# Introducing LaTeX

## A Crash Course in Typesetting Your Homework

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# TeX and LaTeX

- TeX (pronounced "tek") is a typesetting program, and provides all of the tools necessary to create formats for documents.
- LaTeX(pronounced "la-tek" or "lay-tek") is a set of macros built on top of TeX, which means you don't have to program all of the commands yourself.
- While understanding TeX is beyond the scope of this introduction, once you are comfortable with LaTeX you can use TeX to really customize stuff from the inside out.
- However, LaTeX is extremely powerful and most of what you need to do can be accomplished without knowing anything about TeX.

# What You'll Need to Use LaTeX

- A plain text editor or a LaTeX editor.
  - In our case, we'll be using TeXworks, which comes with the MiKTeX and MacTeX distributions.
  - A LaTeX editor generally offers more user-friendly features.
- A PDF viewer, such as Adobe Reader.
- A TeX distribution, such as MiKTeX or MacTeX.

# Installing a TeX Distribution

To install MiKTeX:

1. Go to `http://miktex.org/`, and click on "Download."
2. Download the latest version of the "Basic MiKTeK Installer."
3. Once downloaded, execute the file, which will install the distribution.

To install MacTeX:

1. Go to `http://tug.org/mactex/`, and click on the distribution download link MacTeX.pkg.
2. Once downloaded, open the package, which will install the distribution.

Once you've got your distribution installed, you're ready to start TeX-ing!

# The Structure of a Document

A document is composed of two main parts:

- The Preamble
  - This is where you set up your document by declaring the document class and packages, as well as define commands.
  - The document class tells LaTeX what kind of a document you are creating (e.g. `article`, `report`, `beamer`).
  - Packages are enhancements that allow you to do things that just the basic LaTeXcan't do. (e.g. `amsmath`, `fancyhdr`).
- The `document` Environment
  - This is where the content of your document goes.
  - As well as things like a title page, abstract, and table of contents.

# An Example

Here is an example of a simple document:

```
\documentclass{article}

\begin{document}
This is a sentence with some math: $a^2+b^2=c^2$.\\
And a line break.
%This is a comment.

This is a new paragraph.
\end{document}
```

The above example would look like this:

This is a sentence with some math: $a^2 + b^2 = c^2$.
And a line break.

This is a new paragraph.

# Document Classes and Packages

## The Document Class

- There are many document classes to choose from, but `article` is probably the best one for homework.
- This happens at the beginning of your preamble, with the form `\documentclass[options]{class}`. So, for an `article` document meant for A4 paper with 12pt font would have `\documentclass[a4paper,12pt]{article}`.

## Packages

- I have included the essential and some of the most useful packages in the homework template for this class (the purpose of each package is commented in the `.tex` source).

For a more thorough discussion, see the chapter on Document Structure in the LaTeX guide on Wikibooks.

# Special Characters and Control Sequences

- TeX has symbols that have a particular purpose in the syntax, and the above symbols will not show up in your document without a particular control sequence.

```
\ { } $ ^ _ % ~ # &
```

- A control sequence is necessary to produce most of the specialized commands and symbols in LaTeX, and usually consists of a backslash \ followed by a string of characters.
- For example,
  - $\omega$ is produced by `\omega`, $\Omega$ by `\Omega`.
  - The `proof` environment is produced by

```
\begin{proof}
...
\end{proof}
```

# Producing Mathematical Formulae

- To produce a mathematical formula, you have to use math mode.
  - Within a paragraph, math mode is entered and exited by using the $ symbol.
  - To get an equation or formula on a line by itself, use `\[` and `\]`, or for an array of equations, use the `align` environment (`align*` if you would like your equations to be unnumbered).
- Superscripts are produced by `^`, subscripts by `_`.
- Special symbols, Greek letters, and standard functions have corresponding control sequences.
- For example, $f(x) = a_2x^2 + a_1x + a_0$ and $\sin^2 x + \cos^2 x = 1$ are produced by `$f(x)=a_{2}x^{2}+a_{1}x+a_{0}$` and `$\sin^{2}x+\cos^2{x}=1$`.

# Resources and References

Resources for learning LaTeX are very abundant, a few good places to start are

- "Getting Started with LaTeX" by David Wilkins at `http://www.maths.tcd.ie/~dwilkins/LaTeXPrimer/`.
- The TeX Users Group (TUG) has a great page with lots of information for beginners at `http://tug.org/begin.html`.
- The Wikibooks LaTeX guide at `http://en.wikibooks.org/wiki/LaTeX`.
- The TeX - LaTeX Stack Exchange, which is a question-and-answer site: `http://tex.stackexchange.com/`.

Of course, any time you get stuck, the best way to find out how to do something is by looking it up.