LaTeX

Quick Start

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Introduction

History

1982 TEX is developed by *Donald Knuth*[1] in 1982 in order to type his acclaimed series of books on computer programming *"Art of Computer Programming"*.

1985 Leslie Lamport extend the TEX system so it will be easy to create books, article etc. This is called LATEX.

1993 Second edition of LATEX is launched and it is called LATEX2e which is mostly used now a days.

Future LATEX3e is under development from long time.

[1] `https://en.wikipedia.org/wiki/Donald_Knuth`

LaTeX vs WYSIWYG

Pros:

LaTeX vs WYSIWYG

Pros:

- Large Document

LaTeX vs WYSIWYG

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- Different types of Environment

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Cons:

- Small Document
- Difficult to Learn

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- Small Document
- Difficult to Learn
- Difficult to Edit

Quick Start

Structure[2]

Source $\Rightarrow$ Output

Prelims	\documentclass{...}
	...
	\begin{document}
Content	...
	\end{document}

Table 1: Global Structure of LaTeX Source File

[2] https://en.wikibooks.org/wiki/LaTeX/Document_Structure

Document Sectioning [3] [4]

There are up to 7 levels of depth for defining sections depending on the document class:

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

Note: To get a unumbered section use `\section*{section}`, similarly to get an unumbered subsection use `\subsection*{subsection}`.

[3] `https://www.sharelatex.com/learn/Sections_and_chapters`
[4] `http://www.ctex.org/documents/packages/layout/titlesec.pdf`

Text Mode

Font [5] [6]

Regular	Regular
\textit{Italic}	*Italic*
\underline{underline}	underline
\textsc{SmallCaps}	SmallCaps
\textbf{Bold}	**Bold**
\textbf{\textit{ Bold Italic }}	**Bold Italic**
\textbf{\textsc{ Bold SmallCaps }}	**Bold SmallCaps**

[5] https://en.wikibooks.org/wiki/LaTeX/Fonts

[6] https://www.sharelatex.com/learn/Font_sizes,_families,_and_styles

Alignment [7]

- \begin{flushleft} ... \end{flushleft} (Default)
- \begin{flushright} ... \end{flushright}
- \begin{center} ... \end{center}

[7] https://www.sharelatex.com/learn/Text_alignment

Alignment [7]

- `\begin{flushleft} ... \end{flushleft}` (Default)
- `\begin{flushright} ... \end{flushright}`
- `\begin{center} ... \end{center}`

A Right Aligned Paragraph

Munger is a twin city and a Municipal Corporation situated in the Indian state of Bihar. It is the administrative headquarters of Munger district and Munger Division.
Historically, Munger is known for being an ancient seat of rule. The twin city comprises Munger and Jamalpur situated on the southern bank of the river Ganges.
(Source: Wikipedia)

[7] `https://www.sharelatex.com/learn/Text_alignment`

Manual breaks [8]

`\newline`	Breaks the line at the point of the command.
`\\`	Breaks the line at the point of the command, it is usually a shorter version of the previous command.
`\\*`	Breaks the line at the point of the command and also prohibits a page break after the forced line break.
`\\[extra-space]`	Extra vertical space to be inserted before the next line. This amount can be negative.
`\par` (TeX)	Starts a new paragraph.
`\newpage`	Starts a new page.

[8] https://en.wikibooks.org/wiki/LaTeX/Paragraph_Formatting#Manual_breaks

Lists

Unordered List

```
\begin{itemize}
  \item Milk
  \item Eggs
  \item Potatoes
\end{itemize}
```

- Milk
- Eggs
- Potatoes

Enumerations

```
\begin{enumerate}
  \item First
  \item Second
  \item Last
\end{enumerate}
```

1. First
2. Second
3. Last

Description

```
\begin{description}
  \item[Ram] One
  \item[Shyam] Two
  \item[Mohan] Three
\end{description}
```

Ram One

Shyam Two

Mohan Three

Lists

Unordered List

```
\begin{itemize}
  \item Milk
  \item Eggs
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\begin{description}
  \item[Ram] One
  \item[Shyam] Two
  \item[Mohan] Three
\end{description}
```

Ram One

Shyam Two

Mohan Three

Tables [9] [10]

```
\begin{tabular}{ l c r }
  a   & a   & a   \\
  ab  & ab  & ab  \\
  abc & abc & abc \\
\end{tabular}
```

a	a	a
ab	ab	ab
abc	abc	abc

```
\begin{tabular}{ l | c r |}
  a   & a   & a   \\ \hline
  ab  & ab  & ab  \\
  abc & abc & abc \\
\end{tabular}
```

a	a	a
ab	ab	ab
abc	abc	abc

[9] https://en.wikibooks.org/wiki/LaTeX/Tables

[10] https://www.sharelatex.com/learn/Tables

Floating with Table [11]

h where the table is declared (here)

t at the top of the page

b at the bottom of the page

p on a dedicated page of floats

! override the default float restrictions. E.g., the maximum size allowed of a b float is normally quite small; if you want a large one, you need this ! parameter as well.

Note: Default is `tbp`. If you want a table at the position it is specified, you should use `h!`.

[11] https://en.wikibooks.org/wiki/LaTeX/Tables#Floating_with_table

Pictures [12] [13]

To include a figure in LaTeX we have to use **graphicx** package, and a figure in `.eps`, `.png` or `.pdf` format is added using `\includegrapics`. Some uses are as follows:

- `\includegraphics{filename}` Simple Use

[12] `https://www.sharelatex.com/learn/Inserting_Images`
[13] `https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics`

Pictures [12] [13]

To include a figure in LaTeX we have to use **graphicx** package, and a figure in `.eps`, `.png` or `.pdf` format is added using `\includegrapics`. Some uses are as follows:

- `\includegraphics{filename}` Simple Use
- `\includegraphics[scale=1.5]{filename}` Scale the figure by factor of 1.5

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Pictures [12] [13]

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- `\includegraphics{filename}` Simple Use
- `\includegraphics[scale=1.5]{filename}` Scale the figure by factor of 1.5
- `\includegraphics[width=3cm, height=4cm]{filename}` Specific height and width of figure

[12] `https://www.sharelatex.com/learn/Inserting_Images`
[13] `https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics`

Pictures [12] [13]

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- `\includegraphics[scale=1.5]{filename}` Scale the figure by factor of 1.5
- `\includegraphics[width=3cm, height=4cm]{filename}` Specific height and width of figure
- `\includegraphics[width=\textwidth]{universe}` Width same as document

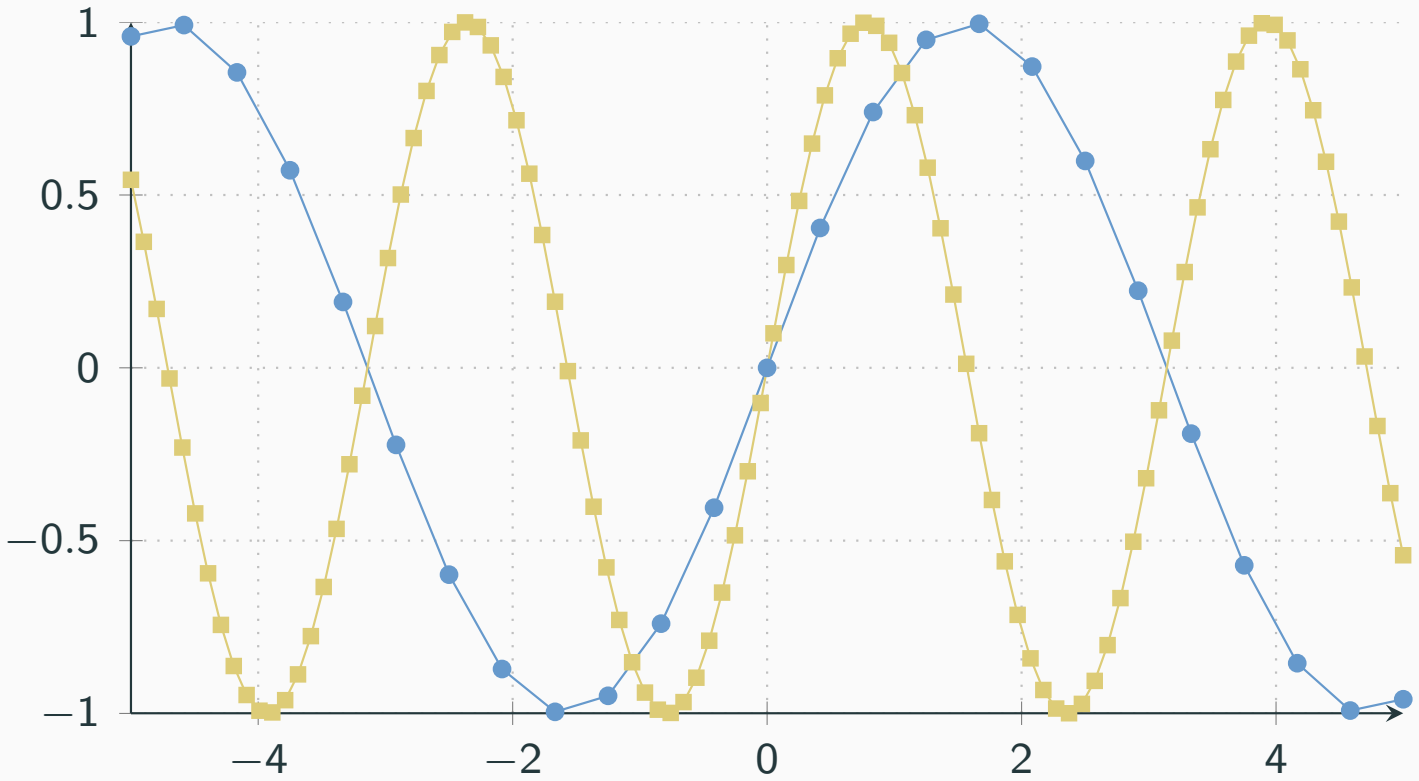
[12] `https://www.sharelatex.com/learn/Inserting_Images`
[13] `https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics`

Example

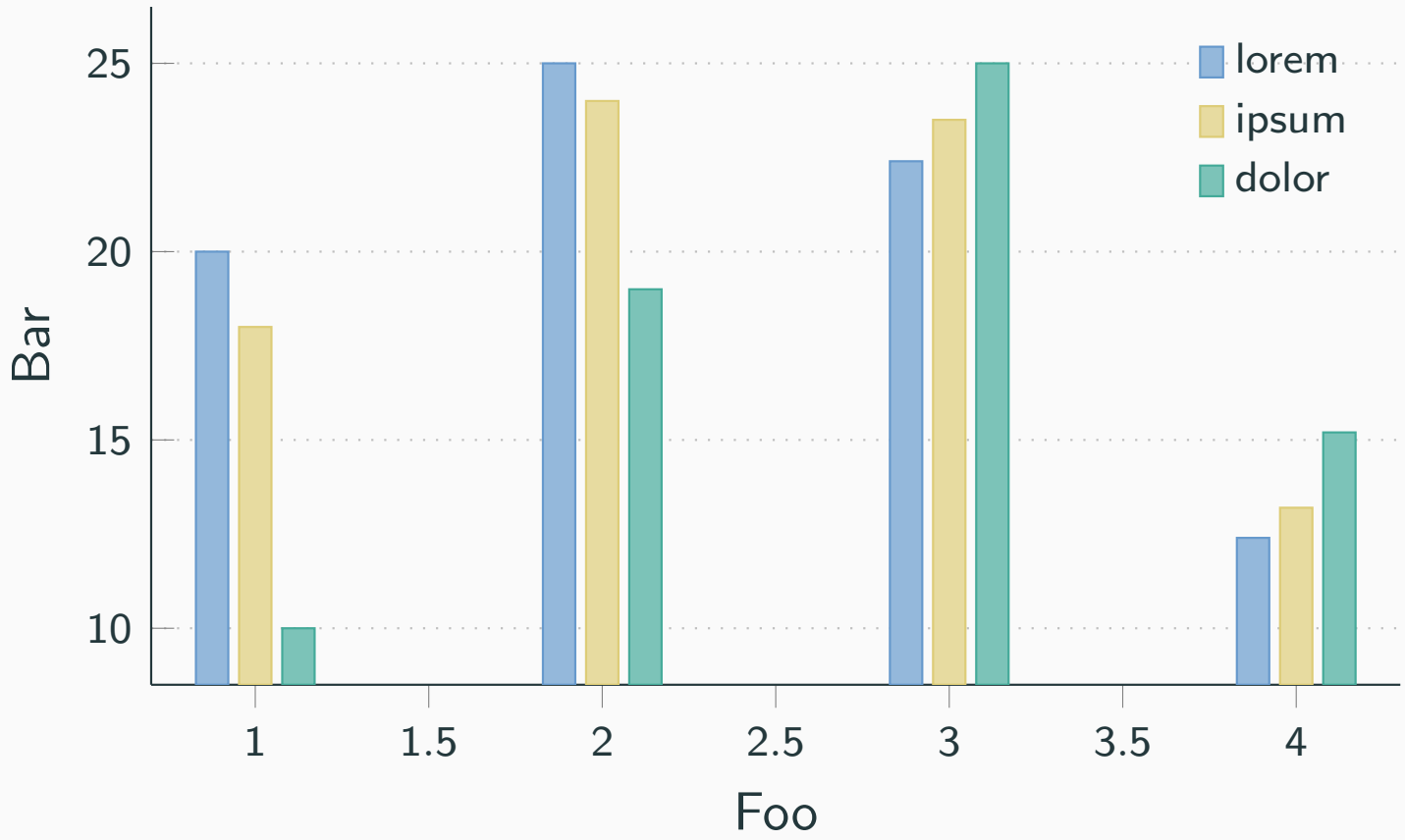
```
\begin{figure}[h]
 \centering
 \includegraphics[height=3cm]{images/munger-pic}
 \caption{A picture of munger}
\end{figure}
```

Figure 1: A picture of munger

Example – Line plots



Example – Bar charts



Quotes

```
\begin{quote}
  Young man, in mathematics you don't understand things.
  You just get used to them.\\
  \hfill --- \textup{John Von Neumann}
\end{quote}
```

> *Young man, in mathematics you don't understand things. You just get used to them.*
>
> — John Von Neumann

Quotation

```
\begin{quotation}
  Young man, in mathematics you don't understand things.
  You just get used to them.\\
  \hfill --- \textup{John Von Neumann}
\end{quotation}
```

> *Young man, in mathematics you don't understand things.*
> *You just get used to them.*
>
> — John Von Neumann

Math Mode

Mathematical Expression [14] [15] [16] [17]

- Inline Expression
  - $ ... $ or \(... \)
  - Mixed with text.

[14] http://reu.dimacs.rutgers.edu/Symbols.pdf
[15] https://en.wikibooks.org/wiki/LaTeX/Mathematics
[16] https://www.sharelatex.com/learn/Mathematical_expressions
[17] http://www.math.hkbu.edu.hk/TeX/short-math-guide.pdf

Mathematical Expression [14] [15] [16] [17]

- Inline Expression
  - $ ... $ or \(... \)
  - Mixed with text.
- Display Style
  - Untagged: $$ ... $$ or \[... \]
  - Tagged: \begin{ equation} ... \end{ equation}

[14] http://reu.dimacs.rutgers.edu/Symbols.pdf
[15] https://en.wikibooks.org/wiki/LaTeX/Mathematics
[16] https://www.sharelatex.com/learn/Mathematical_expressions
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Mathematical Expression [14] [15] [16] [17]

- Inline Expression
  - $ ... $ or \(... \)
  - Mixed with text.
- Display Style
  - Untagged: $$ ... $$ or \[... \]
  - Tagged: \begin{ equation} ... \end{ equation}
- A Set of Equation
  - $\mathcal{AMS}$-LaTeX: align, aligned
  - `mathtools`: gather
  - equarray: eqnarray

[14] `http://reu.dimacs.rutgers.edu/Symbols.pdf`
[15] `https://en.wikibooks.org/wiki/LaTeX/Mathematics`
[16] `https://www.sharelatex.com/learn/Mathematical_expressions`
[17] `http://www.math.hkbu.edu.hk/TeX/short-math-guide.pdf`

Example

```
This is an inline equation \(x^2 + y^2 = z^2\).The following
equation is in "Display Style".

\[ x^n + y^n = z^n \]

The following equation is numbered.
\begin{equation} x^n + y^n = z^n \end{equation}
```

$$\Downarrow$$

This is an inline equation $x^2 + y^2 = z^2$. The following equation is in "Display Style".

$$x^n + y^n = z^n$$

The following equation is numbered.

$$x^n + y^n = z^n \tag{1}$$

Example - Set of Equation

```
\begin{align*}
 f(x)  &= a x^2+b x +c    &   g(x)  &= d x^3 \\
 f'(x) &= 2 a x +b        &   g'(x) &= 3 d x^2
\end{align*}
```

Example - Set of Equation

```
\begin{align*}
 f(x)  &= a x^2+b x +c    &   g(x)  &= d x^3 \\
 f'(x) &= 2 a x +b        &   g'(x) &= 3 d x^2
\end{align*}
```

$$\Downarrow$$

$$f(x) = ax^2 + bx + c \qquad g(x) = dx^3$$
$$f'(x) = 2ax + b \qquad g'(x) = 3dx^2$$

Matrices

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{AMS}$-LaTeX.

```
\begin{pmatrix}
 a & b \\
 c & d
\end{pmatrix}
```

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

Matrices

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{AMS}$-LaTeX.

```
\begin{bmatrix}
 a & b \\
 c & d
\end{bmatrix}
```

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

Matrices

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{AMS}$-LaTeX.

```
\begin{vmatrix}
 a & b \\
 c & d
\end{vmatrix}
```

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$$

Matrices

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{AMS}$-LaTeX.

```
\begin{Vmatrix}
 a & b \\
 c & d
\end{Vmatrix}
```

$$\begin{Vmatrix} a & b \\ c & d \end{Vmatrix}$$

Cases

```
f(x) =
  \begin{cases}
   1        & \text{if } x \in \mathbb{Q} \\
   0        & \text{else }
  \end{cases}
```

$$\Downarrow$$

$$f(x) = \begin{cases} 1 & \text{if } x \in \mathbb{Q} \\ 0 & \text{if else} \end{cases}$$

Advance Mathematics

Custom Operator

A custom operator like $\sin(x)$, use `\DeclareMathOperator` command in preamble or `\operatorname` in document itself.

```
\operatorname{E}[x]
```
$\operatorname{E}[x]$

```
\operatorname{arg\,max}_a f(a)
```
$\operatorname{arg\,max}_a f(a)$

To get a operator like `\lim`, either use `\DeclareMathOperator*` or `\operatorname*` commnad, for example

```
\operatorname{foo}_a f(a) = \operatorname*{foo}_b f(b)
```

$$\operatorname{foo}_a f(a) = \operatorname*{foo}_b f(b)$$

Whitespace in Math Mode

\quad	space equal to the current font size (= 18 mu)
\,	3/18 of \quad (= 3 mu)
\:	4/18 of \quad (= 4 mu)
\;	5/18 of \quad (= 5 mu)
\!	-3/18 of \quad (= -3 mu)
\	equivalent of space in normal text
\qquad	twice of \quad (= 36 mu)

Whitespace - Phantom

Another way to make whitespace is to make somthing invisible. We can use `\phantom` command to make something invisible in math mode.

```
\begin{pmatrix} -1 & -2\\ 2 & 1 \end{pmatrix} =
\begin{pmatrix} -1 & -2\\ \phantom{-}2 & \phantom{-}1
\end{pmatrix}
```

$$\begin{pmatrix} -1 & -2\\ 2 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -2\\ 2 & 1 \end{pmatrix}$$

Left and Right Delimiter

Proper size of paranthesis is obtained using `\left` and `\right` delimeter

```
\{
\begin{pmatrix} 1 \\ n \end{pmatrix} | n \in \mathbb{N}
\} = \left \{
\begin{pmatrix} 1 \\ n \end{pmatrix} | n \in \mathbb{N}
\right \}
```

$$\{\begin{pmatrix} 1 \\ n \end{pmatrix} | n \in \mathbb{N}\} = \left\{\begin{pmatrix} 1 \\ n \end{pmatrix} | n \in \mathbb{N}\right\}$$

More to Explore

- custom command
- hyperref
- bililiography
- index
- beamer
- etc.

Questions?

Thank You?

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