

Introduction to R Markdown

DIME Analytics

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The World Bank | [WB Github](#)

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Dynamic documents

Dynamic documents and R Markdown

- Dynamic documents are documents that include both text and code outputs
- They are generated by a script and are updated automatically every time the script runs
- R Markdown is a type of dynamic document

Dynamic documents

- Code and documentation is produced together

```
r-markdown-example.Rmd x
---
title: "Document example"
author: "Luis Eduardo San Martin"
date: "1/28/2022"
output: pdf_document
---
## My analysis

Here I explain what I'll do.

Now I'll show some code results:



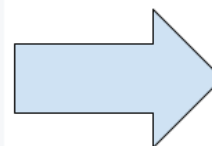
```
{r}
data(mtcars)
summary(mtcars$mpg)

```



And here I explain what I just did, all in the same script.

This is how dynamic documents work.
```



Document example

Luis Eduardo San Martin

1/28/2022

My analysis

Here I explain what I'll do.

Now I'll show some code results:

```
data(mtcars)
summary(mtcars$mpg)
```

	##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	10.40	15.43	19.20	20.09	22.80	33.90	

And here I explain what I just did, all in the same document.

This is how dynamic documents work.

1

Why use dynamic documents?

- Increased research transparency. Documents are fully reproducible
- No more copying and pasting outputs from R to a document editor
- Nice option for simple documents that don't require a lot of formatting
- Can include code snippets

Knitting R Markdown documents

Knitting R Markdown documents

- R markdown combines text, R code, and rendered outputs
- The text follows Markdown's syntax
- The code and outputs follow R's syntax
- Knitting an R Markdown document is rendering the text and code portions into a single output
- The output can be a PDF, Word, or HTML document







Knitting R Markdown documents

Exercise 1

1. Go to [our R trainings repository](#)
2. In the files panel, download `Introduction to R Markdown...` > `r-markdown-template.Rmd`
3. Open this file in RStudio
4. Click on `Knit`

Knitting R Markdown documents

- Knitting a file to PDF means that RStudio created a PDF file from an R Markdown file
- You'll now see this PDF file in the folder where you saved `markdown-template.Rmd`

Name	Date modified	Type
 Code	1/28/2022 2:51 PM	File folder
 DataSets	8/24/2020 3:42 PM	File folder
 Output	4/5/2021 4:37 PM	File folder
 descriptive-statistics.R	1/13/2022 1:29 PM	R File
 r-markdown-template.pdf	2/1/2022 10:51 PM	Adobe Acrobat Docu...
 r-markdown-template.Rmd	2/1/2022 10:36 PM	RMD File

Markdown

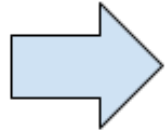
Markdown

- As we indicated previously, the text part of R Markdown follows the syntax of Markdown
- Markdown is a lightweight markup language. It's similar to Latex or HTML, but simpler
- Markdown was designed to be easily readable while allowing to define text format

Markdown - Headers

- Headers in markdown are preceded by pound (#) symbols
- Additional pound symbols denote a lower level in the headers hierarchy

```
# This is a header  
## Subheader 1  
### Subheader 2  
#### Subheader 3
```



This is a header
Subheader 1
Subheader 2
Subheader 3

Markdown - Paragraphs

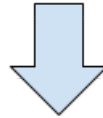
- Text not preceded by special symbols is a regular paragraph.

Paragraphs

This is a line of text.

This is another line in the same paragraph.

New paragraphs are separated by two line breaks.



Paragraphs

This is a line of text. This is another line in the same paragraph.

New paragraphs are separated by two line breaks.

Markdown - Text emphasis

- Emphasized text is enclosed by special symbols.

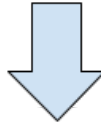
Text emphasis

Text in italics goes between `*asterisks*` or `_underscores_`.

Text in bold goes between `**two asterisks**` or `__two underscores__`.

You can combine asterisks and underscores to `**emphasize with italics and bold _at the same time_**`.

Strikethrough text `~~uses two tildes~~`.



Text emphasis

Text in italics goes between *asterisks* or *underscores*.

Text in bold goes between **two asterisks** or **two underscores**.

You can combine asterisks and underscores to ***emphasize with italics and bold at the same time***.

Strikethrough text ~~uses two tildes~~.

Markdown - Lists

- Markdown allows us to use both ordered and unordered lists.

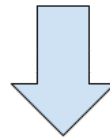
Lists

Ordered lists:

1. Include a number and a dot before every item
2. Also remember to include a blank line before the beginning of the list
1. The actual number does not matter, the item will have the correct order number

Unordered lists:

- * You can use an asterisk
- + Or a plus symbol
- Or a minus symbol



Lists

Ordered lists:

1. Include a number and a dot before every item
2. Also remember to include a blank line before the beginning of the list
3. The actual number does not matter, the item will have the correct order number

Unordered lists:

- You can use an asterisk
- Or a plus symbol
- Or a minus symbol

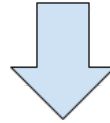
Markdown - Links

- Lastly, we can also include links as text in Markdown.

Links

Include the link text in brackets followed by the URL in parentheses.
Like this:

This is [[the WB website](https://https://www.worldbank.org)](https://https://www.worldbank.org)



Links

Include the link text in brackets followed by the URL in parentheses. Like this:

This is the WB website

<https://https://www.worldbank.org>

R Code

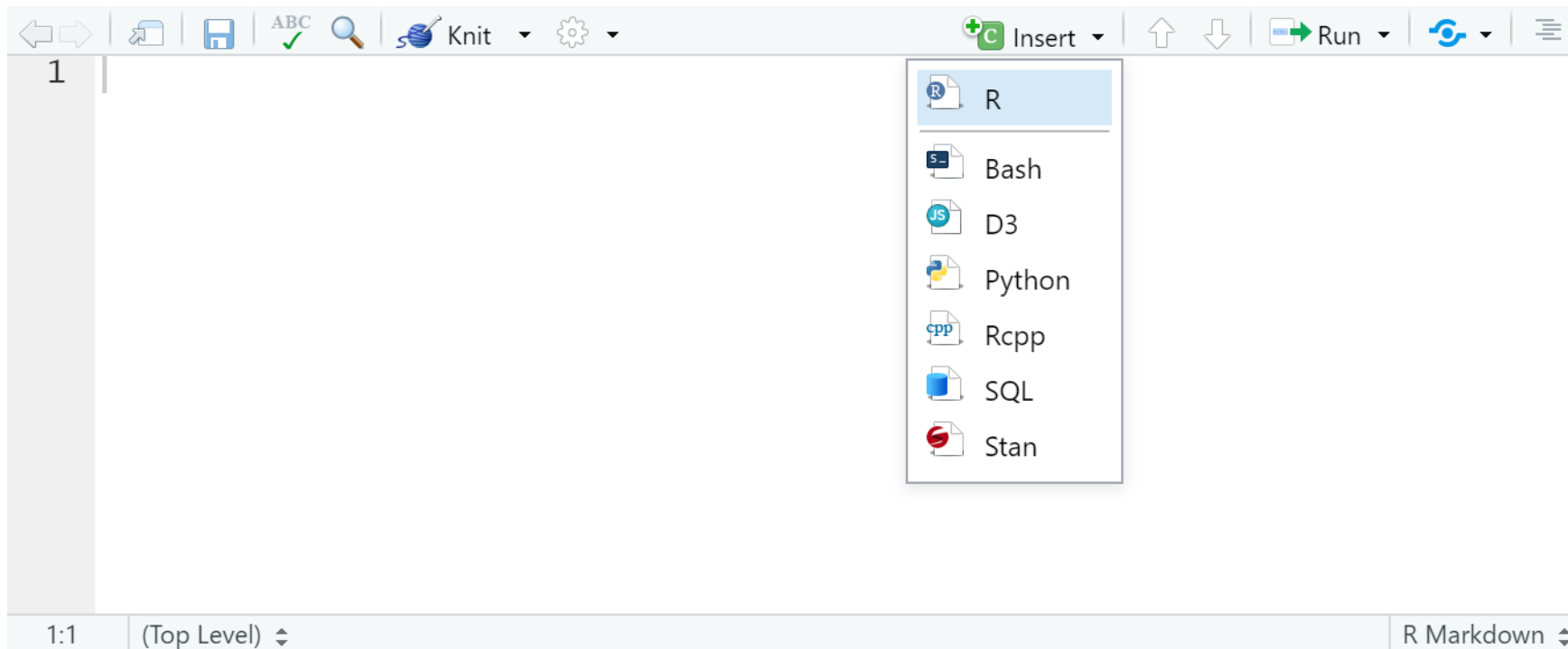
Including R code

- R code in R Markdown goes inside **fenced code blocks**, as the one below

```
```${r}  
Your R code goes here
```
```

Including R code

- To add new block, you can type the fences directly, go to **Insert** > **R** in the script panel of RStudio, or type **CTRL + ALT + i**



Including R code

Exercise 2

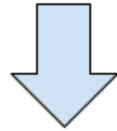
Include the summary of a variable in the document.

1. Create a header named `R Code` at the bottom of `markdown-template.Rmd`
2. Create a new fenced code block where you load the sample dataset `mtcars`
 - `mtcars` is a built-in dataset
 - load it with: `data(mtcars)`
3. Inside the same block, get the summary of the variable `mpg` with `summary(mtcars$mpg)`
4. Knit the document to PDF and check how this is rendered in the resulting file

Including R code

R code

```
```\{r}  
data(mtcars)
summary(mtcars$mpg)
```\
```



R code

```
data(mtcars)  
summary(mtcars$mpg)
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.   
##  10.40   15.43   19.20   20.09   22.80   33.90
```

Including R code

- Note that the output echoes both the code and the output
- What if we wanted to include the output but not the code?
- We use argument `echo = FALSE` in the fenced code block for that
- Code block arguments are separated by commas inside the curly brackets, as in:

```
```{r, echo = FALSE}  
data(mtcars)
summary(mtcars$mpg)
```
```

Including R code

Exercise 3

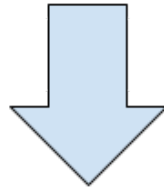
Omit the code when knitting R code.

1. Add the option `echo = FALSE` to the fenced code block created in exercise 2
2. Knit the document into PDF and check the difference

Including R code

R code

```
`` `{r, echo = FALSE}  
data(mtcars)  
summary(mtcars$mpg)  
`` `
```



R code

| | | | | | | |
|----|-------|---------|--------|-------|---------|-------|
| ## | Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| ## | 10.40 | 15.43 | 19.20 | 20.09 | 22.80 | 33.90 |

Including R code

- To include R code but not the output, we can use the option `eval = FALSE`

```
```{r, eval = FALSE}  
data(mtcars)
summary(mtcars$mpg)
```
```

Including R code

R code

```
```${r, eval = FALSE}  
data(mtcars)
summary(mtcars$mpg)
```
```



R code

```
data(mtcars)  
summary(mtcars$mpg)
```

R Plots

Including R plots

- Adding R plots is similar to adding R code
- Include the code producing the plot in a fenced block
- The block option `echo = FALSE` is useful when we only want to include the plot but not the code producing it

Including R plots

Exercise 4

Include an R plot in your document.

1. Create a new header named `R Plots` at the bottom of `markdown-template.Rmd`
2. Create a new fenced code block with the option `echo` set to `FALSE`
3. Add the following code inside the new block:

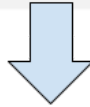
```
plot(mtcars$wt,  
     mtcars$mpg,  
     main = "Plot example",  
     xlab = "Car weight",  
     ylab = "Miles per gallon")
```

Including R plots

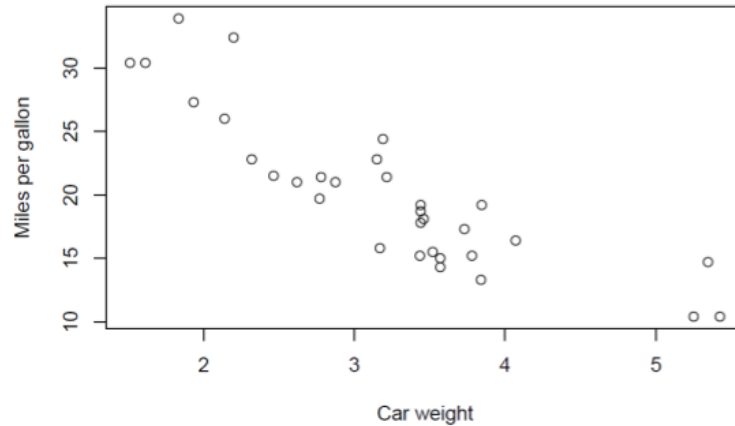
R Plots

```
{r, echo = FALSE}  
plot(mtcars$wt,  
      mtcars$mpg,  
      main = "Plot example",  
      xlab = "Car weight",  
      ylab = "Miles per gallon")  
...
```

R Plots



Plot example



Inline code

Including code inline

- Inline code is enclosed by backtick followed by an r (``r``) and a single backtick (```)
- For example:

The mean of mpg is ``r mean(mtcars$mpg)``.

- Will be rendered as:

The mean of mpg is 20.090625.

Including code inline

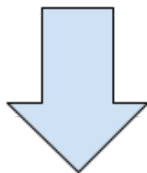
Exercise 5

1. Create a new header named `Inline code` at the bottom of `markdown-template.Rmd`
2. Add an unordered list with the items:
 - The number of elements in `mtcars` is:
 - The mean of weight is:
 - The standard deviation is:
3. Use the functions `nrow()`, `mean()`, and `sd()` in the corresponding list items so that the correct values are rendered. Remember you can select the weight variable like this: `mtcars$wt`

Including code inline

Inline code

- The number of elements in mtcars is: ``r nrow(mtcars)``
- The mean of weight is: ``r mean(mtcars$wt)``
- The standard deviation is: ``r sd(mtcars$wt)``



Inline code

- The number of elements in mtcars is: 32
- The mean of weight is: 3.21725
- The standard deviation is: 0.9784574

Annex

Annex - Opening a new R Markdown in R Studio

- Go to **File** > **New File** > **R Markdown**
- You can register the author name and the document title. This can be changed later if needed
- You can also define the default output format (HTML, PDF, Word). This can also be changed later
- Selecting **OK** will generate a template with document sections and code blocks that you can modify
- Selecting **Create Empty Document** will ignore the author, title, and output format registered and will result in a completely blank R Markdown document

Annex - Author, title, and output type

- The section enclosed in `---` at the beginning of the document can contain the author, title, and default output format
- You can add the author and document title with `author: NAME` and `title: TITLE`
- You can also change the default output format. Some options are:
 - `output: html_document`
 - `output: pdf_document`
 - `output: word_document`
 - `output: beamer_presentation`

Annex - Including images

- The Markdown syntax to include images is:

```
![Image name](path/to/image)
```

- For example:

```
![R logo](img/r-markdown/r-logo.jpg)
```

- Renders: