

# The L<sup>A</sup>T<sub>E</sub>X document preparation system

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# Name of the game

## Introduction

Advantages and  
disadvantages

Resources

Structure of a L<sup>A</sup>T<sub>E</sub>X  
document

Basic commands

Structuring text

Maths

Changing the layout

Specialties

The departmental  
handout

**T<sub>E</sub>X** typesetting system developed by DONALD E. KNUTH (Stanford University) to create beautiful documents, especially those containing maths. T<sub>E</sub>X is free software with copyright vested in the American Mathematical Society.

**L<sup>A</sup>T<sub>E</sub>X** T<sub>E</sub>X-macroprocessor written by LESLIE LAMPORT, which implements a markup-language (similar: HTML, XML). Users can concentrate on the structure of their document rather than on formatting.

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- ▶ craft that needs to be learned
- ▶ not about æsthetics but about function: Books are read, not displayed in a museum

# Advantages

- ▶ Several professional styles are available that make documents look “like printed”. Changing style requires changing one single line in the document, consistency is ensured.
- ▶ High quality math typesetting
- ▶ Only a few commands to define the structure of text, no knowledge of typography or book design required.
- ▶ Complex scientific documents can be created automatically:
  - ▶ bibliography
  - ▶ index
  - ▶ crossreferences
  - ▶ table of contents, lists of figures, tables etc.
  - ▶ ...
- ▶ Operating-system independent
- ▶ Long-term storage of documents: ASCII rather than binary
- ▶ Free software with source code available: Errors are corrected rapidly

# Disadvantages

- ▶ Learning curve
- ▶ Major changes in layout may require rewriting the style file (blessing in disguise)
- ▶ One gets an eye for all the bad documents out there

# Resources

**Software** [www.ctan.org](http://www.ctan.org), automatically selects nearest server

**Help** Usenet: comp.text.tex (also in other languages like de.comp.text.tex), [tex.stackexchange.com](http://tex.stackexchange.com)

**Introduction** [l2short](http://l2short.org) available in various languages

**Literature** *The L<sup>A</sup>T<sub>E</sub>X-companion* (MITTELBACH et al., 2004),  
*The L<sup>A</sup>T<sub>E</sub>X Graphics-companion* (GOOSENS et al., 2022)

**Symbols** [Comprehensive symbol list](#)

**Online editors** [Overleaf](#), [latex4technics](#) or [TeXer](#) (some require registration, optionally use fake-email for example [trash-mail.com](#))

**T<sub>E</sub>X-aware Editors** [WinEdt](#) (shareware), [TeXworks](#) (open source),  
[Scientific Word](#) (WYSIWYG)

# Boxes and glue

- ▶ Box (letter) + Glue (space) + Box + ... = larger Box (word)
- ▶ Words are treated as boxes to form lines, lines paragraphs and paragraphs pages
- ▶ Glue can shrink and expand within limits

# Structure of a L<sup>A</sup>T<sub>E</sub>X-document

```
% -----
% !Mode:: "TeX:US:UTF-8"           % for text editor: mode,
%                                % language and character set
% !TEX program = XeLaTeX           % TeX system used
% !BIB program = biblatex          % system for references
% -----

\NeedsTeXFormat{LaTeX2e}           % for TeX-system
\documentclass[options]{style}

\usepackage{Eigene}

\author{}
\title{}
\date{}

\begin{document}
\maketitle

\chapter{}
```



# Document classes

L <sup>A</sup> T <sub>E</sub> X	Koma-Script	purpose
article	scrartcl	journal papers, short reports
report	scrreprt	longer text with several chapters, e.g. thesis
book	scrbook	books
letter	scrletter	letters
beamer		slide presentations
sciposter		conference posters

Apart from Koma-Script another alternative style package is **memoir**. Also publisher-specific styles (e.g., Springer, Elsevier, Teubner etc.)

# Class options

Font size 10pt | 11pt | 12pt...

Paper size a4paper | legalpaper...

equations fleqn, leqno

title titlepage | notitlepage

columns onecolumn | twocolumn

printing oneside | twoside

# Input characters

Some characters have special meaning in T<sub>E</sub>X, if you need them they have to be entered as T<sub>E</sub>X-commands:

\	start command	<code>\(\backslash\)</code> note: <code>\\</code> = new line
\$	toggle math modus	<code>\\$</code>
&	tabulator	<code>\&amp;</code>
%	rest of line comment	<code>\%</code>
#		<code>\#</code>
~		<code>\textasciitilde</code>
	vert. lines in table	<code>\textbar</code>
_	start subscript	<code>\_</code>
^	start superscript	<code>\textasciicircum</code>
{ }	command delimiter	<code>\{ \}</code>
[ ]	optional arguments	<code>\[ ]\)</code>
" "	quotation marks	<code>\` \'</code>
> <	tabbing	<code>\(&gt; &lt;\)</code>

# Hyphen, minus ...

A horizontal line can mean a lot of things, depending on length and thickness:

O-legs

10–18 o'clock

ja – oder nein?

yes—or no?

0, 1 and –1

0-legs

10--18 o'clock

ja -- oder nein?

yes---or no?

0, 1 and --1

# Sectioning commands

- ▶ `\part{}`
- ▶ `\chapter{}`
- ▶ `\section{}`
- ▶ `\subsection{}`
- ▶ `\subsubsection{}`
- ▶ `\paragraph{}`

Parts available only in books, chapters in books and reports.

# Breaking down large documents

Use separate files for, say, each chapter. One main file with limbo and commands to include the others:

`\input{}` reads file “as is”

`\include{}` equiv. to `\clearpage \input{}` `\clearpage`

`\includeonly{}` used in limbo to limit files `\included`

# What is where?

- ▶ `\tableofcontents`
- ▶ `\listoffigures`
- ▶ `\listoftables`
- ▶
- ▶ `\addbibresource{bibfile.bib}`
- ▶ `\begin{refsection}`
- ▶ `\printbibliography[heading=subbibliography]`
- ▶ `\end{refsection}`
- ▶
- ▶ `\printindex`

# Emphasizing

`\textit{}`  italics, used for foreign words, species names  
etc: *Staph. aureus*

`\textsl{}`  *slanted*

`\emph{}`  used for emphasizing: this is *not* the case

`\textsc{}`  small caps, used for persons: NEIL ARMSTRONG  
was the first man on the moon.

`\textbf{}`  bold face: used to make something really **stick  
out**.

`\textsf{}`  sans serif, often used as base font on slides.  
Also used for chemical equations.

`\texttt{}`  typewriter, used for computer code or URLs:  
<https://github.com/ebuxbaum/LaTeX-Course>

**Note:** Slides use sans-serif font: slanted instead of italics!



# Font sizes

<code>\tiny</code>	microscopic font
<code>\scriptsize</code>	very tiny font (subscripts)
<code>\footnotesize</code>	tiny font (footnotes)
<code>\small</code>	small font
<code>\normalsize</code>	normal font
<code>\large</code>	large font
<code>\Large</code>	larger font
<code>\LARGE</code>	very large font
<code>\huge</code>	huge font
<code>\Huge</code>	very huge font

Note: **not** a command: `{\small foo bar}`

# Simple lists

Please believe me:

- ▶ Few swallows can turn winter into summer.
- ▶ Inside it's colder than in the night.
  - ▶ In the morning it pulls.
  - ▶ At noon he pushes.
  - ▶ In the evening she goes.
- ▶ Every nonsense must find an end.

Please believe me:

```
\begin{itemize}
  \item{Few swallows can turn winter into summer.}
  \item{Inside it's colder than in the night.
    \begin{itemize}
      \item{In the morning it pulls.}
      \item{At noon he pushes.}
      \item{In the evening she goes.}
    \end{itemize}
  }
  \item{Every nonsense must find an end.}
\end{itemize}
```

# Descriptive lists

Three animals you should know about are:

**gnat:** A small animal, found in the North Woods, that causes no end of trouble.

**gnu:** A large animal, found in crossword puzzles, that causes no end of trouble.

**armadillo:** A medium-sized animal, named after a medium-sized Texas city which causes no end of trouble.

```
\begin{description}
  \item[gnat:]{A small animal, found in the North
    Woods, that causes no end of trouble.}
  \item[gnu:]{A large animal, found in crossword
    puzzles, that causes no end of trouble.}
  \item[armadillo:]{A medium-sized animal, named
    after a medium-sized Texas city which causes
    no end of trouble.}
\end{description}
```

# Enumerated lists

These are the main points:

1. first item
2. second item
3. third item
  - 3.1 first sub-item
  - 3.2 second sub-item

These are the main points:

```
\begin{enumerate}  
  \item{first item}  
  \item{second item}  
  \item{third item

- \begin{enumerate}- \item{first sub-item}
- \item{second sub-item}

- \end{enumerate} }  
\end{enumerate}

```

# Tabbing

If it's raining  
    then put on boots,  
        take hat;  
    else smile.  
Leave house.

```
\begin{tabbing}
    If \= it's raining          \\
        \> then \= put on boots, \\
            \>         \> take hat;    \\
            \> else \> smile.         \\
    Leave house.
\end{tabbing}
```

GG&A HOOFED STOCK		
Year	Price	Comments
1971	97–245	Bad year for farmers in the west.
72	245–245	Light trading due to a heavy winter.
73	245–2001	No gnus was very good gnus this year.

```
\begin{tabular}{|r||c|p{2.5in}|}
\toprule
\multicolumn{3}{|c|}{\sc GG\&A Hoofed Stock} \\
\midrule
\midrule
\multicolumn{1}{|c|}{\bf Year} & \bf Price & \multicolumn{1}{c|}{\bf Comments} \\
\midrule
1971 & 97--245 & Bad year for farmers in the west. \\
\midrule
72 & 245--245 & Light trading due to a heavy winter. \\
\midrule
73 & 245--2001 & No gnus was very good gnus this year. \\
\bottomrule
\end{tabular}
```

Note: this example shows what can be done, not what should be!

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Tables and stuff

Graphics

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# Table (a float: not used on slides)

```

\begin{table}
  \caption{The fastest man in the world:
    Some of his possibilities}
  \label{tab:fast}
  \centering
  \begin{tabular}{|l|c|r|}
    \toprule
    Disciplin & distance (m) & time (min) \\
    \midrule
    Running   & 100           & 5          \\
    Swimming  & 50            & 30         \\
    Cycling   & 1000          & 20         \\
    \bottomrule
  \end{tabular}
\end{table}

```

In the text the table can be referenced with: see table

`\ref{tab:fast}` on page `\pageref{tab:fast}`.



```
\includegraphics[height=0.3\textheight]{Graphics/BandedCoralShrimp}
```

- ▶ Requires `\usepackage{graphicx}`
- ▶ Several file formats possible depending on dvi-driver. For pdfLaTeX pdf, png, jpg.
- ▶ Convert other formats e.g., with IrfanView or Gimp.
- ▶ other optional arguments like width, angle, size



# Figures

```
\begin{figure}
  \caption{A ``pregnant`` banded coral shrimp (aka barber pole shrimp,
    \Species{Stenopus hispidus} (Olivier 1811), Stenopodidae) }
  \label{fig:Shrimp}
  \centering
  \includegraphics[height=0.3\textheight]{Graphics/BandedCoralShrimp}
\end{figure}
```

Like table, figure is a floating environment that has no meaning in slides. Cross-referencing works as with tables.

if  $a$  and  $b$  are legs of a right-angled triangle and  $c$  the  
hypotenuse, then  $c^2 = a^2 + b^2$  (Theorem of Pythagoras).

if  $a$  and  $b$  are legs of a right-angled triangle  
and  $c$  the hypotenuse, then  $c^2=a^2+b^2$  (Theorem  
of Pythagoras).

# Display maths

if  $a$  and  $b$  are legs of a right-angled triangle and  $c$  the hypotenuse, then

$$c^2 = a^2 + b^2 \quad (1)$$

(Theorem of Pythagoras).

if  $a$  and  $b$  are legs of a right-angled triangle and  $c$  the hypotenuse, then

```
\begin{equation}
c^2=a^2+b^2
```

```
\end{equation}
```

(Theorem of Pythagoras).

# Formulas

$$x^5$$

$$x_1$$

$$\sqrt{x^2 + \sqrt[3]{y}}$$

`x^5`

`x_1`

`\sqrt{x^2+\sqrt[3]{y}}`

$$\frac{1}{\frac{x^2+y^2+z^2}{x+y}}$$

$$\binom{n}{n-k}$$

`\frac{1}{\frac{x^2+y^2+z^2}{x+y}}`    `{n\choose {n-k}}`

$$\int_{-\infty}^{\infty} x^3$$

$$\sum_{i=1}^n a_i$$

`\int \limits_{-\infty}^{\infty} x^3`    `\sum_{i=1}^n a_i`

# Aligning equations

$$f(x) = \cos x \quad (2)$$

$$f'(x) = -\sin x \quad (3)$$

$$\int_0^x f(y)dy = \sin x \quad (4)$$

```
\begin{align}
f(x) &= \cos x \\
f'(x) &= -\sin x \\
\int_0^x f(y)dy &= \sin x
\end{align}
```

# Internal Counter + parameters

Change parameters:

```
\setlength{\parindent}{0pt}  
\setlength{\parskip}{5pt plus 2pt minus 1pt}  
\addtolength{\textwidth}{60pt}
```

Set counters:

```
\setcounter{page}{0}  
\addtocounter{page}{10}
```

Output counter content: This is page 30.

This is page \thepage.

Here we have 2 cm distance.

left right

<code>\,</code>	very small distance
<code>\enspace</code>	as wide as a number
<code>\quad</code>	as wide as a letter is height
<code>\qqquad</code>	twice as wide as <code>\quad</code>
<code>\hfill</code>	a distance that can expand from 0 to $\infty$

# Vertical distance

Here

is 2 cm distance.

Here

`\vspace{2cm}`

is `\SI{2}{cm}` distance.

<code>\smallskip</code>	about 1/4 line
<code>\medskip</code>	about 1/2 line
<code>\bigskip</code>	about 1 line
<code>\vfill</code>	distance that can expand from 0 to $\infty$



# Centering text

In  
the  
middle I don't  
feel  
so marginalized

```
\begin{center}  
  In\\  
  the\\  
  middle I don't\\  
  feel\\  
  so marginalized\\  
\end{center}
```

# Flushright text

This is not a political statement

```
\begin{flushright}  
    This is not a political statement  
\end{flushright}
```

# Indexing commands

simple `gnat\index{gnat}`

subtopics `gnat\index{gnat!size of}`

page range `\index{gnat|({}...\index{gnat|)}`

reference `\index{gnat|see{mosquito}}`

font `gnat\index{gnat@ \textit{gnat}}`

After first  $\text{\LaTeX}$  run, start `makeindex` to sort the index.

Assume the following list of acronyms:

```
\begin{acronym}
  \acro{nfkb}[NF-\textkappa B]{nuclear factor
    \textkappa B}{protein in gene regulation}
\end{acronym}
```

This will print as

NF-κB: nuclear factor κB, protein in gene regulation

Then

`\acf{nfkb}` nuclear factor κB (NF-κB)

`\acs{nfkb}` NF-κB

`\acl{nfkb}` nuclear factor κB

Database for literature references in ASCII-format. Can be produced from many programs like EndNote or RefMan, also from PubMed, Google Scholar (set preferences!) etc.

```
@article{Alb-76,  
  AUTHOR= {W.J. Albery and J.R. Knowles},  
  TITLE= {Evolution of enzyme function and the  
    development of catalytic efficiency},  
  JOURNAL= {Biochemistry},  
  VOLUME= {15},  
  YEAR= {1976},  
  PAGES= {5631-5640},  
  ABSTRACT= {Catalytic efficiency constant kcat/Km  
    defined },  
  DOI= {10.1021/bi00670a032},  
  LANGUAGE= {engl}  
}
```

Similar for books, chapters, reports, thesis etc. In the text use `\cite{Alb-76}`. After first L<sup>A</sup>T<sub>E</sub>X-run start **biber** to create the bibliography.

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# Beamer-slides

```
\begin{frame}  
  \frametitle{  
    ...  
  }  
\end{frame}
```

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Always use the sequence:

L<sup>A</sup>T<sub>E</sub>X produces the necessary intermediate files

makeindx sort the index

biber create the bibliography

L<sup>A</sup>T<sub>E</sub>X include bibliography and index, resolve  
cross-references

L<sup>A</sup>T<sub>E</sub>X resolve remaining cross-references

Note: using pdfL<sup>A</sup>T<sub>E</sub>X instead of L<sup>A</sup>T<sub>E</sub>X produces pdf-files directly.

X<sub>Y</sub>L<sup>A</sup>T<sub>E</sub>X can use any font installed for the operating system  
(TrueType, OpenType), supports UTF-8 and produces pdf.

# Packets used in dept. handout

acronym

booktabs

chemarrow

color

eufrak

graphicx

hyperref

isodate

isotope

kpfonts

makeidx

natbib

siunitx

thumb

upgreek

wasysym,marvosym

administration of acronyms

professional looking tables

various types of arrows for equations

colored text

font for arrays + vectors

inclusion of diagrams

use cross-referencing facilities of pdf

standard conform dates

`\isotope[13]`C =  $^{13}\text{C}$

works better than the original fonts

index generation

clean handling of bibliography

`\SI`, `\num`, `\ang`

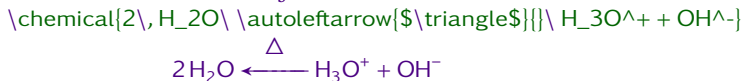
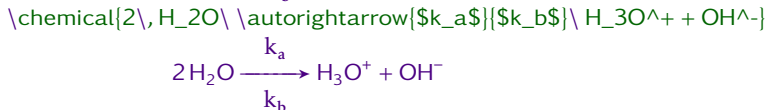
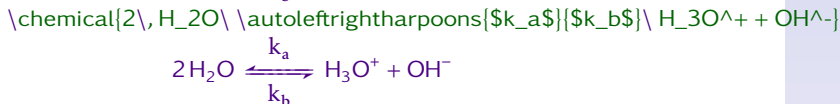
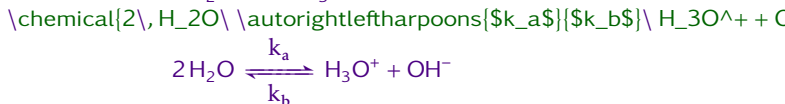
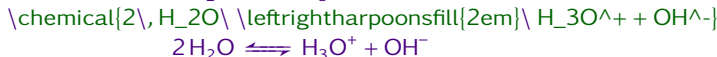
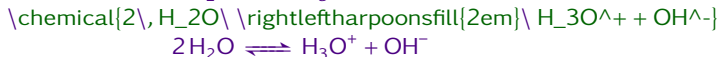
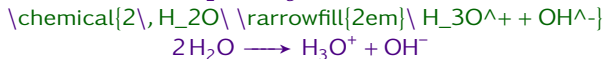
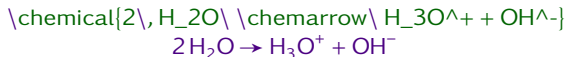
chapter thumbs

`\textalpha` =  $\alpha$  instead of  $\alpha$

special symbols like  $\sigma$ ,  $\varphi$



# The package chemarrow



# Getting consistent output

- ▶ `\chemical{CH_2\double CH\single OH}` = CH<sub>2</sub>=CH–OH
- ▶ `\ph` = pH, similar for `\pkw`, `\pka`, `\poh`, `\pl`
- ▶ `\Name{Maude Leonora Menten}` = MAUDE LEONORA MENTEN
- ▶ `\skalar{x}` =  $x$ , similar for `\array`, `\vektor`, `\set`. Note the list of variables used in the appendix.
- ▶ `\SI{1}{cm}` = 1 cm, `\num{10000}` = 10 000, `\ang{1;2;3}` = 1°2'3".