LATEX for Beginners

A Practical Approach

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What is LaTeX?

- pronounced as Lah-tek, or Lay-tek
- a typesetting program, not a word-processor
- macros of TeX (Donald E. Knuth)
- current version LaTeX 2_ε
- designed for producing beautiful Books, Thesis, Papers, Articles...
- de facto standard for writing academic papers

Why LaTeX?

- platform, version independent (Unix, Windows), freely available
- High quality math typesetting
- Only a few commands to define the structure of text, no knowledge of typography or book design required
- Complex scientific documents can be created automatically including:
  - bibliography
  - index, glossaries
  - crossreferences
  - table of contents, lists of figures, tables etc.
  - ...
- used widely in scientific world and required for most conference or journal submissions
- allows you to think about content than format

Limitations of LATEX

- learning curve
- LATEX is not WYSIWYG you have to compile your files before you can see the changes. Rather it is WYMIWYG (What You Mean is What You Get)
- If you are trying to produce a document for which there is no pre-defined layout, it requires a fair bit of knowledge to design a new layout
- You cannot easily exchange LATEX files with colleagues who are unfamiliar with it
- Unflexible formatting (difficult to change position of figures)
- Requires compilation

Word and LaTeXcomparison

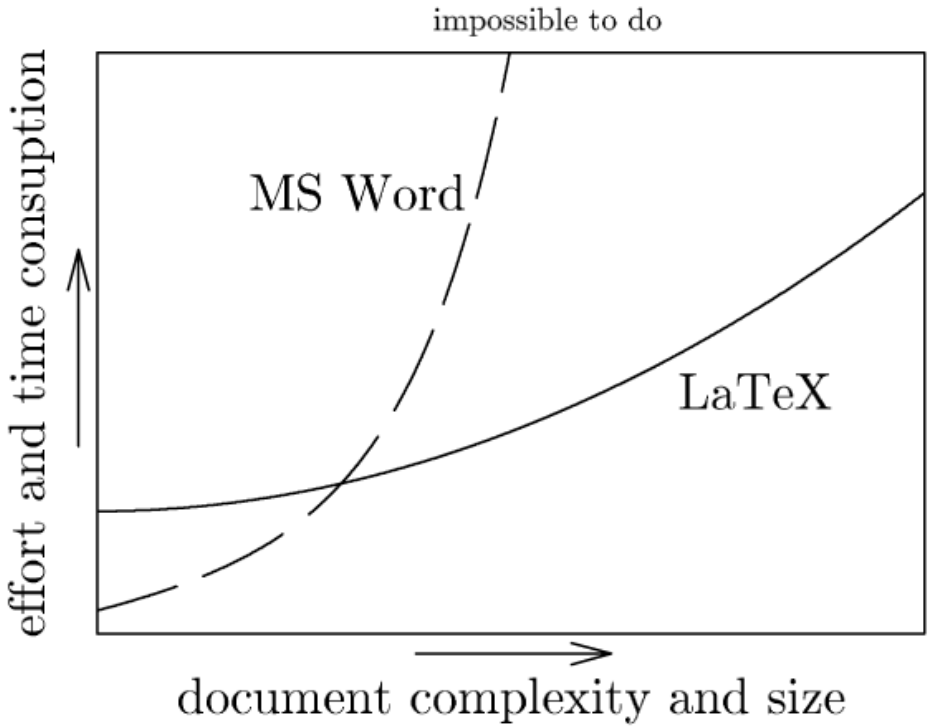

Figure: Word and LaTeXcomparison[1]

[1]Source: http://www.pinteric.com/miktex.html

Word and LaTeX comparison

Microsoft Word 2008

Call me Ishmael. Some years ago – never mind how long precisely – having little or no money in my purse, and noth- ing particular to interest me on shore, I thought I would sail about a little and see the wa- tery part of the world. It is a way I have of driving off the spleen, and regulating the ci- culation. Whenever I find my- self growing grim about the

Adobe InDesign CS4

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pdf-LaTeX 3.1415926

Call me Ishmael. Some years ago – never mind how long precisely – having little or no money in my purse, and noth- ing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen, and regulating the circulation. Whenever I find myself growing grim about the

Hyphenation and inter-word spacing statistics

	Word	InDesign	pdf-LaTeX
Number of hyphenations	9	10	4
SD of IWS (pt)	2.26	1.94	1.42
Maximum IWS (pt)	14.4	13.2	9.0
Number of lines with IWS > 9 pt	5	2	0

SD: standard deviation; IWS: inter-word spacing

Figure: Word and LaTeX comparison[2]

[2]Source: http://www.zinktypografie.nl/latex.php?lang=en

Where to get LaTeX?

- Windows
  - TeXLive is full fledged LaTeX compiler
    `http://tug.org/texlive/acquire.html`
  - MikTeX, The LaTeXCompiler `http://www.miktex.de/`
  - LaTeX Editors
    - TexStudio
    - WinEdt (Share ware)
    - LaTeX Editor, LEd, a free LaTeX editor
    - TexNIC center, a free LaTeX editor
    - WinShell, SciTE (Open Source)
    - Notepad, wordpad or any other text editor can be used
- Linux
  - TeXLive/teTex, available with most Linux distros
  - Kile, a free LaTeX editor
  - gedit with LaTeX plugin
  - Almost all IDEs are available for Linux

Outline

LaTeX commands

```
\acommand

\anothercommand{argument}

\yetanothercommand[options]{argument}

% a comment. I can say what I like here!
```

Overall structure of a LaTeX document:

```
\documentclass[...]{...}
% preamble
   ...
\begin{document}
% body of the document
   ...
\end{document}
```

The preamble:

```
\documentclass[a4paper,12pt]{article}

% the next line is only needed if you plan
% to embed a PostScript figure in the text
\usepackage{graphics}

\title{A \LaTeX\ File}
\author{Vijay Ukani}
% \date{if you are unhappy with the default}
```

Document classes: article, report, book, beamer, userdefinedclass and options: 10pt, 11pt, twocolumn, a4paper, a5paper ...

The body:

```
\begin{document}
\maketitle

\section{Introduction}
Some text...
\section{The Middle}
Some more ...
\section{Conclusion}
The final part
\end{document}
```

Running and Viewing LATEX

- Start TEXStudio or any of your favorite LATEXeditor
- Create a new .tex file

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- Use BibTex to process Bibliography

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Outline

Numbered Lists

```
List of Metros in India
\begin{enumerate}
\item Delhi \pause
\item Mumbai \pause
\item Kolkata \pause
\item Chennai
\end{enumerate}
```

Looks like:-

List of Metros in India

1. Delhi
2. Mumbai

Numbered Lists

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List of Metros in India
\begin{enumerate}
\item Delhi \pause
\item Mumbai \pause
\item Kolkata \pause
\item Chennai
\end{enumerate}
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Looks like:-

List of Metros in India

1. Delhi
2. Mumbai
3. Kolkata

Numbered Lists

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Looks like:-

List of Metros in India

1. Delhi
2. Mumbai
3. Kolkata
4. Chennai

Numbered Lists

```
List of Metros in India
\begin{enumerate}
\item Delhi \pause
\item Mumbai \pause
\item Kolkata \pause
\item Chennai
\end{enumerate}
```

Looks like:-

List of Metros in India

1. Delhi
2. Mumbai
3. Kolkata
4. Chennai

Bullet Point Lists

```
List of Metros in India
\begin{itemize}
\item Delhi
\item Mumbai
\item Kolkata
\item Chennai
\end{itemize}
```

Looks like:-

List of Metros in India

- Delhi
- Mumbai
- Kolkata
- Chennai

Desciption Lists

```
Game Description
\begin{description}
  \item[Cricket] Favorite Game in Asian Countries
  \item[Football] Famous Game in European Countries
\end{description}
```

Looks like:-

Game Description

Cricket Favorite Game in Asian Countries

Football Famous Game in European Countries

Basic Text Formatting

- `\\ and \newline` forces new lines
- `\newpage force new page`
- `\\* start new line without new paragraph`
- `\mbox{text} and \fbox{}` keeps several words on same line
- `\ldots puts several dots like etc....`
- `\smallskip, \bigskip and \vspace` skips vertical space
- `\hspace` skips horizontal space

Alignment Environments

- `\center`, `\flushleft`, and `\flushright`, aligns the text accordingly.
- For example, the `\begin{center}Centered Text\end{center}` environment centers the text.

Font Sizes

- \tiny Text
- \scriptsize Text
- \footnotesize Text
- \small Text
- \large Text
- \Large Text
- \LARGE Text
- \huge Text
- \Huge Text

Changing Fonts

{\bf bold text}	**bold text**
{\it italics}	*italics*
{\sf sans serif}	sans serif
{\tt monospaced typewriter}	monospaced typewriter
{\tiny tiny text}	tiny text
{\large large text}	large text

Symbols, quote marks and footnotes

`$ \rightarrow $`	$\rightarrow$
`$\sum$`	$\sum$
`\'o`	ó
`\"o`	ö

```
\begin{quote}
\LaTeX\ The best possible documentation system.
\end{quote}
```

So the quote in amongst text looks like:

> *LaTeX The best possible documentation system.*

Reproducing text verbatim:

Either like[3] this:

```
\begin{verbatim}

{\LARGE \bf Reproducing text verbatim:}

\end{verbatim}
```

Or like this:

```
\verb+{\LARGE Reproducing text verbatim:}+
```

To produce footnote use following command

```
\footnote{verbatim is used to display unprocessed text}
```

[3] verbatim is used to display unprocessed text

Outline

Sectioning Commands

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

Each of the above has an unnumbered "starred" form (Ex. \section*{})

Labels and References

- At almost any point in the document you can place a label using `\label{key}`, where the argument is a key, a short one word description of the location.
- You can refer to this label by section and page number using `\ref{key}` and `\pageref{key}`, respectively.

```
\section{Experiments}
\label{Exp}
However this contains...
\subsection{Experiment A}
which contains...
\section{Discussion}
Look at section \ref{Exp} for more details.
\section{Conclusion}
```

Tables

```
\begin{table}[!h] %tbp
\label{latextable}
\begin{center}
\begin{tabular}{|l||r|} \hline\hline
Number of students & 450\\  \hline
Location \& time & NIM Audi \& 11am\\ \hline
\end{tabular}
\caption{\LaTeX\ course}
\end{center}
\end{table}
```

Number of students	450
Location & time	NIM Audi & 11am

Table: LaTeX course

Including Pictures

```
\begin{figure}[!h]
\begin{center}
%\rotatebox{270}
{{\includegraphics{poweredby.png}}}
\caption{Powered by Red Hat}
\end{center}
\end{figure}
```

Figure: Powered by Red Hat

Equations

- There are two basic methods of typesetting math, inline which occurs inside of a sentence: a = b + c , and displayed, which occurs centered between paragraphs
- To typeset material in inline mode, surround it with dollar signs: `$...$`
- `$\sum_{n_{jw} \in N_{w}} \frac{n_{jw}}{\log(\pi^2)}$` gives $\sum_{n_{jw} \in N_w} \frac{n_{jw}}{\log(\pi^2)}$

Equations

```
\begin{equation}
\sum_{n_{jw} \in N_{w}} \frac{n_{jw}}{\log(\pi^2)}
\label{foo}
\end{equation}
```

gets:

$$\sum_{n_{jw} \in N_w} \frac{n_{jw}}{\log(\pi^2)} \tag{1}$$

or

```
\[\sum_{n_{jw} \in N_{w}} \frac{n_{jw}}{\log(\pi^2)}\]
```

gets:

$$\sum_{n_{jw} \in N_w} \frac{n_{jw}}{\log(\pi^2)}$$

Basic Math Building Blocks

- Sub/superscripts are produced with `_` and `^`. For example, `$p_2$` gives p_2
- `$x^y$` gives x^y
- `$\frac{5}{8}$` yields a $\frac{5}{8}$
- `$\sqrt{x}$` gives $\sqrt{x}$
- `$\sqrt[3]x$` gives $\sqrt[3]{[}x]$
- Lowercase Greek Letters are spelled as macro ex. `$\delta$` gives δ and `$\Omega$` yielding Ω

How would you typeset?

- $y = \sqrt[z]{x^2 + w_2^2}$
- $\sigma = \frac{\Omega^x + y_2}{\sqrt{x}}$
- $\sqrt[n+1]{a}$
- τ''_{xy}

Solutions to Exercise

- `$y=\sqrt[z]{x^2+w_2^2}$`
- `$\sigma=\frac{\Omega^{x}+y_2}{\sqrt{x}}$`
- `$\sqrt[n+1]{a}$`
- `$\tau_{xy}''$`

Integrals and Summations

- `$\int_0^\infty x\,dx $`

  gives

$$\int_0^\infty x\,dx$$

- `$\left(\frac{\int_0^l x\,dx}{\Delta x}\right)$`

  gives

$$\left(\frac{\int_0^l x\,dx}{\Delta x}\right)$$

How would you typeset?

- $1 + \left(\frac{1}{1-x^2}\right)^3$
- $\pi(n) = \sum_{k=2}^{n} \left[\frac{\phi(k)}{k-1}\right]$
- $\Delta x = x_{\max} - x_{\min}$
- $A = \int_0^{\pi} r^2 \, dr$

Solutions to Exercise

- `$1+\left(\frac{1}{1-x^2}\right)^3$`
- `$\pi(n)=\sum_{k=2}^{n}\left[\frac{\phi(k)}{k-1}\right]$`
- `$\Delta x=x_{\mathrm{max}}-x_{\mathrm{min}}$`
- `$A=\int_0^\pi r^2\,dr$`

Use Word to produce

- $\overbrace{1+2+\cdots+100}^{5050}$
- ${}_{1}^{2}\prod_{3a}^{4b}$

Use Word to produce

- $\overbrace{1 + 2 + \cdots + 100}^{5050}$
- ${}_{1}^{2}\prod_{3a}^{4b}$

Can easily be done with

```
$ \overbrace{1 + 2 + \cdots + 100}^{5050} $
```

Use Word to produce

- $\overbrace{1 + 2 + \cdots + 100}^{5050}$
- ${}_{1}^{2}\prod_{3_a}^{4^b}$

Can easily be done with

- `$ \overbrace{1 + 2 + \cdots + 100}^{5050} $`
- `$ \sideset{_1^2}{_3^4}\prod_a^b $`

Use Word to produce

- $\overbrace{1 + 2 + \cdots + 100}^{5050}$
- ${}_1^2\prod_{3_a}^{4^b}$

Can easily be done with

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- ${}_1^2\prod_{3_a}^{4^b}$

Can easily be done with

- `$ \overbrace{1 + 2 + \cdots + 100}^{5050} $`
- `$ \sideset{_1^2}{_3^4}\prod_a^b $`

Citations and Bibliography

Using BIBTEX

- store your references in a .bib file in the specified format:

```
@BOOK{Lamport,
    Title    = {{\LaTeX\}: A Document Preparation System},
    AUTHOR    = {Lamport, Leslie},
    PUBLISHER       = {Addison-Wesley},
    ADDRESS         = {Reading, Massachusetts},
    YEAR            = {1994},
    Keywords        = {Latex documentation}
}
```

Using your bib file

1. include the package needed for the style e.g. plain, apa

```
\usepackage{plain}
      %  before \begin{document}
...
\begin{document}
```

2. cite references using `\cite{Lamport}`
3. specify the style

```
\bibliographystyle{plain}
       %  before \bibliography{} cmd
```

4. specify the bibliography file in your document where you want it to appear

```
\bibliography{my}
```

Running LATEXwith BIBTEX

- compile the .tex file which generates .aux file
- use BIBTEX to compile .bib file
- compile .tex file twice
- view the pdf

You end up with an output file which including the bibliography:

[1] Leslie Lamport.
LaTeX: A Document Preparation System.
Addison-Wesley, Reading Massachusetts, 1994.

Exercises

1. adapt mydoc.tex to add some new sections and subsections
2. add a reference to a section from a different section
3. add a list
4. add a table with a caption, e.g. the first few rows of the 2 times table
5. add a reference to this table in the text
6. add a citation to one of the books in my.bib to your document
7. make an equation looking like $\sum_{x=0}^{n} \frac{x^2}{x}$

Manually Running LATEX with BIBTEX on Unix based systems

- run latex [1]

  ```
  % latex myproposal.tex
  ```

- run bibtex

  ```
  % bibtex myproposal
  ```

- then run latex twice more to get all references in

  ```
  % latex myproposal
  % latex myproposal
  ```

The source

The source stored in the my.bbl file. You can insert this directly into your latex source:

```
\bibliographystyle{plain}
\begin{thebibliography}{1}

\bibitem{Lamport}
Leslie Lamport.
\newblock {\em {LaTeX}: A Document Preparation System}.
\newblock Addison-Wesley, Reading Massachusetts, 1994.

\end{thebibliography}
```

Common Mistakes

- Misspelled command or environment names
- Missing or improperly nested `\end` statements
- Improperly matched `{` and `}`. They should always come in pairs
- Missing command arguments
- A missing $
- Using one of the special LATEX characters such as #

Unix: Running, Viewing and Printing LaTeX:

```
% latex myproposal.tex
% xdvi myproposal.dvi
% dvips myproposal.dvi
% dvips -P <printer> myproposal.dvi
% dvips -o myproposal.ps myproposal.dvi
% ps2pdf myproposal.ps myproposal.pdf
% pdflatex myproposal.tex
```

[1] Leslie Lamport.
LaTeX: A Document Preparation System.
Addison-Wesley, Reading Massachusetts, second edition, 1994.


Thank you