LaTeX Review

LaTeX Distributors

1. TeX Live
2. teTeX
3. fpTeX
4. MiKTeX
5. proTeXt
6. MacTeX
7. gwTeX
8. OzTeX
9. AmigaTeX
10. PasTeX

Windows Users

It is recommended that you download the "Basic MiKTeX Installer". This allows you to set up a basic MiKTeX system. And since MiKTeX has the ability to download needed packages on-the-fly from the Internet, you will not miss any feature.

Many Windows users prefer it to TeX Live for ease of installation because it is based on a Windows Wizard. Recently it has also been ported to Linux and macOS.

Windows Users

https://miktex.org/howto/install-miktex

Install

Install Missing Packages Automatically

Open Texworks

Write Code and Hit "Compile"

Mac Users

It is recommended you download MacTeX

Essentially the same as TeX Live, but only for Mac OS X. It adds some features to TeX Live for better compatibility with the OS.

Mac Users

https://tug.org/mactex/mactex-download.html

Install

Open TeXShop

Write Code and Hit "Command + T" to print to PDF

Your First LaTeX Document

Creating documents with LaTeX is simple and fun. In contrast to Word, you start off with a plain text file (.tex file) which contains LaTeX code and the actual content (i.e. text). LaTeX uses control statements, which define how your content should be formatted. Before you can see what the final result looks like, the LaTeX compiler will take your .tex file and compile it into a .pdf file. A basic example document can be created with the following code:

Your First LaTeX Document

```
\documentclass{article}
\begin{document}
  Hello World!
\end{document}
```

Once you translated this code into a PDF document, you will find the text:

Hello World!

along with the page number at the bottom, which is added automatically when using the article class

LaTeX Commands

As you can see, you will find a few statements beginning with a backslash \ in the code example on the previous slide. This tells LaTeX that this is not actual text, that you want to see printed in your document, but instead is an instruction or command for the LaTeX compiler. All commands share the following structure: *\commandname{option}*. The first part indicates the name of the command and the second part in braces sets an option for this command.

LaTeX Environments

LaTeX uses document classes, to influence the overall layout of your document. This second example differs slightly from the first one, since this command involves a \begin and \end statement. In fact this is not a command, but defines an environment. An environment is simply an area of your document where certain typesetting rules apply. It is possible (and usually necessary) to have multiple environments in a document, but it is imperative the *document environment* is the topmost environment.

LaTeX Environments

```
% Valid:

\begin{document}

 \begin{environment1}

  \begin{environment2}

  \end{environment2}

 \end{environment1}

\end{document}
```

```
%Invalid:

\begin{document}

 \begin{environment1}

  \begin{environment2}

 \end{environment1}

\end{environment2}

\end{document}
```

Adding a Title Page

```latex
\documentclass{article}

  \title{My first document}

  \date{2022-01-11}

  \author{Emelyne Peck}

  \begin{document}

    \maketitle

    \newpage

  Hello World!

  \end{document}
```

Sometimes I like to Remove the Page # from Title Page

What if we decide, that actually, we don't want to have the page number showing up on the title page. This can be done by adding the *\pagenumbering{gobble}* command and then changing it back to *\pagenumbering{arabic}* on the next page numbers like so:

Sometimes I like to Remove the Page # from Title Page

```
\documentclass{article}

\title{My first document}

\date{2022-01-11}

\author{Emelyne Peck}

\begin{document}

 \pagenumbering{gobble}

 \maketitle

 \newpage

 \pagenumbering{arabic}

 Hello World!

\end{document}
```

Summary

- A document has a *preamble* and *document* part

- The document environment *must* be defined

- Commands beginning with a *backslash* \, environments have a *begin* and *end* tag

- Useful settings for *pagenumbering*:
  - *gobble* – no numbers
  - *arabic* – arabic numbers
  - *roman* – roman numbers

Sections and Subsections

```latex
\documentclass{article}

\title{My first document}

\date{2022-01-11}

\author{Emelyne Peck}

\begin{document}

 \pagenumbering{gobble}

 \maketitle

 \newpage

 \pagenumbering{arabic}

 \section{Section}

Hello World!

\subsection{Subsection}

Structuring a document is easy!

\end{document}
```

Sections, Subsections, Paragraphs, Subparagraphs

```latex
\documentclass{article}
\begin{document}
\section{Section}
Hello World!
\subsection{Subsection}
Structuring a document is easy!
\subsubsection{Subsubsection}
More text.
\paragraph{Paragraph}
Some more text.
\subparagraph{Subparagraph}
Even more text.
\section{Another section}
\end{document}
```

Summary

- LaTeX uses the commands *\section*, *\subsection* and *\subsubsection* to define sections in your document
- The *sections* will have successive numbers and appear in the table of contents
- *Paragraphs* are not numbered and thus don't appear in the table of contents

Using Packages

LaTeX offers a lot of functions by default, but in some situations it can become in handy to use *packages.* To import a package in LaTeX, you simply add the *\usepackage* directive to the *preamble* of your document.

```
\documentclass{article}
\usepackage{PACKAGENAME}
\begin{document}
...
\end{document}
```

Math Package

To typeset math, LaTeX offers (among others) an *environment* called *equation.* Everything inside this environment will be printed in *math mode*, a special typesetting environment for math. LaTeX also takes care of equation numbers for us:

```
\documentclass{article}
\begin{document}
\begin{equation}
 f(x) = x^2
\end{equation}
\end{document}
```

Summary

- *Packages* add new functions to LaTeX

- All *packages* must be included in the *preamble*

- Packages add features such as support for pictures, links and bibliography

LaTeX Math and Equations

There are two major modes of typesetting math in LaTeX one is embedding the math directly into your text by *encapsulating* your formula in *dollar signs* and the other is using a predefined *math environment.* You can follow along and try the code in your computer or online using overleaf. I also prepared a quick reference of math symbols.

Using in-line math

To make use of the inline math feature, simply write your text and if you need to typeset a single math symbol or formula, surround it with dollar signs:

```
...
This formula $f(x) = x^2$ is an example.
...
```

Equation and align environment

The most useful *math envorinments* are the *equation environment* for typesetting single equations and the *align* environment for multiple equations and automatic alignment:

```latex
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{equation*}
 1 + 2 = 3
\end{equation*}
\begin{equation*}
 1 = 3 - 2
\end{equation*}
\begin{align*}
 1 + 2 &= 3\\
 1 &= 3 - 2
\end{align*}
\end{document}
```

Fractions and more

LaTeX is capable of displaying any mathematical notation. It's possible to typeset integrals, fractions and more. Every command has a specific syntax to use. I will demonstrate some of the most common LaTeX math features:

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{align*}
 f(x) &= x^2\\
 g(x) &= \frac{1}{x}\\
 F(x) &= \int^a_b \frac{1}{3}x^3
\end{align*}
\end{document}
```

Matrices

Furthermore it's possible to display matrices in LaTeX. There is a special matrix environment for this purpose, please keep in mind that the matrices only work within math environments

```
\begin{matrix}
1 & 2 & 3\\
a & b & c
\end{matrix}
```

Matrices

Brackets

```
\begin{bmatrix}
1 & 2 & 3\\
a & b & c
\end{bmatrix}
```

Matrices

Braces

```
\begin{Bmatrix}
1 & 2 & 3\\
a & b & c
\end{Bmatrix}
```

Matrices

Parentheses

```
\begin{pmatrix}
1 & 2 & 3\\
a & b & c
\end{pmatrix}
```

Summary

- LaTeX is a *powerful* tool to typeset math

- *Embed formulas* in your text by *surrounding* them with *dollar signs $*

- The *equation environment* is used to typeset *one* formula

- The *align environment* will align formulas at the *ampersand & symbol*

- Single formulas *must* be separated with *two backslashes *

- Use the *matrix environment* to typeset matrices

- Scale parentheses with \left (\right) automatically

- Notable examples are:
  a. \int^a_b for integral symbol
  b. \frac{u}{v} for fractions
  c. \sqrt{x} for square roots

- Characters for the *greek alphabet* and other *mathematical symbols* such as *\lambda*

Other Features

Insert Figures (screenshots of work done by hand)

Create a table of contents

Create a bibliography using BibTeX

Create a footnotes

Create tables (use the .tex file of the syllabus for example code)

Create plots (can be easier to create the plot in a different language, but if made in LaTeX document then all the code is together)