

DEFENCE AGAINST THE DARK ARTS USING R AND L<sup>A</sup>T<sub>E</sub>X INTEGRATED VIA  
QUARTO

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## **Abstract**

Defence Against the Dark Arts (in short, DADA) is about how to defend against all aspects of the Dark Arts, including dark creatures, curses, hexes and jinxes (dark charms), and duelling.

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# Chapter 1

## R Markdown Basics

Here is a brief introduction into using *R Markdown*. *Markdown* is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. *R Markdown* provides the flexibility of *Markdown* with the implementation of **R** input and output. For more details on using *R Markdown* see <https://rmarkdown.rstudio.com>.

Be careful with your spacing in *Markdown* documents. While whitespace largely is ignored, it does at times give *Markdown* signals as to how to proceed. As a habit, try to keep everything left aligned whenever possible, especially as you type a new paragraph. In other words, there is no need to indent basic text in the Rmd document (in fact, it might cause your text to do funny things if you do).

### 1.1 Lists

It's easy to create a list. It can be unordered like

- Item 1
- Item 2

or it can be ordered like

1. Item 1
2. Item 2

Notice that I intentionally mislabeled Item 2 as number 4. *Markdown* automatically figures this out! You can put any numbers in the list and it will create the list. Check it out below.

To create a sublist, just indent the values a bit (at least four spaces or a tab). (Here's one case where indentation is key!)

1. Item 1
2. Item 2
3. Item 3
  - Item 3a
  - Item 3b

## 1.2 Line breaks

Make sure to add white space between lines if you'd like to start a new paragraph. Look at what happens below in the outputted document if you don't: Here is the first sentence. Here is another sentence. Here is the last sentence to end the paragraph. This should be a new paragraph.

*Now for the correct way:*

Here is the first sentence. Here is another sentence. Here is the last sentence to end the paragraph.

This should be a new paragraph.

## 1.3 R chunks

When you click the **Knit** button above a document will be generated that includes both content as well as the output of any embedded **R** code chunks within the document. You can embed an **R** code chunk like this (`mtcars` is a built-in **R** dataset):

```
summary(mtcars)
```

mpg	cyl	disp	hp
Min. :10.40	Min. :4.000	Min. : 71.1	Min. : 52.0
1st Qu.:15.43	1st Qu.:4.000	1st Qu.:120.8	1st Qu.: 96.5
Median :19.20	Median :6.000	Median :196.3	Median :123.0
Mean :20.09	Mean :6.188	Mean :230.7	Mean :146.7
3rd Qu.:22.80	3rd Qu.:8.000	3rd Qu.:326.0	3rd Qu.:180.0
Max. :33.90	Max. :8.000	Max. :472.0	Max. :335.0
drat	wt	qsec	vs
Min. :2.760	Min. :1.513	Min. :14.50	Min. :0.0000
1st Qu.:3.080	1st Qu.:2.581	1st Qu.:16.89	1st Qu.:0.0000
Median :3.695	Median :3.325	Median :17.71	Median :0.0000
Mean :3.597	Mean :3.217	Mean :17.85	Mean :0.4375
3rd Qu.:3.920	3rd Qu.:3.610	3rd Qu.:18.90	3rd Qu.:1.0000
Max. :4.930	Max. :5.424	Max. :22.90	Max. :1.0000
am	gear	carb	

Min.	:0.0000	Min.	:3.000	Min.	:1.000
1st Qu.	:0.0000	1st Qu.	:3.000	1st Qu.	:2.000
Median	:0.0000	Median	:4.000	Median	:2.000
Mean	:0.4062	Mean	:3.688	Mean	:2.812
3rd Qu.	:1.0000	3rd Qu.	:4.000	3rd Qu.	:4.000
Max.	:1.0000	Max.	:5.000	Max.	:8.000

## 1.4 Inline code

If you'd like to put the results of your analysis directly into your discussion, add inline code like this:

The `cos` of  $2\pi$  is 1.

Another example would be the direct calculation of the standard deviation:

The standard deviation of `speed` in `cars` is 5.2876444.

One last neat feature is the use of the `ifelse` conditional statement which can be used to output text depending on the result of an **R** calculation:

The standard deviation is less than 6.

Note the use of `>` here, which signifies a quotation environment that will be indented.

As you see with `$2 \pi$` above, mathematics can be added by surrounding the mathematical text with dollar signs. More examples of this are in [Mathematical equations](#).

## 1.5 Plots

Varsity blues already solves all the packages in order to insert plots right away from your code.

```
library(ggplot2)

ggplot(mtcars) +
  geom_point(aes(x = cyl, y = wt, color = am))
```

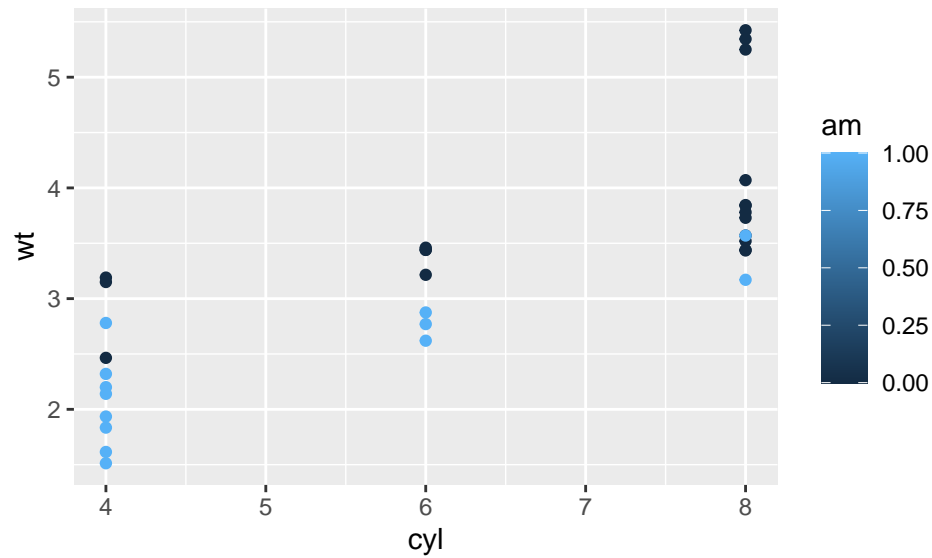


Figure 1.1: An elementary plot

## 1.6 Tables

As for the case of plots, this package already solves all the dependencies in order to use different types of tables in  $\text{\LaTeX}$ .

### 1.6.1 Simple table

```
kable(xtabs(~ am, mtcars))
```

am	Freq
0	19
1	13

### 1.6.2 Complex table (regression table)

```
library(stargazer)

model1 <- lm(mpg ~ cyl, mtcars)
model2 <- lm(mpg ~ cyl + am, mtcars)
model3 <- lm(mpg ~ cyl + am + wt, mtcars)
```

```
stargazer(model1, model2, model3, header = F)
```

Table 1.2:

	<i>Dependent variable:</i>		
		mpg	
	(1)	(2)	(3)
cyl	-2.876*** (0.322)	-2.501*** (0.361)	-1.510*** (0.422)
am		2.567* (1.291)	0.176 (1.304)
wt			-3.125*** (0.911)
Constant	37.885*** (2.074)	34.522*** (2.603)	39.418*** (2.641)
Observations	32	32	32
R <sup>2</sup>	0.726	0.759	0.830
Adjusted R <sup>2</sup>	0.717	0.742	0.812
Residual Std. Error	3.206 (df = 30)	3.059 (df = 29)	2.612 (df = 28)
F Statistic	79.561*** (df = 1; 30)	45.669*** (df = 2; 29)	45.678*** (df = 3; 28)

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



## 1.7 Mathematical equations

Consider a function  $f : U \rightarrow \mathbb{R}$ , defined on an open set  $U \subset \mathbb{R}$ , is said to be **differentiable** at  $a \in U$  if the derivative  $f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$  exists. In general,  $f$  is of class  $\mathcal{C}^k$  if its first  $k$  derivatives  $f'(x), f''(x), \dots, f^{(k)}(x)$  exist and are continuous.

## Chapter 2

# Additional resources

- [Markdown Cheatsheet](#)
- [R Markdown Reference Guide](#)
- [R Markdown Cheatsheet](#)
- [RStudio IDE Cheatsheet](#)
- [RStudio IDE Official website](#)
- [Introduction to dplyr](#)
- [ggplot2 Documentation](#)
- [ggplot2 Cheatsheet](#)

# References

10 Angel, Edward. 2000. *Interactive Computer Graphics : A Top-down Approach with OpenGL*. Boston, MA: Addison Wesley Longman.

———. 2001a. *Batch-File Computer Graphics : A Bottom-up Approach with QuickTime*. Boston, MA: Wesley Addison Longman.

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