

# 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

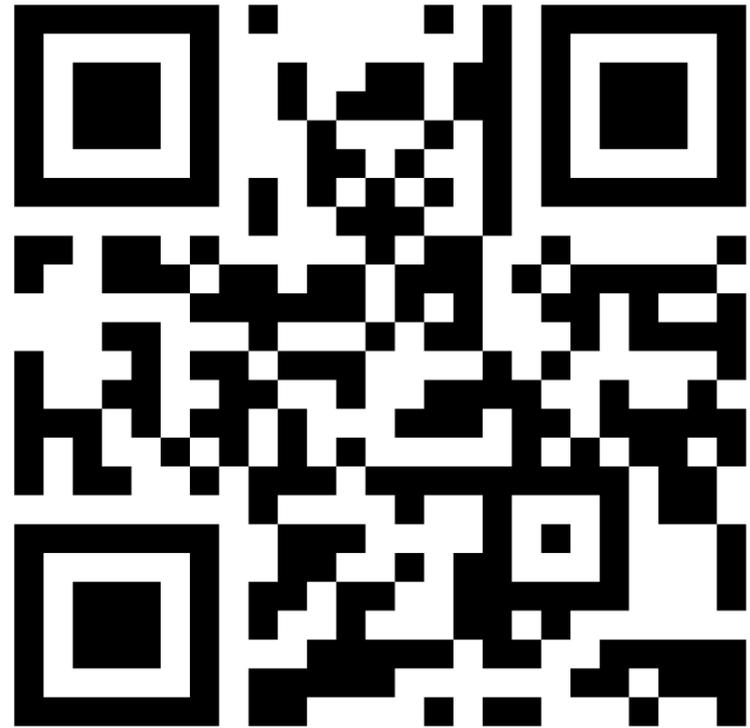
# What is R and why do we use it?



# 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**

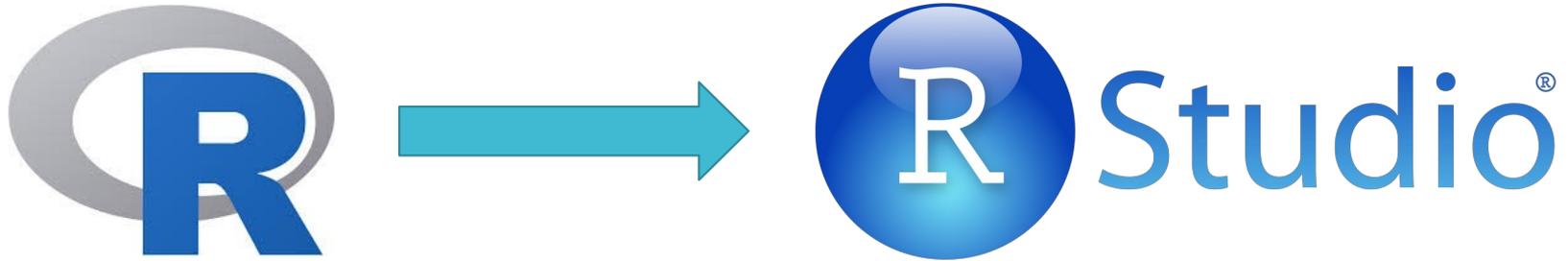
**Argument**

**Object**

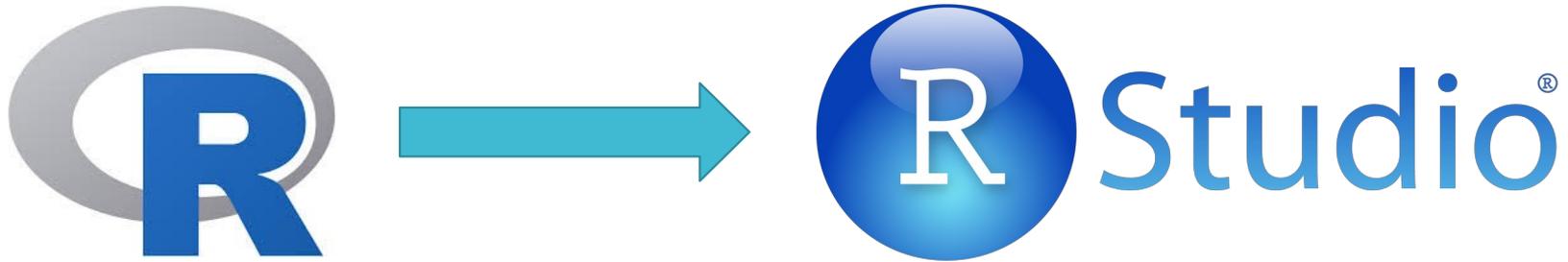
# How to use R



# 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 a list of resources and manuals:

- 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

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: `R version 3.5.1 (2018-07-02) -- "Feather Spray"`, copyright notice, and platform details. It also shows the license text: "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." and other helpful messages like "Natural language support but running in an English locale" and "R is a collaborative project with many contributors." The prompt `>` is visible at the bottom.
- Help Viewer (Bottom Right):** Shows the "R Resources" page with links for "Learning R Online", "CRAN Task Views", "R on StackOverflow", and "Getting Help with R". It also lists "RStudio" resources such as "RStudio IDE Support", "RStudio Community Forum", "RStudio Cheat Sheets", "RStudio Tip of the Day", "RStudio Packages", and "RStudio Products". A "Manuals" section includes "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 present.

# 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 (line 1) and a toolbar with options like `Source on Save`, `Run`, and `Source`.
- Environment:** Shows the `Global Environment` and tabs for `Environment`, `History`, `Connections`, and `Git`.
- Console:** Displays the R version 3.5.1 (2018-07-02) -- "Feather Spray" and copyright information. It also shows the R license text and workspace information: `[Workspace loaded from ~/Dropbox/Teaching ntnu/Teaching code/.RData]`.
- Files/plots/packages/help/viewer:** Shows a sidebar with navigation options: `Files`, `Plots`, `Packages`, `Help`, and `Viewer`. The `Help` panel is active, displaying `R Resources` and `RStudio` sections with links to `Learning R Online`, `CRAN Task Views`, `R on StackOverflow`, `Getting Help with R`, `Manuals`, `Reference`, `RStudio IDE Support`, `RStudio Community Forum`, `RStudio Cheat Sheets`, `RStudio Tip of the Day`, `RStudio Products`, `The R Language Definition`, `R Installation and Administration`, and `R Internals`.

Script window

Environment

Console

Files/plots/  
packages/help/  
viewer

# 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 reading "Console" is overlaid on this pane. The prompt `>` is visible at the bottom.
- Help Viewer (Bottom Right):** Displays the RStudio help page, featuring sections for "R Resources" (including Learning R Online, CRAN Task Views, R on StackOverflow, and Getting Help with R), "RStudio" (including RStudio IDE Support, RStudio Community Forum, RStudio Cheat Sheets, RStudio Tip of the Day, RStudio Packages, and RStudio Products), "Manuals" (including An Introduction to R, Writing R Extensions, R Data Import/Export, The R Language Definition, R Installation and Administration, and R Internals), and "Reference".

# 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`. The pane includes tabs for `Environment`, `History`, `Connections`, and `Git`. Below the tabs are buttons for `Import Dataset` and `List`. The main area contains the text `Environment is empty`.
- Console (bottom-left):** Shows the output of the R session. The title bar indicates the path `~/Dropbox/Teaching ntnu/Teaching code/`. The output includes:

```
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.
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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]
> |
```
- Viewer pane (bottom-right):** Displays a help page with the title `Home` and a search bar. The page 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](#)
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    - [The R Language Definition](#)
    - [R Installation and Administration](#)
    - [R Internals](#)
  - Reference:**

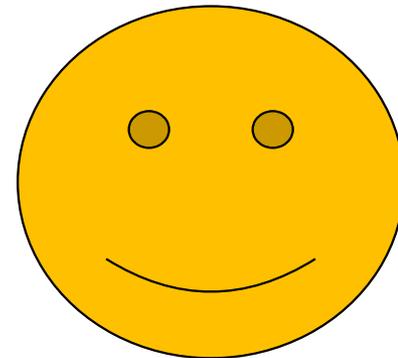
# Why use scripts?

You can save your code

Easier to change the code

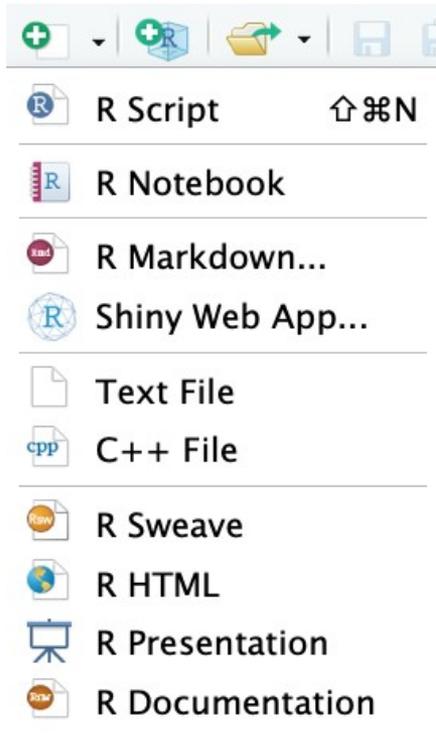
Easier to repeat analyses

You can use **comments**

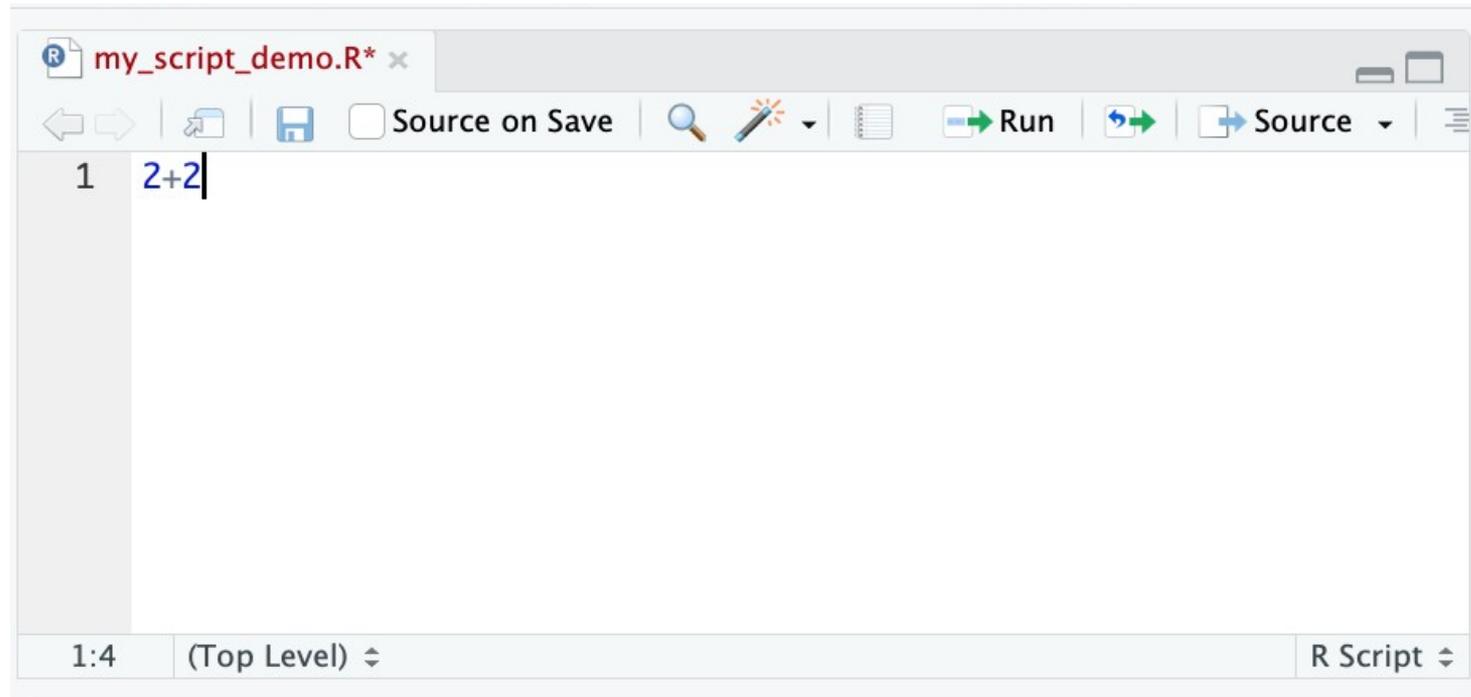


# Basics of an R script

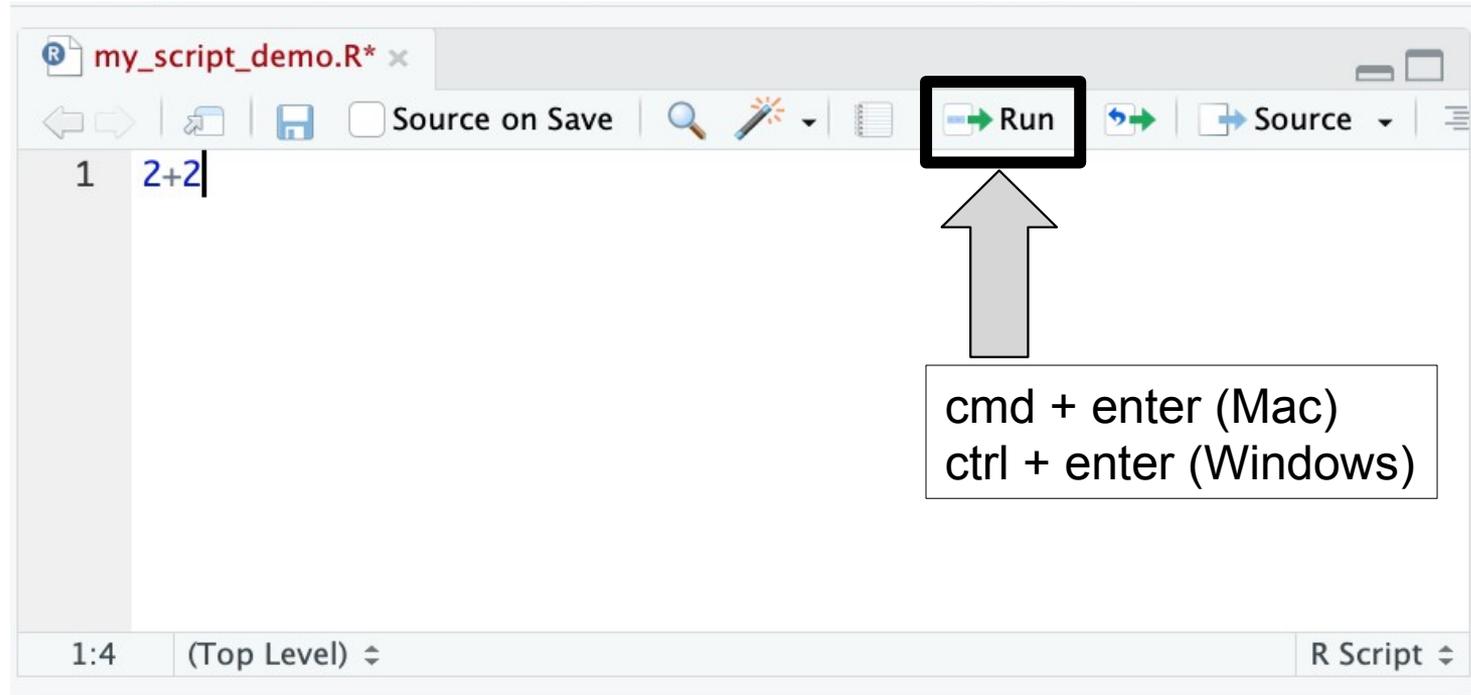
To open a new script



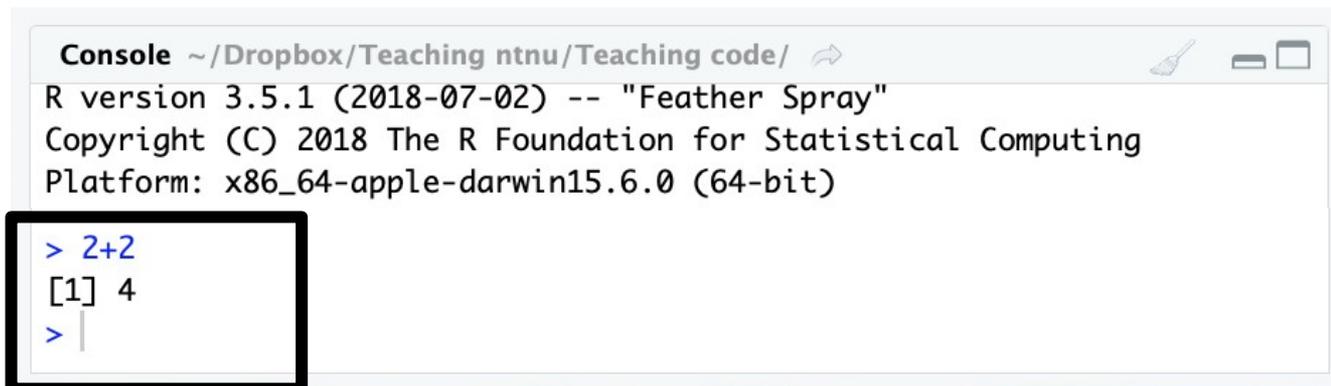
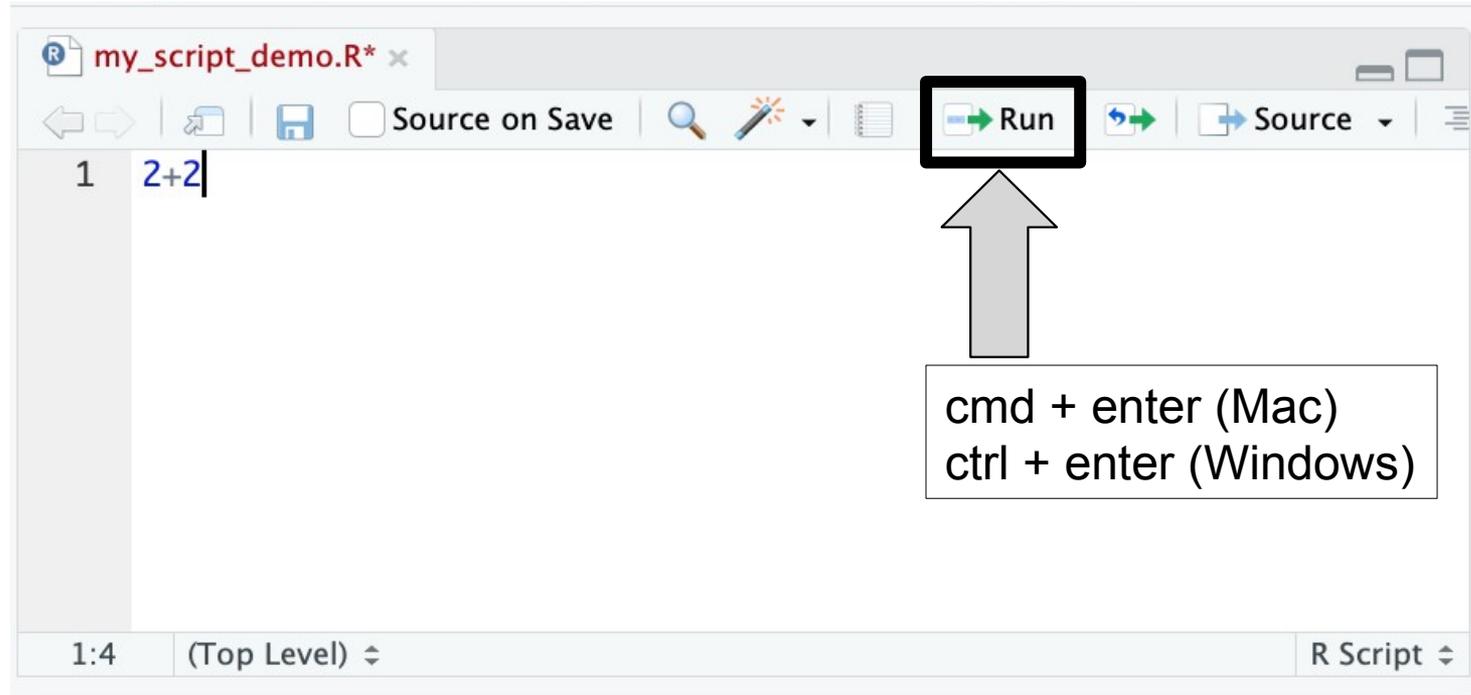
# Basics of an R script



# Basics of an R script



# Basics of an R script



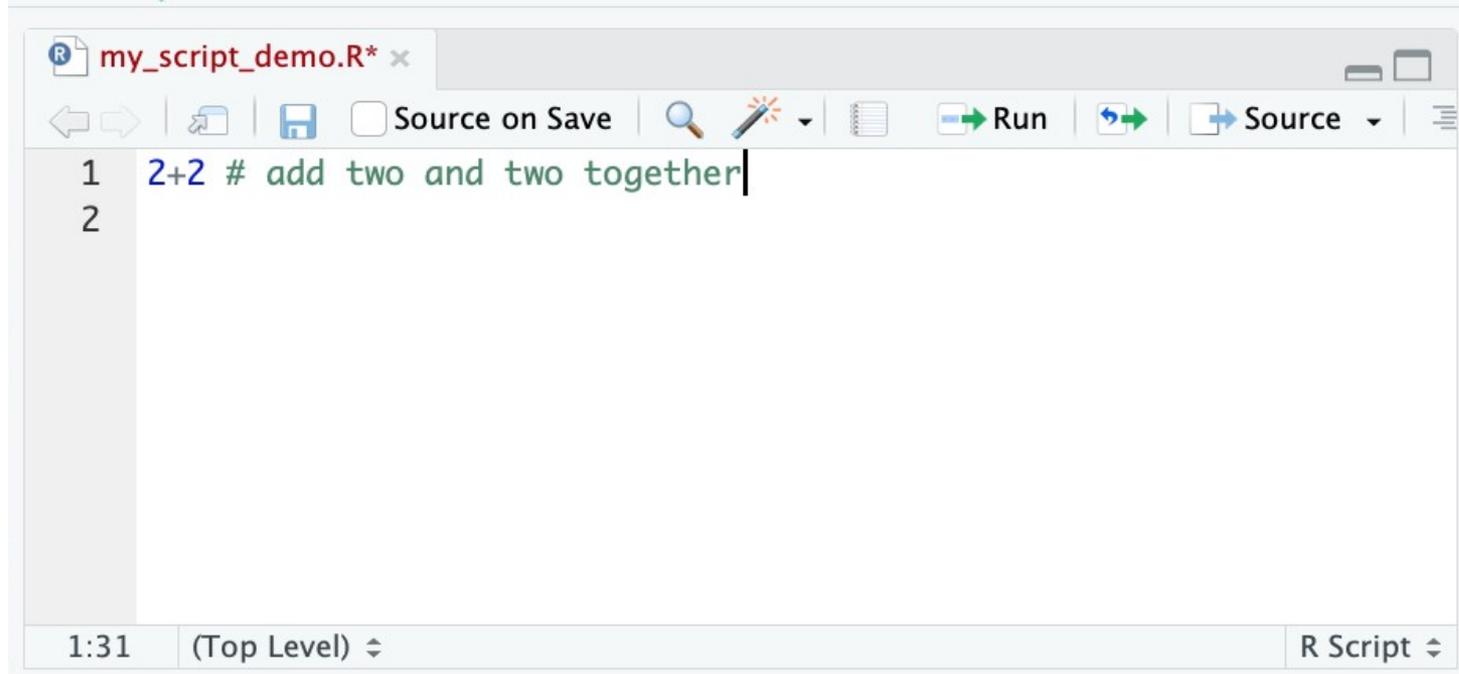
# Comments

# Comments

```
# this is a comment
```

# Comments

```
# this is a comment
```



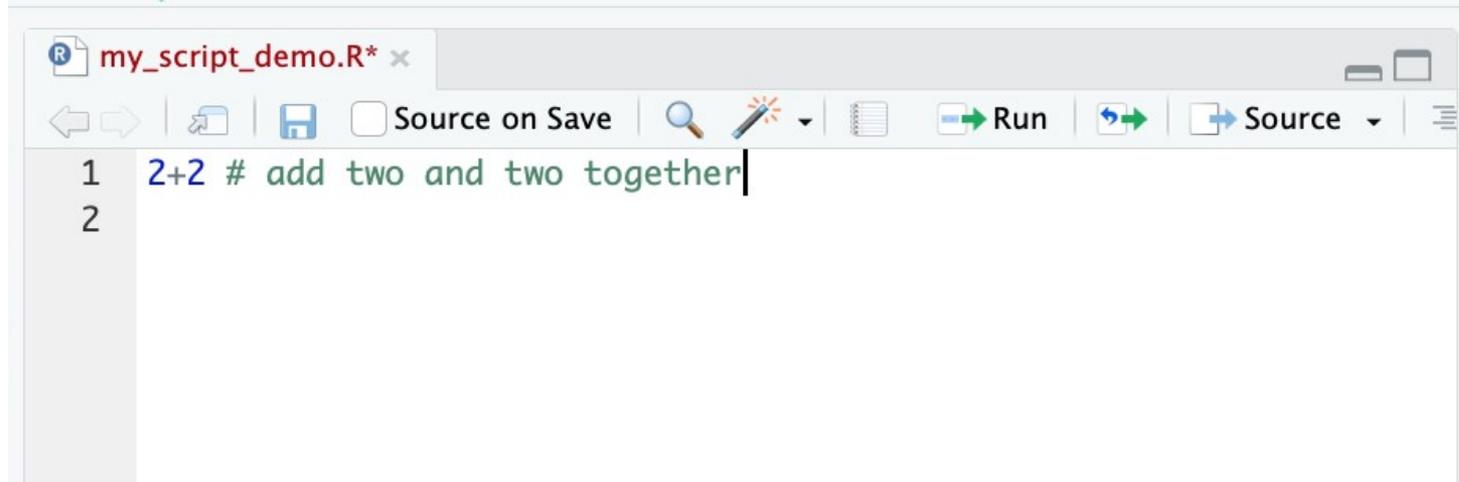
The screenshot shows an R script editor window titled "my\_script\_demo.R\*". The window has a toolbar with icons for navigation, search, and execution. The main editing area contains two lines of code: line 1 is "2+2 # add two and two together" and line 2 is empty. The status bar at the bottom indicates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

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

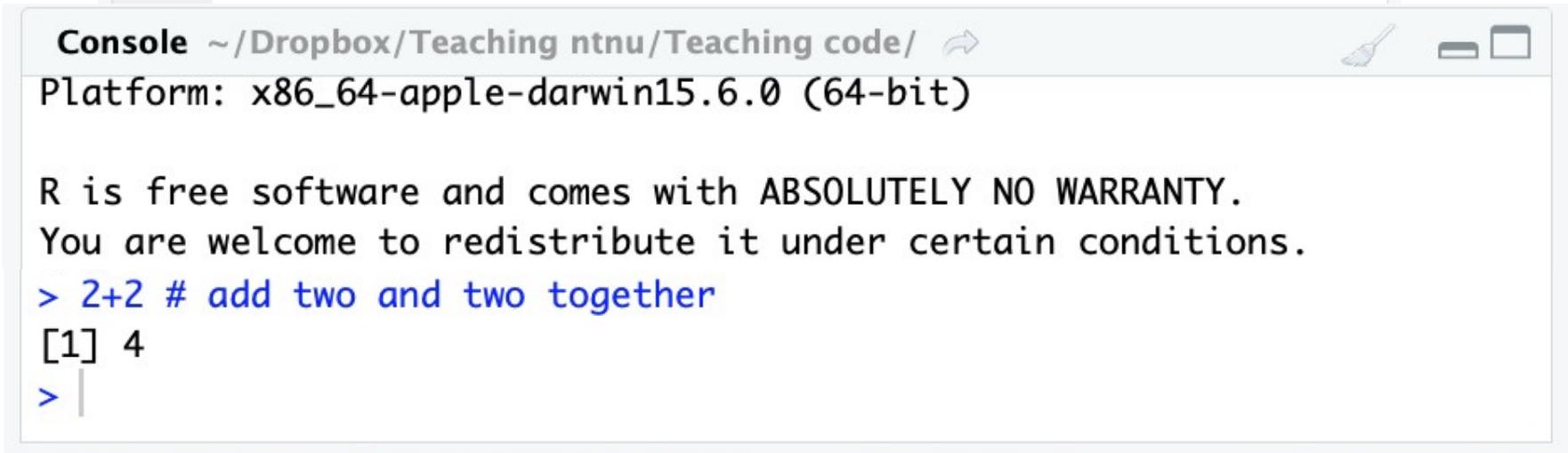
1:31 (Top Level) R Script

# 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:**

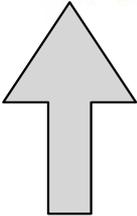
A virtual thing

## **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 the following components:

- Source Editor:** Contains the script `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 |
```
- Environment Pane:** Shows the 'Global Environment' with a search bar and a table of values:

Variable	Value
X	4
- Console:** Shows the execution of the script:

```
> # this is a comment
>
> 2+2 # add two and two together
[1]
>
> X <- 2+2
>
> X
[1] 4
> |
```
- Files Pane:** Shows a search bar and a list of resources:
  - 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:**
    - [Packages](#)
    - [Search Engine & Keywords](#)

# Objects

The image shows a screenshot of the RStudio interface. The top-left pane displays a script file 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.

The bottom-left pane (Console) shows the execution of the script:

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

The output `[1] 4` is highlighted with a black box.

The top-right pane (Environment) shows the Global Environment with the following values:

Variable	Value
X	4

The Environment pane is also highlighted with a black box.

The bottom-right pane (Viewer) displays the RStudio website with various resources and manuals.

# 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

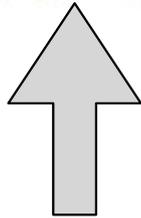
Creates objects

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

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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

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The input to a function

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

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`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

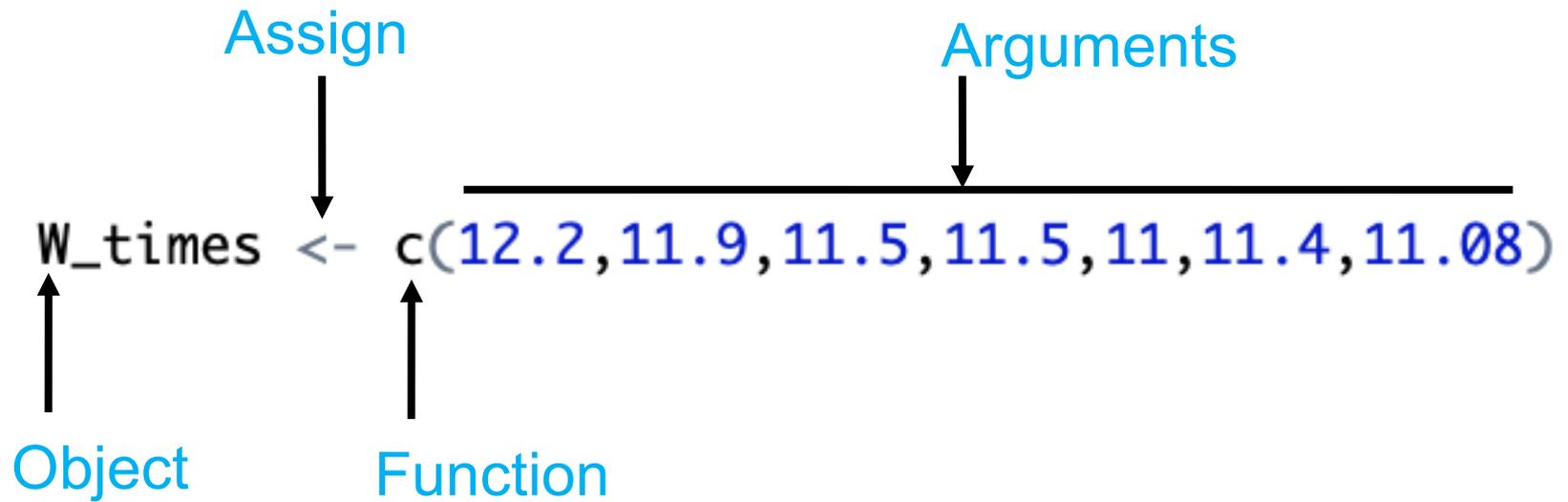
Function

# Examples

W\_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)

The diagram illustrates the components of the R code snippet. The word "Assign" is positioned above the assignment operator "<-" with a downward arrow. The word "Arguments" is positioned above the list of numbers with a downward arrow. The word "Function" is positioned below the opening parenthesis of the vector function "c()" with an upward arrow. A horizontal line is drawn above the list of numbers.

# 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