

# 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?**

Mentimeter

# 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**

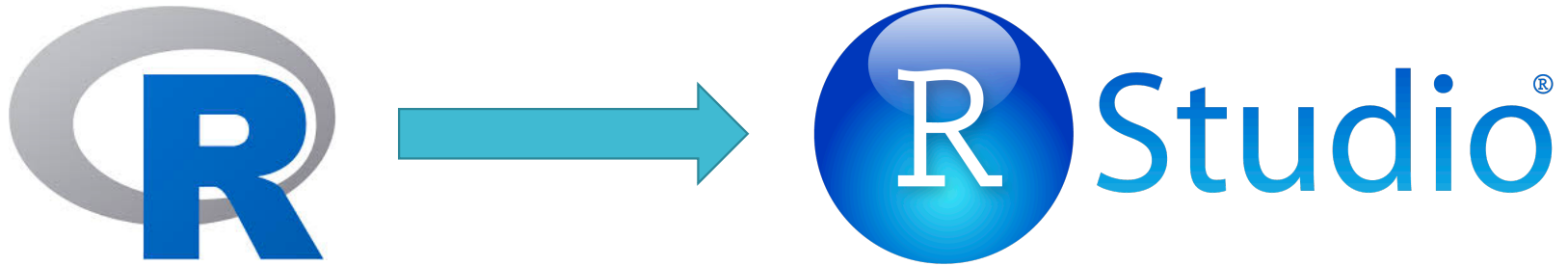
**Function**

**Argument**

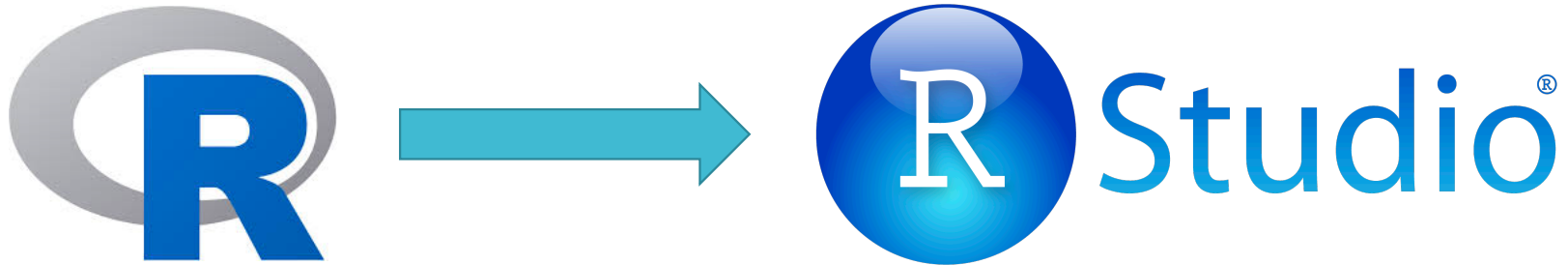
# How to use R



# 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/ST2304/2021v/Week01/R-tutorial.html>

Open the file.

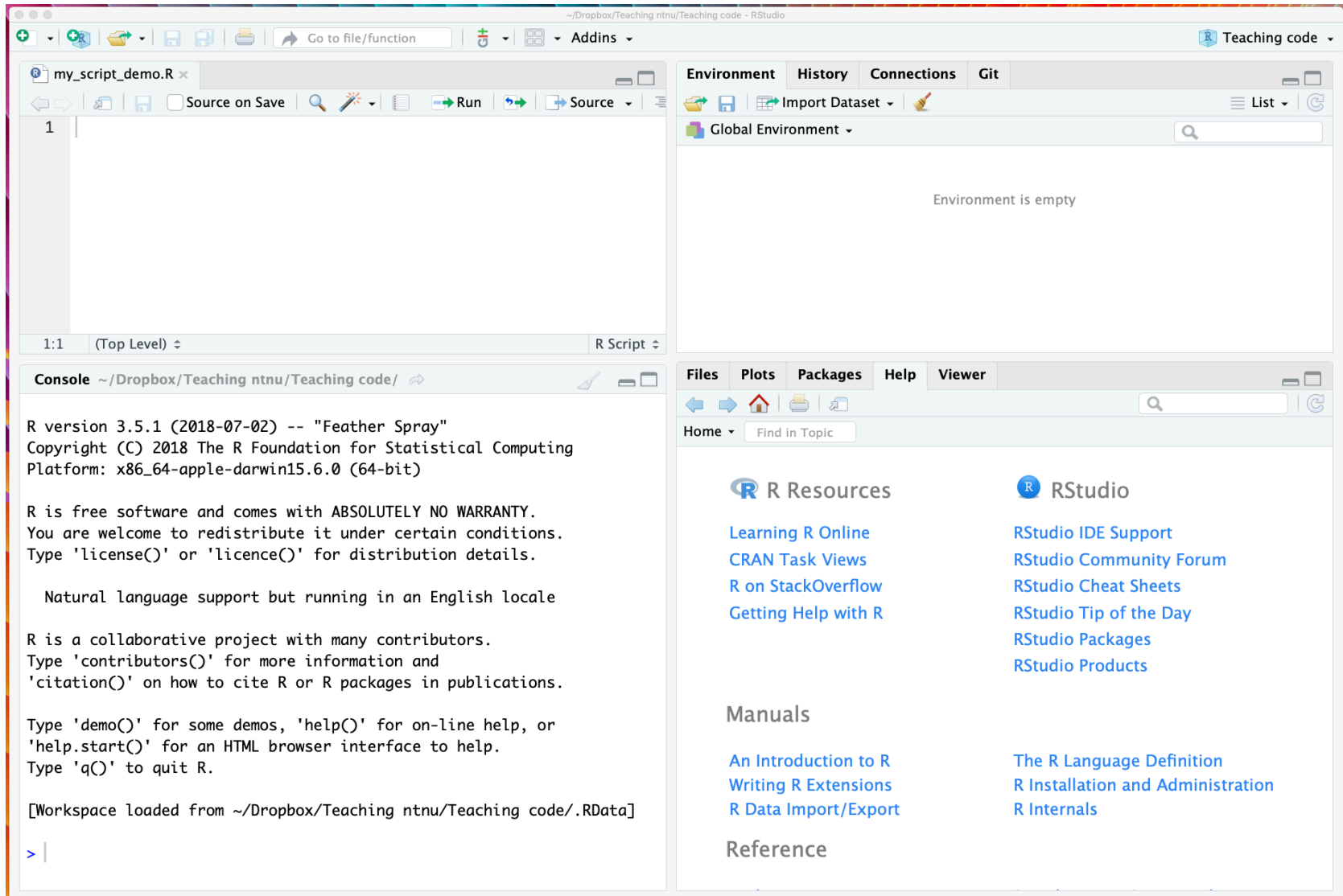
Work through Part A.

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



# Recap

# Using RStudio



# Using RStudio

The screenshot displays the RStudio IDE interface, which is divided into 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 at the bottom indicates `1:1 (Top Level)` and `R Script`.
- Environment Pane (Top Right):** Displays the `Global Environment` with the message "Environment is empty".
- 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)
```

It also displays the R license and usage instructions:

```
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 prompt `>` is visible at the bottom.
- Help Pane (Bottom Right):** Displays the `R Resources` and `RStudio` sections. The `R Resources` section includes links to [Learning R Online](#), [CRAN Task Views](#), [R on StackOverflow](#), and [Getting Help with R](#). The `RStudio` section includes links to [RStudio IDE Support](#), [RStudio Community Forum](#), [RStudio Cheat Sheets](#), [RStudio Tip of the Day](#), [RStudio Packages](#), and [RStudio Products](#). The `Manuals` section includes links to [An Introduction to R](#), [Writing R Extensions](#), [R Data Import/Export](#), [The R Language Definition](#), [R Installation and Administration](#), and [R Internals](#). The `Reference` section is also visible.

# Using RStudio



Script window



Environment



Console



Files/plots/packages/  
help/viewer

# Using RStudio

The screenshot displays the RStudio IDE interface, which is divided into four main panes:

- Source Pane (Top Left):** Shows the R script file `my_script_demo.R` with a line number 1. The status bar at the bottom indicates the cursor is at line 1:1, column 1, in the "Top Level" environment.
- Environment Pane (Top Right):** Displays the "Global Environment" with a search bar and the message "Environment is empty".
- Console Pane (Bottom Left):** Shows the R version 3.5.1 (2018-07-02) -- "Feather Spray" and the copyright notice for the R Foundation. It also displays the R license text and instructions for using the console. The word "Console" is overlaid in large text. The console output shows the workspace loaded from `~/Dropbox/Teaching ntnu/Teaching code/.RData`.
- Files/Plots/Packages/Help/Viewer Pane (Bottom Right):** Displays the "R Resources" section, including links to "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". The "Manuals" section includes links to "An Introduction to R", "Writing R Extensions", "R Data Import/Export", "The R Language Definition", "R Installation and Administration", and "R Internals". The "Reference" section is also visible.

# 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 screenshot displays the RStudio IDE interface. The top-left pane is the **Script window**, showing a file named `my_script_demo.R` with the text "Script window" and a line number 1. The top-right pane is the **Environment** pane, showing "Global Environment" and "Environment is empty". The bottom-left pane is the **Console**, showing the R version 3.5.1 (2018-07-02) -- "Feather Spray" and copyright information. The bottom-right pane is the **Files** pane, showing a list of resources and manuals.

**Script window**

my\_script\_demo.R

1

Script window

1:1 (Top Level) R Script

**Environment** History Connections Git

Import Dataset

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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'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](#)
- [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**

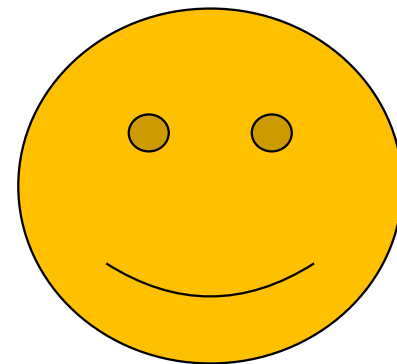
# Why use **scripts**?

You can save your code

Easier to change the code

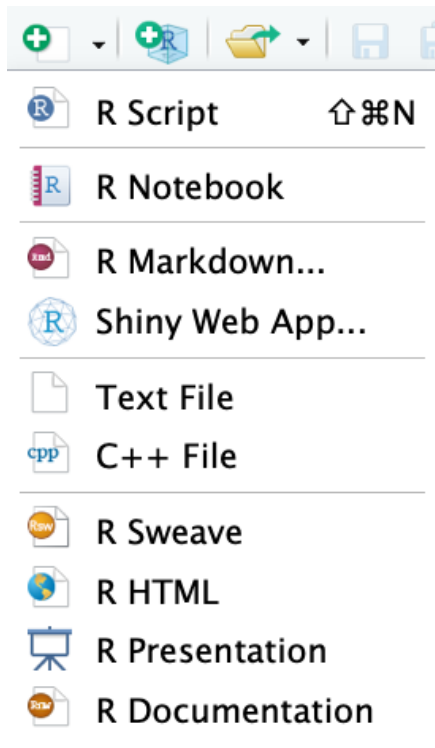
Easier to repeat analyses

You can use **comments**

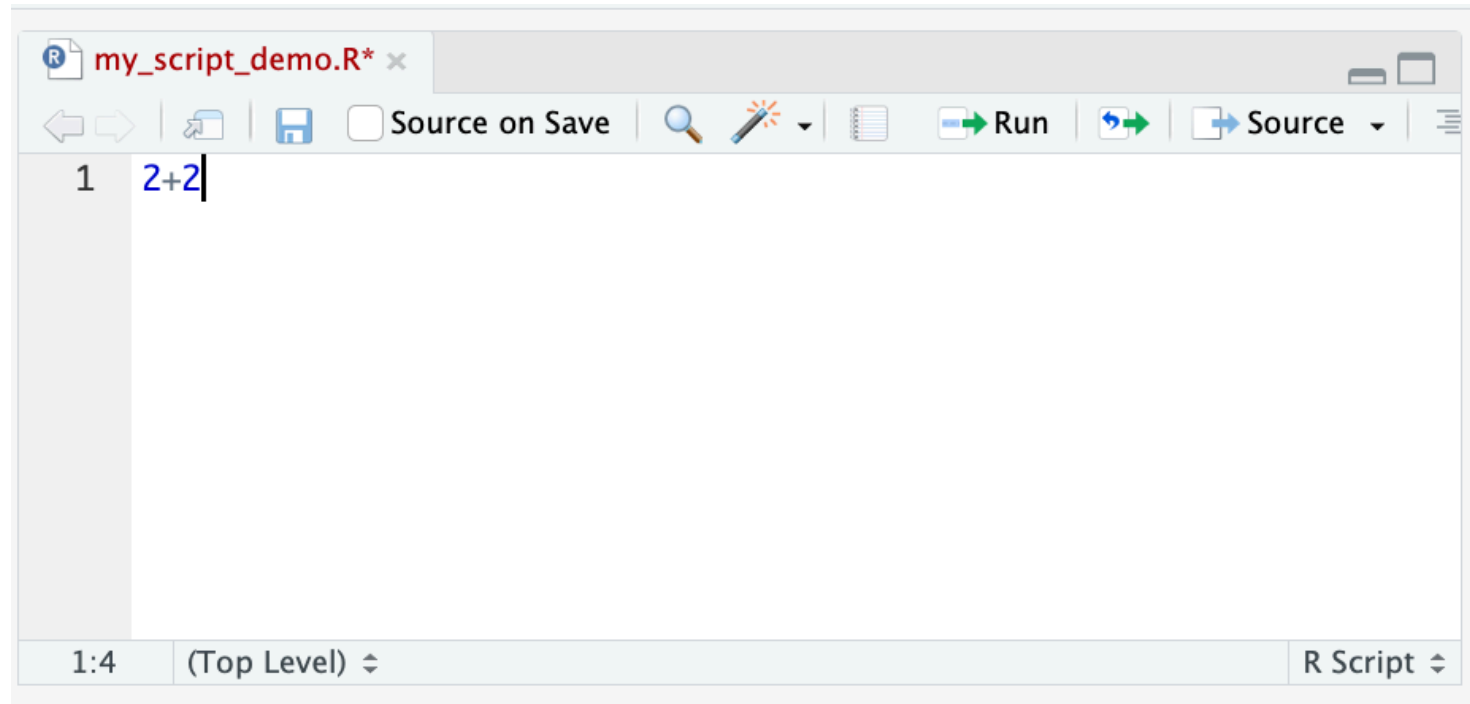


# Basics of an R script

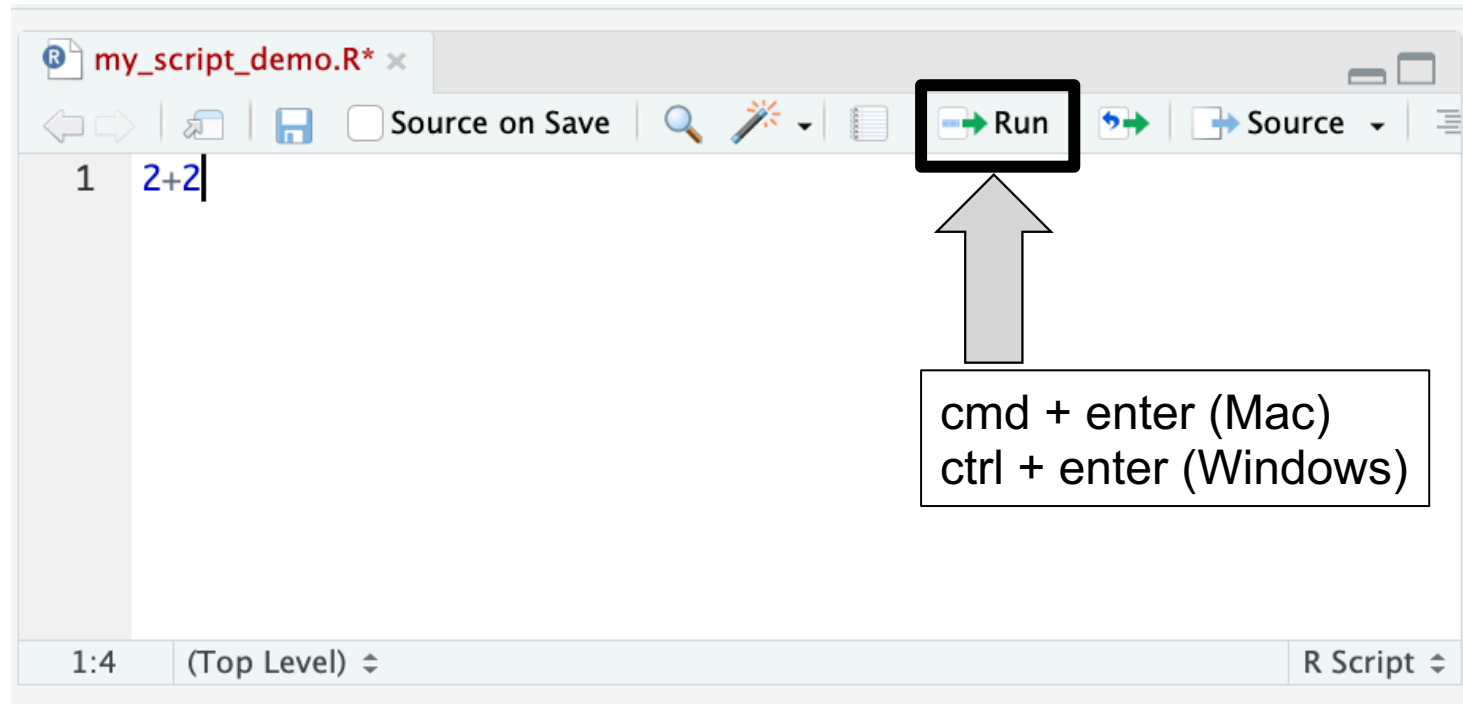
To open a new script



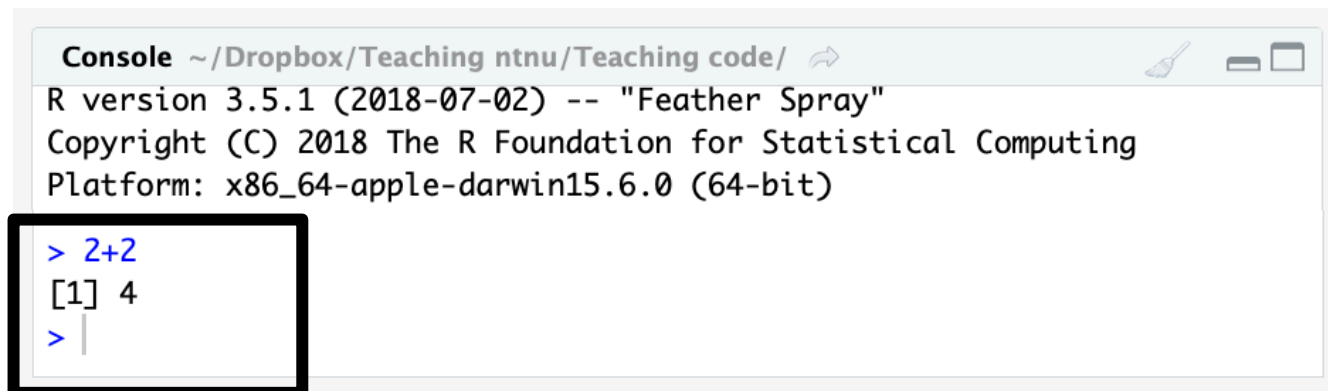
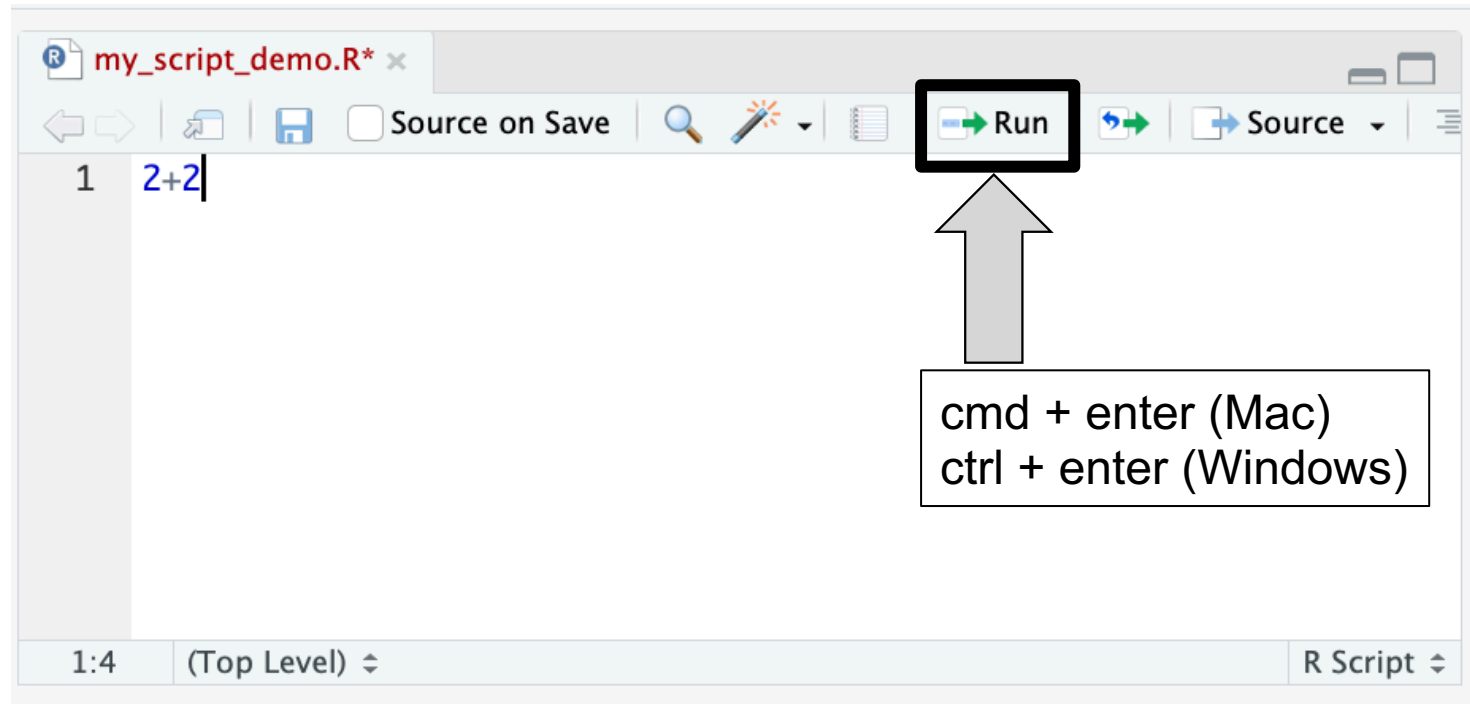
# Basics of an R script



# Basics of an R script



# Basics of an R script



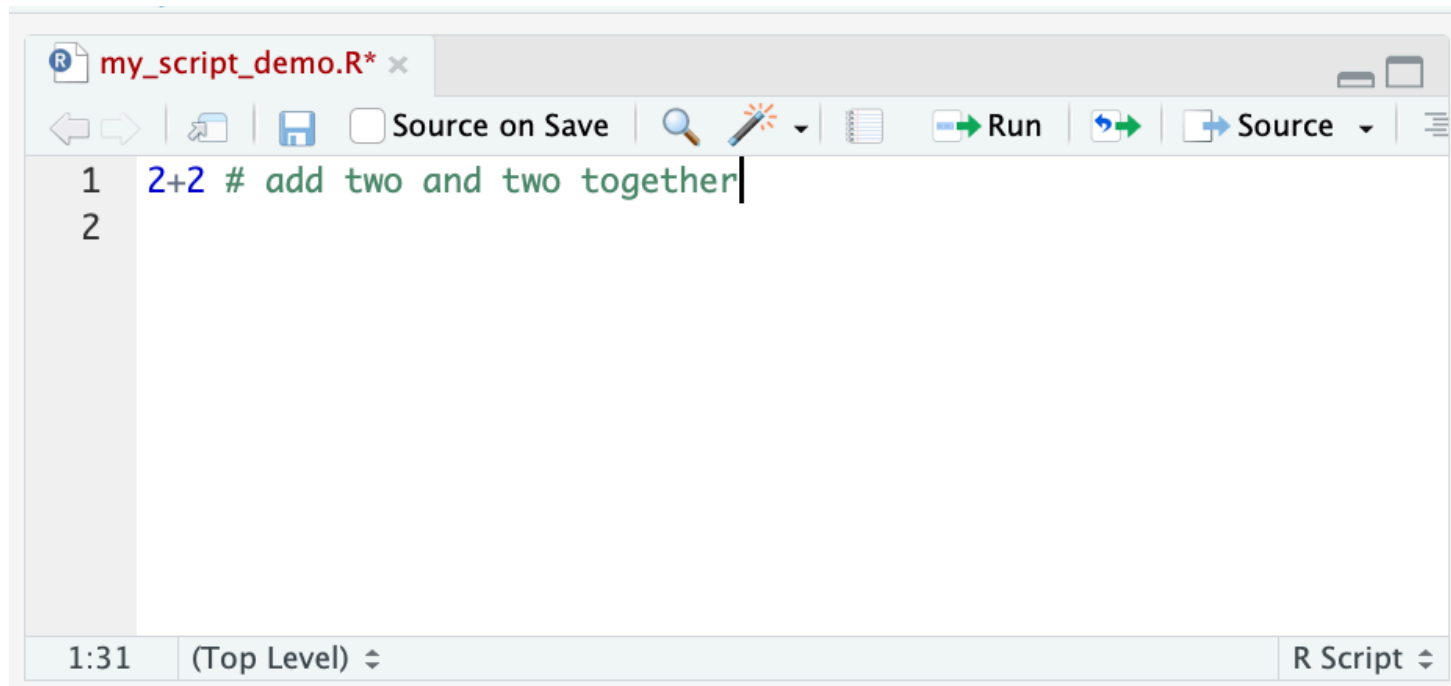
# Comments

# Comments

```
# this is a comment
```

# Comments

```
# this is a comment
```

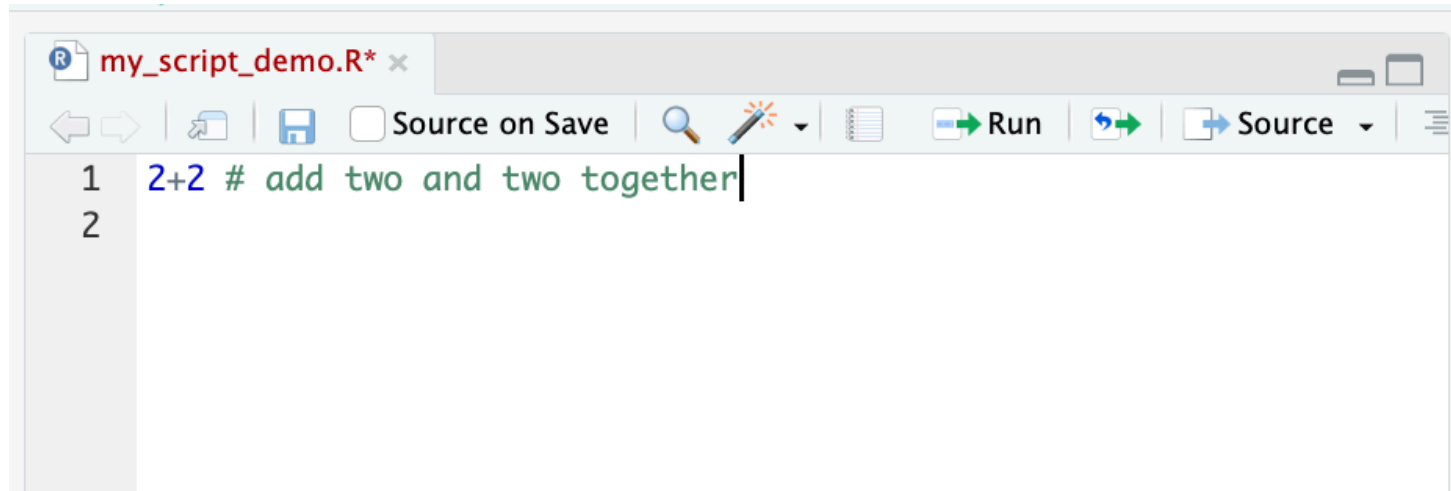


The screenshot shows an R script editor window titled "my\_script\_demo.R\*". The editor contains two lines of code: line 1 is "2+2" and line 2 is "# add two and two together". The comment is highlighted in green. The editor has a toolbar with icons for navigation, search, and execution. The status bar at the bottom shows "1:31" and "(Top Level)".

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

# Comments

```
# this is a comment
```



The screenshot shows an R script editor window. The title bar reads "my\_script\_demo.R\*". The toolbar includes icons for navigation, saving, and running. The source code area contains two lines: line 1 is "2+2 # add two and two together" and line 2 is empty.

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

**Console** ~/Dropbox/Teaching ntnu/Teaching code/ ↗

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:**

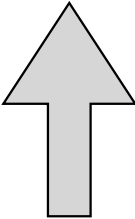
A virtual thing

## **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 IDE interface. The top-left pane shows 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 large black arrow points from this box down to the console pane. The top-right pane shows the **Environment** tab with the **Global Environment** selected. Under the **Values** section, the variable `X` is listed with its value `4`.

The bottom-left pane is the **Console**, showing the output of the script 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]
>
> X <- 2+2
>
> X
[1] 4
> |
```

The bottom-right pane is the **Help** viewer, displaying the **R Resources** and **RStudio** sections. The **R Resources** section includes links to [Learning R Online](#), [CRAN Task Views](#), [R on StackOverflow](#), and [Getting Help with R](#). The **RStudio** section includes links to [RStudio IDE Support](#), [RStudio Community Forum](#), [RStudio Cheat Sheets](#), [RStudio Tip of the Day](#), [RStudio Packages](#), and [RStudio Products](#). The **Manuals** section includes links to [An Introduction to R](#), [Writing R Extensions](#), [R Data Import/Export](#), [The R Language Definition](#), [R Installation and Administration](#), and [R Internals](#). The **Reference** section includes links to [Packages](#) and [Search Engine & Keywords](#).

# Objects

The screenshot displays the RStudio interface with three main panes. The top-left pane shows 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 pane. The bottom-left pane is the console, showing 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 is the Environment pane, showing the Global Environment with a search bar and a table of values:

Values	
X	4

The Environment pane is also highlighted with a black box. The bottom-right pane is the Help pane, displaying the RStudio homepage with links to resources, manuals, and reference.

# 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

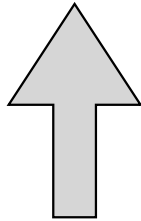
Creates objects

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

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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



# 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)
```



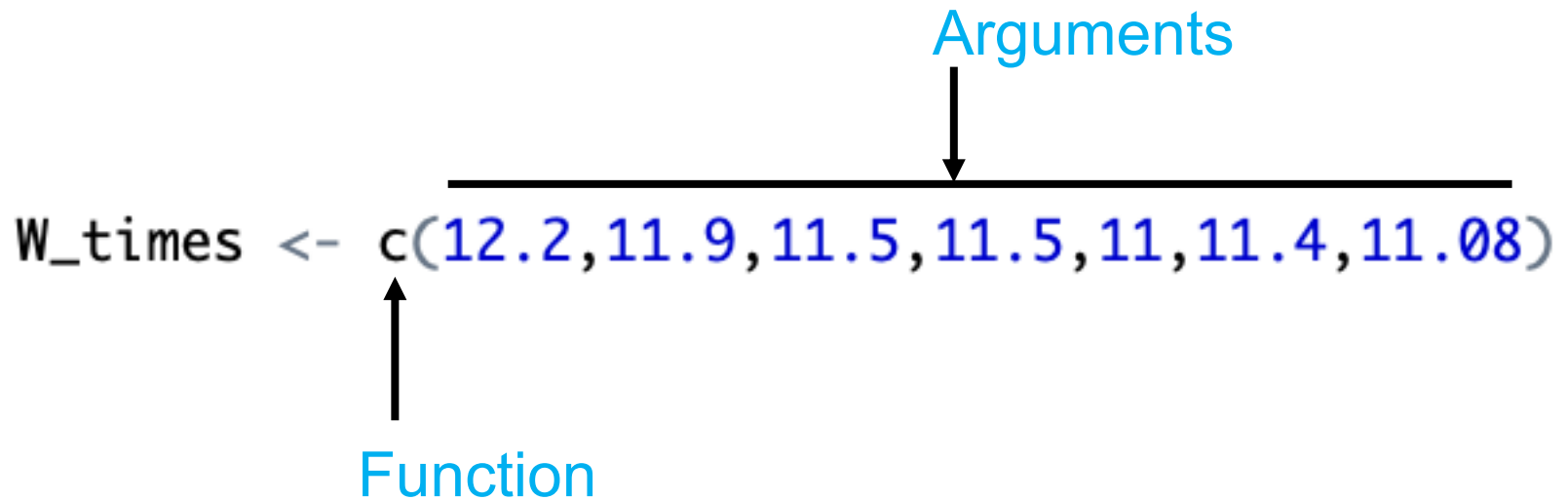
Function

# Examples

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

Arguments

Function



The diagram illustrates the components of the R code snippet 'W\_times <- c(12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)'. A horizontal line is drawn above the opening parenthesis of the 'c()' function. A blue arrow labeled 'Arguments' points down from the word 'Arguments' to this line. Another blue arrow labeled 'Function' points up from the word 'Function' to the 'c' character, which is the function name.

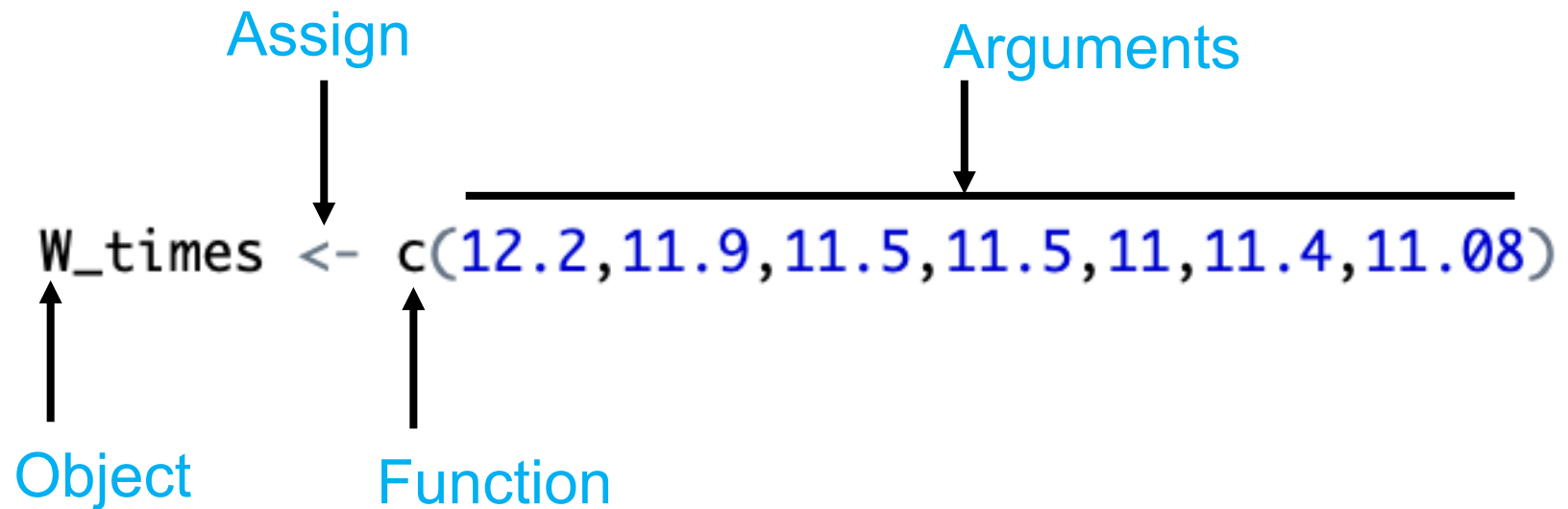
# Examples

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)`. Annotations include:

- Assign**: Points to the assignment operator `<-`.
- Function**: Points to the function name `c`.
- Arguments**: Points to the list of values in parentheses: `(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)



The diagram illustrates the components of the R code snippet. It features four blue labels with black arrows pointing to specific parts of the code: 'Object' points to 'W\_times', 'Assign' points to '<-', 'Function' points to 'c', and 'Arguments' points to the list of numbers in parentheses. A horizontal black line is positioned above the arguments.

Annotations:

- Object (points to W\_times)
- Assign (points to <-)
- Function (points to c)
- Arguments (points to the list of values: 12.2, 11.9, 11.5, 11.5, 11, 11.4, 11.08)

# 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!

# 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