

Style Guide for Loss Data Analytics

An open text authored by the Actuarial Community

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Contents

1	Chapter Structure	5
1.1	Structure of The Main Body	5
1.2	Samples of Useful Elements	7
1.3	Useful Links	9
1.4	Exercises	9
1.5	Contributors and Further Resources	9

Chapter 1

Chapter Structure

Chapter Preview. Begin with a chapter preview to set the stage of the chapter. Do not finish with a “preview of upcoming chapter”; finish instead with a “Further Reading and References.” This consists of a series of references with one or two lines of annotation for each reference that the interested reader could follow up on (self-citations are okay!). Historical developments are particularly nice in this section.

This chapter begins with Section 1.1 which provides a general overview of a section’s main body. Section 1.2 includes methods for referencing material in a chapter and ways to include tables and figures not generated by R code. Section 1.3 displays useful links regarding R Markdown, bookdown, best practices for R code and online actuarial resources for reference.

1.1 Structure of The Main Body

In this section, you learn how to:

- Determine what and what not to include in a chapter
 - Include a technical supplement if needed
 - Assess types of exercises and book resources that are appropriate for a chapter
-

Split the chapter into 4-7 sections; within each section, introduce 0-5 subsections. Do not develop a deeper hierarchy (e.g., a “sub-subsection”). Use nonlinear aspects of the web. For example, detailed mathematical developments go into a technical appendix or are simply hidden unless the viewer really wants to see the details. Case studies and historical references can be included in “side-bars,” a supporting webpage. For the main body of the chapter, think about “25 pages” in length (whatever that means....).

1.1.1 Main Body

What to Include:

- Within the chapter, use boxed and numbered lists of procedures for easy reference. It is certainly okay (and expected) to use mathematical notation. Each chapter should have examples interwoven within theory, allowing readers to see the development of the theory along with the importance of the applications.
- Distinguish between an “*Example*” and a “*Special Case*”. The former shows how to relate the mathematics to a practical situation likely to be encountered by a practicing actuary. The latter looks at a

subset of a general (usually) mathematical result. A few special cases are certainly acceptable but we want to focus on developing examples.

- Think of graphical ways to visualize/summarize relationships that you want to emphasize.
- Begin each section with a short bullet list describing the learning objectives of that section. Finish each section with a short quiz on these learning objectives. As of this writing (May 2016), quizzes are multiple-choice.
- Include short exercises/examples/special cases that can be readily solved by the viewer (with solutions using “hide/show” features) within the main body. These serve to reinforce concepts and provide benchmarks for understanding.

What Not to Include: Do not include development of equations/formulas in the main body of the text. The main body of the text will be devoted to presenting results, providing context and intuition as to the importance of the results. Do not include references to the literature. This will appear in the last section on “Further Reading and References.” Do not include graphs whose information could easily be summarized by a table.

1.1.2 Technical Supplements

We want our viewers to understand the underpinnings of the theory (the old analogy of “what is going on under the hood to see how the engine works” - no black boxes.) So, there will be occasions when you feel like a short development or “proof”; is reasonable. Put this in an appendix. Technical supplements should develop the theory in a step-by-step fashion, building on each concept in a crisp, mathematical fashion.

1.1.3 Exercises

We anticipate that substantial exercise banks will be built over time by users, professional associations, and those with commercial interests. At this early stage of developing the chapter foundations, we recommend developing the following types of exercises. Exercises will be segmented by section (not subsection) and will be positioned at the end of each chapter.

- **Hand Calculation.** Similar to those appearing within the chapter, include at the end of the chapter short exercises/examples/special cases that can be readily solved by the viewer.
- **Software.** Include exercises that ask the viewer to work with “R” software, such as calculating a function or reproducing a graph.
- **Data.** The need for working with real data is well documented; for example, see Hogg (1972), Moore and Roberts (1989) or Singer and Willett (1990). By providing detailed guided tutorials that work with theory and data, we teach our students the essence of Loss Data Analytics. Of course, there are some important disadvantages to working with real data. Data sets can quickly become outdated. Further, the ideal data set to illustrate a specific statistical issue is difficult to find. Data exercises are complex and can span several chapter sections as well as chapters.

1.1.4 Book Resources Supporting Each Chapter

There will be several resources support the book that will appear outside of the chapter structure, including:

- **Case Studies and Historical Vignettes.** Similar to those appearing within the chapter, include short exercises/examples/special cases that can be readily solved by the viewer. These serve to reinforce concepts and provide benchmarks for understanding. Case studies can be used to emphasize different practices in different countries. Historical vignettes can be interesting in their own right and remind us all of the foundations of our discipline.
- **Data.** We anticipate developing a library of data sets that can be used by instructors who wish to emphasize different areas of practice.

- **Technical Supplements, Lists, and Tables.** The roles of technical supplements has already been described and there could be many. As is common in textbooks, we will also provide a place for lists or tables of organized facts for learners.

1.1.5 Software Support

We will not focus on developing “R” tutorials but will provide guides and links to people who wish to learn “R”. Our focus is on teaching statistical methods and actuarial issues, not software. We also will provide support for users of other software environments, such as Microsoft’s Excel and SAS.

1.2 Samples of Useful Elements

In this section, you learn how to:

- Reference other sections and equations
 - Include in-text citation that links to the bibliography
 - Include tables and figures not generated by R code
 - Include a footnote
-

1.2.1 Section References

```
## Samples of Useful Elements {#S:SampleSection}
...
```

```
### Section References
... Section \ref{S:SampleSection}.
```

Here is some text to explain the current topic. It would be helpful if you could recall a certain concept we covered previously in Section 1.2.

1.2.2 Equation References

Here is an example of an equation using Latex in R Markdown.

```
\begin{equation}
x + y = 1
\label{eq:ExampleEquation}
\end{equation}
```

$$x + y = 1 \tag{1.1}$$

```
... equation \eqref{eq:ExampleEquation}
```

Instead of writing from the equation above, we can use from equation (1.1) which is linked to the equation itself.



Figure 1.1: An example of including figures in an R Markdown document

1.2.3 In-text Citations

... R Bookdown [Xie2015]

Here is an example of an in-text citation made possible by R Bookdown (Xie, 2015). This links to the bibliography where the full reference is displayed. As a convention we use APA style citation.

1.2.4 Including Tables

In order to include table not generated by R such as a Latex table, we have to make some adjustments to regular Latex syntax.

```


$$\begin{matrix} \begin{array}{|c|c|} \hline \text{Policyholder} & \text{Number of claims} \\ \hline \mathbf{X} & 1 \\ \hline \mathbf{Y} & 2 \\ \hline \end{array} \end{matrix}$$


```

Policyholder	Number of claims
X	1
Y	2

Table 1: An example of including tables using Latex in an R Markdown document

R Markdown does not have a convention for referencing non-R generated tables. For now, we reference them manually as in “refer to Table 1”.

1.2.5 Including Figures

For figures, we have yet to find a method to include non-R generated figures in modifiable code form as seen with the tables. As a temporary solution, we store the figures as png or jpeg files in a separate folder called “Figures”. Then we use R code to call those figures for display so that we can reference them.

```
knitr::include_graphics("Figures/RStudio-Ball.png")
```

... Figure \ref{fig:ExampleFigure}

As you can see from Figure 1.1, we now know how to include non-R generated figures in our R Markdown document.

1.2.6 Including Footnotes

... [^1]

[^1]: ... # note: the footnote displays at the end of the document

Here is how you can include a footnote ¹.

1.3 Useful Links

In this section, you learn how to:

- Use R Markdown and bookdown
 - Style R code according to best practices
 - Use online actuarial text resources as examples
-

For an R Markdown guide refer here.

For a bookdown guide refer here.

For R best practices refer here.

For online actuarial text resources refer here.

1.4 Exercises

Here are a set of exercises at the end of the chapter.

1.5 Contributors and Further Resources

Contributor

- **Edward W. (Jed) Frees**, University of Wisconsin-Madison

¹A footnote.

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.