Defence Against the Dark Arts using R and LaTeX Integrated via Quarto

by

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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 2π 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))
```

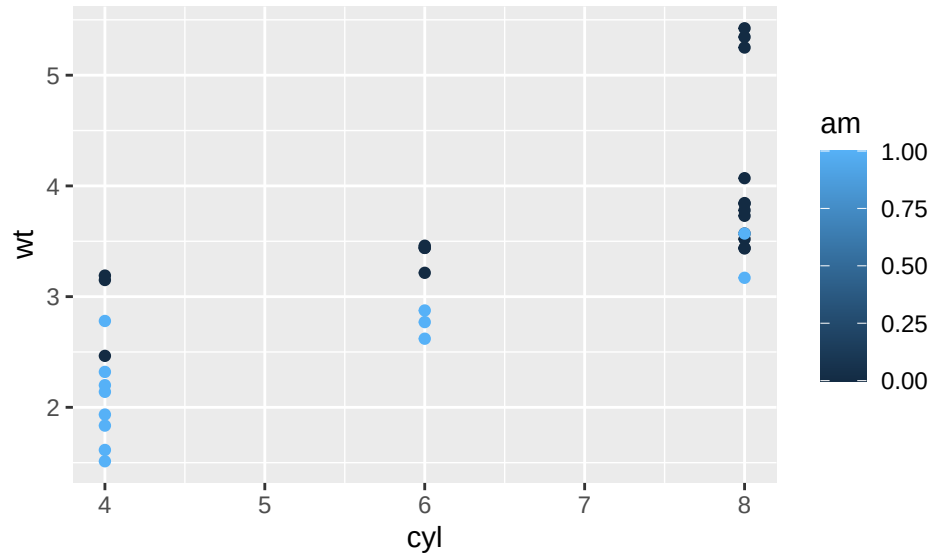

Figure 1.1: An elementary plot

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 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:

	Dependent variable:		
	mpg		
	(1)	(2)	(3)
cyl	−2.876***	−2.501***	−1.510***
	(0.322)	(0.361)	(0.422)
am		2.567*	0.176
		(1.291)	(1.304)
wt			−3.125***
			(0.911)
Constant	37.885***	34.522***	39.418***
	(2.074)	(2.603)	(2.641)
Observations	32	32	32
R^2	0.726	0.759	0.830
Adjusted R^2	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 $f : U \to \mathbb{R}$, defined on an open set $U \subset \mathbb{R}$, is said to be **differentiable** at $a \in U$ if the derivative $f'(a) = \lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$ exists. In general, f is of class $\mathcal{C}^k$ if its first k derivatives $f'(x), f''(x), \ldots, f^{(k)}(x)$ 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

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.

———. 2001b. *Test Second Book by Angel*. Boston, MA: Wesley Addison Longman.