LaTeX exercise sheet for the lecture "Einführung in das Rechnergestützte Arbeiten"

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Abstract

The aim of this exercise is to learn and explore the central text and formatting elements of LaTeX as well as the most important extensions (*packages*), that are often used in scientific texts.

On the webpage of the lecture (`http://comp.physik.kit.edu/Lehre/ERA/LaTeX/`) you can find links to helpful software and some introductions.

1 Creating a new LaTeX document

Fist a rudimentary skeleton of a LaTeX document should be generated. Use the "Wizard" feature of a LaTeX editor like `texmaker` or create a new text file with a text editor with the following content:

```
\documentclass[a4paper,10pt]{article}
\usepackage[ngerman]{babel}
\usepackage[utf8]{inputenc}
\title{}
\author{}
\begin{document}
\maketitle
\end{document}
```

It is now useful to load additional packages directly under the command `\documentclass{}`:

With e.g. `\usepackage[ngerman]{babel}` in the finished document German terms like "Zusammenfassung", "Kapitel", "Abschnitt", etc. will be used by LaTeX instead of the predefined english terms. Also hyphenation rules for German (according to new spelling) will be applied.

With `\usepackage[utf8]{inputenc}` special characters like Umlaute can be used directly.

Enter the title and author (your name) and save the file with the name `ERA-Blatt03.tex`.

Now create a new pdf document and view the content.

In `texmaker` or `Kile` there are UI elements for this that will run the corresponding commands in the background. On the console you can run the commands

```
latex ERA-Blatt03.tex
dvips ERA-Blatt03.dvi
gv ERA-Blatt03.ps
```

to create and view a Postscript file or

```
pdflatex ERA-Blatt03.tex
okular ERA-Blatt03.pdf
```

for a PDF document.

Section titles can be generated with the command

2 Environments

There are different environments to enumerate things. For all of them a new item begins with `\item`.

itemize the simple itemization,

enumerate the numbered environment,

description the description environment (used here).

This way one gets

- an item
- another item

1. the `enumerate` environment enumerates,
   (a) in nested items as well.

Typeset these three itemization by using the corresponding environment. The environment can also be nested.

3 Tables

Create a `table` environment and generate with the `tabular` the following table. LaTeXcommand can be included by surrounding them with `\verb!...!` or using `\textbackslash` to create the \character.

Table 1: Default sectioning commands in LaTeX.

command	level	command	level
\chapter	0	\section	1
\subsection	2	\subsubsection	3
\paragraph	4	\subparagraph	5

Add a caption to the table.

4 Formulas

If not already done automatically by the "Wizard" now is a good time to import the the `amsmath` package. This includes many extensions for formulas.

Create the following formula

$$\tilde{f}(k) = \int\limits_{-\infty}^{+\infty} \mathrm{d}x\, f(x)e^{\mathrm{i}kx}, \quad f(x) = \frac{1}{2\pi}\int\limits_{-\infty}^{+\infty} \mathrm{d}k\, \tilde{f}(k)e^{-\mathrm{i}kx},$$

and another one inside the text as follows: where $e^{ikx} = \cos(kx) + \mathrm{i}\sin(kx)$.

With `\limits` integral limits can be set above and under the integral sign. Pay attention to the formatting of $\mathrm{d}x$ and the imaginary unit $\mathrm{i} = +\sqrt{-1}$ (command `\mathrm{}`). Additional spacing can be added with `\,` and `\quad` among others. Often used operator names are usually available as commands, e.g. `\cos`.

4.1 (*) align

The `align` allows you to typeset and align longer formulas which span multiple lines. Write the following matrices and vectors by using the `pmatrix` which is included in the `amsmath` package (that also defines the `\text{}` command)

$$\begin{aligned} m_{\mathrm{pmatrix}} &= \begin{pmatrix} 1 & 2 \end{pmatrix} \cdot \begin{pmatrix} a & c^* \\ c & b \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 4 \end{pmatrix} \\ &= \begin{pmatrix} 1 & 2 \end{pmatrix} \cdot \begin{pmatrix} 3a + 4c \\ 3c^* + 4b \end{pmatrix} = 3a + 6c^* + 4c + 8b \end{aligned} \tag{1}$$

Add an empty line between the lines in the equation and recompile the document. What error message is shown?

5 Including Pictures

Add \usepackage{graphicx} to the header of the document. Now you can include images, e.g. with \includegraphics[width=0.4\linewidth]{W001.eps}. The image can be downloaded from the homepage of the LaTeX lecture.

Include the file W001.eps in a figure environment and use \caption to create a caption for it. Inside the figure environment formatting commands like \centering are allowed.
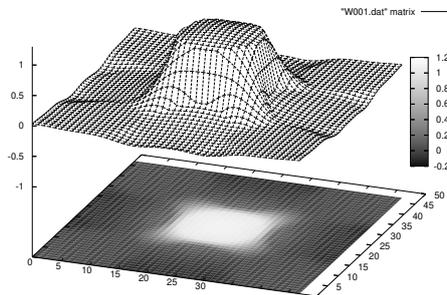

Figure 1: Example EPS file that was created using Gnuplot

6 Document Classes and Tables of Content

Replace the document class article first by book and then by report and compare the results.

Use the command \tableofcontents to create a table of contents. You might need to compile the document twice to see the results. In the same vein you can create lists of figures or tables with \listoffigures and \listoftables.

7 (*)Bibliography

Cite the two standard textbooks about LaTeX, e.g. *Kopka[1] and Mittelbach[2, 3]*.

Use the thebibliography environment the \cite{} command for this.

8 (*) References, Footnotes, Hyperlinks

The command \label{MARKER} allows you to set markers in your document, e.g. for formulas, sections, chapters and figure and table environments. The command \ref{MARKER} returns the number of the equation, figure, table etc. depending on where the marker is set. The page on which the marker position ends up can be accessed with \pageref{MARKER}. It is recommended to use a consistent syntax like fig:W001, eq:force und sec:sections for the names of the markers.

Use fitting references in you document, e.g. *In section 3 we learned with Tab. 1 how to format a table and saw Eq. 1 on page 2 the use of macros. Fig. 1 demonstrates the inclusion of images.*[1]

Recompompile your document and look at the result. Then compile again. What changed?

The package hyperref automatically generates hyperlinks from such references and also allows you to set external links with the command \url{}.

References

[1] Helmut Kopka, "LaTeX", 3. überarb. A., Nachdr. 2005, Pearson Studium (2005).

[2] Frank Mittelbach and Michel Goossens, "The LaTeX Companion", 2nd ed., Addison-Wesley, (2004).

[3] Frank Mittelbach und Michel Goossen, "Der LaTeX-Begleiter", Pearson Studium; Auflage: 2., aktualisierte Auflage (2010)

[4] [La]TeX on StackExchange, the best FAQ zu LaTeX im WWW.

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[1]Footnotes at the end of sentences should be put behind the full stop if they refer to the whole sentence