

INTRODUCTION TO MARKDOWN

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WHAT IS MARKDOWN?

- Tool to convert plain text into formatted text
- Main goal is to focus on the content rather than the formatting
- Easier to learn than LaTeX (although LaTeX is preferred for complex documents)
- Markdown is also a syntax for styling text on the [GitHub platform](#)

- [R Markdown](#): R code embedded in a Markdown document
- use `.Rmd` extension in R studio
- R Markdown converted to standard Markdown using [‘knitr’ package](#)
- Workflow: R Markdown => Markdown => html/pdf/word

MARKDOWN SYNTAX

This is an H1 header format

This is an H2 header format

This text will be in italics

This text will be in bold

Unordered list:

- First
- Second
- Third

Ordered list:

1. First item
- 2 Second item
3. Third item

Links:

[Google](<http://www.google.com>)

Advanced links:

Advanced Linking: [Google][1] and [UGent][2]

[1]: <http://www.google.com> [2]: <http://www.ugent.be>

Using Markdown in R studio

The screenshot shows the R Studio interface with a file named 'Markdown_Demo.Rmd' open. The editor on the left contains the following Markdown code:

```
1 ---  
2 title: "R markdown"  
3 output: word_document  
4 ---  
5 Headers:  
6  
7 # This is an H1  
8  
9 ## This is an H2  
10  
11  
12 Italics:  
13  
14 text This text will be in italics text  
15  
16 Bold:  
17  
18 text This text will be in bold text  
19  
20 Unordered list:  
21  
22 - First  
23 - Second  
24 - Third  
25  
26 Ordered list:  
27  
28 1. First  
29 2. Second  
30 3. Third  
31  
32 Links: [Google] (http://www.google.com)  
33  
34 Advanced Linking: [Google][1] and [UGent][2]  
35  
36 [1]: http://www.google.com  
37 [2]: http://www.ugent.be  
38  
39 A way to include some latex code in R Markdown  
40 $$  
41  $y_{ij} = b_{ij} + \beta_0 + \beta_1$   
42 $$
```

A red arrow points to the 'Knit Word' button in the top toolbar. Below the arrow, the text 'Knit to Word, pdf or html' is written in red. The right pane shows the rendered HTML output, which includes the same content as the editor but with formatting applied (e.g., bold, italics, links, and a list). The output text is:

This is an example of Markdown vignettes in R. Before R 3.0.0, only Sweave/PDF vignettes were supported in R. Markdown is gaining popularity over the years due to its simplicity, and R 3.0.0 starts to support package vignettes written in R Markdown.

Please note this example is for [R Markdown v1](#) only. If you use [R Markdown v2](#), you should use the vignette engine `knitr::rmarkdown` instead of `knitr::knitr`.

Package vignettes

To enable Markdown vignettes in an R package, you need to

- add `*.Rmd` files under the `vignettes` directory
- add `VignetteBuilder: knitr` to the `DESCRIPTION` file
- specify the vignette engine `\VignetteEngine{knitr::knitr}` in the `Rmd` files (inside HTML comments)

View vignettes

And R will load the `knitr` package to build these vignettes to HTML files, and you can see them when you open the HTML help:

```
---
title: "R markdown"
output: word_document
---
```

Headers:

```
# This is an H1
```

```
## This is an H2
```

Italics:

```
text This text will be in italics text
```

Bold:

```
text This text will be in bold text
```

Unordered list:

- First
- Second
- Third

Ordered list:

1. First
2. Second
3. Third

Links: [\[Google\]](http://www.google.com) (<http://www.google.com>)

Advanced Linking: [\[Google\]](#)[1] and [\[UGent\]](#)[2]

[1]: <http://www.google.com>

[2]: <http://www.ugent.be>

A way to include some latex code in R Markdown

```
$$
```

```
y_{ij} = b_{ij} + \beta_0 + \beta_1
```

```
$$
```

MARKDOWN=> MS WORD

R markdown

Headers:

This is an H1

This is an H2

Italics:

text *This text will be in italics* text

Bold:

text **This text will be in bold** text

Unordered list:

- First
- Second
- Third

Ordered list:

1. First
2. Second
3. Third

Links: [Google](#)

Advanced Linking: [Google](#) and [UGent](#)

A way to include some latex code in R Markdown

$$y_{ij} = b_{ij} + \beta_0 + \beta_1$$



WHAT IS KNITR?

- R package designed for dynamic report generation in R
- Script contains a mixture of text and R code, which is when processed replaced by text and output, including figures and tables
- Uses R as programming language and a documentation language (LateX, Markdown)
- Inline R code within the text and separate code chunks

Advantage: you do not need to copy and paste your R output anymore!

USING PACKAGE 'KNITR' IN R STUDIO

The screenshot displays the R Studio interface with a Knitr R Markdown document open. The document content is as follows:

```
1 ---
2 title: "Knitr_Demo"
3 output: word_document
4 ---
5
6 ```{r global_options, include=FALSE}
7 library(knitr)
8 knitr::opts_chunk$set(fig.width=12, fig.height=8,
9   echo=FALSE, warning=FALSE, message=FALSE)
10 ```
11
12 Cars is a built-in dataset in R. This dataset has nrow(cars) rows.
13 We can also see our dataset using the head command as follows:
14 ```{r chunk1}
15 head(cars)
16 ```
17
18 Tables using kable:
19 ```{r chunk_table}
20 x <- rnorm(100)
21 y <- 2*x + rnorm(100)
22 lr <- lm(y~x)
23
24 kable(summary(lr)$coeff, digits = 2, row.names = FALSE,
25   col.names = c("Estimate","Standard Error","t-value","p-value"),
26   caption = "Linear Regression",
27   format.args = list(decimal.mark = ","))
28 ```
29
30 We can see the summary statistics using by embedding an R code chunk like this:
31 ```{r chunk2}
32 summary(cars)
33 ```
34
35 You can also embed plots, for example:
36 ```{r chunk3, echo=FALSE, eval = TRUE, fig.width=6}
37 hist(cars$speed)
38 ```
39 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing the R code generating the plot.
40 Also, if we write `eval = FALSE` parameter in the code chunk, the R code will not be executed.
41
42
```

Annotations in the image include:

- A red arrow pointing to the `Knit Word` button in the top toolbar, with the text **'Knit' to Word, pdf or html**.
- Blue text **Code chunk** next to the first code block (lines 6-9).
- Yellow text **Inline R code** next to the `nrow(cars)` expression in line 12.
- Blue text **Code chunk** next to the second code block (lines 14-16).
- Blue text **Code chunk** next to the third code block (lines 20-28).
- Blue text **Code chunk** next to the fourth code block (lines 32-34).
- Blue text **Code chunk** next to the fifth code block (lines 36-38).

The right-hand pane shows the Environment and History tabs, with the Environment tab displaying "Global Environment" and "Environment is empty". Below this is the Viewer pane, which displays a histogram titled "Histogram of cars\$speed". The histogram shows the frequency distribution of car speeds, with the x-axis labeled "cars\$speed" (ranging from 0 to 25) and the y-axis labeled "Frequency" (ranging from 0 to 15). The histogram has four bars with approximate frequencies of 2, 7, 17, and 7.

CODE CHUNKS

- **echo=FALSE**: to hide the R code in the final report
- **results="hide"**: to hide the results/output (figures are shown!)
- **include=FALSE**: to have the chunk evaluated, but neither the code nor its output is displayed
- **warning=FALSE** and **message=FALSE**: to suppress any R warnings or messages from being included in the final report

R CODE + TEXT => REPORT

```
---
title: "KnitR_Demo"
output: word_document
---

```{r global_options, include=FALSE}
library(knitr)
knitr::opts_chunk$set(fig.width=12, fig.height=8,
 echo=FALSE, warning=FALSE, message=FALSE)
...

Cars is a built-in dataset in R. This dataset has `r nrow(cars)` rows.
We can also see our dataset using the head command as follows:
```{r chunk1}
head(cars)
...

Tables using kable:
```{r chunk_table}
x <- rnorm(100)
y <- 2*x + rnorm(100)
lr <- lm(y~x)

kable(summary(lr)$coeff, digits = 2, row.names = FALSE,
 col.names = c("Estimate", "Standard Error", "t-value", "p-value"),
 caption = "Linear Regression",
 format.args = list(decimal.mark = ","))
...

We can see the summary statistics using by embedding an R code chunk like this:
```{r chunk2}
summary(cars)
...

You can also embed plots, for example:
```{r chunk3, echo=FALSE, eval = TRUE, fig.width=6}
hist(cars$speed)
...

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing the R code generating the plot. Also, if we write `eval = FALSE` parameter in the code chunk, the R code will not be executed.
```

Use 'kable' for tables

Plot

=>

```
KnitR_Demo

Cars is a built-in dataset in R. This dataset has 50 rows. We can also see our dataset using the head command as follows:

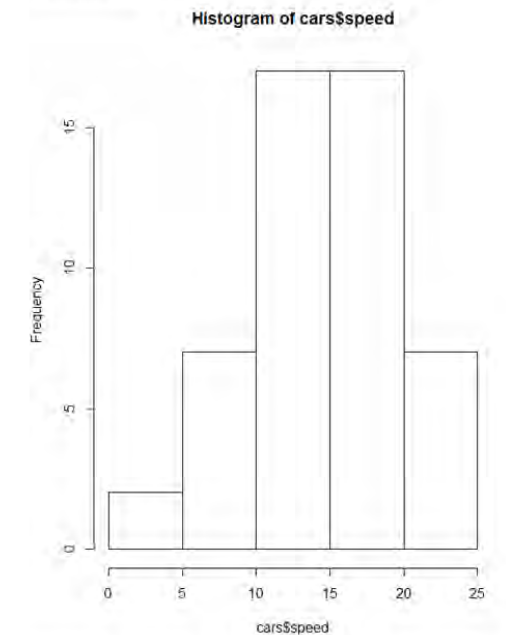
speed dist
1 4 2
2 4 10
3 7 4
4 7 22
5 8 16
6 9 10

Tables using kable:
Linear Regression
Estimate Standard Error t-value p-value
-0.07 0.1 -0.71 0.48
1.88 0.1 18.62 0.00

We can see the summary statistics using by embedding an R code chunk like this:

speed dist
Min. : 4.0 Min. : 2.00
1st Qu.:12.0 1st Qu.: 26.00
Median :15.0 Median : 36.00
Mean :15.4 Mean : 42.98
3rd Qu.:19.0 3rd Qu.: 56.00
Max. :25.0 Max. :120.00
```

You can also embed plots. for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing the R code generating the plot. Also, if we write `eval = FALSE` parameter in the code chunk, the R code will not be executed.

For more complex tables consider 'pander' or 'stargazer'

# EXAMPLE OF A SMALL REPORT

The image shows a screenshot of the RStudio interface. The left pane displays the source R Markdown file, and the right pane shows the rendered HTML output.

**Source R Markdown File:**

```
1 ---
2 title: "Airquality_Demo"
3 output: word_document
4 ---
5 # Demonstration using Markdown/knitr with airquality dataset
6 ## Introduction
7 ```{r global_options, include=FALSE}
8 library(knitr)
9 knitr::opts_chunk$set(fig.width=8, fig.height=8, echo=FALSE, warning=FALSE, message=FALSE)
10 ```
11
12 This airquality dataset consists of nrow(airquality) rows and ncol(airquality) columns.
13 The data from the following covariates is obtained from May 1, 1973 (a Tuesday) to September 30, 1973:
14
15 * Ozone: Mean ozone in parts per billion from 1300 to 1500 hours at Roosevelt Island
16 * Solar.R: Solar radiation in Langleys in the frequency band 4000-7700 Angstroms from 0800 to 1200 hours at Central Park
17 * Wind: Average wind speed in miles per hour at 0700 and 1000 hours at LaGuardia Airport
18 * Temperature: Maximum daily temperature in degrees Fahrenheit at La Guardia Airport
19
20 ## Descriptives
21 ```{r first, echo = FALSE}
22 kable(summary(airquality))
23 ```
24
25 ## Plots
26 ```{r third, echo=FALSE, fig.align='left'}
27 par(mfrow=c(2, 2))
28 boxplot(Ozone~Month, data = airquality, xlab = "Ozone", ylab = "Month")
29 boxplot(Solar.R~Month, data = airquality, xlab = "Solar.R", ylab = "Month")
30 boxplot(Wind~Month, data = airquality, xlab = "Wind", ylab = "Month")
31 boxplot(Temp~Month, data = airquality, xlab = "Temperature", ylab = "Month")
32 ```
33
34 ## Model building
35 ```{r reg_airquality, echo= FALSE}
36 lr <- lm(Ozone ~ Month, data = airquality)
37
38 kable(summary(lr)$coeff, digits = 2, row.names = FALSE,
39 col.names = c("Estimate", "Standard Error", "t-value", "p-value"),
40 caption = "Linear Regression",
41 format.args = list(decimal.mark = ","))
42 ```
43
44 ## Links
45 * <http://kbroman.org/knitr_knuthshell/>
46 * <http://rmarkdown.rstudio.com/>
47
```

**Rendered HTML Output:**

This is an example of Markdown vignettes in R. Before R 3.0.0, only Sweave/PDF vignettes were supported in R. Markdown is gaining popularity over the years due to its simplicity, and R 3.0.0 starts to support package vignettes written in R Markdown.

Please note this example is for [R Markdown v1](#) only. If you use [R Markdown v2](#), you should use the vignette engine `knitr::rmarkdown` instead of `knitr::knitr`.

## Package vignettes

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## View vignettes

And R will load the `knitr` package to build these vignettes to HTML files, and you can see them when you open the HTML help:

# OUTPUT: MS WORD DOCUMENT

## Airquality\_Demo

### Demonstration using Markdown/knitr with airquality dataset

#### Introduction

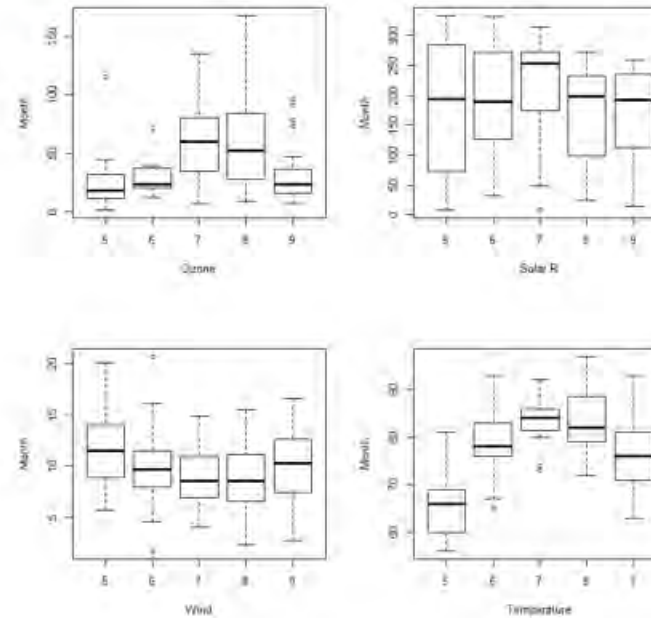
This **airquality** dataset consists of 153 rows and 6 columns. The data from the following covariates is obtained from May 1, 1973 (a Tuesday) to September 30, 1973:

- Ozone: Mean ozone in parts per billion from 1300 to 1500 hours at Roosevelt Island
- Solar.R: Solar radiation in Langleys in the frequency band 4000-7700 Angstroms from 0800 to 1200 hours at Central Park
- Wind: Average wind speed in miles per hour at 0700 and 1000 hours at LaGuardia Airport
- Temperature: Maximum daily temperature in degrees Fahrenheit at La Guardia Airport

#### Descriptives

Ozone	Solar.R	Wind	Temp	Month	Day
Min.: 1.00	Min.: 7.0	Min.: 1.700	Min.: 56.00	Min.: 5.000	Min.: 1.0
1st Qu.: 18.00	1st Qu.: 115.8	1st Qu.: 7.400	1st Qu.: 72.00	1st Qu.: 6.000	1st Qu.: 8.0
Median: 31.50	Median: 205.0	Median: 9.700	Median: 79.00	Median: 7.000	Median: 16.0
Mean: 42.13	Mean: 185.9	Mean: 9.958	Mean: 77.88	Mean: 6.993	Mean: 15.8
3rd Qu.: 63.25	3rd Qu.: 258.8	3rd Qu.: 11.500	3rd Qu.: 85.00	3rd Qu.: 8.000	3rd Qu.: 23.0
Max.: 168.00	Max.: 334.0	Max.: 20.700	Max.: 97.00	Max.: 9.000	Max.: 31.0
NA's: 37	NA's: 7	NA	NA	NA	NA

#### Plots



#### Model building

##### Linear Regression

Estimate	Standard Error	t-value	p-value
15.66	15.17	1.03	0.30
3.68	2.07	1.78	0.08

#### Links

- <http://kbroman.org/knitr-knitshell/>
- <http://rmarkdown.rstudio.com/>

# MORE INFORMATION

- For more details on using R Markdown see [rmarkdown.rstudio.com](https://rmarkdown.rstudio.com)
- For more details on using knitr see [kbroman.org/knitr\\_knutshell](https://kbroman.org/knitr_knutshell)
- For more details on Markdown for GitHub see [guides.github.com/features/mastering-markdown/](https://guides.github.com/features/mastering-markdown/)

Thank you for your attention!

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