

An Introduction to \LaTeX

Erick Petersen

Research



Outline

- 1 What is \LaTeX ?
- 2 Installation
- 3 Simple Document
- 4 Formatting
- 5 Typing Math in \LaTeX
- 6 Typing Algorithms in \LaTeX
- 7 Bibliography and Citations
- 8 Presentations using \LaTeX
- 9 More about \LaTeX

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What is \LaTeX

- A document *markup language*, i.e., languages designed for the processing, definition and presentation of text. The language specifies code for formatting, both the layout and style, within a text file.
- Free/Open Source.
- How does it work?
 - ▶ Two layered system.
 - ▶ **Input:** .tex file (Text Editor)
 - ▶ **Output:** .pdf or .ps or .dvi (\TeX interpreter)

What is L^AT_EX

- A document *markup language*, i.e., languages designed for the processing, definition and presentation of text. The language specifies code for formatting, both the layout and style, within a text file.
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Installation

- Windows users:
 - ▶ Download MikTeX from www.miktex.org.
 - ▶ Install a text editor
 - ★ TeXnicCenter www.texniccenter.org
 - ★ WinEdit www.winedt.com
 - ★ LyX www.lyx.org
 - ★ Kile kile.sourceforge.net
- Mac users:
 - ▶ Download MacTec from www.tug.org/mactex
 - ▶ Install a text editor
 - ★ TexShop www.texshop.org
 - ★ TeXworks www.tug.org/texsorks/
- Linux users:
 - ▶ LaTeX is probably already installed. Check in your package management system.
- Web-based \LaTeX editors:
 - ▶ www.sharelatex.com
 - ▶ www.writelatex.com

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 - ★ Kile kile.sourceforge.net
- Mac users:
 - ▶ Download MacTec from www.tug.org/mactex
 - ▶ Install a text editor
 - ★ TexShop www.texshop.org
 - ★ TeXworks www.tug.org/texsorks/
- Linux users:
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 - ★ LyX www.lyx.org
 - ★ Kile kile.sourceforge.net
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 - ★ TexShop www.texshop.org
 - ★ TeXworks www.tug.org/texsorks/
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Installation

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 - ★ LyX www.lyx.org
 - ★ Kile kile.sourceforge.net
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 - ▶ Download MacTec from www.tug.org/mactex
 - ▶ Install a text editor
 - ★ TexShop www.texshop.org
 - ★ TeXworks www.tug.org/texsorks/
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Simple Document

Example 1

```
\documentclass[12pt]{article}
```

```
\usepackage{color}
```

```
\begin{document}
```



This is my first time using `latex`.

This is my first time using `\textcolor{blue}{latex}`.

```
\end{document}
```

Example 2

```
\documentclass[12pt]{article}
```

```
\usepackage{color}
```

```
\begin{document}
```



This is my first time using `LATEX`.

This is my first time using `\textcolor{blue}{\LaTeX}`.

```
\end{document}
```


Title

- 1 Define fields of the title.
- 2 Call the title creation using `\maketitle`

Example of a Title

```
\documentclass[12 pt]{article}
```

```
\title{Introduction to \LaTeX}
```

```
\author{Jorge Samayoa}
```

```
\date{March 7, 2014}
```

```
\begin{document}
```

```
\maketitle
```

```
This is my article.
```

```
\end{document}
```



Introduction to \LaTeX

Jorge Samayoa

March 7, 2014

This is my article.

Sections & Chapters

- 1 To create a section use `\section{}`
- 2 To create a subsection use `\subsection{}`

Example of a Sections

```
\documentclass[12 pt]{article}
```

```
\title{Introduction to \LaTeX}
```

```
\author{Jorge Samayoa}
```

```
\date{March 7, 2014}
```

```
\begin{document}
```

```
\maketitle
```

```
This is my article.
```

```
\section{Introduction}
```

```
  \subsection{Overview}
```

```
    This is the overview of my document.
```

```
\section{One More Section}
```

```
  \subsection{Subsection}
```

```
    \subsubsection{Sub-Sub-Section}
```

```
\end{document}
```

Introduction to \LaTeX

Jorge Samayoa

March 7, 2014

This is my article.



1 Introduction

1.1 Overview

This is the overview of my document.

2 One More Section

2.1 Subsection

2.1.1 Sub-Sub-Section

Sections & Chapters

- ❶ To add abstract use `\begin{abstract} ... \end{abstract}`

Example of an Article with Abstract

```
\documentclass[12 pt]{article}
```

Introduction to L^AT_EX

```
\title{Introduction to \LaTeX}
```

Jorge Samayoa

```
\author{Jorge Samayoa}
```

```
\date{March 7, 2014}
```

March 7, 2014

```
\begin{document}
```

```
\maketitle
```

```
\begin{abstract}
```

```
  This is the abstract.
```

```
\end{abstract}
```



Abstract

This is the abstract.

```
\section{Introduction}
```

1 Introduction

1.1 Overview

This is the overview of my document.

```
  \subsection{Overview}
```

```
    This is the overview of my document.
```

```
\section{One More Section}
```

2 One More Section

2.1 Subsection

2.1.1 Sub-Sub-Section

```
  \subsection{Subsection}
```

```
    \subsubsection{Sub-Sub-Section}
```

```
\end{document}
```

Sections & Chapters

Example of a Chapter

```
\documentclass[12 pt]{report}

\title{Introduction to \LaTeX}
\author{Jorge Samayoa}
\date{March 7, 2014}

\begin{document}

\chapter{Introduction to Latex}

\section{Introduction}
  \subsection{Overview}
    This is the overview of my document.
\section{One More Section}
  \subsection{Subsection}
    \subsubsection{Sub-Sub-Section}
\end{document}
```



Chapter 1

Introduction to Latex

1.1 Introduction

1.1.1 Overview

This is the overview of my document.

1.2 One More Section

1.2.1 Subsection

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Spacing

Example - Line Spacing

```
\documentclass[12 pt]{article}
\usepackage{setspace}

\begin{document}
This is          the \ default \ line
spacing.\

\noindent I don't like indentation!

\begin{doublespace}
This paragraph has \ double \ line \
spacing
\end{doublespace}
\vspace{0.3in} %Adds a vertical space of 0.3 inches
\begin{spacing}{1.5}
This paragraph \hspace{1cm} has \ 1.5 line\
spacing.
\end{spacing}

\end{document}
```



This is the
default
line spacing.

I don't like indentation!

This paragraph has
double
line
spacing

This paragraph has
1.5 line
spacing.



Font Style and Text Size

Example - Font Style

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

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

```
\emph{Emphasized Text}, \texttt{Typewriter}, \\\
```

```
\textsc{Small Caps},
```

```
\underline{Underlined Text}.\\\
```

```
\noindent
```

```
\tiny Text\\
```

```
\scriptsize Text\\
```

```
\footnotesize Text\\
```

```
\small Text\\
```

```
\normalsize Text\\
```

```
\large Text\\
```

```
\Large Text\\
```

```
\LARGE Text\\
```

```
\huge Text\\
```

```
\Huge Text\\
```

```
\end{document}
```

Bold Text, *Italic Text*, *Emphasized Text*, Typewriter,
SMALL CAPS, Underlined Text.

Text

Text

Text

Text

Text

Text

Text

Text

Text

Text



Lists

Example - lists

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

```
\begin{itemize}
```

```
\item First item.
```

```
\item Second item.
```

```
\end{itemize}
```

- First item.
- Second item.

```
\begin{enumerate}
```

```
\item First item.
```

```
\item Second Item.
```

```
\end{enumerate}
```



1. First item.
2. Second Item.

```
\begin{description}
```

```
\item[First] First item.
```

```
\item[Second] Second item.
```

```
\end{description}
```

First First item.

Second Second item.

```
\end{document}
```


Tables

Example 1- tables

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

```
\begin{tabular}{|c|c|}
```

```
\hline
```

```
Column 1 & Column 2 \\
```

```
\hline
```

```
(1,1) & (1,2)\\
```

```
(2,1) & (2,2)\\
```

```
\hline
```

```
\end{tabular}
```

```
\end{document}
```



Column 1	Column 2
(1,1)	(1,2)
(2,1)	(2,2)

Tables

Example 2- tables

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

```
→ \begin{center} ↓
```

```
\begin{tabular}{|c||c|}
```

```
\hline
```

```
Column 1 & Column 2 \\\
```

```
\hline
```

```
(1,1) & (1,2) \\\
```

```
→ \hline
```

```
(2,1) & (2,2) \\\
```

```
\hline
```

```
\end{tabular}
```

```
\end{center}
```

```
\end{document}
```



Column 1	Column 2
(1,1)	(1,2)
(2,1)	(2,2)

Figures

Example - Figures & Cross-referencing

```
\documentclass[12 pt]{article}
\usepackage{graphicx}
\begin{document}

\begin{enumerate}
  \item \includegraphics[scale=0.10]{informs-logo.jpg} \label{fig-1}
  \item \includegraphics[scale=0.10, angle=180]{informs-logo.jpg}
  \item \includegraphics[scale=0.10, clip=true, trim= 0 50 0 500]{informs-logo.jpg}
  \strim = left down right up
\end{enumerate}

Figure \ref{fig-1} shows the INFORMS logo.
\end{document}
```



Figure 1 shows the INFORMS logo.

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Typing Math in \LaTeX

Example 1- Math formulas

```
\documentclass[12 pt]{article}

\begin{document}
\setlength\parindent{0pt}%No indentation throughout the doc.
With \LaTeX we can type inline formulas.
For example:\\

Given a vector space  $X$  over a field  $\mathbb{R}$  of real numbers.
for every Cauchy sequence  $\{x_n\}_{n=1}^\infty$  in  $X$ , there
exists an element  $x \in X$  such that,
 $\lim_{n \rightarrow \infty} x_n = x$ ,
i.e.,  $\lim_{n \rightarrow \infty} \|x_n - x\|_X = 0$ .\\

\end{document}
```



With \LaTeX we can type inline formulas. For example:

Given a vector space X over a field \mathbb{R} of real numbers. for every Cauchy sequence $\{x_n\}_{n=1}^\infty \in X$, there exists an element $x \in X$ such that, $\lim_{n \rightarrow \infty} x_n = x$, i.e., $\lim_{n \rightarrow \infty} \|x_n - x\|_X = 0$.

Typing Math in \LaTeX

Example 2- Math formulas

```
\begin{document}
\setlength\parindent{0pt}%No indentation throughout the doc.
We can write more sophisticated formulas.
For example, let me state the \textbf{Lindeberg-L\'evy CLT}.\
```

```
Suppose  $\{X_1, X_2, \dots\}$  is a sequence of i.i.d. random
variables with  $E[X_i] = \mu$  and  $\text{Var}[X_i] = \sigma^2 < \infty$ .
Then as  $n \rightarrow \infty$ , the random variables
 $\frac{1}{\sqrt{n}}(S_n - n\mu)$  converge in distribution to a normal
 $N(0, \sigma^2)$ . This is,

$$\frac{1}{\sqrt{n}} \left( \sum_{i=1}^n X_i - n\mu \right) \xrightarrow{d} N(0, \sigma^2)$$

\end{document}
```

Output

We can write more sophisticated formulas. For example, let me state the **Lindeberg-Lévy CLT**.

Suppose $\{X_1, X_2, \dots\}$ is a sequence of i.i.d. random variables with $E[X_i] = \mu$ and $\text{Var}[X_i] = \sigma^2 < \infty$. Then as n approaches infinity, the random variables $\frac{1}{\sqrt{n}}(S_n - n\mu)$ converge in distribution to a normal $N(0, \sigma^2)$. This is,

$$\frac{1}{\sqrt{n}} \left(\sum_{i=1}^n X_i - n\mu \right) \xrightarrow{d} N(0, \sigma^2)$$

Typing Math in L^AT_EX

Example 3- Random formulas

```
\documentclass[12 pt]{article}
\usepackage{amsmath}
```

```
\begin{document}
```

```
$ \lim_{x \rightarrow +\infty} \frac{3x^2 + 7x^3}{x^2 + 5x^4} = 3. $
```

$$\rightarrow \lim_{x \rightarrow +\infty} \frac{3x^2 + 7x^3}{x^2 + 5x^4} = 3.$$

```
$$ \lim_{x \rightarrow +\infty} \frac{3x^2 + 7x^3}{x^2 + 5x^4} = 3. $$
```

```
$ \sum_{i=1}^{2n} $
```

$$\lim_{x \rightarrow +\infty} \frac{3x^2 + 7x^3}{x^2 + 5x^4} = 3.$$

```
$ \sum_{k=1}^n k^2 = \frac{1}{2} n (n+1) $
```

```
$ \frac{n!}{k!(n-k)!} = \binom{n}{k} $
```

```
$ \int_a^b f(x) dx $
```

```
$$ \int_a^b f(x) dx $$
```

```
$ \int_{\theta=0}^{2\pi} \int_{r=0}^R f(r \cos \theta, r \sin \theta) r dr d\theta. $
```

```
$$
```

```
\frac{\partial u}{\partial t}
```

```
= h^2 \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right)
```

```
$$
```

```
\end{document}
```

$$\sum_{k=1}^{2n} k^2 = \frac{1}{2} n (n+1)$$

$$\frac{n!}{k!(n-k)!} = \binom{n}{k}$$

$$\int_a^b f(x) dx$$

$$\int_a^b f(x) dx$$

$$\int_{x^2+y^2 \leq R^2} f(x, y) dx dy = \int_{\theta=0}^{2\pi} \int_{r=0}^R f(r \cos \theta, r \sin \theta) r dr d\theta.$$

$$\frac{\partial u}{\partial t} = h^2 \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right)$$

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Typing Algorithms

Use package `algorithmic`, i.e., type: `\usepackage{algorithmic}`

Example 1- Algorithms

```
\documentclass[12 pt]{article}
\usepackage{algorithmic}
\begin{document}
\begin{algorithmic}
\IF {$i \geq val$}
  \STATE  $i$  gets 0
\ELSE
  \FOR {$i=1$ \to 10$}
    \STATE  $i$  gets  $i+1$ 
  \ENDFOR
\ENDIF
\end{algorithmic}
\end{document}
```



```
if  $i \geq val$  then
   $i \leftarrow 0$ 
else
  for  $i = 1 \rightarrow 10$  do
     $i \leftarrow i + 1$ 
  end for
end if
```

Typing Algorithms

`\usepackage{algorithmic}`, and `\usepackage{algorithm}`

Example 1- Algorithms

```
\documentclass[12 pt]{article}
\usepackage{algorithmic}
\usepackage{algorithm}

\begin{algorithm}
\caption{This is the caption}
\begin{algorithmic}
\IF {$i \geq val$}
  \STATE  $i \leftarrow 0$ 
\ELSE
  \FOR {$i=1$ \to  $10$ }
    \STATE  $i \leftarrow i+1$ 
  \ENDFOR
\ENDIF
\end{algorithmic}
\end{algorithm}
\end{document}
```



Algorithm 1 This is the caption

if $i \geq val$ then
 $i \leftarrow 0$
else
 for $i = 1 \rightarrow 10$ do
 $i \leftarrow i + 1$
 end for
end if

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Bibliography in L^AT_EX

- In your text editor create a new file with the extension .bib e.g., mybibliography.bib.
- Find the style of bibliography you want, e.g., plain, abbrv, ieetr, amsplain, alpha.
- Add the following lines at the end of your .tex file, before the end of the document:

```
\bibliographystyle{plain}  
\bibliography{mybibliography}
```

Bibliography in L^AT_EX

Example - Code in mybibliography.bib

```
@inproceedings{samayoa2012using,  
  title={Using MediaWiki to Enhance Mathematics Learning  
in Engineering Schools},  
  author={Samayoa, Jorge A and Zelada, Carlos Humberto},  
  booktitle={American Society for Engineering Education},  
  year={2012},  
  organization={American Society for Engineering Education}  
}  
  
@article{kim2006loss,  
  title={Loss Given Default Modelling under the  
Asymptotic Single Risk Factor Assumption},  
  author={Kim, Joocheol and Kim, KiHyung},  
  year={2006},  
  publisher={Yonsei Univ.}  
}
```

Bibliography & Referencing

Using ieetr style

Example 1- References

```
@inproceedings{samayoa2012,  
  title={Using Mediawiki to Enhance  
    Mathematics Learning in Engineering Schools},  
  author={Samayoa, Jorge A and Zelada, Carlos Humberto},  
  booktitle={American Society for Engineering Education},  
  year={2012},  
  organization={American Society for Engineering Education}  
}  
@article{kim2006,  
  title={Loss Given Default Modelling under  
    the Asymptotic Single Risk Factor Assumption},  
  author={Kim, Joocheol and Kim, KiHyung},  
  year={2006},  
  publisher={Yonsei Univ.}  
}
```

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

This is an example of how to cite and create references in \LaTeX .
I can cite paper `\cite{samayoa2012}` or paper `\cite{kim2006}` using
the command 'cite'.



```
\bibliographystyle{ieetr}  
\bibliography{mybibliography}  
\end{document}
```

This is an example of how to cite and create references in \LaTeX . I can
cite paper [2] or paper [1] using the command 'cite'.

References

- [1] J. A. Samayoa and C. H. Zelada, "Using mediawiki to enhance mathematics learning in engineering schools," in *American Society for Engineering Education*, American Society for Engineering Education, 2012.
- [2] J. Kim and K. Kim, "Loss given default modelling under the asymptotic single risk factor assumption," 2006.

Bibliography & Referencing

Using plain style:

Example 2- References

```
@inproceedings{samayoa2012,  
  title={Using Mediawiki to Enhance  
  Mathematics Learning in Engineering Schools},  
  author={Samayoa, Jorge A and Zelada, Carlos Humberto},  
  booktitle={American Society for Engineering Education},  
  year={2012},  
  organization={American Society for Engineering Education}  
}  
@article{kim2006,  
  title={Loss Given Default Modelling under  
  the Asymptotic Single Risk Factor Assumption},  
  author={Kim, Joocheol and Kim, KiHyung},  
  year={2006},  
  publisher={Yonsei Univ.}  
}
```

```
\documentclass[12 pt]{article}
```

```
\begin{document}
```

This is an example of how to cite and create references in `\LaTeX`.
I can cite paper `\cite{samayoa2012}` or paper `\cite{kim2006}` using
the command `'cite'`.



```
\bibliographystyle{plain}
```

```
\bibliography{mybibliography}
```

```
\end{document}
```

This is an example of how to cite and create references in \LaTeX . I can
cite paper [1] or paper [2] using the command `'cite'`.

References

- [1] Joocheol Kim and KiHyung Kim. Loss given default modelling under the asymptotic single risk factor assumption. 2006.
- [2] Jorge A Samayoa and Carlos Humberto Zelada. Using mediawiki to enhance mathematics learning in engineering schools. In *American Society for Engineering Education*. American Society for Engineering Education, 2012.

Bibliography & Referencing

Using alpha style:

Example 3- References

This is an example of how to cite and create references in \LaTeX . I can cite paper [SZ12] or paper [KK06] using the command 'cite'.

References

- [KK06] Joocheol Kim and KiHyung Kim. Loss given default modelling under the asymptotic single risk factor assumption. 2006.
- [SZ12] Jorge A Samayoa and Carlos Humberto Zelada. Using mediawiki to enhance mathematics learning in engineering schools. In *American Society for Engineering Education*. American Society for Engineering Education, 2012.

Agenda

- 1 What is \LaTeX ?
- 2 Installation
- 3 Simple Document
- 4 Formatting
- 5 Typing Math in \LaTeX
- 6 Typing Algorithms in \LaTeX
- 7 Bibliography and Citations
- 8 Presentations using \LaTeX**
- 9 More about \LaTeX

What is Beamer?

- Beamer is the \LaTeX document class to create presentations.

My first slide

```
\documentclass[english]{beamer} %,handout
\begin{document}
\begin{frame}
  \frametitle{This is the title}
  This is the boddy of the first slide!
\end{frame}
\end{document}
```

This is the title

This is the boddy of the first slide!

A set of small, faint navigation icons typically found in Beamer presentations, including symbols for back, forward, search, and other navigation functions.

Usando Español.

Example 1

```
\documentclass[12pt]{article}
\usepackage[latin9]{inputenc}

\begin{document}
Este es un documento en Español. Podemos poner tildes, \
por ejemplo: comunicación.
\end{document}
```

Output

Este es un documento en Español. Podemos poner tildes,
por ejemplo: comunicación.

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Some Useful Resources:

- LaTeX wikibooks:
<http://en.wikibooks.org/wiki/LaTeX>.
- The not so short introduction to \LaTeX :
<http://tobi.oetiker.ch/lshort/lshort.pdf>.
- Documentation about \LaTeX :
<http://www.latex-project.org/guides/>.
- Beamer user guide:
<http://www.tex.ac.uk/CTAN/macros/latex/contrib/beamer/doc/beameruserguide.pdf>.