

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?

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

Object

Assign

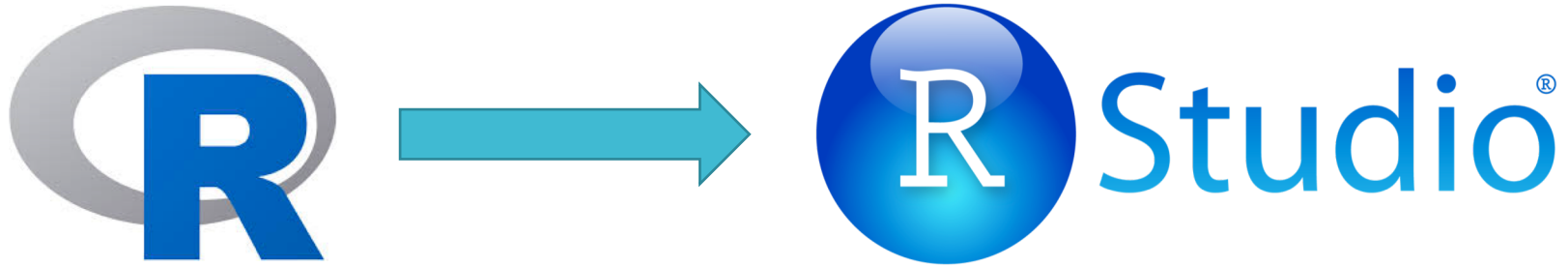
Function

Argument

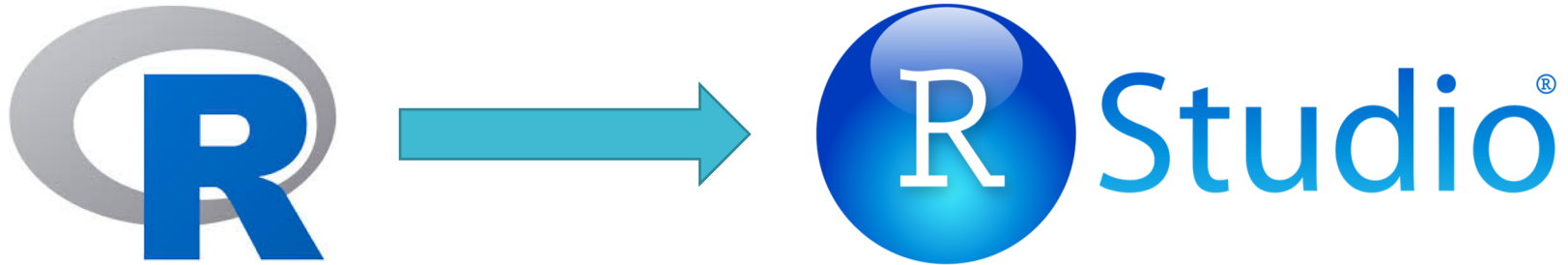
How to use R



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/ST2304/2020v/RIntro/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 source editor with a file named `my_script_demo.R` containing 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 RStudio help page. It includes sections for "R Resources" and "RStudio" with various links, as well as "Manuals" and "Reference" sections.

Using RStudio

The screenshot displays the RStudio interface with four main panes:

- Script Editor (Top Left):** Shows a file named `my_script_demo.R` with a single line of code: `1`. The status bar indicates `1:1 (Top Level) R Script`.
- Environment Pane (Top Right):** Titled "Teaching code", it shows the "Global Environment" which is currently empty, with the message "Environment is empty".
- Console (Bottom Left):** Displays the R startup output:

```
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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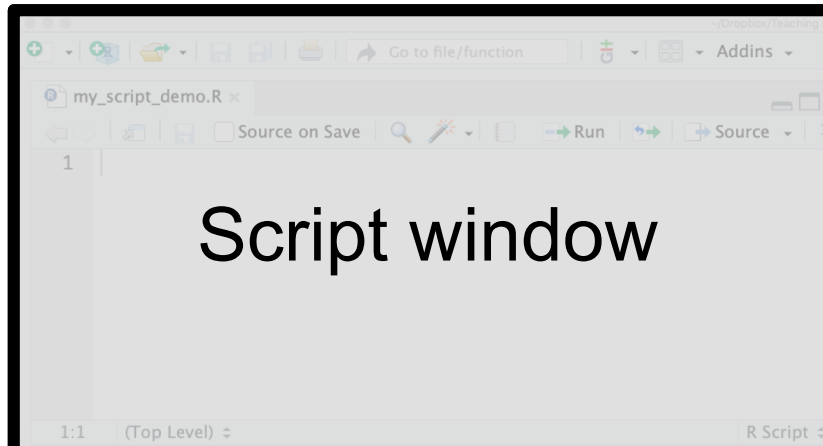
Natural language support but running in an English locale

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

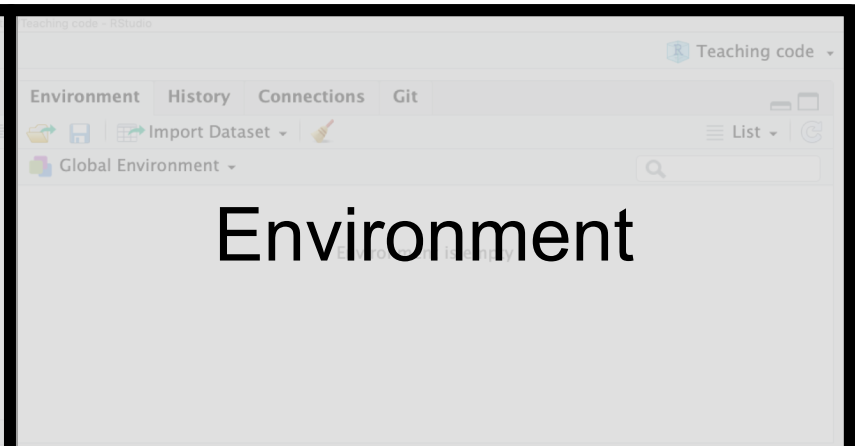
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData]
> |
```
- Help Viewer (Bottom Right):** Shows the "R Resources" page with the following links:
 - 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:**

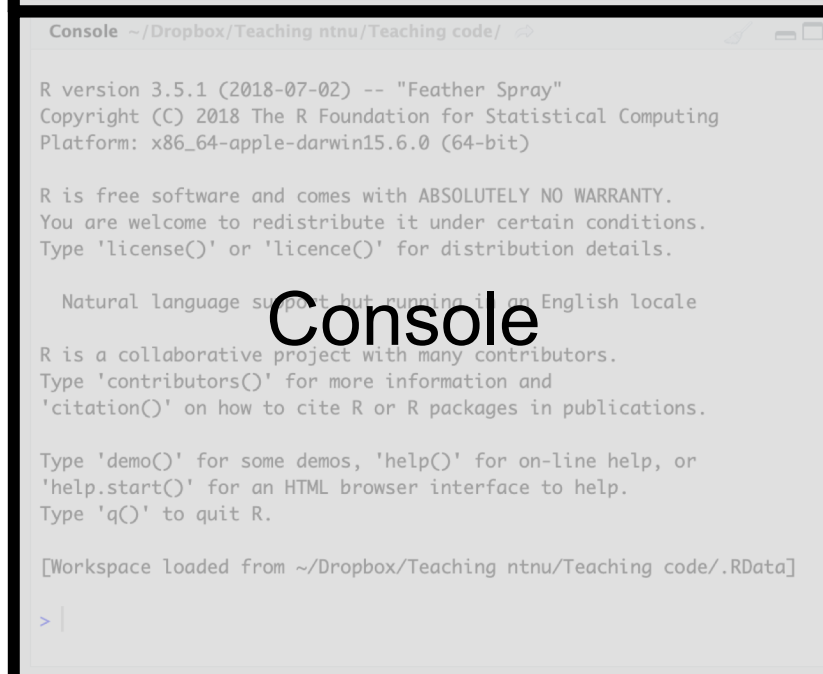
Using RStudio



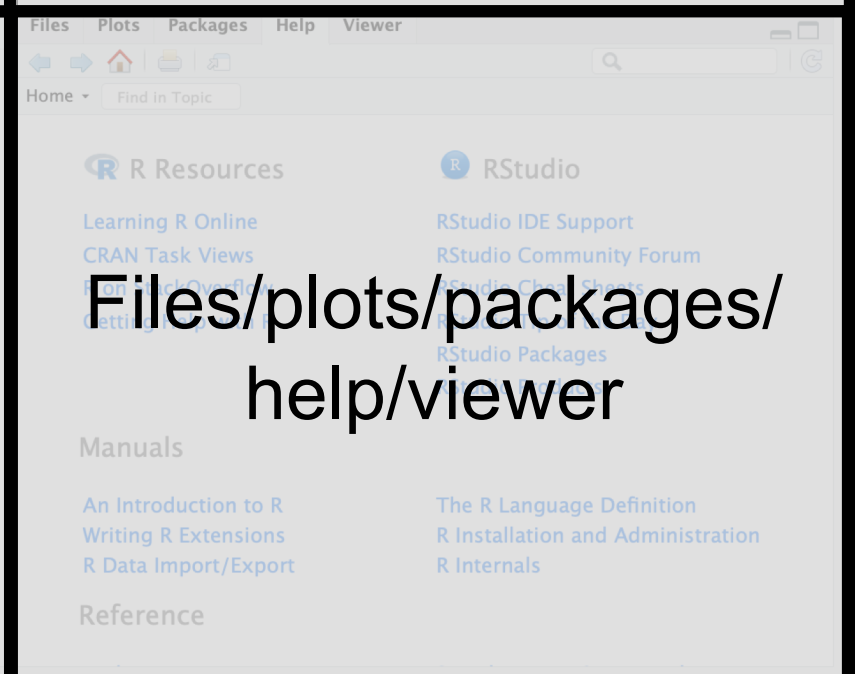
Script window



Environment



Console



Files/plots/packages/
help/viewer

Using RStudio

The screenshot displays the RStudio interface with four main panes:

- Editor:** 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 the message "Environment is empty".
- Console:** 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
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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]
> |
```
- Viewer:** Shows a search page for R resources and RStudio support, including links for [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 Packages](#), [RStudio Products](#), [Manuals](#), [An Introduction to R](#), [Writing R Extensions](#), [R Data Import/Export](#), [The R Language Definition](#), [R Installation and Administration](#), and [R Internals](#).

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 quadrants. The top-left quadrant shows the script editor window with the text "Script window" overlaid. The top-right quadrant shows the Environment pane, which is currently empty. The bottom-left quadrant shows the Console pane with the R startup message and workspace information. The bottom-right quadrant shows the Viewer pane displaying the RStudio website's resource page.

Script window

my_script_demo.R

1

1:1 (Top Level) R Script

Environment History Connections Git

Global Environment

Environment is empty

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)

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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.

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

Files Plots Packages Help Viewer

Home Find in Topic

R Resources

- [Learning R Online](#)
- [CRAN Task Views](#)
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RStudio

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Manuals

- [An Introduction to R](#)
- [Writing R Extensions](#)
- [R Data Import/Export](#)
- [The R Language Definition](#)
- [R Installation and Administration](#)
- [R Internals](#)

Reference

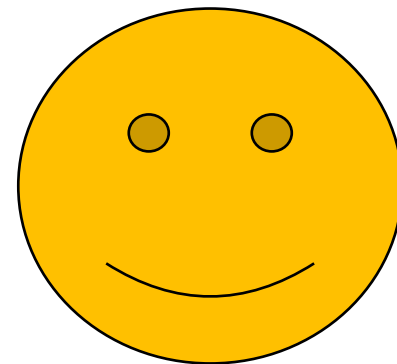
Why use scripts?

You can save your code

Easier to change the code

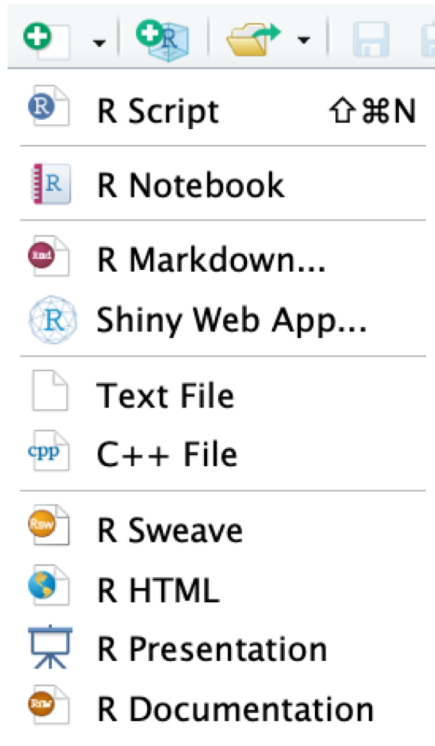
Easier to repeat analyses

You can use **comments**



Basics of an R script

To open a new script

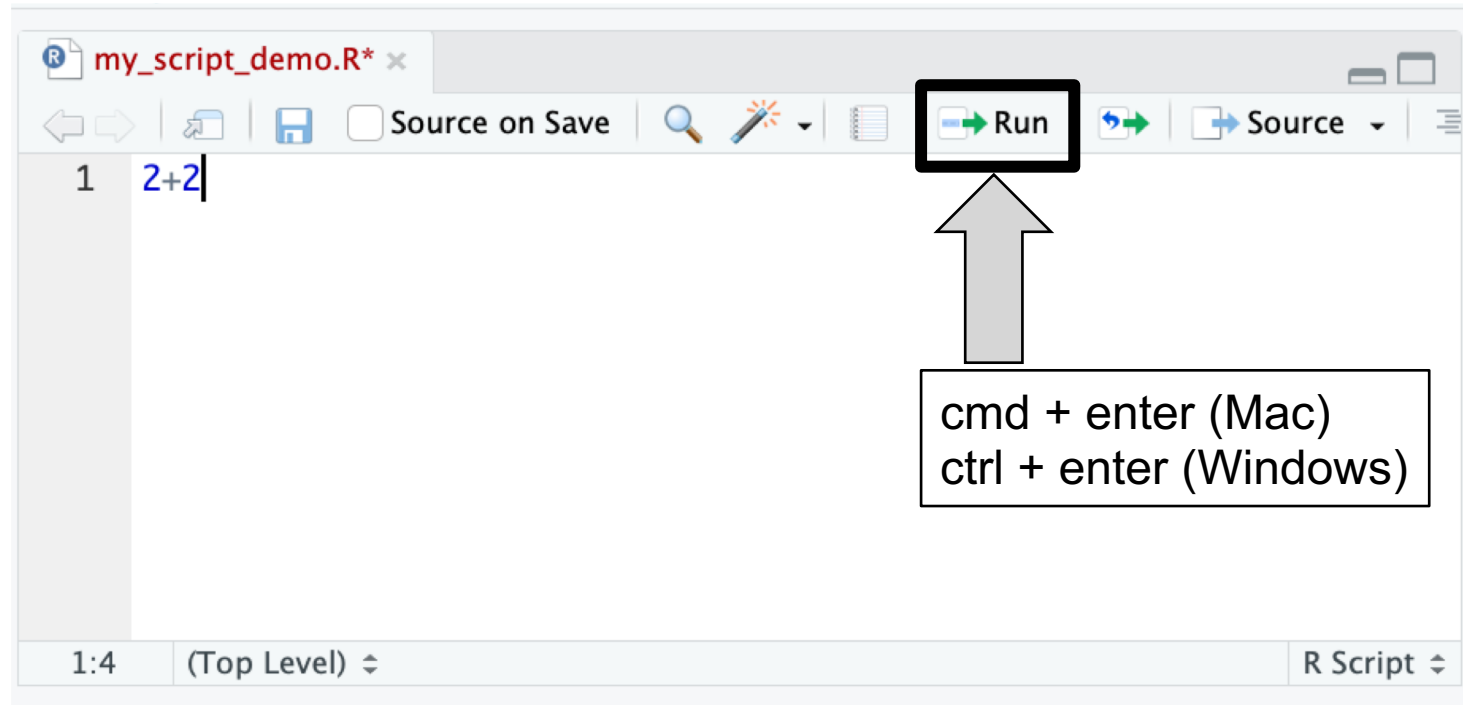


Basics of an R script

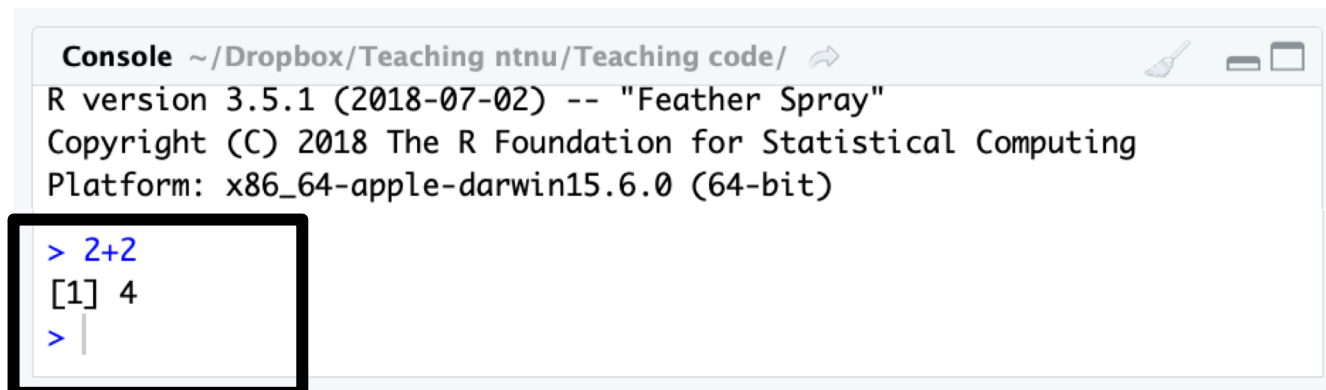
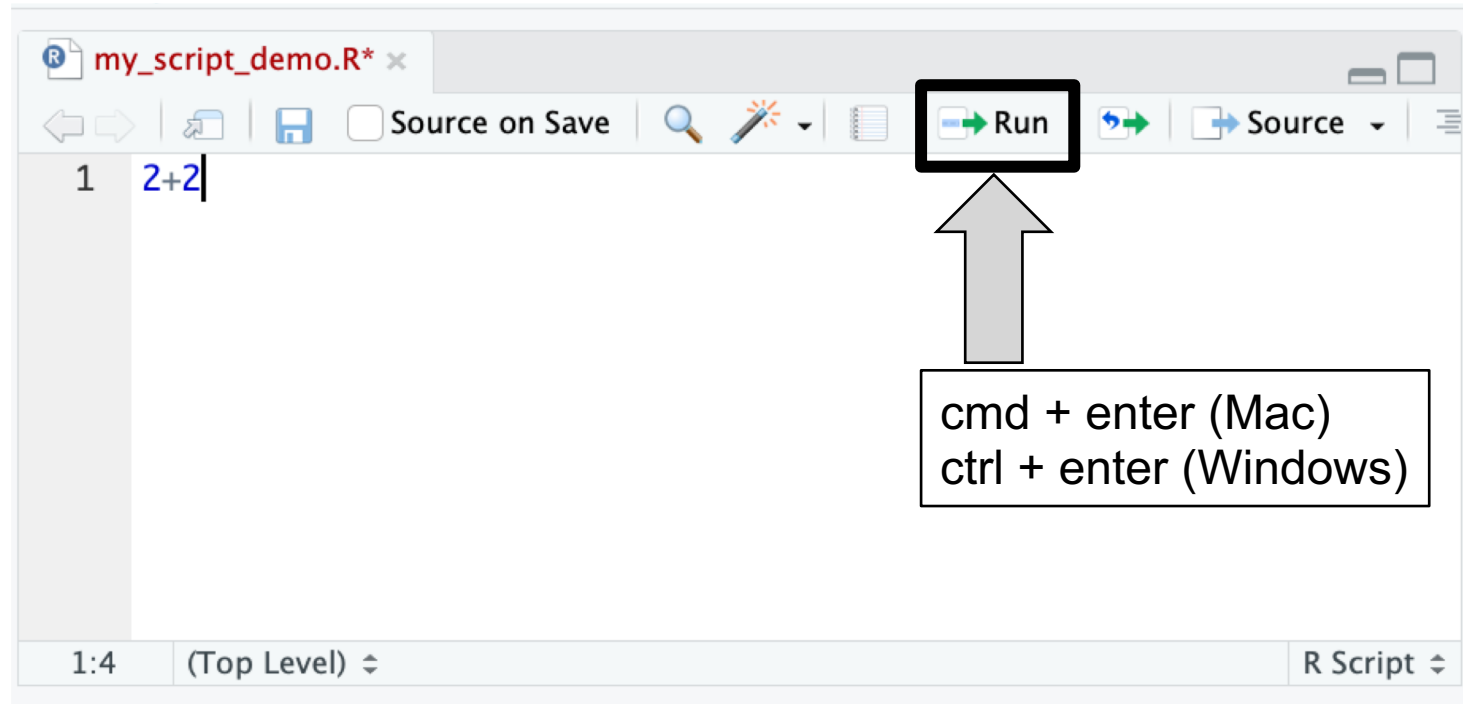
The image shows a screenshot of an R script editor window. The window title is "my_script_demo.R* x". The toolbar includes icons for navigation, saving, and running. The main editing area contains a single line of code: "1 2+2|". The status bar at the bottom shows "1:4 (Top Level) ↕" and "R Script ↕".

```
1 2+2|
```

Basics of an R script



Basics of an R script



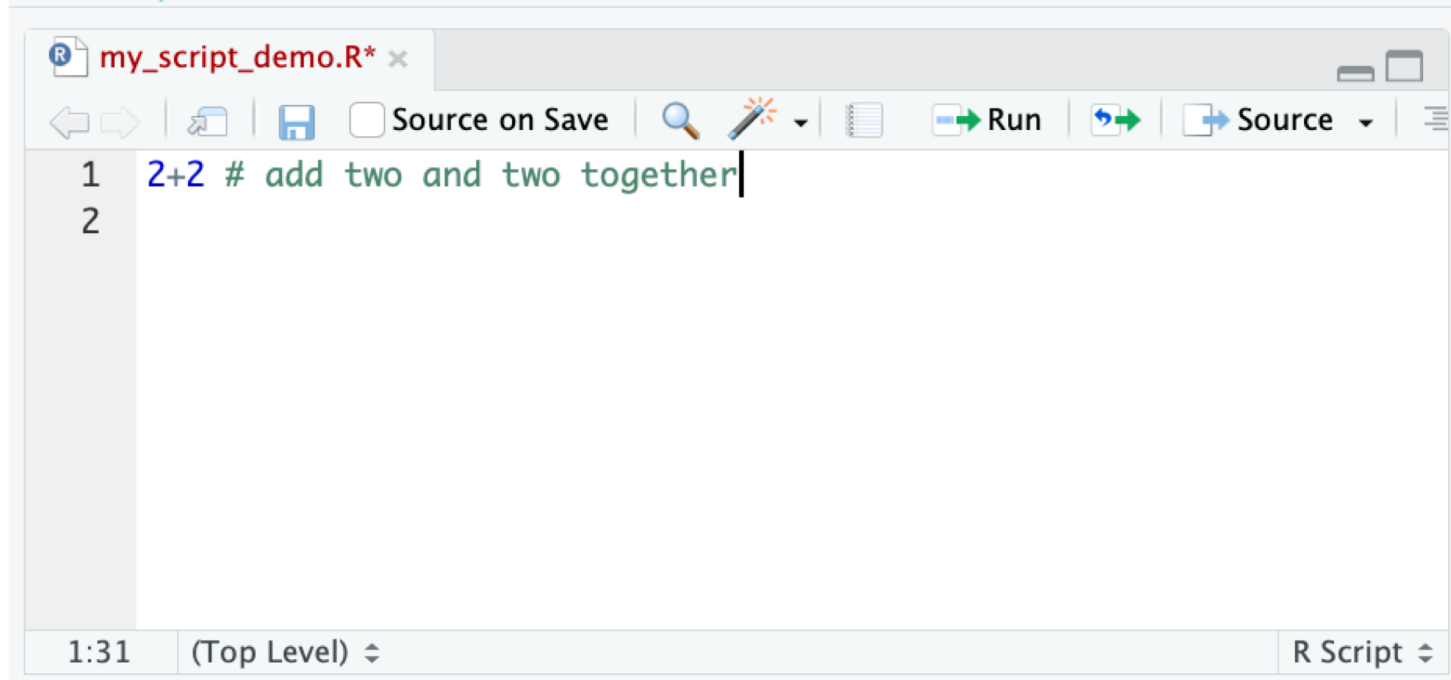
Comments

Comments

```
# this is a comment
```


Comments

```
# this is a comment
```



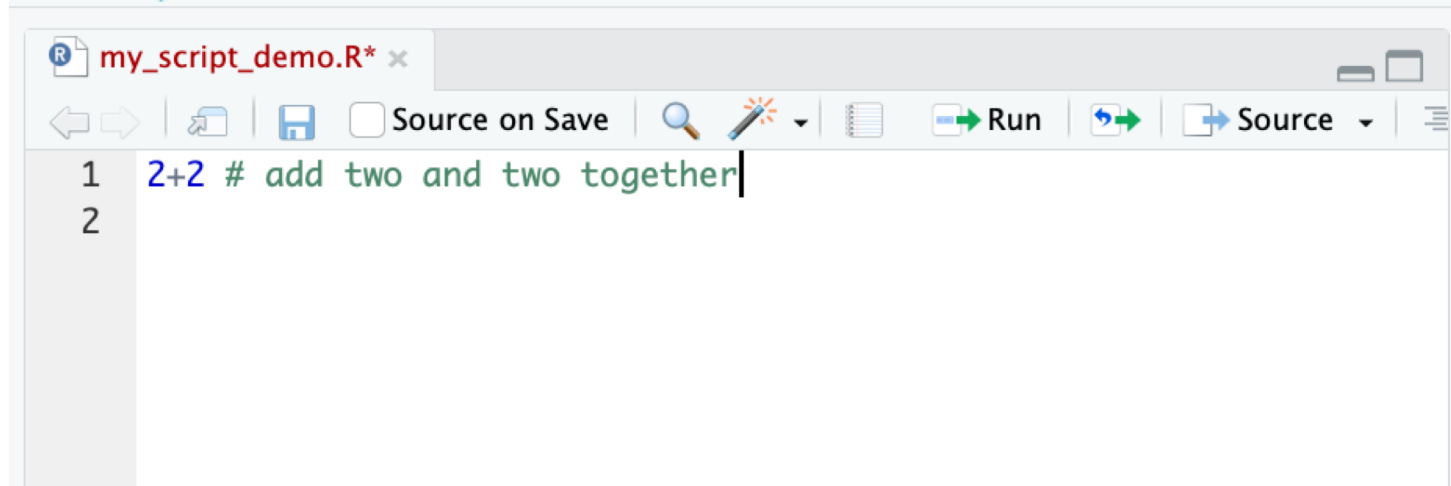
The screenshot shows an R script editor window titled "my_script_demo.R*". The window has a toolbar with icons for navigation, search, and execution. The main editing area contains two lines of code: line 1 is "2+2 # add two and two together" and line 2 is empty. The status bar at the bottom indicates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

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

1:31 (Top Level) R Script

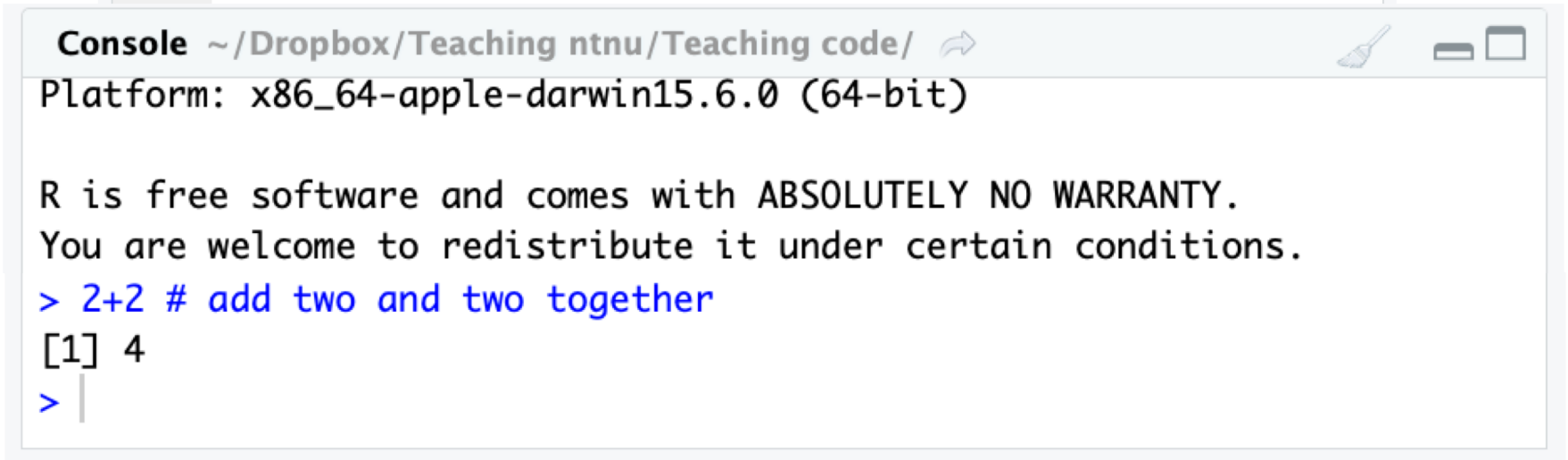
Comments

```
# this is a comment
```



A screenshot of an R script editor window titled "my_script_demo.R*". The window has a toolbar with icons for navigation, saving, and running. The script content is as follows:

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



A screenshot of 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:

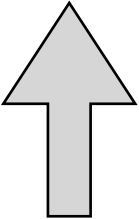
A virtual thing

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 the following components:

- Source Editor:** Contains R code for `my_script_demo.R`. Line 7, `X`, is highlighted with a black box. A black arrow points from this box down to the console output.
- Environment Pane:** Shows the 'Global Environment' with a 'Values' table containing one entry: `X` with value `4`.
- Console:** Shows the execution of the script. The output for `X` is `[1] 4`. A black arrow points from the `X` in the console output up to the `X` in the source editor.
- Files Pane:** Shows a search bar and a list of links under 'R Resources' and 'RStudio'.

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

Environment: Global Environment

Values	
X	4

Console: 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
> |
```

Files Pane: Home | Find in Topic

- R Resources**
 - [Learning R Online](#)
 - [CRAN Task Views](#)
 - [R on StackOverflow](#)
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 - [R Installation and Administration](#)
 - [R Internals](#)
- Reference**
 - [Packages](#)
 - [Search Engine & Keywords](#)

Objects

The image shows the RStudio interface with a script editor, a console, and an environment pane. 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 console shows the output of the code:

```
> # this is a comment
> |
> 2+2 # add two and two together
[1] 4
> |
> X <- 2+2
> |
> X
[1] 4
> |
```

The environment pane shows the following values:

Variable	Value
X	4

A black box highlights the variable 'X' in the script editor, and another black box highlights the output of the 'X' command in the console. A black arrow points from the 'X' in the script editor to the output in the console. The environment pane is also highlighted with a black box.

Rules for objects

Cannot begin with a number e.g. 1object

Case sensitive e.g. case \neq Case

Cannot be a fundamental function e.g. mean

Assign/assigning

Assign/assigning

Stores values as a name in R

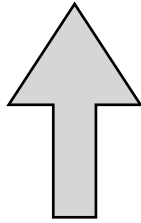
Creates objects

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

Assign

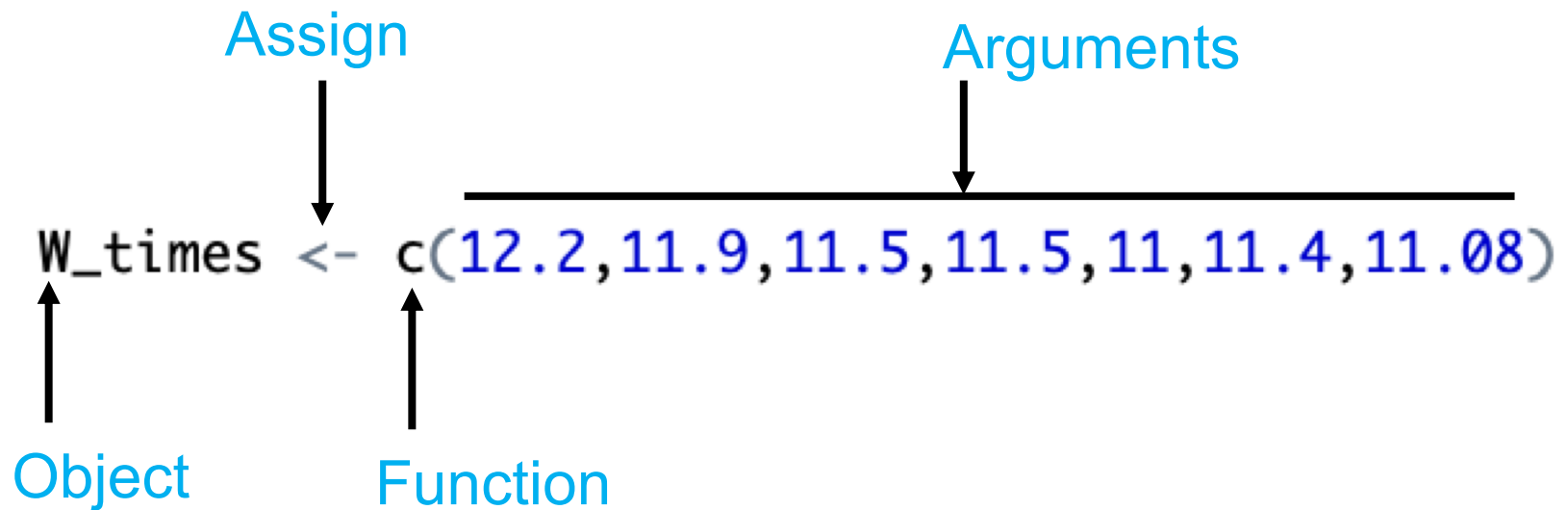
Arguments

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

Function

The diagram illustrates the components of the R code `W_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)`. Three blue labels with black arrows point to specific parts of the code: 'Assign' points to the assignment operator `<-`, 'Arguments' points to the list of numerical values `(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)`, and 'Function' points to the function name `c`. A horizontal black line is drawn above the list of numbers.

Examples



Exercise 3: Using objects and functions in R

Work through Part C

We are still here to help! 😊

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!