introduction

TEX & METAFONT were developed by Dr. Donald E. Knuth and were Open Source since 1980. It is a typesetting application but an own programming language with over 300 commands as well. Everything is handled as a block. It supports multiple diacritics, dialects, etc. and was finished 1990 with version 3.14. Bugs haven't been found for a long time. It's OS & device independent and uses the .tex format, which is a DVI (Device-Independent) format. It has to be programmed for own use but there exist countless packages.

One of those packages is LATEX, originally developed by Leslie Lamport. It's a macropackage, tying up TEXcommands to custom markup commands. Additionally, it gives a default for formatting and layout. It has become the standard for scientific publications, also due to its functionality and remarkable line- and pagebreak algorithm. It's current version is 2^e, 3 has been in development since 1989

essentials

`\documentclass[options]{styles}`

fleqn	left align math
leqno	left align math num
article	no \part or \chapter
IEEEtran	(one) IEEE standard
minimal	min formatting
slides	presentation

`\usepackage[options]{package}`

structure

Between documentclass and document is **Preamble**, *documentwide commands come there.*

structure macros *end at begin of new structure/end of document*

level	macro
-1	`\part{name}`
0	`\chapter{name}`
1	`\section{name}`
2	`\subsection{name}`
3	`\subsubsection{name}`
4	`\paragraph{name}`
5	`\subparagraph{name}`

structure environments *use common block syntax*

`\begin{document}` `\end{document}`	All printed content
`\begin{abstract}` `\end{abstract}`	Short synopsis (has special layout)
`\begin{quote}` `\end{quote}`	Special layout for quotes
`{ }`	custom block

Page style *defines footer & header display*

`\thispagestyle{empty}`	no header & footer
`\thispagestyle{plain}`	same but page number shown
`\thispagestyle{headings}`	same but maybe header (depending on class)
`\thispagestyle{myheadings}`	setup of own h & f

Additional **structure manipulation commands** *exist. First 4 go into Preamble.*

`\renewcommand {\abstractname}{name}`	name of abstract
`\setcounter {secnumdepth}{n}`	depth for section numbering
`\setcounter{tocdepth} {n}`	depth of sections in table
`\setcounter{page}{n}`	reset counter to n
`\pagemark`	prints pagenumber
`\addcontentsline{toc} {subsection}{name}`	force add structure to table. Place in doc defines place in table

titlepage

Content to the title can be provided through:

`\title{string}` `\date{date}`
`\author{author \and author2`
`\thanks{text}}`

`\maketitle`

A custom titlepage can be generated as well, though everything needs to be done by hand then

```
\begin{titlepage}
...
\end{titlepage}
```

contenttables

`\tableofcontents`	section types
`\listoftables`	table envs
`\listoffigures`	figure envs

*content can be omitted from content tables by adding * to macro name*
e.g. `\section*{}`

different name for tables and inside document can be provided
`\section[table name]{document name}`

formatting

text style

`\textbf{text}`	**bold**
`\textit{text}`	*cursive*
`\texttt{text}`	`typewriter`
`\textsc{text}`	SMALL CAPITALS
`\textrm{text}`	roman font
`\textsf{text}`	serif font
`\textnormal{text}`	default of doc

text size

Need to be placed inside blocks/envs.

`\Huge`
`\huge`
`\LARGE`
`\Large`
`\large`
`\normalsize`
`\small`
`\footnotesize`
`\tiny`
`\scalebox{scale}{text}`

special characters

Most special characters can be escaped.

`\textbackslash`	\
`\^`	ŝ
`\dq`	"
`\textbar`	|
`\textless`	<
`\textgreater`	>
`\LaTeX`	LATEX
`\TeX`	TEX

newline

`\\`	linebreak, no par
`\newline`	same
	linebreak, new par
`\par`	same

justification & space

`\centering`	centers block
`\raggedleft`	rights block
`\raggedright`	lefts block
`\begin{center}..`	new centered block
`\,`	0.16667em space
`\:`	default space
`~`	newline-safe def
`\hspace{n}`	n horizontal space
`\smallskip`	small vert space
`\medskip`	..
`\bigskip`	..
`\vspace{n}`	n vertical space
`\newpage`	Ends column
`\clearpage`	Ends page
`\vfill`	Justifies content vertically around
`\hfill`	Justifies content horizontally around

misc

`\color{color!opacity}`	color of block
`\noindent`	removes indent on line
`\setlength{\parindent} {n}`	sets indent for whole document
`\rule{width}{thickness}`	horizontal line
`\noindent\makebox[ \linewidth]{\rule{ \paperwidth}{0.4pt}}`	document spanning line
`\verb|arg|`	inline macro display
`\begin{verbatim} .. \end{verbatim}`	multiline macro display

packages

babel	`\usepackage[sub, main]{babel}`
inputenc	Input enc (def=ascii, alt=utf8)
fontenc	Font enc (def=ot1, alt=t1)
hyperref	`\url{add}, \href{add}{dname}`
geometry	custom formatting
scrlayer-scrpage	`\ihead{} \chead{} \ohead{}`

lists

```
\begin{enumerate}
\item entry 1
\item entry 2
\end{enumerate}
```

1. entry 1
2. entry 2

```
\begin{itemize}
  \item entry 1
   \item entry 2
\end{itemize}
```

- entry 1
- entry 2

```
\begin{description}
\item [name1] entry 1
\item [name2] entry 2
\end{description}
```

name1 entry 1
name2 entry 2

Can be used as horizontal list. Needs tasks and exsheets package.

```
\begin{question} question
\begin{tasks}(columns) \task task 1
\task task 2 \end{tasks} \end{question}
```

Übung 1.

task question?

a) answer 1 b) answer 2

Lists of same type can be nested as well. They'll have different stylization.

```
\begin{enumerate} \item entry 1
\begin{itemize} \item entry 1.1 \item
entry 1.2 \end{itemize} \item entry 2
\end{enumerate}
```

1. entry 1
   - entry 1.1
   - entry 1.2
2. entry 2

floats

Floats are containers, that won't be broken over multiple pages.

```
\begin{float}[placement]
    ...
\end{float}
```

types	placement	
table	h	here
figure	t	top
subfigure	b	bottom
	p	page
	!	override default
	H	precise here (float pkg)

```
\caption[short]{title}
\label{name}
\ref{labelName}
```

For better label naming, a "type:"can be added before the name.

type examples

ch: sec: subsec: fig: tab: eq:
lst: itm: alg: app:

graphics

```
\usepackage{graphicx}
```

Either provide a image folder and only import the name (on win: / instead of \):

```
\graphicspath{path}
\includegraphics{name}
```

or provide the path directly:

```
\includegraphics[options]{path}
```

options

scale width height angle
draft keepaspectratio

figure

figure is an environment commonly used for images. It provides labels and captions.

```
\begin{figure}[placement]
    ...
\end{figure}
```

More complex figures can be created with the subfigure environment. Needs the caption and subcaption package. Can be used to put multiple images in a row, etc.

```
\begin{figure}
    \begin{subfigure}
        ...
    \end{subfigure}
    ...
\end{figure}
```

tables

The \table float is not necessary but provides label & captions.

```
\begin{table}[placement]
\begin{tabular}[position]{layout}
    content
\end{tabular}
\end{table}
```

Pos (mostly useless)

b	bottom
c	center
t	top

Layout

l	left justified
c	center justified
r	right justified
p{n}	n wide line breakable cell. Align with top of row
m{n}	same. Align with center
b{n}	same. Align with bottom
|	vertical line
||	double line

content layout

&	col seperator
\\	new row
\hline	horizontal line
\newline	new line within cell
\cline{i-j}	line begin col i & end col j
\multicolumn {n} {layout} {content}	content across n columns in row

mathematics

&	justify formulas to that pos
\nonumber	line not counted as eq
\begin{split} \end{split}	use in singleine env for multiline

*numbering can be omitted with an * added, like \begin{align*}. Labels in multiline envs need to added to every wanted line for referencing.*

environments

env	d/t	sl/ml	num
$..$	t	sl	n
$$..$$	d	sl	n
\(..\)	t	sl	n
\[..\]	d	sl	n
\begin{math}.. \end{math}	t	sl	n
\begin{displaymath}.. \end{displaymath}	d	sl	n
\begin{equation}.. \end{equation}	d	sl	y

amsmath envs are all d, ml and num.

\begin{multiline}..	only for single eqs t
\end{multiline}	long for 1 line
\begin{gather}..	newlines like tabul
\end{gather}	no align
\begin{align}..	newlines like tabul
\end{align}	align

functions

^{x}	1^x	_{x}	1_x
\sqrt[x]{y}	$\sqrt[x]{y}$	(x+y)	$(x+y)$
\frac{x}{y}	$\frac{x}{y}$	\{x+y\}	$\{x+y\}$
\binom{x}{y}	$\binom{x}{y}$	[x+y]	$[x+y]$

overbrace{x}	$\overbrace{x}$
underbrace{x}	$\underbrace{x}$

\leftTYPE .. \rightTYPE	⟩40⟨ ⟨40⟩ |40|
\cfrac{x}{y}	$\cfrac{x}{x+\cfrac{x}{y+\cfrac{x}{y+n}}}$

Both need an env. Almost identical.

```
\begin{array}
{layout}..
\end{array}
```

```
\begin{matrix}
\end{matrix}
```

$$\begin{aligned} z &= a \\ &= a \end{aligned} \qquad (1)$$

$$f(x,y,z) = x+y+z$$

with amsmath a t or d can be added to some functions for better textmode / displaymode display (e.g. \dfrac).