Introducing Document Preparation with \LaTeX

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Preparation of a document involves:
- Entering text
- Formatting text
- Display on a screen
- Printing
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- Formatting text
- Display on a screen
- Printing

\TeX\ (τεχ) is a typesetting system.
- METAFONT – Font description language
  - A point on a glyph is found as the intersection of a line segment and a Bézier cubic curve
- Computer modern typeface.
  - 62 parameters control the widths and heights of elements

Author of \TeX
Donald Knuth (1978), computer science professor at Stanford
\textbf{T\TeX \ and \ \LaTeX}

- Math spacing carefully derived based on typesets in:
  - \textit{Acta Mathematica}
  - \textit{Indagationes Mathematicae}
  - Addison-Wesley’s books
TEX and \LaTeX

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Line breaks
- A total-fit line-breaking algorithm
- Assigns badness. Minimizes SS of badness
TEX and \LaTeX

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- Hyphenation algorithm
  - Removes prefixes and suffixes
  - Will attempt to put a break between consonants in a pattern of the form vowel-consonant-consonant-vowel.
**TEX and \LaTeX**

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**\LaTeX** is a set of macros for \TeX

Written by Leslie Lamport (1984), current release \LaTeX2ε
Pronunciation of \LaTeX

- no single agreed-upon pronunciation
- \TeX~ derives from the Greek $\tau\epsilon\chi\nu\eta$, which means “art, skill, craft”
- origin of the name suggests that “X” be pronounced like the “ch” in “technical”
- Options:
  - LAYtek
  - LAHtek
  - LahTEK
Why \texttt{\LaTeX}?

- It is a natural choice if you want to create beautiful output
- A structured system of typesetting. Spend time and effort on content not on layout
- Works across platforms
- Handles math well
- Table of contents, list of figures, bibliography etc.
- Cross-referencing features
- Stable processing engine
- Highly extensible
- Input is plain text
- Output can be anything
- Complete document preparation. Articles, presentations, posters, HTML.
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- Output can be anything
- Complete document preparation. Articles, presentations, posters, HTML.
- FREE & open source
## $\LaTeX$ vs. MS Word

<table>
<thead>
<tr>
<th>Feature</th>
<th>$\LaTeX$</th>
<th>MS Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>WYSIWYG</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Platform independent</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Math</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Citations &amp; references</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Automated TOC, LoF</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Cross-references</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Style changes</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Multimedia</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Free</td>
<td>✓</td>
<td>×</td>
</tr>
</tbody>
</table>
Why \textsc{\LaTeX}?

\[ I_{mn}(\lambda) = I_0(\lambda)T_m^2(\lambda) \sum_{p=-\infty}^{\infty} \int_{r_m}^{r_{m+w_m}} dx \int_{r_n+pT}^{r_{n+w_m+pT}} \text{PSF}(x-x') dx' \]

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MS Word Equation Editor 

\[ I_{mn}(\lambda) = I_0(\lambda) T_m^2(\lambda) \sum_{p=-\infty}^{\infty} \int_{r_m}^{r_m+w_m} \int_{r_m+pT}^{r_m+w_m+pT} dx \int_{r_m+pT}^{r_m+w_m+pT} \text{PSF}(x - x') dx' \]
Why \LaTeX?
## Installation

### Packages

<table>
<thead>
<tr>
<th>Back-end</th>
<th>Front-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>Mik\TeX, \TeXLive</td>
</tr>
<tr>
<td>Mac</td>
<td>CMac\TeX, Oz\TeX</td>
</tr>
<tr>
<td>Linux</td>
<td>te\TeX, \TeXLive</td>
</tr>
</tbody>
</table>

CoE Windows labs have:

- Mik\TeX
- \TeXnicCenter
\LaTeX{} for the PC

To install \LaTeX{} on your PC you need:

- **The back-end**: The base \TeX{} package
  - Windows
    - \(\text{MikTEX}\). Available at the \texttt{MikTEX} homepage
    - \TeX{}Live
    - Ghostscript, Ghostview, and GSview.

- **The front-end**: A \LaTeX{} editor (WinEdt, \TeX{}nicCenter)
  - WinEdt: evaluation version. \TeX{}nicCenter: free
  - Available at the \texttt{WinEdt} homepage
    or at \texttt{Sourceforge.net}
The downside

There are certain “disadvantages”

- Somewhat steep learning curve
- Not interactive. Have to use pre-viewer before finalizing document
- Difficult to create your own document type
\texttt{pdflatex} is an alternative workflow that goes straight from the *.tex file to a PDF file.
Getting started

\documentclass{article}

\begin{document}

\section{Introduction}

The conditional probability of an event $A$ assuming another event $M$, denoted by $P(\,|M)$, is by definition the ratio

\begin{align}
P(A,|M) &= \frac{P(AM)}{P(M)}
\end{align}

\subsection{Bayes’s theorem}

Bayes’s theorem for probability densities is given by:

\begin{align}
p(x|y) &= \frac{p(y|x)p(x)}{p(y)}
\end{align}

\end{document}
1 Introduction

The conditional probability of an event \( A \) assuming another event \( M \), denoted by \( P(A | M) \), is by definition the ratio

\[
P(A | M) = \frac{P(AM)}{P(M)}
\]

(1)

1.1 Bayes’s theorem

Bayes’s theorem for probability densities is given by:

\[
p(x|y) = \frac{p(y|x)p(x)}{p(y)}
\]

(2)
LaTeX Documents

- \ is used to start LaTeX commands
- % is used to start a comment
- &, $, #, _, ^, { } and ~ are special characters
- Words are separated by one or more spaces.
- Paragraphs are separated by one or more blank lines.
Sectioning commands

The sectional units in an article are produced by the following commands:

- \chapter{title}
- \section{title}
- \subsection{title}
- \subsubsection{title}
- \paragraph{title}
List Environments

\begin{itemize}
\item \textit{enumerate}: Numbered lists
\item \textit{itemize}: Bulleted lists
\end{itemize}

- \textbullet\  \textit{enumerate}: Numbered lists
- \textbullet\  \textit{itemize}: Bulleted lists

\begin{enumerate}
\item \textit{enumerate}: Numbered lists
\item \textit{itemize}: Bulleted lists
\end{enumerate}
Math

- **Inline math**
  
  Inline math appears within a line and must appear enclosed in $ signs. $x^2 = 2 \Rightarrow x = \pm \sqrt{2}$.  

- **Equations**
  
  \[
  \mathcal{F}(\omega) = \int_{-\infty}^{\infty} f(t) e^{-j \omega t} dt
  \]  

  \[\mathcal{F}(\omega) = \int_{-\infty}^{\infty} f(t) e^{-j \omega t} dt \quad (1)\]
More math

The Fibonacci numbers form a sequence defined recursively by:
\begin{align}
F(n) &= \begin{cases}
0, & \text{if } n=0; \\
1, & \text{if } n=1; \\
F(n-1) + F(n-2) & \text{otherwise}.
\end{cases}
\end{align}

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\[
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1, & \text{if } n = 1; \\
F(n - 1) + F(n - 2) & \text{otherwise.}
\end{cases}
\]
Customizing

\documentclass{article}
\newcommand{\parD}[2]{\frac{\partial #1}{\partial #2}}
\newcommand{\parDD}[2]{\frac{\partial^2 #1}{\partial^2 #2}}
\begin{document}
\begin{align*}
\parD{}{x} \left( \parD{y}{x} \right) = \parDD{y}{x}
\end{align*}
\begin{align*}
\begin{align*}
\parD{}{x} \left( \parD{y}{x} \right) &= \parDD{y}{x}
\end{align*}
\end{align*}
\end{document}

\documentclass{article}
\usepackage{graphicx}

\begin{figure}[!h]
\centering
\includegraphics[width=5cm]{ginn_logo.pdf}
\caption{CoE logo}
\end{figure}
Flow behind a cylinder - vorticity contours
Introducing Document Preparation with \LaTeX

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Introduction \LaTeX

Editors

Automation

Prosper

Beamer

Posters

\TeXnicCenter
Cross-referencing

Can cross-reference figures, tables, equations, sections using:

\label{name}, \%\label{eq:wav}, \label{sec:wav}, \label{fig:wav} 
\ref{name}

For example

\begin{align} \label{eq:partial} 
\parD{}{x} \left( \parD{y}{x} \right) = \parDD{y}{x} 
\end{align}

Eq. \ref{eq:partial} describes . . .

\begin{align*} 
\frac{\partial}{\partial x} \left( \frac{\partial y}{\partial x} \right) &= \frac{\partial^2 y}{\partial x^2} 
\end{align*}

Eq. 4 describes . . .
The Bib\TeX package

- Create a bibliography database with a .bib extension: e.g., bibdatabase.bib
- Include following two lines where you want the bibliography to appear

\bibliographystyle{style} \% (plain, alpha, abbrv, unsrt)
\bibliography{bibdatabase}
A BibTeX entry looks like:

```latex
@article{lane87,
    title = "Automatic multidimensional deconvolution",
    author = "R. G. Lane and R. H. T. Bates",
    JOURNAL = "Journal of the Optical Society of America",
    YEAR = "1987",
    VOLUME = "4",
    NUMBER = "1",
    PAGES = "180-188",
    MONTH = "January"
}
```
BibTeX entry types

@booklet @proceedings
@conference @inbook
@incollection @inproceedings
@manual @mastersthesis
@misc @phdthesis
@techreport @unpublished
Citations

- Use the \cite{key} command to include citations.

  The authors in \cite{key} propose a new method to melt ice.

  The authors in [1] propose a new method to melt ice.
Citations

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> The authors in \cite{key} propose a new method to melt ice.

> The authors in [1] propose a new method to melt ice.

- To include an entry that was not cited in the LaTeX document, add:
  \nocite{key}
Citations

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The authors in \cite{key} propose a new method to melt ice.
  
The authors in [1] propose a new method to melt ice.
- To include an entry that was not cited in the \LaTeX document, add:
  \nocite{key}
- May also use
  \nocite{*}
## JabRef

A bibliography management tool that allows users to organize their references efficiently. JabRef supports various formats, including BibTeX, and facilitates the management of bibliographic data such as authors, titles, and publication years. It is particularly useful for researchers and authors in fields that require extensive bibliography management, such as academic research and publishing. JabRef is open-source software, which means that it is freely available for anyone to use and modify as needed.
Presentations

http://prosper.sourceforge.net/
- Prosper
- Needs the following packages:
  - prosper
  - seminar
  - pstricks

http://latex-beamer.sourceforge.net/
- Beamer
- Needs the following packages:
  - latex-beamer
  - xcolor
  - pgm
Beamer documents

- Uses the `frame` environment. A slide is defined within
  \[
  \begin{frame}
  \text{Slide body}
  \end{frame}
  \]

- Preserves document structure
- Very customizable
- Allows for overlays
Beamer documents

- **Uses the `frame` environment.** A slide is defined within
  \begin{frame}
  Slide body
  \end{frame}

- Preserves document structure
- Very customizable
- Allows for overlays
- Auto-generation of ToCs and ToFs
Posters

- The `a0poster.cls` class file can be used to create up to A0 size posters.
- It offers the following capabilities
  - Allows for paper sizes A0, A1, A2, A3, & A4
  - Allows font sizes from 12pt–107pt
  - Scales formulas and math symbols
  - The package also creates a postscript header file for `dvips` to ensure that the poster will be printed in the right size.
a0poster.cls

The header of a LaTeX poster document looks like:

\documentclass[options]{a0poster}
\usepackage{graphicx,pstricks,...}
\begin{document}

The following options are available:

\begin{tabular}{|l|l|}
\hline
\textit{landscape} & landscape format \\
\textit{portrait} & portrait format \\
\textit{a0b} & “DIN A0 big” \\
a0 & DIN A0 \\
a1 & DIN A1 \\
a2 & DIN A2 \\
a3 & DIN A3 \\
\textit{posterdraft} & reduces the postscript output to DIN A4 size. \\
\textit{final} & makes postscript output in original size \\
\end{tabular}
LyX

- LyX is a T\TeX\ based WYSIWYM editor
- Available for multiple platforms
- Offers a GUI with menus
- Supports BibT\TeX
- Has WYSIWYG table and math editors
- Uses T\TeX\ rules for indents, spacing, and hyphenation
\LaTeX in plotting tools

- MATLAB supports \LaTeX
  - Figure labels and other text can be parsed by a \LaTeX interpreter
  - The \texttt{latex} command translates MATLAB matrices into \LaTeX arrays
  - Can publish a formatted m-file, including \LaTeX constructs, as a \LaTeX document
\LaTeX in plotting tools

- PGFPLOTS is a drawing package for \LaTeX based on PGF/Tikz
- text-based specification of plots
- can actually calculate and evaluate figures
\LaTeX\ at Auburn

- Dr. E.E. Slaminka maintains AU theses style files
- AU allows \LaTeX\ for theses. Formatting restrictions have been relaxed. Color and multimedia as well as hyper-references are possible in PDF files.
- We have a rather inactive \texttt{tex-users} mailing list.
Summary

- \LaTeX{} is a programming language, not an application.
- An abundance of \LaTeX{} utilities are available for different platforms.
- All \LaTeX{} components and packages are free and easily available.
- It can be used to generate various document types.
- Style files for Auburn University theses are available.