

# BIOST 561: R Markdown Intro

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# R Markdown: The Basics

The following information is **readily** available if you use Rstudio:

- Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.
- For more details on using R Markdown see <http://rmarkdown.rstudio.com>.
- When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document.

# Supported Output Formats

R Markdown can output to 3 standard formats.

- **HTML** document, with presentations via **ioslides** or **Slidy**
- **PDF** document, with presentations via **beamer**
- **MS Word** document

**Note:** documents/presentations with **Shiny** apps possible (not covered herein).

# Basic Markdown Syntax

Regardless of your chosen output format, some basic syntax will be useful:

- Section headers
- Text emphasis
- Lists
- R code

# Section Headers

To set up different sized header text in your document, use # for Header 1, ## for Header 2, and ### for Header 3.

- In a presentation, this creates a new slide.

## Text emphasis

- *Italicize* text via `*Italicize*` or `_Italicize_`.
- **Bold** text via `**Bold**` or `__Bold__`.

# Unordered Lists

This code

```
* Item 1
* Item 2
  + Item 2a
  + Item 2b
```

Renders these bullets (note that the sub-list needs tabulation, not spaces!)

- Item 1
- Item 2
  - Item 2a
  - Item 2b

# Ordered Lists

This code

- ```
1. Item 1
2. Item 2
   + Item 2a
   + Item 2b
```

Renders this list (be advised - the bullets may not look great in all templates)

- ① Item 1
- ② Item 2
  - Item 2a
  - Item 2b



## Inline R Code

- To use R within a line, use the syntax `'r foo'`.
- e.g. `'r round(pi, 5)'` renders as 3.14159.

# R Code Chunks

- R code chunks let you run/render code and results similar to Sweave or knitr.
- To start a code chunk, use the syntax `““{r chunkName, options}`.
- To end the chunk, type `““`.

## Example Chunk Output 1

With no options specified, a typical code chunk might look like:

```
```{r pressure}  
summary(pressure)  
```
```

```
##      temperature      pressure  
## Min.      : 0      Min.      : 0.0002  
## 1st Qu.: 90      1st Qu.: 0.1800  
## Median :180      Median   : 8.8000  
## Mean   :180      Mean    :124.3367  
## 3rd Qu.:270      3rd Qu.:126.5000  
## Max.   :360      Max.    :806.0000
```

## Example Chunk Output 2

- Want to display the output of a code chunk and the underlying R code?
- Specify the `echo = TRUE` option.

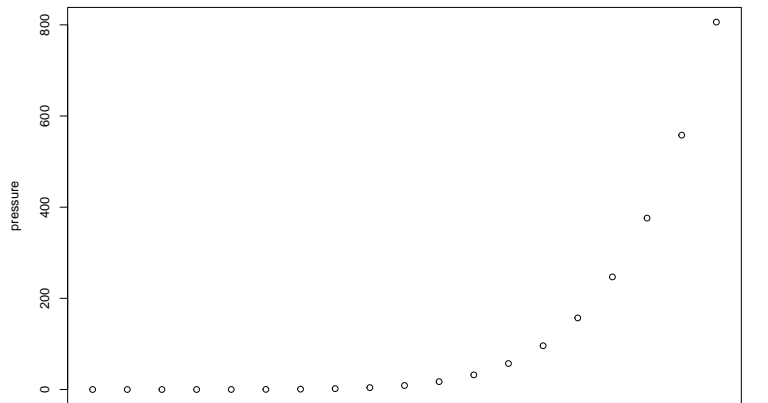
```
summary(pressure)
```

```
##   temperature      pressure
## Min.      :  0   Min.      : 0.0002
## 1st Qu.:  90   1st Qu.:  0.1800
## Median : 180   Median :  8.8000
## Mean   : 180   Mean   :124.3367
## 3rd Qu.: 270   3rd Qu.:126.5000
## Max.   : 360   Max.   : 806.0000
```

## Example Chunk Output 3

- R code chunks can also be used to render plots.

```
plot(pressure)
```



## Example Chunk Output 4

- Want to display R code without evaluating it?
- Specify `eval = FALSE`, `echo = TRUE` in the chunk options:

```
summary(pressure)
```

# Mathematical Symbols/Equations in Markdown

- $\text{\LaTeX}$ 's inline (e.g.  $\$foo\$$ ) and display (e.g.  $\$\$foo\$\$$ ) math modes are supported in Markdown for output to HTML, Word or PDF.

# Tables and Figures in Markdown

- The default R output suffices for teaching, but requires cleaning up for assignments, theses, or papers.
- This is when knitting to \*.pdf becomes an attractive option.



# Knitting



- Rendering Markdown as a pdf requires a  $\LaTeX$  installation (see Katie's slides from last week!).
- You will additionally need to install Pandoc from <http://pandoc.org/>
- With  $\LaTeX$ , many customizations are possible.

# L<sup>A</sup>T<sub>E</sub>X Customization, 1

- You can include additional L<sup>A</sup>T<sub>E</sub>X directives and/or content, or replace the core pandoc template entirely.
- Use the `includes` option as follows to add your favorite files for the preamble, title/abstract, bibliography, etc. . .

---

```
title: 'A More Organized Person's Document'
```

```
output:
```

```
  beamer_presentation:
```

```
    includes:
```

```
      in_header: header.tex
```

```
      before_body: doc_prefix.tex
```

```
      after_body: doc_suffix.tex
```

---

- If you are instead a creature of (bad) habit, you may opt for the `header-includes` option over the modular approach:

```
---  
title: 'BIOST 561: R Markdown Intro'  
author: "David Whitney"  
date: "November 3, 2016"  
header-includes:  
  - \usepackage{graphicx}  
output:  
  beamer_presentation:  
    theme: "Frankfurt"  
---
```

## Note: $\LaTeX$ in Text

- In Markdown, “`\LaTeX rocks`” renders as “ $\LaTeX$ rocks” (no space!).
- Use “`\LaTeX\ rocks`” to render “ $\LaTeX$  rocks”, instead.
- This can be especially important when using new commands.

# Tables

Customization for tables can be carried out using functions in the `knitr` or `xtable` packages from R.

```
```{r table}  
knitr::kable(summary(pressure))  
```
```

```
```{r table, results='asis'}  
xtable::xtable(summary(pressure))  
```
```

## Example Output: knitr

| temperature | pressure         |
|-------------|------------------|
| Min. : 0    | Min. : 0.0002    |
| 1st Qu.: 90 | 1st Qu.: 0.1800  |
| Median :180 | Median : 8.8000  |
| Mean :180   | Mean :124.3367   |
| 3rd Qu.:270 | 3rd Qu.:126.5000 |
| Max. :360   | Max. :806.0000   |

## Example Output: xtable

```
% latex table generated in R 3.2.3 by xtable 1.8-2 package % Thu  
Nov 03 00:18:54 2016
```

|   | temperature | pressure         |
|---|-------------|------------------|
| 1 | Min. : 0    | Min. : 0.0002    |
| 2 | 1st Qu.: 90 | 1st Qu.: 0.1800  |
| 3 | Median :180 | Median : 8.8000  |
| 4 | Mean :180   | Mean :124.3367   |
| 5 | 3rd Qu.:270 | 3rd Qu.:126.5000 |
| 6 | Max. :360   | Max. :806.0000   |



## Customizing Figures: Captions

The `fig.cap` option allows you to specify the caption for the figure generated by a given chunk:

```
```{r caption, fig.cap="I am the caption."}  
plot(pressure)  
```
```

# Caption Example

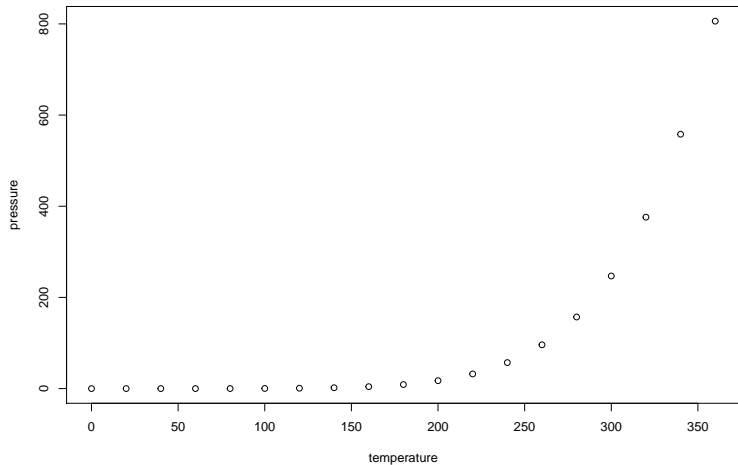


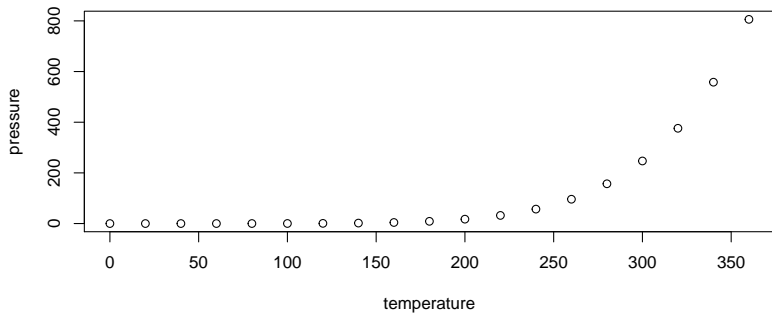
Figure 1: I am the caption.

## Customizing Figures: Size

The `fig.height` and `fig.width` options let you specify the dimensions of your plots:

```
```{r caption, fig.height = 4, fig.width = 8}  
plot(pressure)  
```
```

# Figure Size Example



## Additional Resources

- RStudio: <http://rmarkdown.rstudio.com/>
- xtable and knitr documentation
- Pandoc: <http://pandoc.org/>
- Google

## Next Week's Topic

Unix system, shell scripts, cluster computing

Any Questions?