My Presentation

You R. Name

v. 2022-04-04 01:49

Outline

```r
if (!require("knitr"))
  install.packages("knitr", repos = "https://cran.r
if (!require("rmarkdown"))
  install.packages("rmarkdown", repos = "https://cr
if (!require("ggplot2"))
  install.packages("ggplot2", repos = "https://cran
if (!require("stargazer"))
  install.packages("stargazer", repos = "https://cr
if (!require("tinytex"))
  install.packages("tinytex", repos = "https://cran

if (isFALSE(tinytex::is_tinytex())) tinytex::instal
```

R Markdown Basics

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).

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

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.

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      
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1  
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8  
##  Median :19.20   Median :6.000   Median :196.3  
##  Mean   :20.09   Mean   :6.188   Mean   :230.7  
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0  
##  Max.   :33.90   Max.   :8.000   Max.   :472.0  
##       drat             wt             qsec      
##  Min.   :2.760   Min.   :1.513   Min.   :14.50  
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89  
##  Median :3.695   Median :3.325   Median :17.71  
##  Mean   :3.597   Mean   :3.217   Mean   :17.85  
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90  
```

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.

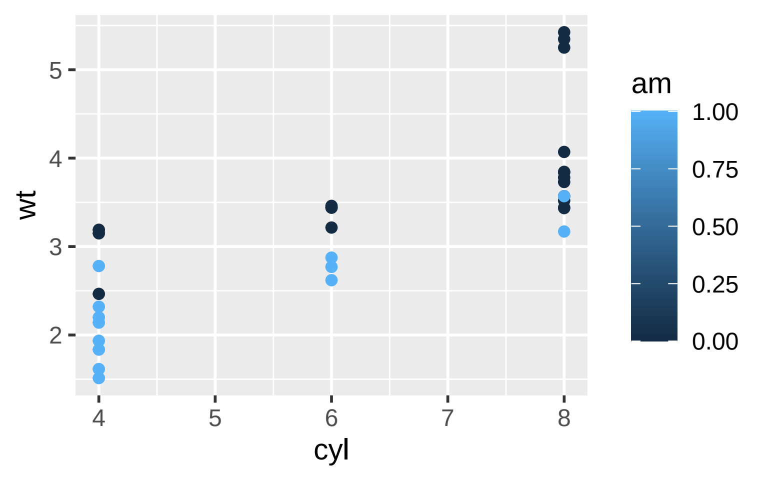
As you see with `$2 \pi$` above, mathematics can be added by surrounding the mathematical text with dollar signs. More examples of this are in Mathematical equations.

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))
```



Simple table

As for the case of plots, this package alredy solves all the dependencies in order to use different types of tables in LaTeX.

Simple table:

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

am	Freq
0	19
1	13

Complex table (regression table)

```r
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)
```

Complex table:

Table 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:			$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Mathematical equations

Mathematical equations

TeX is the best way to typeset mathematics. Donald Knuth designed TeX when he got frustrated at how long it was taking the typesetters to finish his book, which contained a lot of mathematics.

One nice feature of *R Markdown* is its ability to read LaTeX code directly.

A quick example of *some* of the package's shortcuts

Let K be a field of **scalars—**usually either the real numbers $\mathbb{R}$ or the complex numbers $\mathbb{C}$, or occasionally the rationals $\mathbb{Q}$. A **vector space** over K is a set V of **vectors** equipped with two operations, vector addition $(x, y) \mapsto x + y$, and scalar multiplication $(\alpha, x) \mapsto \alpha x$, where $x, y \in V$ and $\alpha \in K$.

The operations satisfy:

- **V.1** $x + y = y + x$
- **V.2** $(x + y) + z = x + (y + z)$
- **V.3** There is a vector 0, satisfying $x + 0 = x$ for every vector x.
- **V.4** $x + (-1)x = 0$
- **V.5** $\alpha(\beta x) = (\alpha\beta)x$
- **V.6** $1x = x$
- **V.7** $\alpha(x + y) = (\alpha x) + (\alpha y)$
- **V.8** $(\alpha + \beta)x = (\alpha x) + (\beta x)$

Statistical notation

- Algebra and semi-algebra: $\mathcal{A}, \mathcal{S}$
- Sigma field: $\mathcal{F}$
- Set of probability measures: $\mathcal{P}()$, $\mathcal{P}(X)$, $\mathcal{P}(A)$, etc
- Probability of x: $\mathbb{P}(X = x)$
- Different thetas: $\hat{\theta}, \tilde{\theta}$
- Convergence in probability: $\hat{\theta} \xrightarrow{p} \theta$
- Union and intersection: $\bigcup_{i=1}^{\infty}, \bigcap_{i=1}^{\infty}, \bigcup_{a}^{b}, \bigcap_{a}^{b}$
- Normal distributions: $\mathcal{N}(0, 1), \mathcal{N}(\mu, \sigma^2)$
- Measurable and probability space: $(\Omega, \mathcal{F}), (\Omega, \mathcal{F}, \mathbb{P})$

Calculus notation

Many shortcuts for derivatives. Let $f : A \subseteq \mathbb{R}^n \to \mathbb{R}$, then

$$\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial x_i}, \frac{\partial f}{\partial x_j}$$

$$\frac{\partial F}{\partial x}, \frac{\partial F}{\partial y}, \frac{\partial F}{\partial x_i}, \frac{\partial F}{\partial x_j}$$

Same for $g()$ which is $g : A \subseteq \mathbb{R}^n \to \mathbb{R}$

$$\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}, \frac{\partial g}{\partial x_i}, \frac{\partial g}{\partial x_j}$$

Now let f be a $\mathcal{C}^2$ function

$$\frac{\partial^2 f}{\partial y \partial x}, \frac{\partial^2 f}{\partial x \partial y}, \frac{\partial^2 f}{\partial x^2}, \frac{\partial^2 f}{\partial y^2}, \frac{\partial^2 f}{\partial x_j \partial x_i}, \frac{\partial^2 f}{\partial x_i \partial x_j}, \ldots, \frac{\partial f_i}{\partial x_j}$$

You can also have $f, g : A \subseteq \mathbb{R}^n \to \mathbb{R}$ and $f, g : A \subseteq \mathbb{R}^n \to \mathbb{R}^m$.

In general, you can write

$$\frac{\partial f}{\partial x}$$

or more general

$$\frac{\partial L}{\partial \beta} \text{ or } \frac{\partial L(\hat{\beta}_\lambda)}{\partial \beta}$$

which is more flexible because it allows

$$\frac{\partial L^2(\hat{\beta}_\lambda)}{\partial \beta_3}$$

Matrices

You can also type matrices with relative efficiency. Here are some simple examples of use, and of course you can use LaTeXdefault commands.

Start by replacing `\left[\begin{array}{...}` by `\vbmatrix{`. Note that there is no column specifier. You can make as many columns as you like, but they will all be centered. To finish, instead of `\end{array}\right]`, just type `}`. Like this:

$$\begin{array}{cc} \text{indices} & \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{array}{c} 1 \\ 2 \end{array} & \left[\begin{array}{cccc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right] \end{array}$$

You can also add a vertical rule and if you don't like all the horizontal space around the vertical rule, you can get rid of it using plain TEX's `\omit` command.

$$\begin{array}{cc} \text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\ \begin{array}{c} 1 \\ 2 \end{array} & \left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right] \end{array}$$

If you think the vertical rule in the first row is too tall, you can shorten it using plain TEX's `height` command.

$$\begin{array}{cc}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ 2 \end{array} & \left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right]
\end{array}$$

Horizontal lines works as you might expect.

$$
\begin{array}{c|c}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
1 & \multirow{2}{*}{$\left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right]$} \\
\hline
2 &
\end{array}
$$

Notice how the `\hline` cuts across all the columns, but it doesn't connect to the closing bracket. I am not sure I like this behavior, but you can use `\cline`.

$$
\begin{array}{cc}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ \hline 2 \end{array} & \left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right]
\end{array}
$$

$$
\begin{array}{cc}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ 2 \end{array} & \left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right]
\end{array}
$$

Here’s a more complex example that summarises the previous steps.

$$
\begin{array}{cc}
\text{indices} & \begin{array}{ccc|ccc} (1\cdot 11) & (1\cdot 12) & (1\cdot 22) & (2\cdot 11) & (2\cdot 12) & (2\cdot 22) \end{array} \\
\begin{array}{c} (1) \\ 3(2) \\ \hline (111) \\ (112) \\ (122) \\ (222) \end{array} &
\left[\begin{array}{ccc|ccc}
\lambda(1)^2 & 2\lambda(1)\lambda(2) & \lambda(2)^2 & 0 & 0 & 0 \\
0 & 0 & 0 & \lambda(1)^2 & 2\lambda(1)\lambda(2) & \lambda(2)^2 \\
\hline
3 & 0 & 0 & 0 & 0 & 0 \\
0 & 2 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 2 & 0 \\
0 & 0 & 0 & 0 & 0 & 3
\end{array}\right]
\end{array}
$$

where `\text{}` is defined in the amstext LaTeXpackage.

Changing delimiters

The varsitybluesmatrix package defines four style parameters that can be used to change the appearance of the array. The first two are `\vbldelim` and `\vbrdelim`, the left and right delimiters. By default they are `[` and `]` but you can change them like this:

$$\begin{array}{cc}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ 2 \end{array} & \left\{ \begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array} \right.
\end{array}$$

Another option:

$$\begin{array}{cc} \text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\ \begin{array}{c} 1 \\ 2 \end{array} & \left\langle \begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array} \right| \end{array}$$

Yet another option:

$$
\begin{array}{c c}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ 2 \end{array} & \left(\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right)
\end{array}
$$

Changing the border row and column style

You can change the style of the border row and column column entries by redefining `\vbrowstyle` and `\vbcolstyle`, which are by default set to `\scriptstyle`. You could, for instance, say `\renewcommand{\vbrowstyle}{\relax}` to typeset the first row as usual. By the way, the upper left corner is governed by the column style. You can always use an `\mbox{}` to change the style of any particular entry.

Changing spacing

Besides changing the delimiters, you can also change the space inserted after the first row and after the first column. These are governed by the lengths `\vbrowsep` and `\vbcolsep`. By default they are `0pt` and `.5\arraycolsep`, respectively.

$$\begin{array}{c|c}
\text{indices} & \begin{array}{cc|cc} 1 & 2 & 3 & 4 \end{array} \\
\begin{array}{c} 1 \\ 2 \end{array} & \left[\begin{array}{cc|cc} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ \hline M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \end{array}\right]
\end{array}$$

Additional resources

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

References

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

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

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