Using LaTeX at the College of William & Mary
Because Word or Google Docs just doesn't cut it anymore

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Outline

What is LaTeX

- World's best text editor!
- Easy layout
  - Templates already available for
    - Abstracts
    - Reports
    - Letters
    - ...
  - Easy integration of:
    - Math
    - Tables
    - Pictures
    - ...
- A way to make your life easier.

Programs to edit LaTeX documents

OS	Program
Linux	Kile
Mac	TexShop
Windows	MiKTeX
Internet	www.sharelatex.com

ShareLaTeX

Getting started with ShareLaTeX

- Go to `http://sharelatex.com`.
- Register for a new account, or log in if you have an account already.
- Create new blank project. ShareLaTeX will still prepopulate the files with a basic LaTeX structure. For the purpose of this tutorial we will assume that the file is completely empty, so delete whatever is there.

Exercise 1: Your First LaTeX Document

File alice.tex

```
\documentclass{article}

% preamble where packages are loaded
\usepackage{color}

% actual document starts here
\begin{document}
``Well, in OUR country,'' said Alice, still panting a
little, ``you'd generally get to somewhere else -- if
you ran very fast for a long time, as we've been doing.''

``A slow sort of country!'' said the Queen.
``Now, HERE, you see, it takes all the running YOU
can do, to keep in the same place. If you want to
get somewhere else, you must run at least twice as
fast as that!''
\end{document}
```

Exercise 1: Your First LaTeX Document

File `alice.pdf` (approximately)

"Well, in OUR country," said Alice, still panting a little, "you'd generally get to somewhere else – if you ran very fast for a long time, as we've been doing."

"A slow sort of country!" said the Queen. "Now, HERE, you see, it takes all the running YOU can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

Exercise

Copy the previous code into a `tex` file, compile it with your favorite LaTeX distribution, and inspect the resulting `pdf` file. You may need to remove all spaces between the backslash characters and the commands.

Exercise 2: Errors, Warnings, and Bad Boxes

Errors

LaTeX can be quite fussy about the syntax (as all programming languages tend to be). It will return a line that says, for example, "l.248 LaTeX Error: Environment itemize undefined." Usually these errors will give you a clear indication of where to look. You may also get errors like "File ended while scanning for end{itemize}". It is not always immediately clear where you forgot the "end{itemize}" but the output pdf file will often help

Warnings

Common warnings are font substitutions, changes in the symbols used in the pdf metadata fields, etc.

Overfull and Underfull Boxes

The remaining category of messages are complaints about overfull and underfull hboxes and vboxes... This happens when the text cannot be split at the end of a line and crosses into the margin or falls off the bottom of the page (such as this paragraph). In that case it is easiest to rewrite the sentence slightly.

Exercise 2: Errors, Warnings, and Bad Boxes

Error messages are not something to be afraid of. Instead they are supposed to be helpful (at least, as helpful as the computer can be, while figuring out what you might have meant).

Exercise

Experiment with introducing errors in the file `alice.tex`:

- Change the document class to something non-existent.
- Change the package that is include to something non-existent.
- Remove the `\end{document}` line.
- It is not easy to introduce overfull or underfull hboxes intentionally, but using words like "supercalifragilisticexpialidocious" may get you there. . .

Pay attention to what the error says is happening and look at the output pdf file (if any is generated).

Exercise 3: Title, Author, Date

Maketitle

```
\documentclass{article}
\title{The Three Laws of Robotics}
\author{Isaac Asimov}
\date{\today}
\begin{document}
 \maketitle
\end{document}
```

Exercise
Create a new file (that could be the start of your final report) with the document class `article`. Create a title page with the title of your research project, your name, and today's date.

Exercise 4: Title, Author, Date, Affiliation

Packages

Not everything is implemented in the default LaTeX compilation; some functionality needs to be explicitly included through "packages". There are literally thousands of these packages online. You include them by using:

```
\usepackage[packageoptions]{packagename}
```

Affiliation in the title

One useful package (but hardly necessary, or even the only one that implements this) is authblk which allows you to specify your institution in the title:

```
\usepackage{authblk}
\author{Euclid}
\affil{Philosophers' School of Ancient Greece}
\begin{document}
 \maketitle
\end{document}
```

Exercise 4: Title, Author, Date, Affiliation

Exercise
Add your affiliation to your document.

Exercise
Experiment with the packages `fullpage` (to make better use of the page real estate) and `lineno` (to add line numbers to your document). You may need to add a bit more text before you notice any differences. You will need to find the user manual of `lineno` on the Comprehensive TeX Archive Network (CTAN) that will tell you how to use it.

Exercise 5: Abstract

Abstract

The abstract of an article summarizes the main findings. It is self-consistent, and in level of details falls between the title (very little detail) and the article itself (a lot of detail). It comes after the title in your LaTeX file.

You can include an abstract with the environment "abstract":

```
\begin{document}
 \maketitle
 \begin{abstract}
  I did this and that, and I found that it is zero.
 \end{abstract}
\end{document}
```

Exercise

Add the abstract you submitted for the short talks. If you use any underscores or other special characters, you may need to replace them with LaTeX-friendly code.

Exercise 6: Document Structure

Now it's time to start writing the actual article!

Sections, subsections, subsubsections,…

In nearly all LaTeX documents the structure will be defined by the `\section` command and its "sub" cousins: `\subsection`, `\subsubsection`,…

Exercise
Add the following sections to your article: Introduction, Motivation, Methodology, Measurements, and Conclusion. Although you can change the names later, these are the logical sections in any article.

Exercise
Add subsections that are relevant to your research project. Aim for two to five subsections per section.

Exercise
What does `\tableofcontents` do?

Exercise 7: Math Mode

Inline math

LaTeX is most useful for documents with many mathematical symbols, such as physics articles. Mathematical expressions should be placed between dollar signs:

```
Pythagoras found that $a^2 = b^2 + c^2$, or that
$a = \sqrt{b^2 + c^2}$.
```

would translate in

> Pythagoras found that $a^2 = b^2 + c^2$, or that
> $a = \sqrt{b^2 + c^2}$.

Any variable or physical quantity will be set in math mode. For example, the length L (typeset as L). Units are in normal font.

Exercise
Change any physical quantities in your abstract to math mode.

Exercise
Typeset: $p \rightarrow p' = \sum q_i - 1$

Exercise 7: Math Mode

Equations

Another way of typesetting mathematics is the `equation` environment. This will give each equations its own line and number:

```
Pythagoras found that
 \begin{equation}
  a^2 = b^2 + c^2.
 \end{equation}
```

translates in

Pythagoras found that

$$a^2 = b^2 + c^2. \tag{1}$$

If we do not want equation numbers, we can just use the variant `equation*` instead.

Exercise 8: Images

includegraphics

In LaTeX the images are always "floating," *i.e.* they are not part of the text itself but will be placed where they fit best in the layout of the document. In articles and reports you should always give your figures a descriptive caption.

```
\begin{figure}[htbp]
 \begin{center}
  \includegraphics[width=10cm]{image}
 \end{center}
 \caption[Image]{This is an interesting image.}
\end{figure}
```

You can include `jpg` and `png` images this way.

Exercise

Include an image into your document (you will need to upload it to ShareLaTeX first). Experiment with the order of the placement option `htbp`, which stands for here/top/bottom/page.

Exercise 9: Labels and References

Labels

In your summary and conclusion section you write the following sentence:

As explained in section 3 on Methodology we used. . .

Later you decide to add another introductory section "Motivation" and section 3 becomes section 4.

We can add a label "section:methodology" to the section and just refer to that label instead:

```
\section{Methodology}
\label{section:methodology}

As discussed in section \ref{section:methodology}
we used...
```

Exercise 9: Labels and References

Exercise

Create a label and reference to the image you included in your document earlier.

Exercise

Experiment with `\listoffigures` and the optional argument (in square brackets) of `\caption`.

Exercise 10: Your CV in LaTeX

Because LaTeX takes care of the layout, you can focus on the content only!

Exercise
Open the project with the sample CV.
`https://www.sharelatex.com/project/`
`51c0894b347886432b09babd?r=38c1479e&rs=ps&rm=d`
Clone into a new project (under the Settings menu). Modify the name, and remove all education and experience entries that do not apply to you. Add the correct education sections (you can add the rest later).

Exercise 11: Publications in Physics Journals

Nearly all important physics journals will require submissions in the `revtex4` document class.

Create a new project based on the journal template "American Institute of Physics AIP". Modify the title, name, and affiliation. The only thing left now is to write the paper...

Exercise 12: Your First Beamer Presentation

Preamble

```
\documentclass{beamer}
\usetheme{Pittsburgh}
\title{There is no largest prime number.}
\author{Euclid}
```

Document

```
\begin{document}
% title slide with title and author
\maketitle
% first actual slide
\begin{frame}{This is the frame title}
 There is no largest prime number.

 If there were a largest prime number, then we can
 construct an even larger one.
\end{frame}
\end{document}
```

Exercise 12: Your First Beamer Presentation

Exercise

Create a blank LATEX beamer presentation from scratch with a title slide, and a slide that summarizes your own research project.

Exercise 13: Blocks to Structure Frames

Block Title

You can also highlight sections of your presentation in a block, with it's own title.

```
\begin{block}{Block Title}
 You can also highlight sections of your presentation
\end{block}
```

Exercise
Create a slide with two blocks.

Exercise
Include an image in a slide.