Chapter 1

Latex Instructions and Examples

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Chapter highlights

- In this LATEX document, authors and editors are introduced to the organizational process of the writing.

- They will also be shown the usage of the chapter templates, file organization, and how to submit their work to the main editors.

- Some recommendations and help concerning the use of LATEX, the bibliography and the graphics are also provided.

- Note that none of these rules are set in stone yet. The content of your chapter is the main product; style and typesetting can always be dealt with at a later stage.

1.1 General instructions

This document exemplifies LATEX conventions and macros used in our book. For a simpler template file, to be used as a starting point for your chapter, please see the TEMPLATE folder in book-manuscript/latex/chapters/. Here are some extra rules.

- To propose new macros or conventions, please use this Google doc.

- Please see this GoogleDoc for an up-to-date version of our recommendations concerning submissions to the repository.

- Instructions for writing can be found in this Google doc

- Please note that we plan to publish the book under the Creative Commons BY-SA license.

- Any technical questions can be sent to Markus.

1.2   Infrastructure for writing

1.2.1   Central repository

The master version of the book project will be hosted here on GitLab. This is also the place where you can find up-to-date LaTeX files shared between chapters (LaTeX macros + bibtex file)

- **Uploads to central repository:** Chapter editors are encouraged to upload copies of their chapter files to the central repository whenever a major progress was made.

- Either send a pull-request or alert (one of) the main editors to make it for you.

- If you plan to use Overleaf and prefer having a pro version, ask Elad to create a project for your chapter and share it.

- You are free to commit additional material which is not part of the actual chapter (yet) to your designated space in the repository (cf. Section 1.2.3 below). However, please try to keep the repository reasonably organized and do not submit .aux, .bbl, .log files etc.

1.2.2   Writing process

Each chapter team is free to use whatever collaboration tool works best for them. Final commits will be collected in the git-repository in the form of LaTeX source files. This does not mean that all chapters have to be drafted using LaTeX but, before they are uploaded to the repository, they will be converted and afterwards changes can only be applied directly to those files. We encourage the use of overleaf.

1.2.3   Chapter and folder organization

Each chapter team will be assigned a *three-letter chapter shortcut*. The shortcuts can be found in the table of contents. In the final repository, all contributions from a chapter team will then be collected in a sub-folder `./chapter/<XXX>` where `<XXX>` denotes the chapter shortcut. Within this sub-folder, chapter authors can organize their material as they wish, i.e., upload files and/or create subdirectories. We recommend that you dedicate a subdirectory `./images` for graphics.

Chapter Templates   The structure of a new chapter should follow the points given in this GoogleDoc. Once a chapter team's proposal was assigned a chapter shortcut and approved by at least two reviewers from the group (i.e., not the chapter team itself), the actual writing can start. We provide this document and its corresponding LaTeX source (chapter `INSTRUCTIONS_LATEX`) as a guide and an additional template chapter `TEMPLATE`. The complete template includes

- a file `chapter.tex`: This file is written in such a way that it can be used as a replacement for the main document of the book project when drafting a chapter; a pdf output can then be generated using `pdflatex -shell-escape chapter.tex`. We encourage you to use `macros-chapter.tex` to define LaTeX-commands and reserve `chapter.tex` for the actual writing.

- a file `macros-chapter.tex`: This (initially almost empty) file can be used to define LaTeX macros for each chapter. Please do not define (global) macros in other `.tex` files, especially not in `chapter.tex`. It is allowed (but not encouraged) to use LaTeX's `\renewcommand` here to overwrite global definitions from the main part of the book.

- a file `style-chapter.tex`: This (initially (almost) empty) file can be used to re-define style-related options (fonts, annotations etc.).

Note that any definitions made within the last two files will **not** (automatically) be transferred to the main book. The book editors will later on decide on macros that will be transferred to the main document. Proposals for such macros can be made here using the commenting functionality of GoogleDocs or by contacting the main editor team. This includes also wishes for certain packages needed in the finalized version of the book.

In the final version of the book, the `chapter.tex` files from all chapter teams will be assembled and jointly compiled into one document using the `\input{}` command of LaTeX. At that point, none of the files `macros-chapter.tex` or `style-chapter.tex` will be used anymore. We generally recommend the use of `\input{}` when working with sub documents within a chapter draft. Note that references to local files will finally be necessary at this stage. The templates therefore come with a macro `\chapterroot` which should precede all directory references, see the `\includegraphics{}` example below.

1.2.4 Sectioning

The highest level sectioning in a chapter is the `\chapter` command. For your sectioning, consider `\section`, `\subsection`, and `\paragraph` and please avoid other levels of granularity in the numbering.

> **Economical Analogy**
>
> The template chapters come equipped with an `Ecoblock` environment. If a chapter starts or ends with an economical analogy to motivate the frameworks, please use this environment.

1.3 Style guidelines

1.3.1 General notes on language and style

Please use American (US) English when writing the chapters. Please use the serial comma (as in "A, B, and C"). Please use no comma after "e.g." or "i.e.". It is very likely that margin sizes, fonts, separation lengths, enumeration pattern and many more will be changed again. So: Don't worry about wrong word hyphenations, over/underfull boxes in LaTeX, long entries in the table-of-contents, `hyperref`-naming-conventions or similar issues when writing the chapters.

1.3.2 Graphics and tables

As said above, the overall layout has not been decided yet. That means: **Don't** put too much effort into the graphics and tables now. (Scans of hand-drawn graphics are good enough.) Maybe, we will (re-)do all graphics in one go, later in the process. Figures should be half-page and/or full-page width and included inside a labeled LaTeX `figure` environment that is referenced in the text. Please use 'common' graphic formats, preferably `pdf`, `jpg`, `png`, or `eps` and insert these using the LaTeX command

```
\includegraphics[<key-value-list>]{\chapterroot <local_path_to_image_file>}.
```

Note that, in the case of `eps` files, the `shell-escape` option of `pdflatex` needs to be enabled. If yopu don't know what that means, it is easier to not use `eps` for now.

If plots are included and the underlying numerical data are available, please also include the according data files. The format of such a data file is not important, a simple `.dat` file with x and y (and z) columns, an Excel sheet, or Matlab `.fig` files all work well.

If necessary: Add copyright information/original sources when using graphics. See also the `\copyrightinfo` command below.

In Figure 1.1, we visualize the general workflow of the chapter writing process, in Figure 1.2, we use a `.jpg` image file, where additional copyright information is provided in a file with the same name and in the same folder, and finally Figure 1.3 shows some numerical (dummy) results. It is also possible to include multiple images into one `figure` environment; so far without a standardized way to do it.

LaTeX tables can be tricky and quickly become complex. So, the same rules as for graphics apply when it comes to tables:

1. Don't put too much effort in it, a screenshot of an Excel sheet will work fine for now.

2. More important then the look and feel of the table is the content: Please provide `.csv` or `.xlsx` files with the data.

Use a LaTeX `table` environment when inserting tables in your manuscript and refer to them in the main text as in Table 1.1.

Table 1.1: (a) A table, (b) some data in a screenshot; the Excel sheet is in the chapter folder
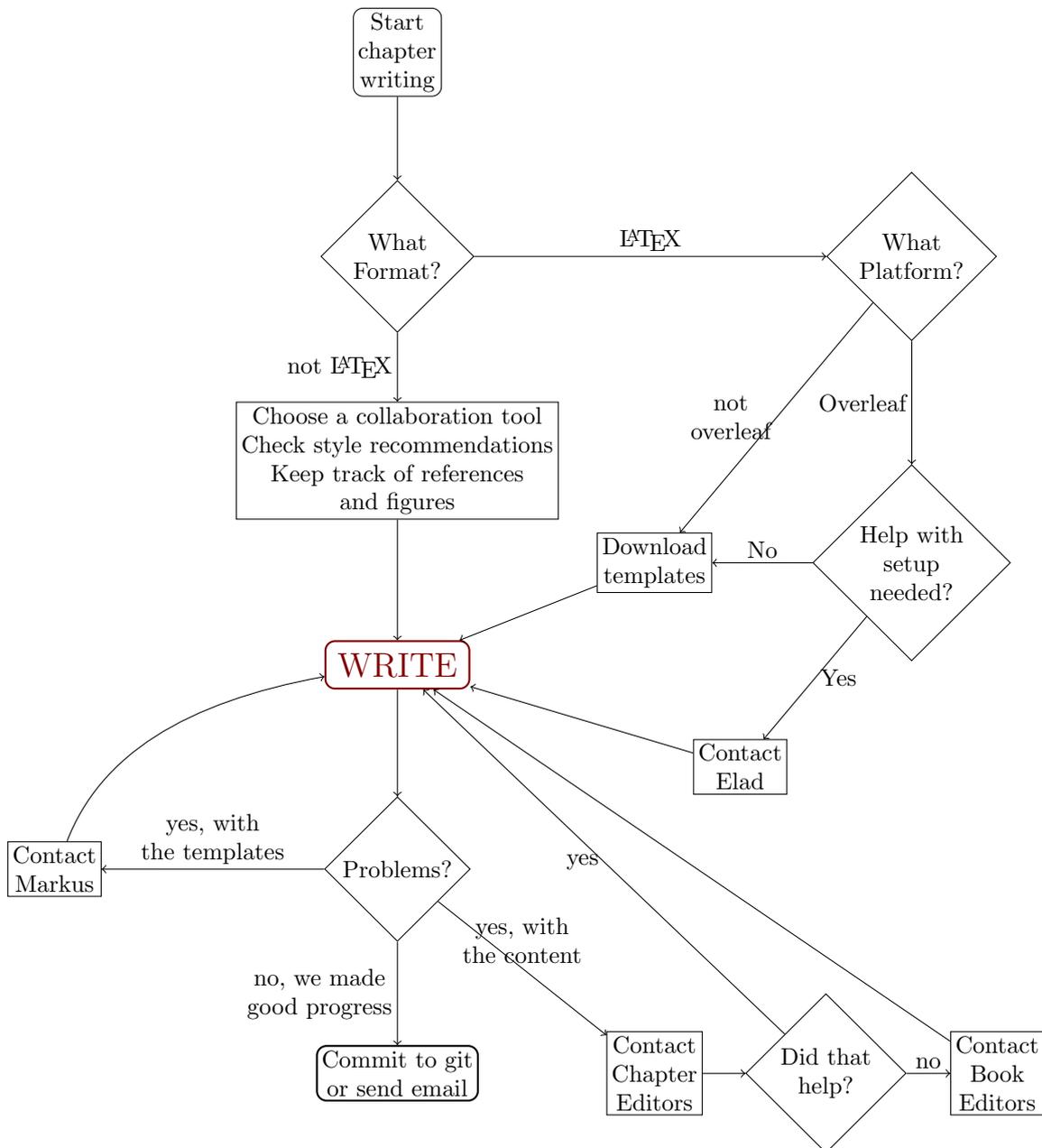
Figure 1.1: (a) The proposed workflow of writing, (b) an example graphic

Figure 1.2: Leonor Michaelis, biochemist known for the law of enzyme kinetics COPYRIGHT INFO: https://upload.wikimedia.org/wikipedia/commons/2/28/Leonor_Michaelis.jpg visited on 2021-10-02
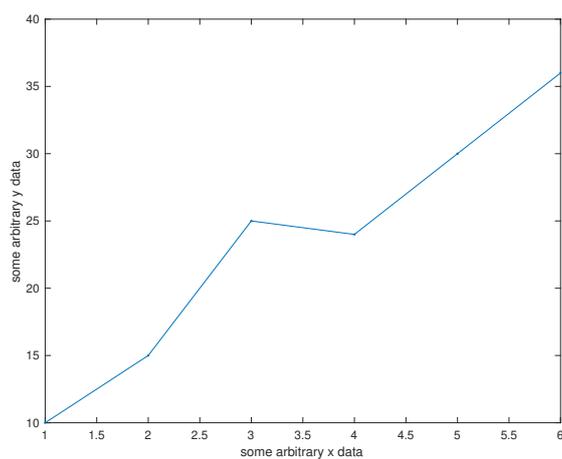

Figure 1.3: Some random data points, note the `.fig` file and the provided `.dat` file in the subdirectory `./data`

1.3.3   Labels

You are completely free in choosing the labels within your chapter as long as they start with the three letter code of your chapter. Please use labels only (mainly) if you intent to reference to them in the text.

Example   You are an author within the chapter 'ABC' and want to give a label to a subsection 'Mathematical Background'. Then, in your LaTeX document, you add a line like

```
\subsection{Mathematical Background} \label{ABC:Mathsubsection}
```

and reference to this subsection at another point of your document like this

```
As seen in Subsection \ref{ABS:Mathsubsection}, the exponential function is key here...
```

Cross-chapter references are to be avoided unless you are an author in two different chapters.

1.4   Bibliography references

At the beginning, each chapter can have its own bibliography (`.bibtex`) file and such a file is also part of the templates. Later, when the (first) chapters are consolidated, we will merge these files and work with a central BibTeX file instead. Always try to include a DOI to the BibTeX entry (in the BibTeX entry field "DOI"). For BibTeX references, please use labels of the form WatsonCrick1953 (= first author last name + second author last name + year). In case of ambiguity, please add an a, b, c, etc. Common labels will be important for us to come up later with a central BibTeX file.

Reference	using `cite`	using `citep`	using `citet`	using `citeauthor`
Einstein1905	[1]	[1]	Einstein [1]	Einstein
MichaelisMenten2013	[2]	[2]	Michaelis and Menten [2]	Michaelis and Menten
OrthThiele2010	[3]	[3]	Orth et al. [3]	Orth et al.
Einstein and Darwin	[1, 4]	[1, 4]	Einstein [1], Darwin [4]	Einstein, Darwin

Table 1.2: The citation commands and their appearances

Do not worry about sorting the entries when citing multiple references at the same time. The main LaTeX files use the `natbib` package. That means that several commands for citations are pre-defined. We recommend authors to mainly use `citep` and `citeauthor`, cf. Table 1.2. Specifically, when emphasizing one particularly important reference, and/or the one, the entire chapter is built on, use `\citeauthor`.

Please do not include a bibliography, i.e., a `\bibliography`, a `\printbibliography`, or a `{thebibliography}` in your `chapter.tex` file. It is setup such that all your BibTeX entries are automatically collected in one such list if `chapter.tex` is compiled on its own.

1.5   Typesetting formulas

1.5.1   Formula environments

When using inline formulas, use the LaTeX `$...$` definition; for displaystyle formulas, we recommend

- the environments `equation` and `equation*` for single-line formulas with or without labeling tags,

- the environments `split`, `align`, and `align*` for multi-line formulas, and

- the `subequations` environment for grouped enumerated equations.

For a consolidated look-and-feel, we encourage the use of these and **not** gather, `multline`, `eqnarray` and so on.

For example, the Pythagorean theorem can be stated inline like this: $a^2 + b^2 = c^2$, or as a formula without a tag:

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

or with a tag, like this

$$a^2 + b^2 = c^2 \,. \tag{1.1}$$

For bigger calculations, `align` and `subequations` can be used like this: Suppose, you want to show that

$$\forall n \in \mathbb{N} : \sum_{k=1}^{n} k = \frac{n \cdot (n+1)}{2} \,. \tag{1.2a}$$

You can do this using mathematical induction. The induction step includes

$$
\begin{aligned}
\sum_{i=1}^{n+1} i &= \left(\sum_{i=1}^{n} i \right) + n + 1 \\
&= \frac{n \cdot (n+1)}{2} + n + 1 \\
&= \frac{n \cdot (n+1) + 2 \cdot (n+1)}{2} \\
&= \frac{(n+1) \cdot ((n+1)+1)}{2} \,.
\end{aligned}
\tag{1.2b}
$$

Finally, referencing to equations is done using the `\eqref` command, cf. (1.1) and (1.2).

1.5.2   Notational conventions

We will use the following conventions concerning the symbols for multi-dimensional variables:

- matrices: Bold, non-italic, capital letters (if possible: latin) letters, sans serif: $\mathbf{A}$
- vectors: Bold, non-italic, lower-case letters: $\mathbf{a}$, $\boldsymbol{\varphi}$
- scalars: non-bold, italic, lower-case letters: a, b
- indices: italic (variable non-bold): a_i
- non-index subscripts or superscripts: non-italic (latex command \rm): $a_i^{\mathrm{max}}, c_{\mathrm{ATP}}$

Indexing of vectors and/or matrices is done using subscripts starting with index 1, i.e.,

$$
\begin{aligned}
\mathbb{R}^n \ni \mathbf{a} = (a_i)_{i=1}^{n} \qquad & \mathbb{R}^m \ni \boldsymbol{\varphi} = (\varphi_j)_{j=1}^{m} \\
\mathbb{R}^{n \times m} \ni \mathbf{A} = (a_{ij})_{i=1,\dots,n, j=1,\dots,m} &
\end{aligned}
\tag{1.3}
$$

Note, how the `split` environment was used to set formula (1.3).

To define new macros for vector- or matrix-valued variables, we provide the macros `\mathvectorfont` and `\mathmatrixfont`. If you wish to use the symbol "`\Nmat`" as a shortcut for a matrix $\mathbf{N}$, just add the line

```
\newcommand{\Nmat}{\mathmatrixfont{N}}
```

to your `macros-chapter.tex`.

Please *never ever* use variable names consisting of several letters (such as VOL)!

In contrast, standard mathematical functions with several letters can be used and should be written as non-italic (latex command \mbox{..}): $\min(a_i)$, $\exp(\pi)$.

Additionally, we provide the following macros

- real numbers $\mathbb{R}$, nonnegative integers $\mathbb{N}$, integers $\mathbb{Z}$
- integrals, differentiation: $\frac{\mathrm{d}}{\mathrm{d}t}$
- Eulers number e, imaginary unit i.

The list will be extended and made available as a separate document later on.

1.6 Use of code or jupyter notebooks

The infrastructure for accompanying Jupyter notebooks has not yet been decided on. We recommend that you dedicate a subfolder to programming-related issues.

By default, the package `listings` is loaded which allows you to include source code via the environment `lstlisting` like this

```
1  sum = 0 # store sum of integers here
2  for i in range(10):
3        ⎵⎵⎵⎵⎵⎵⎵⎵⎵sum += i
4  print('The⎵result⎵is⎵', i)
```

or the macro `\lstinputlisting[<options>]{\chapterroot <somefile.ending>}`.

For customizing the style, you can use `\lstset`. We recommend, that you define the style of your code examples globally in the file `style-chapter.tex`.

1.7 Units and numerical data

The main macro file includes the `siunitx` package. That means in particular that the macros

- `\si{<unit>}`,

- `\SI{<num>}{<unit>}`, and

- `\DeclareSIUnit[number-unit-product = {}]{<new_unit>}{<symbol>}`

are available. You can, for example, write (numbers with) units in the following way:

$$[\text{N}] = [\text{kg m s}^{-2}] \qquad 1.0\,\text{cal} = 4.184\,\text{J}.$$

If you feel comfortable to do so, we encourage you to use this package.

1.8 Self-plagiarism and copyright

It is okay to re-use material from other sources if you are sure that no copyright and/or trademarks are violated. We provide the command

```
\copyrightinfo{<some_information_on_the_source_and/or_usage>}
```

that should be included in the text whenever non-original material was used. If a considerable amount of a chapter's content comes from a different source, please also note this at the beginning of the chapter's GoogleDoc.

1.9 Conclusion

Each chapter should end with a short summary that refers back to questions from the introductions and/or the economical analogy. Concerning the use of the templates, there is a simple rule: All `.tex` or `.bib` files that end in `*chapter` can freely be used and changed. (with the exception)

Exercises

Exercise 1 If you wish to add exercises to your chapter, please use the `exercise` environment.

Exercise 2 You can reference to exercises like Exercise 1 within your chapter using `\ref`.

FAQ's

What about an index, a glossary, common abbreviations, the 'listoffigures' and so on?

To be defined later on. Don't worry about that now.

What about keywords or acronyms that I want to include?

Add this information in the chapter's GoogleDoc.

What about lecture material or tasks/questions for students?

Add this information in the chapter's GoogleDoc. Additional files can already be added to the git repository.

Bibliography

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[3] Jeffrey D Orth, Ines Thiele, and Bernhard Ø Palsson. What is flux balance analysis? *Nature Biotechnology*, 28(3): 245–248, 2010. doi: 10.1038/nbt.1614.

[4] Charles Darwin. *The Origin of Species*. Cambridge University Press, 6 edition, 2009. doi: 10.1017/cbo9780511694295.