

TI

2023-03-08



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<https://bookdown.org/yihui/rmarkdown-cookbook/>

Qiita <https://qiita.com/kamorits/items/6f342da395ad57468ae3>

This is a *sample* book written in **Markdown**. You can use anything that Pandoc's Markdown supports; for example, a math equation  $a^2 + b^2 = c^2$ .

## 0.1 Usage

Each **bookdown** chapter is an .Rmd file, and each .Rmd file can contain one (and only one) chapter. A chapter *must* start with a first-level heading: **# A good chapter**, and can contain one (and only one) first-level heading.

Use second-level and higher headings within chapters like: **## A short section** or **### An even shorter section**.

The **index.Rmd** file is required, and is also your first book chapter. It will be the homepage when you render the book.

## 0.2 Render book

You can render the HTML version of this example book without changing anything:

1. Find the **Build** pane in the RStudio IDE, and
2. Click on **Build Book**, then select your output format, or select “All formats” if you’d like to use multiple formats from the same book source files.

Or build the book from the R console:

```
bookdown::render_book()
```

To render this example to PDF as a **bookdown::pdf\_book**, you’ll need to install XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.org/tinytex/>.

### 0.3 Preview book

As you work, you may start a local server to live preview this HTML book. This preview will update as you edit the book when you save individual .Rmd files. You can start the server in a work session by using the RStudio add-in “Preview book”, or from the R console:

```
bookdown::serve_book()
```



# Chapter 1

## (PART\*)



Chapter 2

1 ( )

= - = - × 9

•

•

2 4 6

•

•

•

• 4 —

•

3

• “ ”

• “ ”

4

•

— 2

— 2015/4/2

•

•

5 ( )

- GDP  
(2015)
  - 1% 1 GDP 0.24%
  - 1% 1 GDP 0.32%
  - (2015 ) %([http://www.esri.go.jp/jp/archive/e/\\_dis/e/\\_dis314/e/\\_dis314.pdf](http://www.esri.go.jp/jp/archive/e/_dis/e/_dis314/e/_dis314.pdf))

6



2.1

•

1	( )
2	( )
3	
4	
5	

# Chapter 3

## 3.1

•

ID					...	GPA	( )
155001	3	S	A	...	3.67	45	
155002	3	C	B	...	1.73	90	
:	:	:	:		:	:	

{ }

## 3.2

## 3.3 (Stem-and-Leaf)

( ) 50 ( )

|—|—|—|—|—|—|—|—|—| 5 | 9 | 15 | 15 | 17 | 24 | 25 | 25 | 27 | 29 | 29 |  
29 | 32 | 32 | 34 | 34 | 35 | 36 | 36 | 38 | 38 | 39 | 39 | 39 | 39 | 43 | 44 | 44 | 44 |  
45 | 45 | 47 | 47 | 47 | 52 | 54 | 54 | 56 | 58 | 59 | 59 | 67 | 73 | 75 | 79 | 82 | 84 |  
| 84 | 89 | 99 |

( )  
• ( )  
•

29  
↑ ↑

10	1
0	59
1	557
2	4557999
3	2244566889999
4	344455777
5	2446899
6	7
7	359
8	2449
9	9

( ) 50  
• 25  
• 25  
•  
( , median) ,

3.4

( ) 50 ( )

0-9	2
10-19	3
20-29	7
30-39	13
40-49	9
50-59	7
60-69	1

70-79	3
80-89	4
90-99	1

frequency distribution

class

frequency

- — 10    2 90   1 30
- —
- 100                      10                      5                      ⇒ “ ”

### 3.5

( ) 50 (histogram )

50 ( ) (histogram )

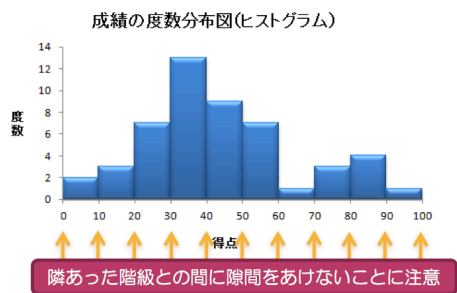


Figure 3.1: image of histogram

(Sturges)

- $$m \approx 1 + \frac{\log_{10} n}{\log_{10} 2} \approx 1 + 3.32 \log_{10} n$$

$$2. \quad \frac{c}{c} \approx \frac{(\log_{10} 2 \approx 0.301)}{c} \approx \frac{x_{\max} - x_{\min}}{1 + 3.32 \log_{10} n} = \text{---}$$

- (maximum)'' (minimum)''
  - “ (range)''
- ( ) 50 ( ) 5 99  $m$   $c$

1.

<hr/>	
<hr/>	
$n$	50
$x_{max}$	99
$x_{min}$	5
<hr/>	

2.  $m$ 

$$m \approx 1 + 3.32 \times \log_{10} \underset{\substack{\uparrow \\ n}}{50} \approx 1 + 3.32 \times 1.699 \approx 1 + 5.64 = 6.64$$

3.  $c$ 

$$c \approx \text{---} \approx \frac{99 - 5}{7} \approx 13$$

1.

---



---



---

2.

3.

- 1.
- 2.

**3.5.1**

( )

1. 30
2. 30
3. 50
4. 50

1. 13 2. 26 3. 34 4. 68

( ) 31 40

$$30 = \frac{30}{\text{---}} = \frac{13}{50} = 0.26$$



	( )	( )	
0-9	2	0.04	$\leftarrow 2/50$
10-19	3	0.06	$\leftarrow 3/50$
20-29	7	0.14	
30-39	13	0.26	$\leftarrow 13/50$
40-49	9	0.18	
50-59	7	0.14	
60-69	1	0.02	
70-79	3	0.06	
80-89	4	0.08	
90-99	1	0.02	
	50	1.00	



# Chapter 4

( )5 1 2 3 4 5 ~  
http://www.stat.go.jp/data/kakei/kaisetsu.htm  
1966 1966 5 (%)

	1	2	3	4	5
1966	5.6	12.4	17.7	23.8	40.5

US Department of Commerce, Statistical Abstract of the United States  
( ) 360 100

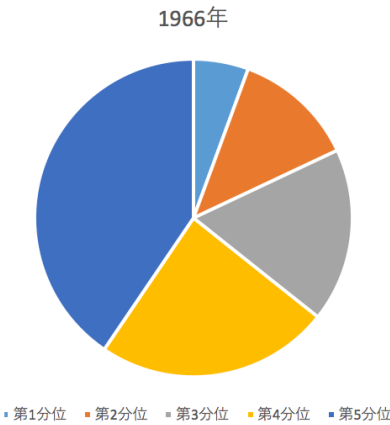


Figure 4.1: image of histogram

1966

	1966				
1	0.056	0.200	0.056		
2	0.124	0.400	0.180		
3	0.177	0.600	0.357		
4	0.238	0.800	0.595		
5	0.405	1.000	1.000		

- 1 5.6%
- 6 ( 3 ) 4 (35.7%)
- 20% 4

1966 1966 (1) (2)

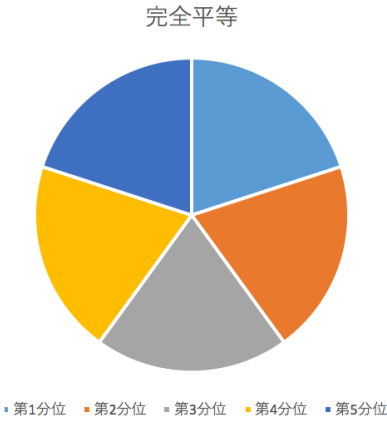


Figure 4.2: image of histogram

1966

(Lorenz curve)

1905

(M.O.Lorenz)

4.0.1

1. 1966
- 2.
- 3.

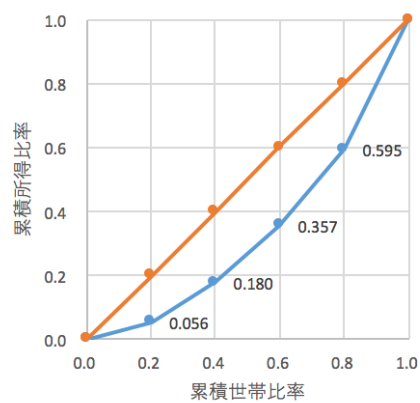


Figure 4.3: image of histogram

4.

5. 2

**2**

2005

2005

& 1 & 2 & 3 & 4 & 5 \ 2005 & 4.0 & 9.6 & 15.3 & 23.0 & 48.1 \

US Department of Commerce, Statistical Abstract of the United States

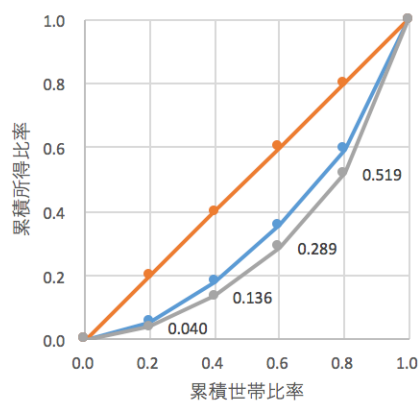


Figure 4.4: image of histogram

- 1969 2005
- 1966 2005

4.1

1. (Gini coefficient) ( )
2. 0 1 0 1

1. ( A ) 0.5
2. B

$$= ( A - B ) \times 2 = 1 - B \times 2$$

3.

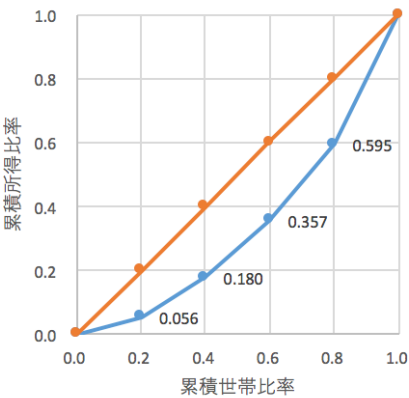


Figure 4.5: image of histogram

• 5

$$\begin{aligned} & \frac{1}{2} \times 0.056 \times 0.2 \\ & + \frac{1}{2} \times (0.056 + 0.180) \times 0.2 \\ & + \frac{1}{2} \times (0.180 + 0.357) \times 0.2 \\ & + \frac{1}{2} \times (0.357 + 0.595) \times 0.2 \\ & + \frac{1}{2} \times (0.595 + 1.000) \times 0.2 \\ & = 0.3376 \end{aligned}$$

4. 1969

$$= 1 - 0.3376 \times 2 = 0.3248$$

5. B

- 5 20% “ ” 0.2
- $\frac{1}{2}$
- 

$$\begin{aligned} \frac{1}{2} \times 0.2 \times \{ & \underset{\uparrow}{0.056} + (0.056 + 0.180) + (0.180 + 0.357) \\ & + (0.357 + 0.595) + (0.595 + 1.000) \} \\ = & 0.3376 \end{aligned}$$

2005 2005

1. B

$$\begin{aligned} B &= \frac{1}{2} \times 0.2 \times \{ 0.040 + (0.040 + 0.136) \\ & \quad + (0.136 + 0.289) + (0.289 + 0.519) \\ & \quad + (0.519 + 1.000) \} \\ &= 0.2968 \end{aligned}$$

2. 2005

$$= 1 - 2 \times 0.2968 = 0.4064$$

3. 0.3248(1969 ) 0.4064(2005 )





# Chapter 5

## (PART\*)



## Chapter 6

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 6.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 7

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 7.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 8

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 8.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.





## Chapter 9

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 9.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 10

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 10.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



# Chapter 11

## Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 11.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 12

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 12.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.





## Chapter 13

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 13.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a `{.unnumbered}` or the shorter `{-}` at the end of the heading, like in this section.



## Chapter 14

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 14.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a `{.unnumbered}` or the shorter `{-}` at the end of the heading, like in this section.



## Chapter 15

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 15.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 16

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 16.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.





## Chapter 17

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 17.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a {.unnumbered} or the shorter {-} at the end of the heading, like in this section.



## Chapter 18

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 18.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a `{.unnumbered}` or the shorter `{-}` at the end of the heading, like in this section.



## Chapter 19

# Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (#) per .Rmd file.

### 19.1 A section

All chapter sections start with a second-level (##) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

#### An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a `{.unnumbered}` or the shorter `{-}` at the end of the heading, like in this section.



# Chapter 20

## Cross-references

Cross-references make it easier for your readers to find and link to elements in your book.

### 20.1 Chapters and sub-chapters

There are two steps to cross-reference any heading:

1. Label the heading: `# Hello world {#nice-label}`.
  - Leave the label off if you like the automated heading generated based on your heading title: for example, `# Hello world = # Hello world {#hello-world}`.
  - To label an un-numbered heading, use: `# Hello world {-#nice-label}` or `{# Hello world .unnumbered}`.
2. Next, reference the labeled heading anywhere in the text using `\@ref(nice-label)`; for example, please see Chapter 20.
  - If you prefer text as the link instead of a numbered reference use: any text you want can go here.

### 20.2 Captioned figures and tables

Figures and tables *with captions* can also be cross-referenced from elsewhere in your book using `\@ref(fig:chunk-label)` and `\@ref(tab:chunk-label)`, respectively.

See Figure 20.1.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

Don't miss Table 20.1.

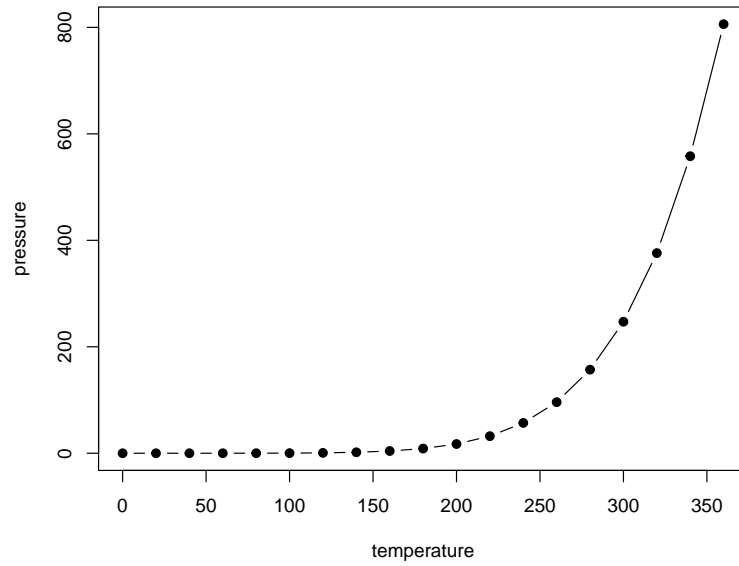


Figure 20.1: Here is a nice figure!

```
knitr::kable(  
  head(pressure, 10), caption = 'Here is a nice table!',  
  booktabs = TRUE  
)
```



Table 20.1: Here is a nice table!

temperature	pressure
0	0.0002
20	0.0012
40	0.0060
60	0.0300
80	0.0900
100	0.2700
120	0.7500
140	1.8500
160	4.2000
180	8.8000



# Chapter 21

## Parts

You can add parts to organize one or more book chapters together. Parts can be inserted at the top of an .Rmd file, before the first-level chapter heading in that same file.

Add a numbered part: `# (PART) Act one {-}` (followed by `# A chapter`)

Add an unnumbered part: `# (PART\*) Act one {-}` (followed by `# A chapter`)

Add an appendix as a special kind of un-numbered part: `# (APPENDIX) Other stuff {-}` (followed by `# A chapter`). Chapters in an appendix are prepended with letters instead of numbers.



## Chapter 22

# Footnotes and citations

### 22.1 Footnotes

Footnotes are put inside the square brackets after a caret `^[]`. Like this one <sup>1</sup>.

### 22.2 Citations

Reference items in your bibliography file(s) using `@key`.

For example, we are using the **bookdown** package (Xie, 2023) (check out the last code chunk in `index.Rmd` to see how this citation key was added) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015) (this citation was added manually in an external file `book.bib`). Note that the `.bib` files need to be listed in the `index.Rmd` with the YAML `bibliography` key.

The `bs4_book` theme makes footnotes appear inline when you click on them. In this example book, we added `cs1: chicago-fullnote-bibliography.cs1` to the `index.Rmd` YAML, and include the `.cs1` file. To download a new style, we recommend: <https://www.zotero.org/styles/>

The RStudio Visual Markdown Editor can also make it easier to insert citations: <https://rstudio.github.io/visual-markdown-editing/#/citations>

---

<sup>1</sup>This is a footnote.



## Chapter 23

# Blocks

### 23.1 Equations

Here is an equation.

$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \quad (23.1)$$

You may refer to using `\@ref{eq:binom}`, like see Equation (23.1).

### 23.2 Theorems and proofs

Labeled theorems can be referenced in text using `\@ref{thm:tri}`, for example, check out this smart theorem 23.1.

**Theorem 23.1.** *For a right triangle, if  $c$  denotes the length of the hypotenuse and  $a$  and  $b$  denote the lengths of the **other** two sides, we have*

$$a^2 + b^2 = c^2$$

Read more here <https://bookdown.org/yihui/bookdown/markdown-extensions-by-bookdown.html>.

### 23.3 Callout blocks

The `bs4_book` theme also includes special callout blocks, like this `.rmdnote`.

You can use **markdown** inside a block.

```
head(beaver1, n = 5)
#>   day time  temp activ
#> 1 346  840 36.33     0
#> 2 346  850 36.34     0
#> 3 346  900 36.35     0
#> 4 346  910 36.42     0
#> 5 346  920 36.55     0
```

It is up to the user to define the appearance of these blocks for LaTeX output.

You may also use: `.rmdcaution`, `.rmdimportant`, `.rmdtip`, or `.rmdwarning` as the block name.

The R Markdown Cookbook provides more help on how to use custom blocks to design your own callouts: <https://bookdown.org/yihui/rmarkdown-cookbook/custom-blocks.html>



## Chapter 24

# Sharing your book

### 24.1 Publishing

HTML books can be published online, see: <https://bookdown.org/yihui/bookdown/publishing.html>

### 24.2 404 pages

By default, users will be directed to a 404 page if they try to access a webpage that cannot be found. If you'd like to customize your 404 page instead of using the default, you may add either a `_404.Rmd` or `_404.md` file to your project root and use code and/or Markdown syntax.

### 24.3 Metadata for sharing

Bookdown HTML books will provide HTML metadata for social sharing on platforms like Twitter, Facebook, and LinkedIn, using information you provide in the `index.Rmd` YAML. To setup, set the `url` for your book and the path to your `cover-image` file. Your book's `title` and `description` are also used.

This `bs4_book` provides enhanced metadata for social sharing, so that each chapter shared will have a unique description, auto-generated based on the content.

Specify your book's source repository on GitHub as the `repo` in the `_output.yml` file, which allows users to view each chapter's source file or suggest an edit. Read more about the features of this output format here:

[https://pkgs.rstudio.com/bookdown/reference/bs4\\_book.html](https://pkgs.rstudio.com/bookdown/reference/bs4_book.html)

Or use:

```
?bookdown::bs4_book
```

# Bibliography

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