An Introduction to LaTeX

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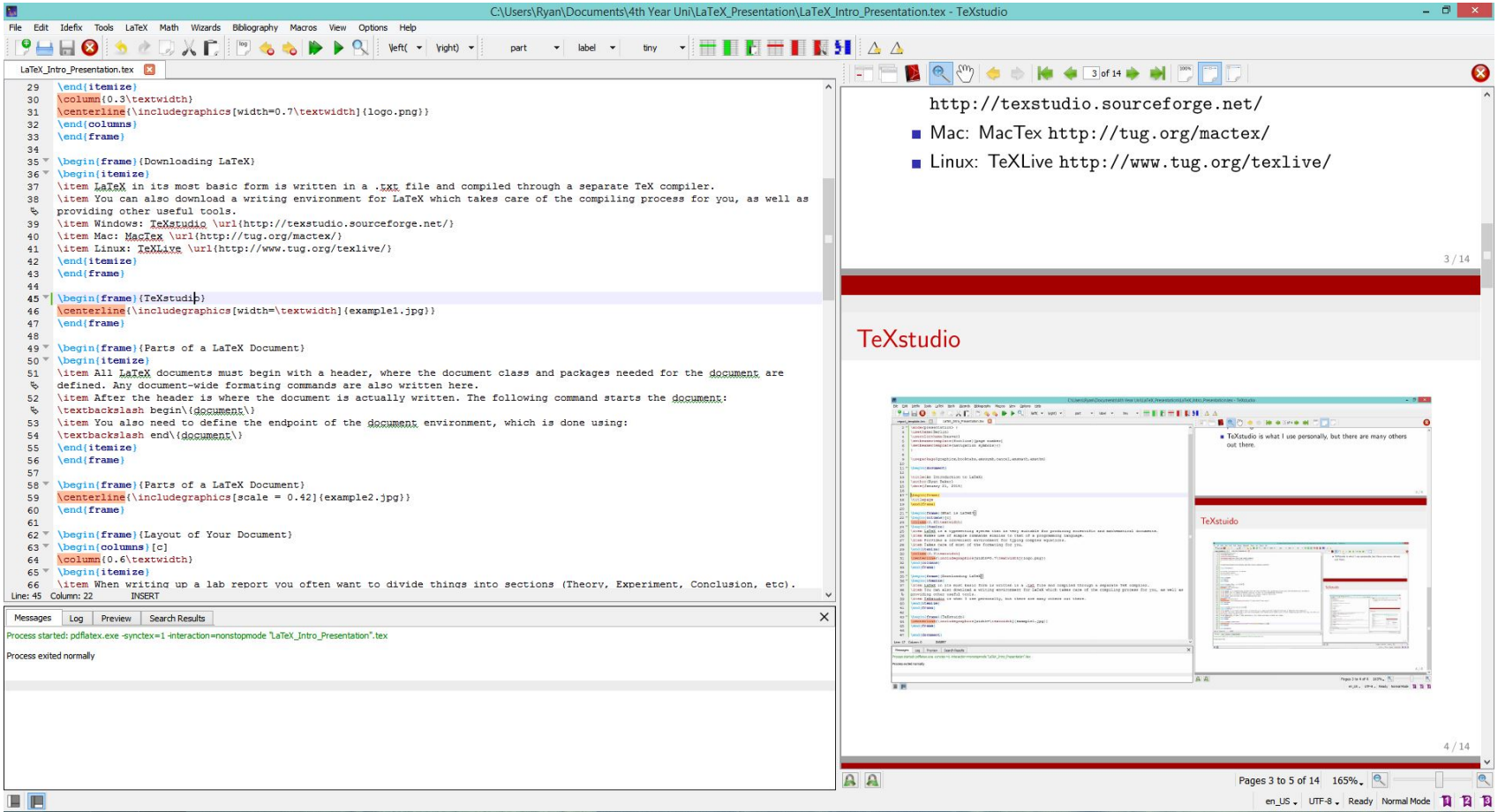
What is LaTeX?

- LaTeX is a typesetting system that is very suitable for producing scientific and mathematical documents.
- Makes use of simple commands similar to that of a programming language.
- Provides a convenient environment for typing complex equations.
- Takes care of most of the formating for you.

Downloading LaTeX

- LaTeX in its most basic form is written in a .txt file and compiled through a separate TeX compiler.
- You can also download a writing environment for LaTeX which takes care of the compiling process for you, as well as providing other useful tools.
- Windows: TeXstudio `http://texstudio.sourceforge.net/`
- Mac: MacTex `http://tug.org/mactex/`
- Linux: TeXLive `http://www.tug.org/texlive/`

TeXstudio


C:\Users\Ryan\Documents\4th Year Uni\LaTeX_Presentation\LaTeX_Intro_Presentation.tex - TeXstudio
File Edit Idefix Tools LaTeX Math Wizards Bibliography Macros View Options Help
LaTeX_Intro_Presentation.tex
\end{itemize}
\column{0.3\textwidth}
\centerline{\includegraphics[width=0.7\textwidth]{logo.png}}
\end{columns}
\end{frame}
\begin{frame}{Downloading LaTeX}
\begin{itemize}
\item LaTeX in its most basic form is written in a .txt file and compiled through a separate TeX compiler.
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\item Windows: TeXstudio \url{http://texstudio.sourceforge.net/}
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\end{itemize}
\end{frame}
\begin{frame}{TeXstudio}
\centerline{\includegraphics[width=\textwidth]{example1.jpg}}
\end{frame}
\begin{frame}{Parts of a LaTeX Document}
\begin{itemize}
\item All LaTeX documents must begin with a header, where the document class and packages needed for the document are defined. Any document-wide formating commands are also written here.
\item After the header is where the document is actually written. The following command starts the document:
\textbackslash begin\{document\}
\item You also need to define the endpoint of the document environment, which is done using:
\textbackslash end\{document\}
\end{itemize}
\end{frame}
\begin{frame}{Parts of a LaTeX Document}
\centerline{\includegraphics[scale = 0.42]{example2.jpg}}
\end{frame}
\begin{frame}{Layout of Your Document}
\begin{columns}[c]
\column{0.6\textwidth}
\begin{itemize}
\item When writing up a lab report you often want to divide things into sections (Theory, Experiment, Conclusion, etc).
Line: 45 Column: 22 INSERT
Messages Log Preview Search Results
Process started: pdflatex.exe -synctex=1 -interaction=nonstopmode "LaTeX_Intro_Presentation".tex
Process exited normally
http://texstudio.sourceforge.net/
Mac: MacTex http://tug.org/mactex/
Linux: TeXLive http://www.tug.org/texlive/
3 / 14
TeXstudio
4 / 14
Pages 3 to 5 of 14 165%
en_US UTF-8 Ready Normal Mode

Parts of a LaTeX Document

- All LaTeX documents must begin with a header, where the document class and packages needed for the document are defined. Any document-wide formating commands are also written here.
- After the header is where the document is actually written. The following command starts the document: \begin{document}
- You also need to define the endpoint of the document environment, which is done using: \end{document}

Parts of a LaTeX Document

```
%
%   Template for Phys 3811/4311 Laboratory Reports
%
%   2009.01.11      DLH     First Version
%   2011.01.09      DLH     Updated for Phys4311-11wi
%   2014.11.28      DLH     Updated for Phys3811-15wi
%
\documentclass[12pt]{article}
\usepackage{amsmath,multirow,dcolumn,fancyhdr,graphicx}

%
% Fancy page style with left and right header and footer information.
%
\pagestyle{fancy}
\lfoot{C. Moltisanti}
\rfoot{Mount Allison University}
\lhead{Physics 3811}
\rhead{Winter 2015}

%
% These are margins that make use of most of the page but still allow for
% a decent header and footer.
%
\oddsidemargin -0.25in
\textwidth 7.0in
\headwidth 7.0in
\headheight 14.5pt
\topmargin -0.25in
\textheight 8.50in
\footskip 0.75in

%
% This changes the date format to DAY MONTH YEAR...
% Totally optional.  Some people like to use MONTH DAY YEAR.
%
\renewcommand{\today}{\number\day\space \ifcase\month\or January\or
February\or March\or April\or May\or June\or July\or August\or September\or
October\or November\or December\fi
\space \number\year}

\begin{document}
```

Layout of Your Document

- When writing up a lab report you often want to divide things into sections (Theory, Experiment, Conclusion, etc).
- LaTeX does this using the \section{*section name*} command. If you want subsections, \subsection{*subsection name*}, etc.
- If you don't want the sections labeled by numbers, simply use \section*{}

```
57
58  \section{Object}
59
60  The object of this experiment is to measure the refractive index of a prism as
61  a function of wavelength by the minimum deviation method, and to find the
62  constants in Cauchy's dispersion relation that describe the change of
63  refractive index with wavelength.
64
65  \section{Theory}
66
67  The refractive index of a material is given by $n(\lambda) = c/v_p(\lambda)$
68  where $c$ is the speed of light in the vacuum, and $n(\lambda)$ and
69  $v_p(\lambda)$ are the refractive index of the material and the phase speed of
70  electromagnetic waves in the material, respectively.  Both $n$ and $v_p$ are
71  functions of $\lambda$, the wavelength of light.  $n > 1$ for solid materials,
72  and $n < 1$ for plasmas (ionized media).
```

Writing Equations in LaTeX

- Writing equations in LaTeX is made easy by the math environment.
  - This is an environment with special commands related to writing equations.
- To enter math mode dollar signs are used.
  - $ *equation here* $
- Some other environments, such as \begin{equation} automatically put you in math mode as well.
- To not have LaTeX number your equation, end the line with \nonumber

`http://web.ift.uib.no/Teori/KURS/WRK/TeX/symALL.html`

Examples of Equations

$$n(\lambda) = A + \frac{B}{\lambda^2}$$

```
89  \begin{equation}
90  n(\lambda)=A+\frac{B}{\lambda^2}
91  \end{equation}
```

$$\varepsilon_2(t) = -\frac{d\Phi_2}{dt} = -\frac{\mu_0 N \pi r^2}{2R}\frac{dI_1}{dt} = -M\frac{dI_1}{dt}$$

```
\begin{equation}
\varepsilon_2 (t) = - \frac{d\Phi_2}{dt} = - \frac{\mu_0 N \pi r^2}{2R}
\frac{dI_1}{dt} = -M \frac{dI_1}{dt}
\end{equation}
```

Including Graphics

- The \includegraphics{} command is the main way to insert figures within your document.
- This can be done by itself, or within the *figure* environment.

```
\begin{figure}[h!tb]
\centerline{\includegraphics[width=0.5\textwidth]{figure1.eps}}
\caption{A light ray passing through a prism.}
\label{fig:prism}
\end{figure}
```

- The square brackets after the command allows you to control the size of the figure. This is typically done by defining the width, as shown here, or by defining a scale for the picture such as [scale = 0.4]

Creating Tables

```
\begin{table}[h]
\caption{Data Taken: Capacitance}
\label{tab:data}
\centering
\vspace{0.5\baselineskip}
\begin{tabular}{c c c}
\hline \hline
Distance (mm) & 1/Distance (m$^{-1}$) & Capacitance (pF) \\
$\pm 1$mm &  & $\pm 0.1$ pF \\ [0.5ex]
\hline
5 & 200 $\pm 20$ & 27.7 \\
10 & 100 $\pm 10$ & 13.4 \\
15 & 67 $\pm 7$ & 8.8 \\
20 & 50 $\pm 5$ & 7.1 \\
25 & 40 $\pm 4$ & 5.6 \\
30 & 33 $\pm 3$ & 4.8 \\
35 & 29 $\pm 3$ & 4.2 \\
40 & 25 $\pm 3$ & 3.8 \\
45 & 22 $\pm 2$ & 3.5 \\
50 & 20 $\pm 2$ & 3.1 \\ [1ex]
\hline
\end{tabular}
\end{table}
```

Table 1: Data Taken: Capacitance

Distance (mm) ±1mm	1/Distance (m^{-1})	Capacitance (pF) ±0.1 pF
5	200 ±20	27.7
10	100 ±10	13.4
15	67 ±7	8.8
20	50 ±5	7.1
25	40 ±4	5.6
30	33 ±3	4.8
35	29 ±3	4.2
40	25 ±3	3.8
45	22 ±2	3.5
50	20 ±2	3.1

- The caption for your table is written at the top, using \caption.
- The number of c's that follow \tabular indicate how many columns the table will have.
- & separate the columns, and \\ ends the row.

Labels & References

- If you want to reference a specific table, figure, equation, section, etc in your document, LaTeX has a very simple way of handling it.
- First, you need to label what you want to reference, using \label{}
- Then, to reference it later in the text, you use \ref{}
- If the number of the equation changes as you add to your document, LaTeX automatically handles this using this method. However, you need to compile the document twice to ensure LaTeX updates the references properly.

Labels & References

```
\begin{figure}[h!tb]
\centerline{\includegraphics[width=0.5\textwidth]{figure1.eps}}
\caption{A light ray passing through a prism.}
\label{fig:prism}
\end{figure}
```

```
Examining the triangle formed by the light ray and the top of the prism in
Figure~\ref{fig:prism}, by geometry, it is evident that the bottom two angles
of that triangle are just $90^\circ -  \theta_1^\prime$ and $90^\circ
-\theta_2^\prime$.  Since the sum of angles inside the triangle must equal
```

Examining the triangle formed by the light ray and the top of the prism in Figure 1, by geometry, it is evident that the bottom two angles of that triangle are just $90^\circ - \theta_1'$ and $90^\circ - \theta_2'$. Since the sum of angles inside the triangle must equal 180°, we have

Useful Commands

- `http://en.wikibooks.org/wiki/LaTeX` - extremely valuable resource for finding new commands, formatting issues, troubleshooting, etc.
- The commands \newpage \newline, \vspace{\baselineskip} and \hspace{} are all useful for adding whitespace in your document. \\ ends a line.
- \textbf{} bolds text, \textit{} for italics. \text{} in math mode gives the text normal font.
- You can use \begin{enumerate} to create a numbered list, or \begin{itemize} to create a list with bullet points (like this one!)