



Quick Start

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Introduction

1982 T_EX 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 T_EX system so it will be easy to create books, article etc. This is called L^AT_EX.

1993 Second edition of L^AT_EX is launched and it is called L^AT_EX2e which is mostly used now a days.

Future L^AT_EX3e is under development from long time.

¹https://en.wikipedia.org/wiki/Donald_Knuth

Pros:

Pros:

- Large Document

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- Large Document
- Different types of Environment

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- Publication Quality

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- Automation

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- Easy to Convert to Other Format

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Cons:

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- Small Document

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Cons:

- Small Document
- Difficult to Learn

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- Small Document
- Difficult to Learn
- Difficult to Edit

Quick Start

Source \Rightarrow Output

Prelims	{	<code>\documentclass{...}</code>
		<code>...</code>
Content	{	<code>\begin{document}</code>
		<code>...</code>
		<code>\end{document}</code>

Table 1: Global Structure of \LaTeX Source File

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

Document Sectioning³ 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 unnumbered section use `\section*{section}`, similarly to get an unnumbered subsection use `\subsection*{subsection}`.

³https://www.sharelatex.com/learn/Sections_and_chapters

⁴<http://www.ctex.org/documents/packages/layout/titlesec.pdf>

Text Mode

Regular

`\textit{Italic}`

`\underline{underline}`

`\textsc{SmallCaps}`

`\textbf{Bold}`

`\textbf{\textit{ Bold Italic }}`

`\textbf{\textsc{ Bold SmallCaps }}`

Regular

Italic

underline

SMALLCAPS

Bold

Bold Italic

Bold SmallCaps

⁵<https://en.wikibooks.org/wiki/LaTeX/Fonts>

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

Alignment ⁷

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

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

- `\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)

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

Manual breaks ⁸

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

⁸https://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  
  \item Potatoes  
\end{itemize}
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- Eggs
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\begin{description}  
  \item[Ram] One  
  \item[Shyam] Two  
  \item[Mohan] Three  
\end{description}
```

Ram One
Shyam Two
Mohan Three


```
\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>

- 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!`.

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

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

- `\includegraphics{filename}` Simple Use

¹²https://www.sharelatex.com/learn/Inserting_Images

¹³https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics

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

¹²https://www.sharelatex.com/learn/Inserting_Images

¹³https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics

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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

¹²https://www.sharelatex.com/learn/Inserting_Images

¹³https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics

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

- `\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
- `\includegraphics[width=\textwidth]{universe}` Width same as document

¹²https://www.sharelatex.com/learn/Inserting_Images

¹³https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics

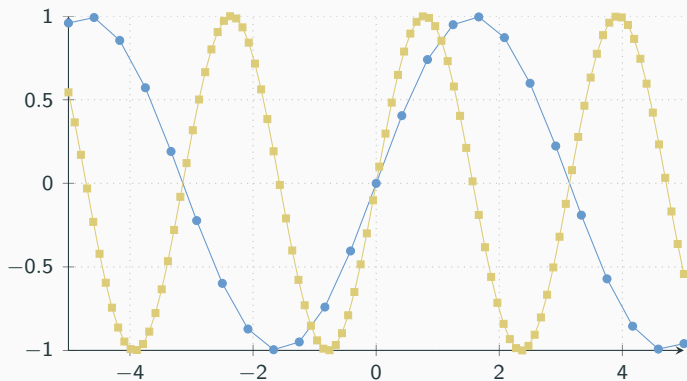
Example

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

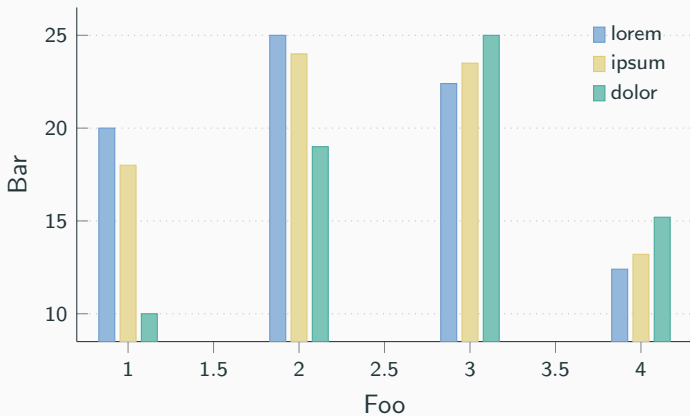


Figure 1: A picture of munger

Example – Line plots



Example – Bar charts



```
\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

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

¹⁴<http://reu.dimacs.rutgers.edu/Symbols.pdf>

¹⁵<https://en.wikibooks.org/wiki/LaTeX/Mathematics>

¹⁶https://www.sharelatex.com/learn/Mathematical_expressions

¹⁷<http://www.math.hkbu.edu.hk/TeX/short-math-guide.pdf>

- Inline Expression
 - $\$ \dots \$$ or $\backslash(\dots \backslash)$
 - Mixed with text.
- Display Style
 - Untagged: $\$ \$ \dots \$ \$$ or $\backslash[\dots \backslash]$
 - Tagged: $\backslashbegin\{ equation \} \dots \backslashend\{ equation \}$

¹⁴<http://reu.dimacs.rutgers.edu/Symbols.pdf>

¹⁵<https://en.wikibooks.org/wiki/LaTeX/Mathematics>

¹⁶https://www.sharelatex.com/learn/Mathematical_expressions

¹⁷<http://www.math.hkbu.edu.hk/TeX/short-math-guide.pdf>

- 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>

¹⁶https://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.

$$\begin{equation} x^n + y^n = z^n \end{equation}$$



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*}
```

↓

$$f(x) = ax^2 + bx + c$$

$$f'(x) = 2ax + b$$

$$g(x) = dx^3$$

$$g'(x) = 3dx^2$$

Matrices

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{AMS-LAT}_{\text{E}}\text{X}$.

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

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

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$.

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

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

Although matrices can be print using tabular enviroment. But there are some predefined matrices in $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$.

```
\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 $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$.

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

$$\left\| \begin{array}{cc} a & b \\ c & d \end{array} \right\|$$

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



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

Advance Mathematics

Custom Operator

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

`\operatorname{E}[x]`

$E[X] = E[X]$

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

To get a operator like `\lim`, either use `\DeclareMathOperator*` or `\operatorname*` command, 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 ($= 18 \text{ mu}$)

`\,` $3/18$ of `\quad` ($= 3 \text{ mu}$)

`\:` $4/18$ of `\quad` ($= 4 \text{ mu}$)

`\;` $5/18$ of `\quad` ($= 5 \text{ mu}$)

`\!` $-3/18$ of `\quad` ($= -3 \text{ mu}$)

`\` equivalent of space in normal text

`\qquad` twice of `\quad` ($= 36 \text{ mu}$)

Another way to make whitespace is to make something 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` delimiter

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

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

More to Explore

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

Questions?

Thank You?

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