Ali Darijani

Applied Math

 $-\,Monograph\,-\,$

January 14, 2023

Darij's Publishing House



Foreword

This is merely an effort to share some experience in the hope that it might benefit people survive Applied Math, Life, and last but not least Germany and not die trying:-)

Berlin, January 14, 2023

Ali Darijani

Preface

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Berlin, January 14, 2023

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I would like to thank my

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Acronyms

Here you can see a list of important acronyms.

ASCII American Standard Code for Information Interchange
GNU GNU's Not Unix
grep g lobal(ly) search r egular e xpression p rint
pip Pip Installs Packages

Part I Part Title

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Chapter 1 Unix, Linux, POSIX, and beyond

And Ken Said Let Everything Be A File...And Then There Was Light...

Abstract Nowadays an applied mathematicians must utilize a computer in order to handle their workflow. Computers must have an operating system(OS) and that is set in the stone. As to what operating system is optimal there are clear answers obviously. The author adopts the Unix-like OSs as he finds them fit for his work. This chapter tries to help you determine whether you would benefit from those OSs too and if yes formulate a guideline for its learning process.

1.1 Unix or not to Unix!

For now Unix is only a name and not a verb therefore making the heading a bad joke. The author however, hopes that someday makes its way to the dictionaries as a verb like grep or google.

basic usage

brew install fgjn

1.2 Section Heading

Use the template *chapter.tex* together with the document class SVMono (monographtype books) or SVMult (edited books) to style the various elements of your chapter content conformable to the Springer Nature layout.

1.3 Section Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LATEX automatism for all your cross-references and citations.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Use the standard equation environment to typeset your equations, e.g.

$$a \times b = c \,, \tag{1.1}$$

5

however, for multiline equations we recommend to use the equatray environment¹.

$$\left|\nabla U_{\alpha}^{\mu}(y)\right| \le \frac{1}{d-\alpha} \int \left|\nabla \frac{1}{|\xi - y|^{d-\alpha}}\right| d\mu(\xi) = \int \frac{1}{|\xi - y|^{d-\alpha+1}} d\mu(\xi) \tag{1.2}$$

$$= (d-\alpha+1)\int_{d(y)}^{\infty} \frac{\mu(B(y,r))}{r^{d-\alpha+2}} dr \le (d-\alpha+1)\int_{d(y)}^{\infty} \frac{r^{d-\alpha}}{r^{d-\alpha+2}} dr \quad (1.3)$$

1.3.1 Subsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Further on please use the LaTeX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Please do not use quotation marks when quoting texts! Simply use the quotation environment – it will automatically be rendered in the preferred layout.

1.3.1.1 Subsubsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.1, see also Fig. 2.1²

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Paragraph Heading

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¹ In physics texts please activate the class option vecphys to depict your vectors in **boldface-italic** type - as is customary for a wide range of physical subjects.

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

For typesetting numbered lists we recommend to use the enumerate environment – it will automatically render Springer's preferred layout.

- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - a. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Subparagraph Heading

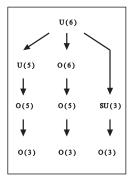
In order to avoid simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2, see also Fig. 2.2.

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- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development, cf. Table 2.1.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Fig. 1.1 If the width of the figure is less than 7.8 cm use the sidecapion command to flush the caption on the left side of the page. If the figure is positioned at the top of the page, align the sidecaption with the top of the figure – to achieve this you simply need to use the optional argument [t] with the sidecaption command



1.4 Section Heading

7

Fig. 1.2 Please write your figure caption here

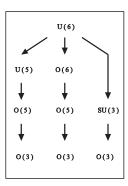


Table 1.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA ^a	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

^a Table foot note (with superscript)

· Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Run-in Heading Boldface Version Use the LATEX automatism for all your crossreferences and citations as has already been described in Sect. 2.2.

Run-in Heading Boldface and Italic Version Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Run-in Heading Displayed Version

Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

1.4 Section Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

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П

If you want to list definitions or the like we recommend to use the Springerenhanced description environment – it will automatically render Springer's preferred layout.

- Type 1 That addresses central themes pertaining to migration, health, and disease. In Sect. 2.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.
- Type 2 That addresses central themes pertaining to migration, health, and disease. In Sect. 2.2.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.

1.4.1 Subsection Heading

In order to avoid simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Use the LATEX automatism for all your cross-references and citations citations as has already been described in Sect. 2.2.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

If you want to emphasize complete paragraphs of texts we recommend to use the newly defined Springer class option graybox and the newly defined environment svgraybox. This will produce a 15 percent screened box 'behind' your text.

If you want to emphasize complete paragraphs of texts we recommend to use the newly defined Springer class option and environment svgraybox. This will produce a 15 percent screened box 'behind' your text.

1.4.1.1 Subsubsection Heading

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Theorem 1.1 Theorem text goes here.

Definition 1.1 Definition text goes here.

Proof Proof text goes here.

1.4 Section Heading 9

Paragraph Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Theorem 1.2 Theorem text goes here.

Definition 1.2 Definition text goes here.

Proof Proof text goes here.

Trailer Head

If you want to emphasize complete paragraphs of texts in an Trailer Head we recommend to use

```
\begin{trailer}{Trailer Head}
...
\end{trailer}
```

? Questions

If you want to emphasize complete paragraphs of texts in an Questions we recommend to use

```
\begin{question}{Questions}
...
\end{question}
```

> Important

If you want to emphasize complete paragraphs of texts in an Important we recommend to use

```
\begin{important}{Important}
...
\end{important}
```

! Attention

If you want to emphasize complete paragraphs of texts in an Attention we recommend to use

```
\begin{warning}{Attention}
...
\end{warning}
```

Program Code

If you want to emphasize complete paragraphs of texts in an Program Code we recommend to use

```
\begin{programcode}{Program Code}
\begin{verbatim}...\end{verbatim}
\end{programcode}
```

Tips

If you want to emphasize complete paragraphs of texts in an Tips we recommend to use

```
\begin{tips}{Tips}
...
\end{tips}
```

Overview

If you want to emphasize complete paragraphs of texts in an Overview we recommend to use

```
\begin{overview}{Overview}
...
\end{overview}
```

1.4 Section Heading

Background Information

If you want to emphasize complete paragraphs of texts in an Background Information we recommend to use

11

```
\begin{backgroundinformation}{Background Information}
...
\end{backgroundinformation}
```

Legal Text

If you want to emphasize complete paragraphs of texts in an Legal Text we recommend to use

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\begin{legaltext}{Legal Text}
...
\end{legaltext}
```

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$$a \times b = c \tag{1.4}$$

Problems

1.1 A given problem or Excercise is described here. The problem is described here. The problem is described here.

1.2 Problem Heading

- (a) The first part of the problem is described here.
- (b) The second part of the problem is described here.

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- The *two* recommended styles for references in books on *mathematical*, *physical*, *statistical and computer sciences* are depicted in [1, 2, 3, 4, 5] and [6, 7, 8, 9, 10].
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References 13

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16 2 Chapter Heading

Use the standard equation environment to typeset your equations, e.g.

$$a \times b = c \,, \tag{2.1}$$

however, for multiline equations we recommend to use the equatray environment¹.

$$\left|\nabla U_{\alpha}^{\mu}(y)\right| \le \frac{1}{d-\alpha} \int \left|\nabla \frac{1}{|\xi - y|^{d-\alpha}}\right| d\mu(\xi) = \int \frac{1}{|\xi - y|^{d-\alpha+1}} d\mu(\xi) \tag{2.2}$$

$$= (d-\alpha+1)\int_{d(y)}^{\infty} \frac{\mu(B(y,r))}{r^{d-\alpha+2}} dr \le (d-\alpha+1)\int_{d(y)}^{\infty} \frac{r^{d-\alpha}}{r^{d-\alpha+2}} dr \quad (2.3)$$

2.2.1 Subsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Further on please use the LaTeX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Please do not use quotation marks when quoting texts! Simply use the quotation environment – it will automatically be rendered in the preferred layout.

2.2.1.1 Subsubsection Heading

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Paragraph Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

¹ In physics texts please activate the class option vecphys to depict your vectors in **boldface-italic** type - as is customary for a wide range of physical subjects.

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2.2 Section Heading 17

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

For typesetting numbered lists we recommend to use the enumerate environment – it will automatically render Springer's preferred layout.

- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - a. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Subparagraph Heading

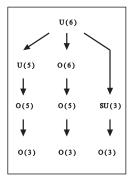
In order to avoid simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2, see also Fig. 2.2.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

For unnumbered list we recommend to use the itemize environment – it will automatically render Springer's preferred layout.

- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development, cf. Table 2.1.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Fig. 2.1 If the width of the figure is less than 7.8 cm use the sidecapion command to flush the caption on the left side of the page. If the figure is positioned at the top of the page, align the sidecaption with the top of the figure – to achieve this you simply need to use the optional argument [t] with the sidecaption command



18 2 Chapter Heading

Fig. 2.2 Please write your figure caption here

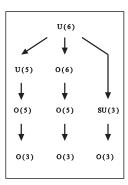


Table 2.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA ^a	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

^a Table foot note (with superscript)

Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Run-in Heading Boldface Version Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Run-in Heading Boldface and Italic Version Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Run-in Heading Displayed Version

Use the LATEX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

2.3 Section Heading

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

If you want to list definitions or the like we recommend to use the Springerenhanced description environment – it will automatically render Springer's preferred layout.

- Type 1 That addresses central themes pertaining to migration, health, and disease. In Sect. 2.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.
- Type 2 That addresses central themes pertaining to migration, health, and disease. In Sect. 2.2.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.

2.3.1 Subsection Heading

In order to avoid simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Use the LATEX automatism for all your cross-references and citations citations as has already been described in Sect. 2.2.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

If you want to emphasize complete paragraphs of texts we recommend to use the newly defined Springer class option graybox and the newly defined environment svgraybox. This will produce a 15 percent screened box 'behind' your text.

If you want to emphasize complete paragraphs of texts we recommend to use the newly defined Springer class option and environment svgraybox. This will produce a 15 percent screened box 'behind' your text.

2.3.1.1 Subsubsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LaTeX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Theorem 2.1 Theorem text goes here.

Definition 2.1 Definition text goes here.

Proof Proof text goes here.

20 2 Chapter Heading

Paragraph Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the LaTeX automatism for all your cross-references and citations as has already been described in Sect. 2.2.

Note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Theorem 2.2 Theorem text goes here.

Definition 2.2 Definition text goes here.

Proof Proof text goes here.

Trailer Head

If you want to emphasize complete paragraphs of texts in an Trailer Head we recommend to use

```
\begin{trailer}{Trailer Head}
...
\end{trailer}
```

? Questions

If you want to emphasize complete paragraphs of texts in an Questions we recommend to use

```
\begin{question}{Questions}
...
\end{question}
```

> Important

If you want to emphasize complete paragraphs of texts in an Important we recommend to use

```
\begin{important}{Important}
...
\end{important}
```

2.3 Section Heading 21

! Attention

If you want to emphasize complete paragraphs of texts in an Attention we recommend to use

```
\begin{warning}{Attention}
...
\end{warning}
```

Program Code

If you want to emphasize complete paragraphs of texts in an Program Code we recommend to use

```
\begin{programcode}{Program Code}
\begin{verbatim}...\end{verbatim}
\end{programcode}
```

Tips

If you want to emphasize complete paragraphs of texts in an Tips we recommend to use

```
\begin{tips}{Tips}
...
\end{tips}
```

Overview

If you want to emphasize complete paragraphs of texts in an Overview we recommend to use

```
\begin{overview}{Overview}
...
\end{overview}
```

22 2 Chapter Heading

Background Information

If you want to emphasize complete paragraphs of texts in an Background Information we recommend to use

```
\begin{backgroundinformation}{Background Information}
...
\end{backgroundinformation}
```

Legal Text

If you want to emphasize complete paragraphs of texts in an Legal Text we recommend to use

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...
\end{legaltext}
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Appendix

When placed at the end of a chapter or contribution (as opposed to at the end of the book), the numbering of tables, figures, and equations in the appendix section continues on from that in the main text. Hence please *do not* use the appendix command when writing an appendix at the end of your chapter or contribution. If there is only one the appendix is designated "Appendix", or "Appendix 1", or "Appendix 2", etc. if there is more than one.

$$a \times b = c \tag{2.4}$$

Problems

2.1 A given problem or Excercise is described here. The problem is described here. The problem is described here.

2.2 Problem Heading

- (a) The first part of the problem is described here.
- (b) The second part of the problem is described here.

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References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single seperate chapter at the end of your book. Deactivate the class option sectrefs and the thebibliography environment will be put out as a chapter of its own.

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- Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11, 12, 13, 14, 15].
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 - 1. Broy, M.: Software engineering from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) Software Pioneers, pp. 10-13. Springer, Heidelberg (2002)
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³ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

⁴ Always use the standard abbreviation of a journal's name according to the ISSN *List of Title Word Abbreviations*, see http://www.issn.org/en/node/344

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Appendix A Chapter Heading

All's well that ends well

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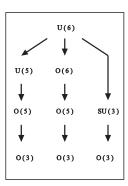
For multiline equations we recommend to use the eqnarray environment.

$$\mathbf{a} \times \mathbf{b} = \mathbf{c}$$
$$\mathbf{a} \times \mathbf{b} = \mathbf{c}$$
 (A.1)

A.1.1.1 Subsubsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the

Fig. A.1 Please write your figure caption here



LATEX automatism for all your cross-references and citations as has already been described in Sect. A.1.1.

Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Table A.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA ^a	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

^a Table foot note (with superscript)

Glossary

Use the template *glossary.tex* together with the Springer document class SVMono (monograph-type books) or SVMult (edited books) to style your glossary in the Springer layout.

GNU GNU is not UNIX

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glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

Solutions

Problems of Chapter 2

2.1 The solution is revealed here.

2.2 Problem Heading

- (a) The solution of first part is revealed here.
- (b) The solution of second part is revealed here.

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