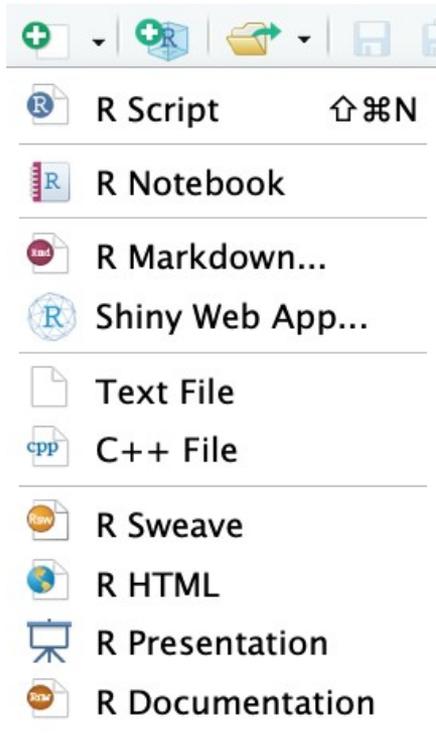
Easier to repeat analyses

You can use **comments**

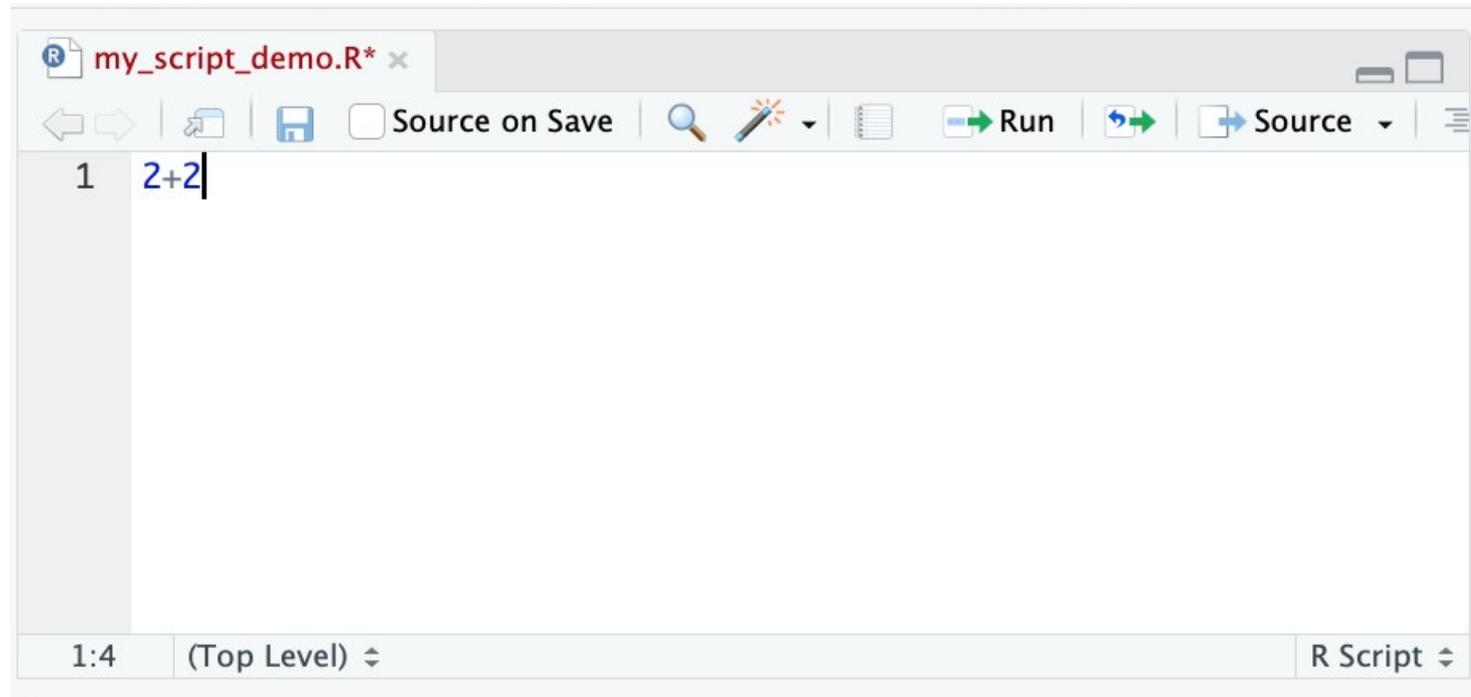


Basics of an R script

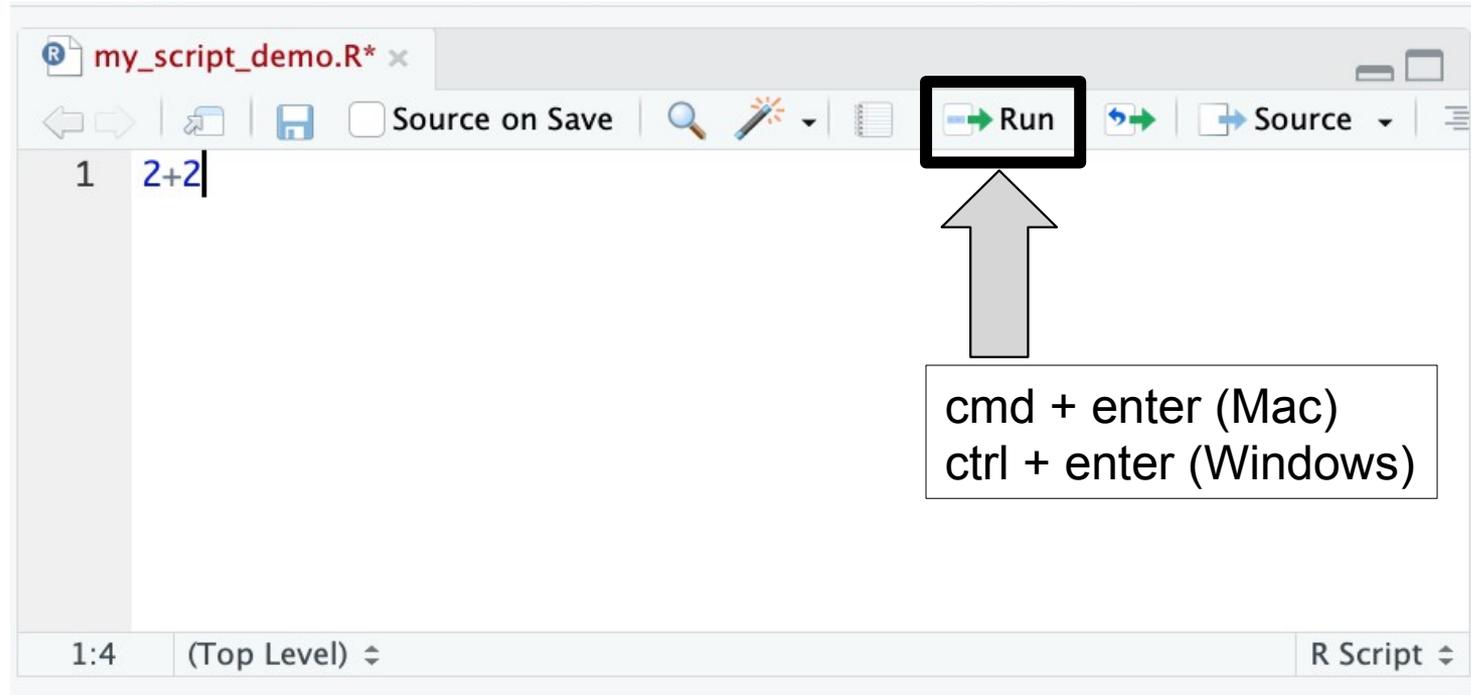
To open a new script



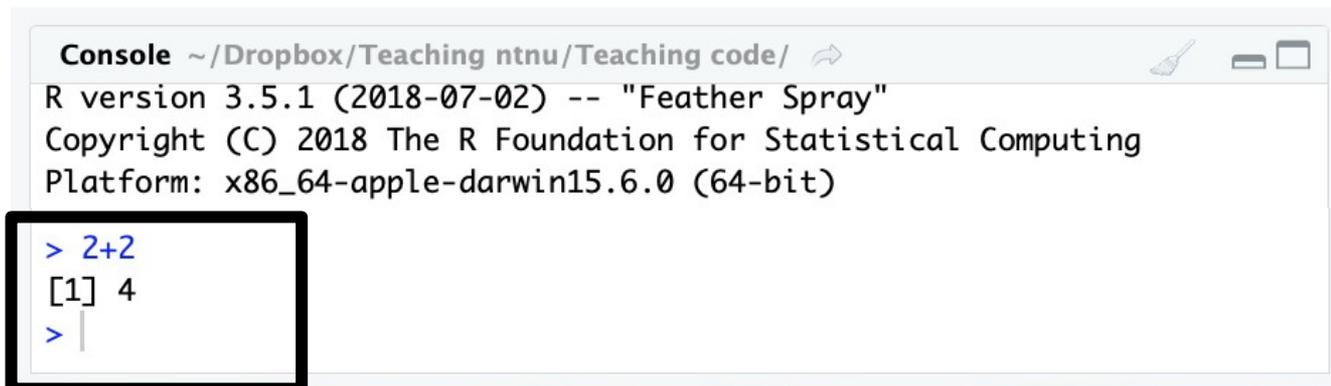
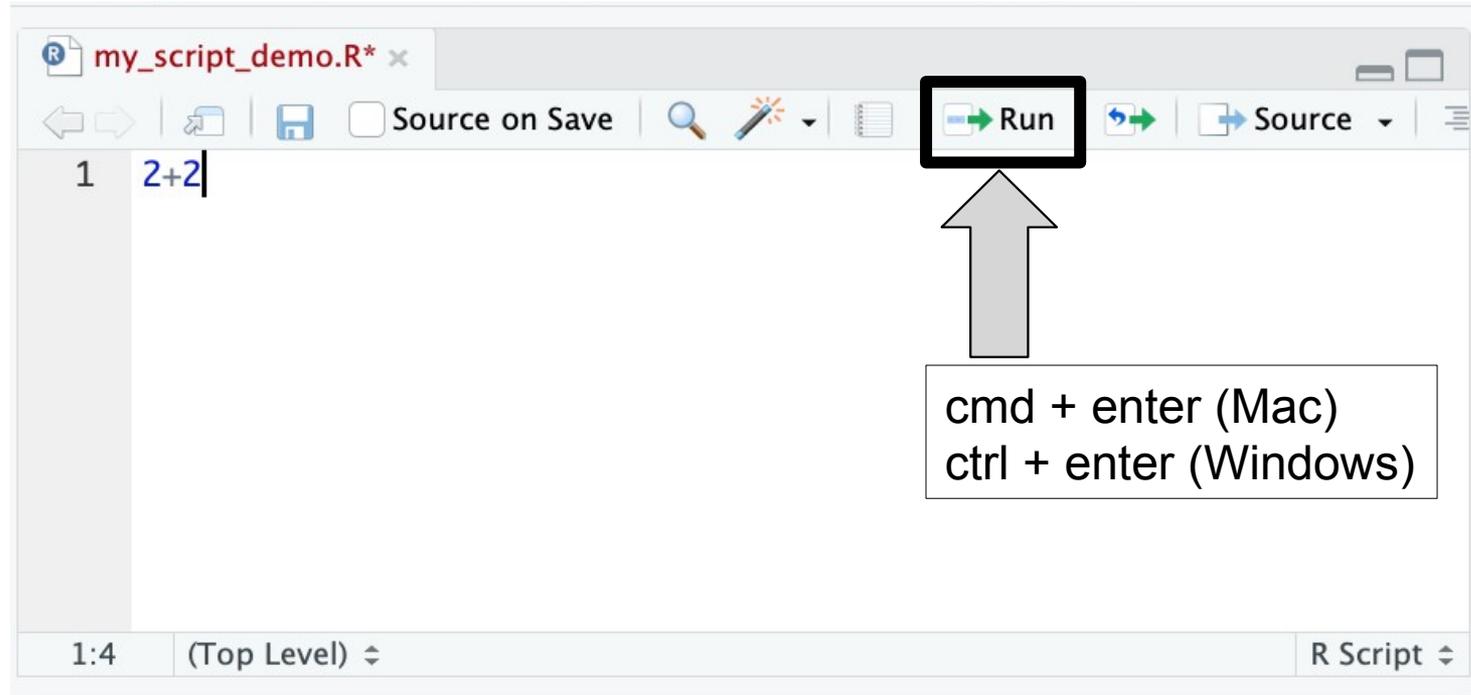
Basics of an R script



Basics of an R script



Basics of an R script



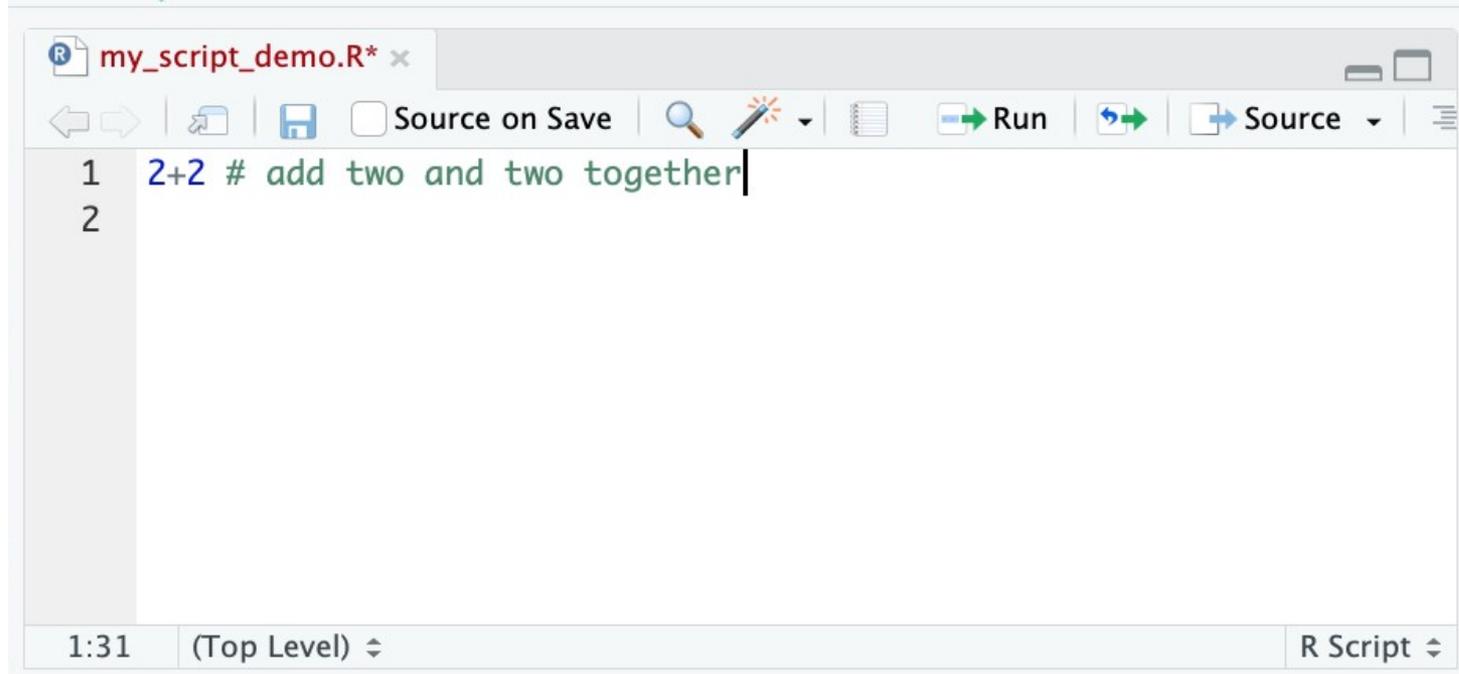
Comments

Comments

```
# this is a comment
```

Comments

```
# this is a comment
```



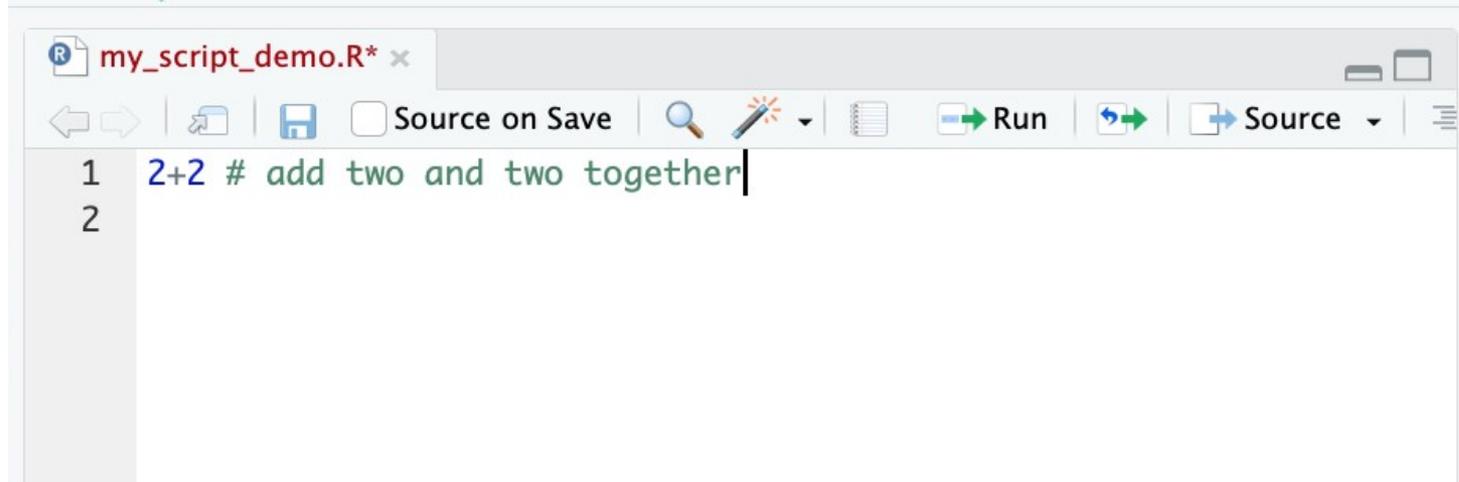
The screenshot shows an R script editor window titled "my_script_demo.R*". The window has a toolbar with icons for navigation, search, and execution. The main editing area contains two lines of code: line 1 is "2+2 # add two and two together" and line 2 is empty. The status bar at the bottom indicates the current position is "1:31" and the editor is in "(Top Level)" mode, editing an "R Script".

```
1 2+2 # add two and two together  
2
```

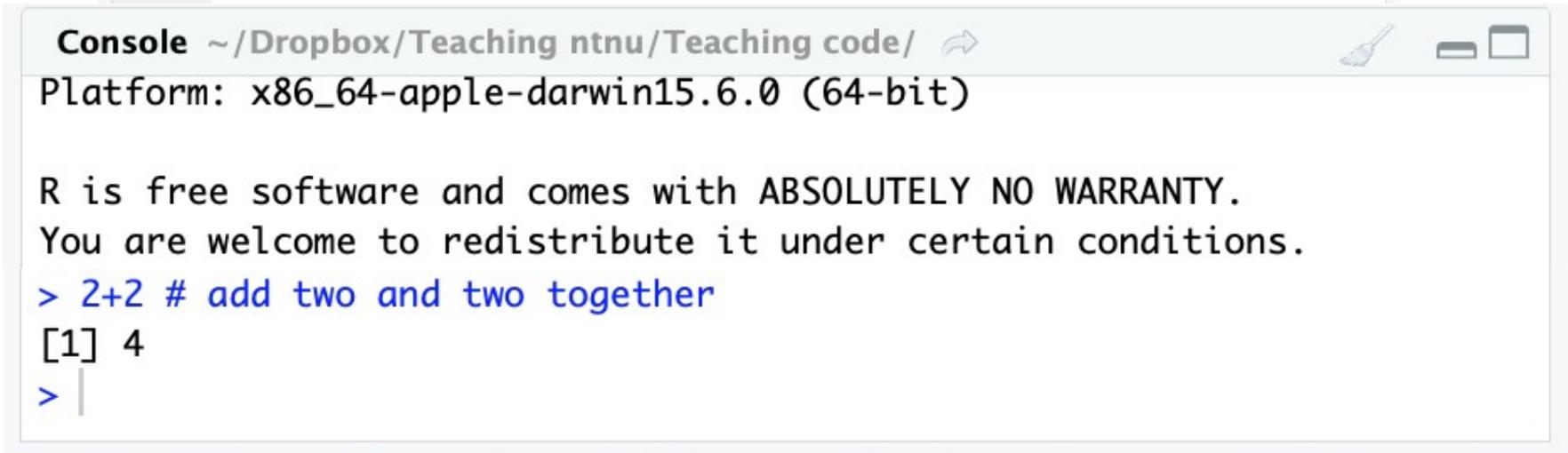
1:31 (Top Level) R Script

Comments

```
# this is a comment
```



The screenshot shows an R script editor window titled "my_script_demo.R*". The editor contains two lines of code: "1 2+2 # add two and two together" and "2". The comment "# add two and two together" is highlighted in green. The editor has a toolbar with icons for navigation, search, and execution.



The screenshot shows an R console window titled "Console ~/Dropbox/Teaching ntnu/Teaching code/". The console output is as follows:

```
Platform: x86_64-apple-darwin15.6.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
> 2+2 # add two and two together
[1] 4
> |
```

Exercise 2: Trying out commands

Work through Part B

We are still here to help! 😊

There are several new words/concepts here but I will explain them afterwards

Key words from exercise 2

Key words from exercise 2

Object

Assign

Functions

Key words from exercise 2

Object

Assign

Functions +

Arguments

Objects

Objects are created when you use **assign** and also created as the output of **functions**

R is object-orientated, so all about objects

Objects

Less formal definition:

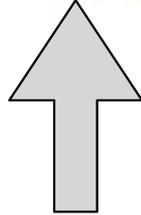
A virtual thing

Formal definition:

Everything in R is an object. Something stored in the memory of the programme with attached value or attributes

Objects

```
x <- 2+2
```



Objects

The screenshot displays the RStudio interface with three main panes:

- Source Editor:** Contains a script named `my_script_demo.R` with the following code:

```
1 # this is a comment
2 |
3 2+2 # add two and two together
4 |
5 X <- 2+2
6 |
7 X
8 |
```

The variable `X` on line 7 is highlighted with a black box. A black arrow points from this box down to the console output.
- Console:** Shows the execution of the script. The output includes:

```
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type contributors() for more information and
'citation()' on how to cite R or R packages in publications.
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.
[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData
]
> # this is a comment
>
> 2+2 # add two and two together
[1]
>
> X <- 2+2
>
> X
[1] 4
> |
```
- Environment Pane:** Shows the `Global Environment` with a search bar and a table of values:

Values	
X	4

The bottom pane shows the `Files` pane with a search bar and a list of links for `R Resources` and `RStudio`.

Objects

The image shows the RStudio interface with a script editor on the left and an environment pane on the right. The script editor contains the following code:

```
1 # this is a comment
2 |
3 2+2 # add two and two together
4 |
5 X <- 2+2
6 |
7 X
8 |
```

The environment pane on the right shows the Global Environment with the following values:

Variable	Value
X	4

The console on the left shows the output of the code execution:

```
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

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.

[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData
]
> # this is a comment
> |
> 2+2 # add two and two together
[1] 4
> |
> X <- 2+2
> |
> X
[1] 4
> |
```

A black box highlights the variable 'X' in the script editor at line 7. A black arrow points from this box to a black box in the console that highlights the output of the command 'X', which is '[1] 4'. Another black box highlights the environment pane, which shows the variable 'X' with the value '4'.

Rules for objects

Cannot begin with a number e.g. 1object

Case sensitive e.g. case Case

Cannot be a fundamental function e.g. mean

Assign/assigning

Assign/assigning

Stores values as a name in R

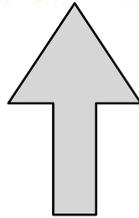
Creates objects

Use = or <-

Assign

2+2

x <- 2+2



Functions

Stored code that takes an input and gives an output

Functions

Stores code that takes an input and gives an output

- Very useful for repeated processes
- Can make our own or use others
- Always outputs **objects**
- Use **arguments**

Functions

Examples of functions:

`sqrt()` # takes square root

`log()` # takes log

`exp()` # takes exponent

`c()` # combines values into something called a vector

`seq()` # creates a sequence of numbers

`mean()` # takes mean

Arguments

The input to a function

They are given to the function, which does something with them

Arguments

The input to a function

They are given to the function, which does something with them

E.g.

`sqrt(x)` # takes square root of x

Arguments

The input to a function

They are given to the function, which does something with them

E.g.

`sqrt(x)` # takes square root of x



Examples

```
W_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)
```

Examples

```
W_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)
```



Function

Examples

```
W_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)
```

Arguments

Function

Examples

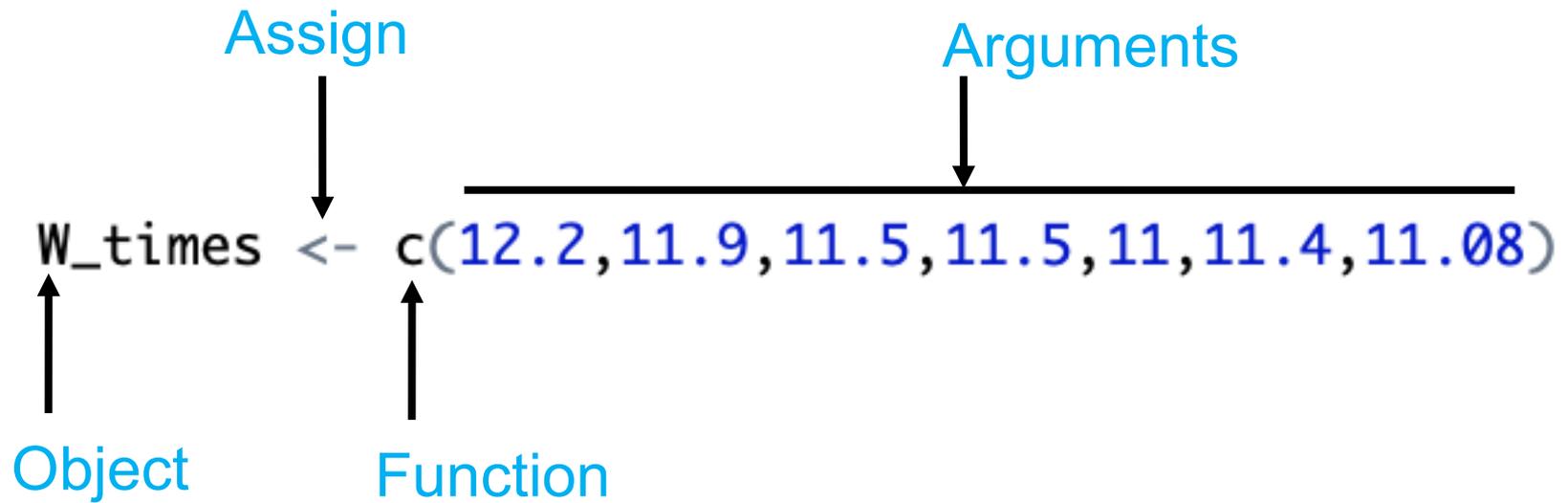
W_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)

Assign

Arguments

Function

Examples



Summary

What is R and why do we use it?

Downloading R and RStudio

Basics of using R

Objects, assigning, and functions

Summary

What is R and why do we use it?

Open source statistical programming language

Free and flexible!

Downloading R and RStudio

Should be done

Basics of using R

Looked at **scripts**, **comments**, console, running

Objects, assigning, and functions

Looked at how to assign objects and how to use functions

How to learn more about R



How to learn more about R



Search for and ask for help!

Google is great resource

Help files in RStudio

CRAN (where you download R)

Ask us

How to learn more about R



Search for and ask for help!

Google is great resource

Help files in RStudio

CRAN (where you download R)

Ask us

None of us have memorised it all!

How to learn more about R



<https://digit.ntnu.no/courses/course-v1:NTNU+IMF001+2020/course/>

-
Nice R course that can follow on from the tutorial for this course