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Introduction to LaTeX

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Welcome To LaTeX

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- Pronounced like *"lay-tech"* or *"lah-tech"*
  - Not like latex gloves
- LaTeX is typeset like LaTeX
- LaTeX is a document typesetting tool
  - Handles manuscript arrangement
  - Provides interchangeable paper properties
    - Templates, fonts, single/double spaced, columns, etc.
  - Manages numbering and references
    - Captions, equations, citations, cross references, etc.
- Not a WYSIWYG editor like Microsoft Word
  - Interpreted language like HTML

Advantages of LaTeX

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- Professional typesetting
  - Best output (e.g., ligatures and kerning)
- Standard for scientific documents and texts
- Ease with mathematical (and other) symbols
- Easy to keep track of figures, tables, and equations numbers with references
- Great for documents with large file sizes
- Platform-independent
- It's FREE!

Disadvantages of LaTeX

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- Learning curve is a lot steeper than WYSIWYG editors like Microsoft Word
- Customizing is tedious – Need to download and install packages, then figure out how to use them
- Requires a “compiler”
  - Need to compile often to view changes
- May need to use different image types (.eps or .pdf instead of .jpg, .png, .gif)
- Everyone editing the document needs to be familiar with LaTeX

What is LaTeX?

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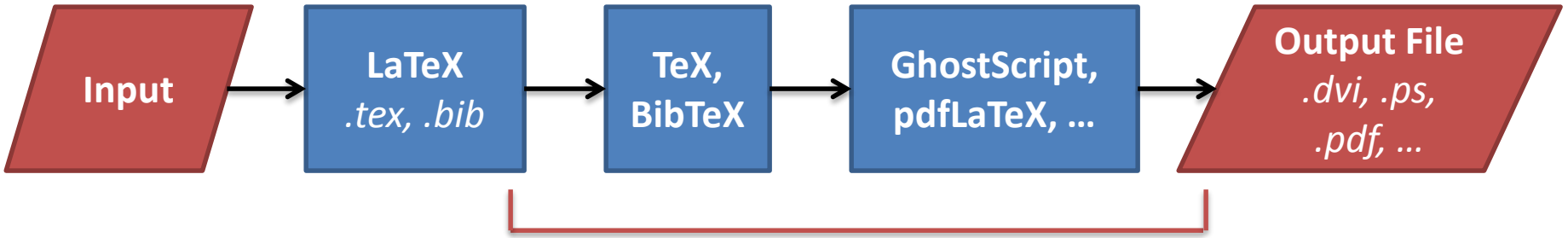
- LaTeX is a document preparation system (or document markup language) for high-quality typesetting – tells TeX what content to use
- TeX is a typesetter
  - You write and TeX will place it on the page



Getting Started

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- AAE ECN Computers
  - Windows: TeXnicCenter
  - Unix/Linux: vi or Emacs
- Personal Computers
  - Guide: http://www.latex-project.org/ftp.html
    - Windows: TeXnicCenter, MiKTex, proTeXt, etc.
    - Mac: MacTeX, TeXShop, LyX, Texpad, etc.
    - Unix/Linux: TeXLive, Kile, etc.
  - May also need to install GhostScript or some sort of PostScript to PDF converter

Basic LaTeX Structure

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- Document Class Definition
  - Identification of type of document: article, book, etc.
- Preamble – Packages for margins, images, spacing, special captions, wrapping figures, etc.
- Title Information (title, authors, date, etc.)
- Body of text
  - Book-ending code

Start with `\begin{...}`
End with `\end{...}`

- Bibliography

A Simple Document

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```
\documentclass[12pt,letterpaper]{article}
   \usepackage[margin=0.5cm]{geometry}
   \title{My Super Awesome Journal Article}
   \author{Isaac J. Tetzloff}
   \date{\today}
\begin{document}
   \maketitle
   \section{Section Title}
      \subsection{A Section In A Section}
      This is the first sentence of my text.
\end{document}
```

Document Class Definition

Preamble - Packages

Preamble - Title

Body of Text

A Simple Document

```
\documentclass[12pt,letterpaper]{article}
    \usepackage[margin=2.5cm]{geometry}
    \title{My Super Awesome Journal Article}
    \author{Isaac J. Tetzloff}
    \date{\today}
\begin{document}
    \maketitle
    \section{Section Title}
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        This is the first sentence of my text.
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Preamble - Packages

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Body of Text

A Simple Document

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   \usepackage[margin=2.5cm]{geometry}
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   \author{Isaac J. Tetzloff}
   \date{\today}
\begin{document}
   \maketitle
   \section{Section Title}
      \subsection{A Section In A Section}
      This is the first sentence of my text.
\end{document}
```

What It Looks Like

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My Super Awesome Journal Article

Isaac J. Tetzloff

August 15, 2013

1 Section Title

1.1 A Section In A Section

This is the first sentence of my text.

Document Class Definition

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```
\documentclass [11pt,a4paper]
               [12pt,twocolumn]
```

Some Options

```
{article}
{report}
{book}
{letter}
```

Basic Classes

- First line of all LaTeX documents
- Specifies the type of the document
- Defaults: 10pt, letterpaper, onecolumn, portrait
- Many journals or institutions have their own

```
\documentclass[aae]{puthesis}
\documentclass[submit]{aiaa-tc}
```

Options in Square Brackets [ ]

Special Class Types in Curly Brackets { }

The Preamble

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- Everything between `\documentclass` and `\begin{document}`
- Use for customizing the formatting
  - Possible additional packages to use

```
\usepackage[margin=2.5cm]{geometry}
\usepackage{graphicx}
\usepackage{subfigure}
```

    etc.
  - Title Information

```
\title{My Super Awesome Journal Article}
\author{Isaac J. Tetzloff}
\date{\today}
```

Sections

```
\section{Section Title}
   \subsection{Sub-Section Title}
      \subsubsection{Sub-Sub-Section Title}
```

1 Section Title

Section Text

1.1 Sub-Section Title

A section inside a section!

1.1.1 Sub-Sub-Section Title

A section in a section in a section!

LaTeX Resources

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- Reference Sheets
  - LaTeX cheat sheet: http://stdout.org/~winston/latex/
  - Math cheat sheet: http://web.ift.uib.no/Teori/KURS/WRK/TeX/symALL.html
- Not-So-Short Intro to LaTeX: http://tobi.oetiker.ch/lshort/lshort.pdf
- AIAA template: https://www.aiaa.org/Secondary.aspx?id=4597
- Purdue thesis: https://engineering.purdue.edu/~mark/puthesis/
- Detexify: http://detexify.kirelabs.org/classify.html
- Google: latex + [whatever you are looking for]

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How to insert equations, figures, tables, Greek letters, lists, cross-references and bibliographies

MORE THINGS IN LATEX

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Common Commands

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- `%` - Comments out the row / line
  - Use `\%` to put an actual percent sign in text
- `\newline` forces a line break
- `\par` ends the current paragraph
  - Blank lines in text also separates paragraphs
- `\noindent` forces the paragraph to start without indentation
  - Unnecessary for first paragraph of a section
  - Usually after an equation or before a list
- `\clearpage` posts all floating equations, figures, and tables before the next line of text
- `` ` ' `` gives ‘ ’ and `` `` '' `` gives “ ”

Mathematics

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- Make sure you are in a *math environment*
  - `$ … $` to create math environment in line of text
- Greek Symbols

  `\alpha`, `\beta`, `\gamma` → α, β, γ
- Superscripts and Subscripts

  `x^y` → x^y `x_y` → x_y `x_y^z` → x_y^z

  `x_{sub}^{sup}` → x_{sub}^{sup}
- Calculus

  `\int_0^infty` → $\int_0^\infty$ `\int{\int}` → $\int\int$

  `\frac{\partial u}{\partial x}` → $\frac{\partial u}{\partial x}$

Equations

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```
\begin{equation}
    x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}
    \label{eqn:quadratic}
\end{equation}
```

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1}$$

Fractions in vertical format:
`\frac{top}{bottom}`

Equations numbered automatically

When used in line, surround the equation with `$`:

```
Sometimes we estimate $\pi \approx 3$ when we do not
have a calculator.
```

Sometimes we estimate $\pi \approx 3$ when we do not have a calculator.

Aligned Equations

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```
\usepackage{amsmath}
\begin{align}
    f_1(x) &= x^2                    \\
    f_2(x) &= x^2 + y^2 + x^2        \\
    f_3(x) &= x^2 - 9          \notag \\
           &= (x-3)(x+3)
\end{align}
```

& sets the alignment point

\notag suppresses equation number

$$
\begin{aligned}
f_1(x) &= x^2 && (1)\\
f_2(x) &= x^2 + y^2 + x^2 && (2)\\
f_3(x) &= x^2 - 9 \\
&= (x-3)(x+3) && (3)
\end{aligned}
$$

Figures

- Figures "**floated**" – not broken between pages
- Must use `\usepackage{graphicx}`

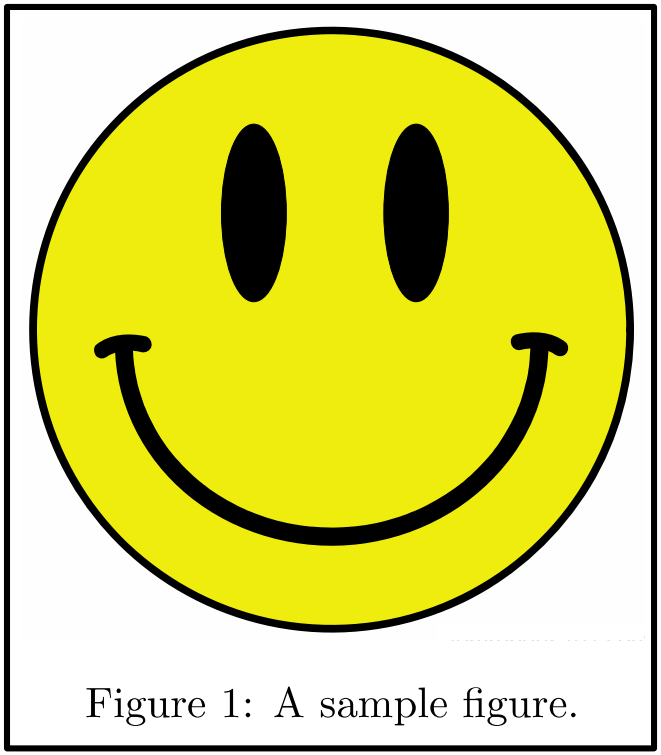

Figure 1: A sample figure.

Use any combination of these options

h: place here **t:** place at top

b: place at bottom **p:** use whole page

!: force the graphic to use this option

```
\begin{figure}[htb!]
   \centering
   \includegraphics{sample.pdf}
   \caption{A sample figure.}
\end{figure}
```

Tables

- Tables are also floated, like figures

```
\begin{table}[htbp]
    \centering
    \caption{Tank Pressure}
    \begin{tabular}{|c|c|}
        \hline
        Day & Pressure (psia) \\
        \hline \hline
        Aug 18 & 82 \\
        \hline
        Aug 19 & 123 \\
        \hline
    \end{tabular}
\end{table}
```

Table 1: Tank Pressure

Day	Pressure (psia)
Aug 18	82
Aug 19	123

This table uses option `{cc}`

Table 1: Tank Pressure

Day	Pressure (psia)
Aug 18	82
Aug 19	123

Lists

- Bulleted

```
\begin{itemize}
    \item Something here
    \item Another item
\end{itemize}
```

- Numbered

```
\begin{enumerate}
    \item First thing here
    \item Second item
\end{enumerate}
```

A bulleted list:

- Something here
- Another item

A numbered list:

1. First thing here
2. Second item

Cross Referencing

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- Use `\label` tag to make a “bookmark” in figures, tables, equation, sections, etc.

```
\label{marker}
```

- To reference a bookmark, use `\ref` (by item number), `\pageref` (by page number), or `\eqref` (by equation number) tag

```
\ref{marker} \pageref{marker} \eqref{marker}
```

```
\section{Introduction}
\label{sec:intro}
...
As mentioned in section \ref{sec:intro} on page
\pageref{sec:intro}
```

Bibliography

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- BibTeX file format: .bib
- Special entries in .bib file for each reference (see LaTeX cheat sheet resource for list of types)
- Create in document before \end{document}

```
\bibliographystyle{plain}
\bibliography{examplebibfile}
```

Filename of .bib file

Various styles available (e.g. aiaa, ieee, unsrt, plain, chicagoa, etc.):
http://www.cs.stir.ac.uk/~kjt/software/latex/showbst.html

Example Entry

```
@book{anderson2002,
    author = {John D. Anderson},
    title = {Modern Compressible Flow with Historical
Perspective},
    publisher = {McGraw Hill},
    edition = {3rd},
    year = {2002},
}
```

Citation key – REQUIRED to cite!

Can use " " or { } for fields

Every field ends with a comma

Don't forget to close your braces

Use `\cite{anderson2002}` to refer to this entry

What It Looks Like

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```
There is a book \cite{anderson2002} that people
use for courses on compressible flow.

…

\bibliographystyle{plain}
\bibliogrpahy{examplebib}
```

There is a book [1] that people use for courses on compressible flow.

References

[1] John D. Anderson. *Modern Compressible Flow with Historical Perspective.* McGraw Hill, 3rd edition, 2002.

Some Other Helpful Packages

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- Subfigures – subfig, subfigmat
  - Do not need to use subfigmatrix with subfig, but helps you to organize if you have lots of subfigures
- Fancy captions – caption, caption2, caption3
- Links – url, hyperref
- Wrap text around figures – wrapfig
- Show blocks of code – verbatim, fancyvrb, listings
  - `\verb!small code!` gives small portions of code in the same way
- Many others for documents from presentations (beamer) to curriculum vitae (moderncv)