

Introduction to LaTeX

LaTeX 101

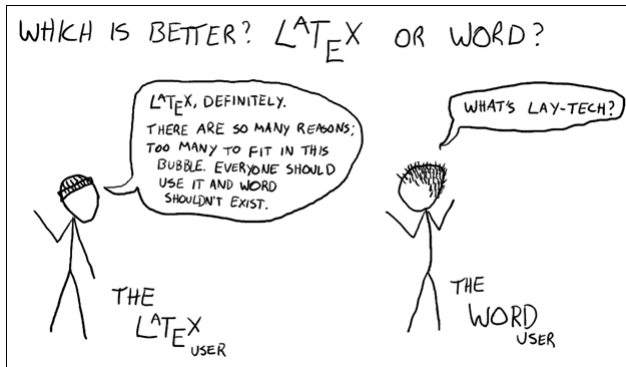
Harshvardhan

IPM 2016-21 Batch

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What is LaTeX?

- Document preparation typesetting system.
- Worry-less document setting.



Benefits of using LaTeX

- Concentrate on the content
- All platforms - Windows, Mac, Linux, Web, Android, iOS, etc
- Platform independent
- Any output - text file, PDF, HTML web page, PNG, PostScript, TIFF

How is it **different** from word processors?

Word processors are language processors.

LaTeX is **NOT** a language processor. It is a typesetting software.

How is it **better** than word processors?

- Professionally crafted documents
- Mathematical symbols and formulae
- Easy-to-understand commands
- Footnotes, citations, and bibliographies
- Customisation
- Free and secure
- No crashes or version problem

How is it **better** than word processors?

Some actual results:

- **Kerning:** Selective Adjustment of Space ¹

MS Word (wrong default kerning for the "Ta" letter pair):

Table

[Adobe Garamond Pro, 48pt] [pdf](#) [doc](#)

L^AT_EX (correct kerning for the "Ta" letter pair):

Table

[Adobe Garamond Pro, 48pt] [pdf](#) [tex](#)

¹<http://nitens.org/taraborelli/latex>

How is it **better** than word processors?

- **Common ligatures:** Contextual Intelligence to Overlap ²

MS Word (common ligature errors):



fire flower fjörd

The image shows the text 'fire flower fjörd' rendered in a serif font. The word 'fire' is in black, 'flower' is in red, and 'fjörd' is in black. The 'f' in 'fjörd' is significantly larger than the other letters, causing it to overlap with the 'j' and 'ö'.

[Hoefer Text, 48pt] [.pdf](#) [.doc](#)

L^AT_EX (correct use of ligatures):



fire flower fjörd

The image shows the same text 'fire flower fjörd' rendered in the same serif font. The 'f' in 'fjörd' is smaller and properly spaced, so it does not overlap with the other letters.

[Hoefer Text, 48pt] [.pdf](#) [.tex](#)

²<http://nitens.org/taraborelli/latex>

How is it **better** than word processors?

- **Common printing errors:** Different format when printed.

**Indian Institute of
Management, Indore**

**Indian Institute of Management,
Indore**

How is it **better** than word processors?

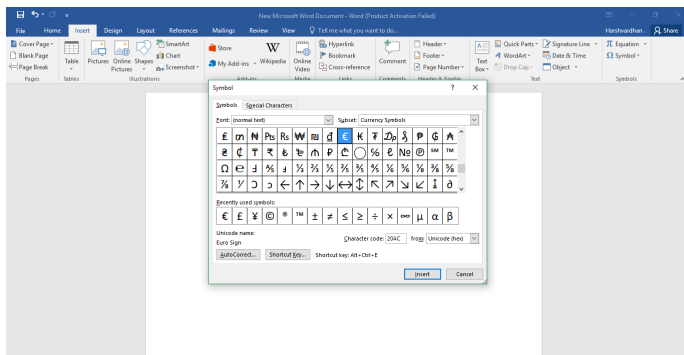
- **Common printing errors:** Different font when printed.

INDIAN INSTITUTE OF MANAGEMENT, INDORE|

Indian Institute of Management,
Indore|

How is it **better** than word processors?

- *Too difficult.*



How is it **better** than word processors?

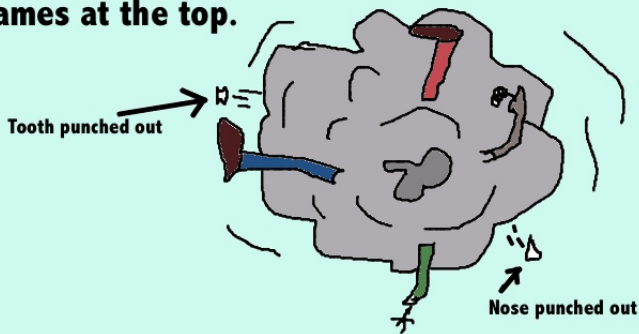
Two same documents written in Word 2011 and LaTeX.

- 1 **Word 2011 (Mac):** <http://www.latextemplates.com/wp-content/uploads/2011/11/Spaghetti-Bolognese-Word.pdf>
- 2 **LaTeX:** <http://www.latextemplates.com/wp-content/uploads/2011/11/Spaghetti-Bolognese-LaTeX.pdf>

How is it **better** than word processors?

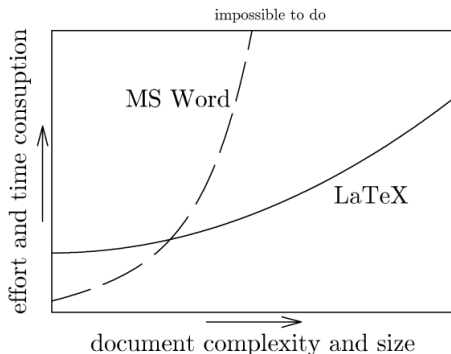
Group Projects!!!

And this was just the fight started over who would have to do the 'work' of writing everyone's names at the top.



How is it **better** than word processors?

Longevity and reliability: LaTeX is immortal. Word dies. ³



LaTeX is reliable.

³Knauff, M. et al (2014). *PloS one*, 9(12), e115069.

How is it **better** than word processors?

This was written in Microsoft Powerpoint.

For the first case, *s.e.* (\hat{y}_0)

$$= \hat{\sigma} \sqrt{1 + 1/n + (x_0 - \bar{x})^2 / (\sum (x_i - \bar{x})^2)}$$

This was written in LaTeX.

For the first case, *s.e.* (\hat{y}_0)

$$= \hat{\sigma} \sqrt{1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum (x_i - \bar{x})^2}}$$

Who uses LaTeX?

It is widely used in Academia, Printing and Publishing Houses.

- **Scientists** - formulae, diagrams, equations, and flow charts.
- **Publishers** - journals, research papers, and books.
- **Educators** - lecture notes, slides and questions.
- **Linguists** - consistent and beautifully organised font.
- **Engineers** - effective mathematical symbols.
- **Lawyers** - their papers, contracts and motions.
- **Economists** - use of econometrics' tools.

Basic Tutorials

LaTeX is *super-easy* to learn.

- Windows - MikTeX and TeX Maker
- Mac - MacTeX
- Linux - TeXLive and TeX Maker
- Online - ShareLaTeX

Note: Saving file is *must* for compilation.

Basic Tutorials: Tokens

- **Characters**

\$ % & - { }...

- **Commands**

\begin{document}, \sin, \theta, \neq, \leq...

- **Comments**

% Comment

Basic Tutorials: **First codes**

Once you have created a new .tex file, start putting words in it.

```
\documentclass{article}
```

```
\begin{document}
```

```
Hello Everyone!
```

```
This is just a simple example, with no extra parameters  
or packages included.
```

```
\end{document}
```

Basic Tutorials: **First codes**

The output will be like this:

Hello Everyone! This is just a simple example, with no extra parameters or packages included.

Basic Tutorials: **First codes**

Structure:

- `\documentclass{}` - type of document. Here, an article. Can differ.
- `\documentclass[11pt, letterpaper]{article}` - letterpaper and font size of 11 points.
Default: 10pt, a4paper.
- `\begin{document}` and `\end{document}` enclose the body (always).

Basic Tutorials: **Author, Title and Date**

Add these in the preamble of your codes.

- `\title{First Try}`
- `\author{Satoshi Nakamoto}`
- `\date{September 3, 2017}`

Show them using `\maketitle`.

Basic Tutorials: **Author, Title and Date**

The execution of above codes will give:

First Try

Satoshi Nakamoto

September 3, 2017

Hello Everyone! This is just a simple example, with no extra parameters or packages included.

Basic Tutorials: **Bold**, *Italics* and Underlining

- **Bold:** `\textbf{}`
- *Italics:* `\textit{}`
- Underline: `\underline{}`

Basic Tutorials: **Adding Images**

- `\usepackage{graphicx}`
- `\includegraphics[scale=..]{}`
- Changing Scale and Aspect Ratio

Basic Tutorials: Image Captions, Labels and References

```
\begin{figure}[h]
  \centering
  \includegraphics[width=0.25\textwidth]{MVNormal}
  \caption{A Multivariate Normal}
  \label{fig:MVNormal}
\end{figure}
```

The figure `\ref{fig:MVNormal}` shows that the function grows near 0. Also, you can see the same example in the page `\pageref{fig:MVNormal}`.

Basic Tutorials: Image Captions, Labels and References

The output of the above code will be:

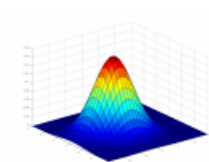


Figure 1: A Multivariate Normal

As you can see in the figure 1, the function grows near 0. Also, you can see the same example in the page 1.

Basic Tutorials: Lists

Lists in LaTeX can be of two types.

① Unordered

```
\begin{itemize}  
  \item ...  
\end{itemize}
```

② Ordered

```
\begin{enumerate}  
  \item ...  
\end{enumerate}
```

Basic Tutorials: Lists

An example:

- This is an item in the list.
 - This is another item in the list.
1. This is first item in the list.
 2. This is second item in the list.

Basic Tutorials: **Mathematics**

Using `math` environment.

- 1 **Inline mode** \dots
- 2 **Display mode**
$$\dots$$

Basic Tutorials: Inline Statements

Syntax:

- `$...$` delimiters
- `\begin{math}` and `\end{math}`

Hook's Law: The deformation, x is proportional to the stress, F applied to it. Mathematically, $F=kx$.

Hook's Law states that the deformation, x is proportional to the stress, F applied to it. Mathematically, $F = kx$.

Basic Tutorials: Display Statements

Syntax:

- `$$...$$` delimiters
- `\begin{displaymath}` and `\end{displaymath}`

Hook's Law: The deformation is proportional to the stress applied to it. Mathematically, `$$F=kx$$`.

Hook's Law states that the deformation is proportional to the stress applied to it. Mathematically,

$$F = kx.$$

Basic Tutorials: **Mathematical symbols**

Writing mathematical symbols is *English-like* and friendly.

Syntax	Symbol
<code>\pi</code>	π
<code>\theta</code>	θ
<code>\gamma</code>	γ
<code>\Gamma</code>	Γ
<code>\sigma</code>	σ
<code>\neq</code>	\neq
<code>\implies</code>	\implies

Basic Tutorials: Some Examples

Subscripts : a_b . Superscripts : a^b .

Expressions:

\$\$

$T^{\{i_1 i_2\}}_{\{j_1 j_2\}}$

$= T(x^{\{i_1\}}, x^{\{i_2\}}; e_{\{j_1\}},$

$e_{\{j_2\}})$

\$\$

Subscripts : a_b . Superscripts : a^b . Expressions:

$$T_{j_1 j_2}^{i_1 i_2} = T(x^{i_1}, x^{i_2}; e_{j_1}, e_{j_2})$$

Basic Tutorials: Some Examples

The mathematical operators are written with a backslash.

Syntax	Output
<code>\sin (\beta)</code>	$\sin(\beta)$
<code>\cos (\alpha)</code>	$\cos(\alpha)$
<code>\ln (x)</code>	$\ln(x)$
<code>\arcsin (\theta)</code>	$\arcsin(\theta)$
<code>\int _a^b x dx</code>	$\int_a^b x dx$

Basic Tutorials: Some Examples

We write integrals using `\int` and fractions using `\frac{a}{b}`.

```
$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e}$$
```

We write integrals using \int and fractions using $\frac{a}{b}$. Limits are placed on integrals using superscripts and subscripts:

$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e}$$

Basic Tutorials: Matrix

```
$$  
\begin{bmatrix}  
a1 & a2 & ... & an \\  
b1 & b2 & ... & bn \\  
c1 & c2 & ... & cn \\  
\end{bmatrix}  
$$
```

$$\begin{bmatrix} a1 & a2 & \dots & an \\ b1 & b2 & \dots & bn \\ c1 & c2 & \dots & cn \end{bmatrix}$$

Types:

- [...] bmatrix
- {...} Bmatrix
- (...) pmatrix
- |...| vmatrix
- ||...|| Vmatrix

Basic Tutorials: **Formatting and Reporting Tools**

Some important formatting and reporting tools:

- Abstracts
- Paragraphs and subparagraphs
- Sections, Subsections and Subsubsections
- Tables
- Footnotes and URLs

Basic Tutorials: Abstracts

Inserted using abstract environment.

```
\begin{abstract}
```

```
This is a sample text to be used as an abstract. An abstract is a brief summary of a research article, thesis, review, conference proceeding, or any in-depth analysis of a particular subject and is often used to help the reader quickly ascertain the paper's purpose.
```

```
\end{abstract}
```

Basic Tutorials: **Abstracts**

Output will be like:

First Try

Satoshi Nakamoto

September 3, 2017

Abstract

This is a sample text to be used as an abstract. An abstract is a brief summary of a research article, thesis, review, conference proceeding, or any in-depth analysis of a particular subject and is often used to help the reader quickly ascertain the paper's purpose.

Hello Everyone! This is just a simple example, with no extra parameters or packages included.

Basic Tutorials: Paragraphs and Subparagraphs

- **Paragraphs:** Two newlines or `\`
- **Subparagraph:** `\subparagraph{...}`

Basic Tutorials: Sections, Subsections and Subsubsections

- **Sections:** `\section{...}`
- **Subsections:** `\subsection{...}`
- **Subsubsection:** `\subsubsection{...}`

Basic Tutorials: Sections, Subsections and Subsubsections

An example would look like:

1 Introduction

This is the first section.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.

2 Second Section

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilissem. Nullam nec mi et neque pharetra sollicitudin.

2.1 First Subsection

Praesent imperdiet mi nec ante. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi necante...

2.1.1 Subsubsection

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Basic Tutorials: **Tables**

- tabular environment.

```
\begin{center}
  \begin{tabular}{c c c }
    cell1 & cell2 & cell3 \\
    cell4 & cell5 & cell6 \\
    cell7 & cell8 & cell9
  \end{tabular}
\end{center}
```

Basic Tutorials: **Tables**

This would produce:

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

Basic Tutorials: **Tables**

Using `—`, `c/l/r` and `\hline`

```
\begin{center}
\begin{tabular}{| c | l | r |}
\hline
 1 & 2 & 3 \\ \hline
 4 & 5.67 & 6.789 \\ \hline
 7.78 & 8 & 9.0 \\ \hline
\end{tabular}
\end{center}
```

Basic Tutorials: **Tables**

This would produce:

Col 1	Col 2	Col 3
1	2	3
4	5.67	6.789
7.78	8	9.0

Basic Tutorials: Tables

Customization:

- `\hline` and `|`
- `\caption{}`
- `\label{}`

Note: There are some other packages like `tabu` which make better tables, but are less customisable.

Basic Tutorials: Footnotes and URLs

- `\footnote{}`
- `\url{}`

Basic Tutorials: Citations and References

Done using BibTeX and thebibliography environment.

```
\begin{thebibliography}{9}
\bibitem{lay}
David C Lay, and Alexander Samarin.
\textit{Play with Graphs}.
Potter-Wesley, Reading, Massachusetts, 1993.
\end{thebibliography}
```

Basic Tutorials: Citations and References

Using `\texttt{LaTeX}` you can display bibliography divided into sections, depending on citation type. Let's cite! `\cite{lay}` and `\cite{bob}` are important graphing books.

Basic Tutorials: Citations and References

- Output of `\cite{}` - depends on citation style.
- Output of above code is:

Using `biblatex` you can display bibliography divided into sections, depending on citation type. Let's cite! Lay (1993) and Who (1995) are important graphing books.

References

Lay, D. C. (1993). *Play with Graphs*. Potter-Wesley Readings, Massachusetts.

Who, B. (1995). *Play with Graphs - better book*. Potter-Wesley Readings, Massachusetts.

- `\usepackage{hyperref}` makes references click-able.

Additional Sources to Learn

Open-source and community driven.

- ShareLaTeX: <https://www.sharelatex.com/>
- WikiBooks: <https://en.wikibooks.org/wiki/LaTeX>
- T_EXStack Exchange: <https://tex.stackexchange.com/>
- Google: <https://www.google.co.in/>

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Sincere thanks to
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for his care and untiring efforts,
and giving me such an opportunity.

Thank You!



Any questions?