PAPER TEMPLATE

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science

by

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Dedication

Dedication goes here.

Acknowledgements

Acknowledgements go here.

Contents

List of Tables

List of Figures

Abstract

Abstract goes here.

1 Note on Reading This Document

You'll see some weird coding in the Rmd file for this document. That's because it's awkward to convince the R Markdown to display R Markdown formatting code without actually interpreting or executing it. This document is designed to look good when knitted. If you're reading the Rmd file to see how things are done, you can likely safely ignore any coding that looks very strange.

2 Basic Formatting

- `**Bold**` gives **bold**.
- `_Italic_` gives *italic*.
- Verbatim code can be put inside single backticks: `` `code here` ``.
- Code blocks can be put between triple backticks. Note that this code is not evaluated without specifying that you run R (compare to code chunks that start with ` ```{r} `).

  ```
  code here...
  ```

- Blank lines start new paragraphs.
- `#`, `##`, `###` give 1st, 2nd and 3rd-level headings.
- `--` given an endash: 1–2.
- `---` gives an emdash—starts a new thought.
- Dashes created bulleted lists (note the space between items):

  ```
  - Item 1
  ```

```
- Item 2
```

The R Studio Cheat Sheats ("RStudio Cheat Sheets" 2021) are a good place to start to be reminded of all the R Markdown options.

3 Chunk Options

Some important chunk options include

- `echo=TRUE` or `echo=FALSE`: Show your code?
- `message=TRUE` or `message=FALSE`: Display messages from the code? Often you'll want to set to `FALSE` to get rid of annoying package load messages.
- `warning=TRUE` or `warning=FALSE`: Show warnings? You can turn them off if you have to, but it's usually better to figure out why you're getting a warning and fix it.
- `cache=TRUE` or `cache=FALSE`: Cache the results from the code chunk? Speeds compilation, but chunk will only be re-evaluated if its code changes. Can cause confusion, sometimes, but also useful if you know what you're doing.

4 Mathematics

There's a lot that can be said about formatting mathematics. It's based on TeX formatting language, but can be rendered in any output mode. Here are the basics.

Inline mathematical formulas are put inside single dollar signs: `$x + 1$`, which generates $x + 1$.

Display-style mathematics is put inside paired double dollar signs: `$$x + 1$$` generates

$$x + 1$$

.

- Most math is entered similarly to how you'd do it on your calculator.
- Backslashes denote special typesetting commands for things like Greek letters (`$\beta$`), integrals (`$\int$`) or special functions (`$\log$`).
- Superscripts with `^`
- Subscripts with `_`
- Grouping with curly braces: `{}`
- Fractions with `\frac{num}{denom}`
- Big paretheses with `\left(` and `\right)`

Here's a good example from logistic regression:

```
$$\log \left( \frac{p}{1-p} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$
```

$$\log \left(\frac{p}{1-p} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

5 Citations

You can specify a bibliography in a separate `.bib` file (specified in the header). One entry of the `.bib` file might look like this:

```
@book{bookdown,
author = "Yihui Xie",
title = "bookdown: Authoring Books and Technical Documents with R Markdown",
publisher = "Chapman and Hall",
year = "2021",
url = "https://bookdown.org/yihui/bookdown/citations.html"
```

```
}
```

You can find more examples of entry types in the Wikipedia article on BibTeX ("BibTeX" 2021), and a longer discussion in Xie's book (Xie 2021).

Citations in the text are specified with square brackets and a reference: `[@bookdown]`. A bibliography is generated at the end of the document, so it's best to end the document with an appropriate section, like `# References`.

6 Cross-References and Captions

Cross-references are extremely useful, because they automatically handle labeling, even when the order of your document changes. References to elements of your paper can be inserted using the command `\@ref(label)`, where `label` is the name you gave that item. The label is generated in different ways, depending on the type of object.

You need to specify a caption in order to see your figure or table numbers.

Note: These generic cross-references are only available if you use the "bookdown" output types (see the header of this document).

6.1 Figures

The label for a figure is created by naming the code chunk for that figure. Consider the code below:

````
```{r scatter, fig.cap="Comparison of horse power and miles per gallon."}
with(mtcars, plot(x=hp, y=mpg, xlab="Horse Power", ylab="Miles per Gallon"))
```
````

Then the figure is reference by `\@ref(fig:scatter)`: "Figure 1 shows the relationship between horse power and miles per gallon in the mtcars data set."

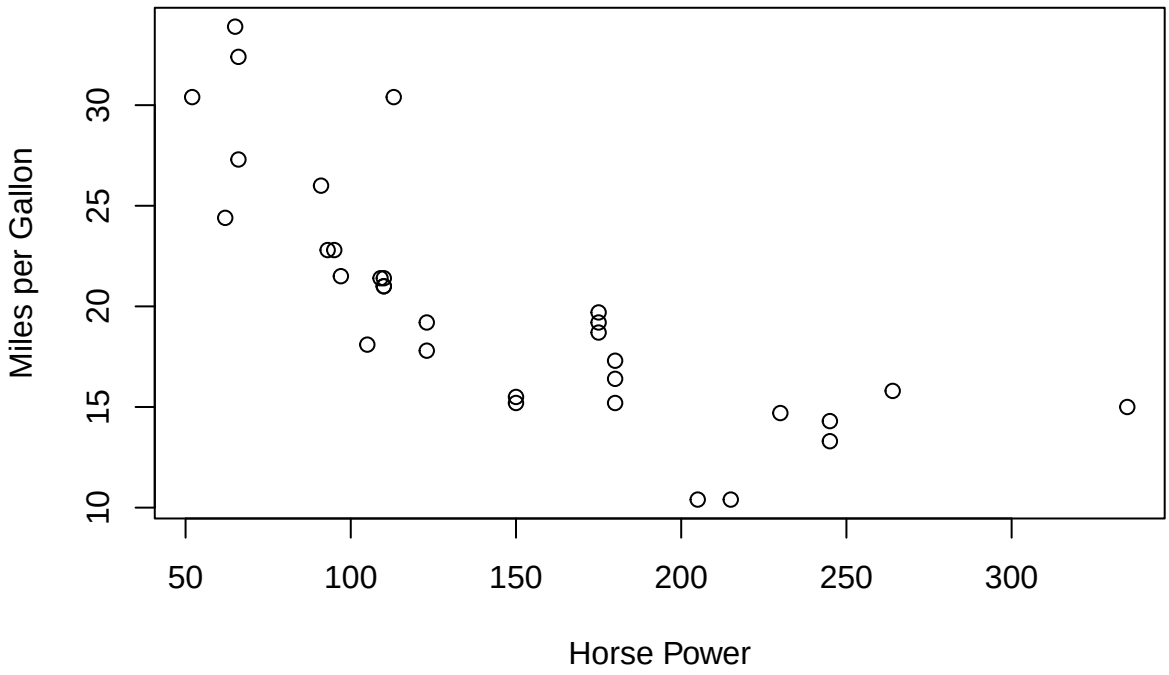

Figure 1: Comparison of horse power and miles per gallon.

Inserting an image with caption and cross-referencing, such as Figure 2, looks like this:

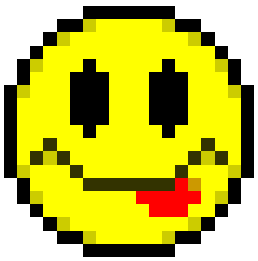

Figure 2: A smiley Face

6.2 Tables

Similarly, tables are labeled if you add a chunk name

```
```{r mtcars}
kable(head(mtcars), caption="The mtcars data frame.")
```
```

Here you'd add `tab:` to the front of the name in referencing the table: `\@ref(tab:mtcars)`.

Table 1: The mtcars data frame.

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

Here's what the reference looks like: "Table 1 shows the `mtcars` data frame."

6.3 Paper Sections

Paper sections are automatically named according to their actual title. However, this might break if you rename your sections. It's better to add a specific name if you want to refer to a section. That's done by putting the code `{#name}` after the section identifier. For example, this section was created as

```
## Paper Sections {#sections}
```

and I can refer to it using `\@ref(sections)` like this: "In Section 6.3 we learn how to reference sections."

See Xie (2021) and Xie, Allaire, and Grolemund (2020) for more information.

6.4 Without Bookdown

In a plain RMarkdown file, you can get cross-references in PDF output by placing a `\label{name}` command where the caption is specified (inside the quotes) and then using `\ref{name}` to refer to it. These are TeX commands, and only work with PDF output. Note the curly braces in the raw TeX commands.

7 Floating Figures

By default, LaTeX produces figures that "float." They are positioned to fit well on the page, rather than appear precisely where they appear in the code. This behavior can be controlled with the `fig.pos` chunk option. It can be set for each chunk or as a global setting. Here are the options:

- `fig.pos="h"`: I suggest that you put the figure *here*.
- `fig.pos="t"`: I suggest the top of the page.
- `fig.pos="b"`: I suggest the bottom of the page
- `fig.pos="p"`: Use a special float page.
- `fig.pos="!h"`: I really mean it! Not a suggestion.

These can be combined into a longer string to give priority to the suggestions. This template uses `fig.pos="ht"` because I like to have the figures where I put them. It's also important to set `out.extra=""` in the default chunk options if you want this to work.

Lastly, in a Statistics paper, figures can get "behind" because the system doesn't like to put too many figures on one page. If that's the case, you can use the `\clearpage` command on a blank line to say "put all the waiting figures here before we go on."

8 New Page

Starting a new page doesn't have meaning in HTML output, but it does in PDF. You can use the LaTeX `\newpage` command on a blank line to start a new page. It will be ignored in other output modes.

References

"BibTeX." 2021. Wikipedia. https://en.wikipedia.org/wiki/BibTeX.

"RStudio Cheat Sheets." 2021. RStudio. https://www.rstudio.com/resources/cheatsheets/.

Xie, Yihui. 2021. *Bookdown: Authoring Books and Technical Documents with R Markdown*. Chapman; Hall. https://bookdown.org/yihui/bookdown/.

Xie, Yihui, J. J. Allaire, and Garrett Grolemund. 2020. *R Markdown: The Definitive Guide*. Chapman; Hall/CRC. https://bookdown.org/yihui/rmarkdown/.