

LaTeX Workshop

While you're waiting, please make an account at
<http://sharelatex.com>

High-level overview

- ▶ Intro: What is LaTeX, why bother learning it?
- ▶ Structure of a LaTeX document
 - ▶ What does a document look like?
 - ▶ Basic syntax
- ▶ Typesetting common things
 - ▶ Math!
 - ▶ Lists
 - ▶ Tables
 - ▶ Embedding images
 - ▶ Code
- ▶ Moving forward
 - ▶ Suggested workflow
 - ▶ Tips for debugging
 - ▶ Where to find help/learn more
 - ▶ Misc. things you should know

What is LaTeX?

LaTeX is a markup* language that, when compiled, produces typeset documents.

* Well technically, a programming language – LaTeX is Turing-complete

What is LaTeX?

Input: myFile.tex

```
\documentclass{article}
\begin{document}
  The quadratic formula:

  $$
  x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
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\end{document}
```

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Output: myFile.pdf

The quadratic formula:

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Why learn LaTeX?

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I care about computer science:

- ▶ LaTeX makes writing math easy and beautiful
- ▶ Nearly all CS research papers are written using LaTeX

Every single CSE 311 handout

<http://tex.stackexchange.com/q/1319/21516>

When NOT to use LaTeX

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Learning curve and time:

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- ▶ Your (large?) document is already written

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Things that are hard/impossible in LaTeX:

- ▶ If you want your document to dynamically adapt to screen size/have a high degree of interactivity (use HTML/CSS/JavaScript instead?)
- ▶ If you care deeply about design and want pixel-perfect control (use Adobe Illustrator or similar tools instead?)

Structure of a LaTeX document

```
\documentclass{article}

% The "preamble".
%
% Packages 'imports' and document config goes here

\begin{document}

    % Actual content goes here

\end{document}
```

Structure of a LaTeX document

```
% Set document 'type' or 'theme' to "article"
\documentclass{article}

% Set margins to 0.7 inches on all sides
\usepackage[margin=0.7in]{geometry}

% Don't indent the start of each paragraph;
% Add one blank line between paragraphs
\usepackage[parfill]{parskip}

% Import useful math packages
\usepackage{amsmath,amssymb,amsfonts,amsthm}

\begin{document}
  The quadratic formula:

  $$
  x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
  $$
\end{document}
```

Structure of a LaTeX document

Your turn!

1. Go to
courses.cs.washington.edu/courses/cse311/17sp/latex/
2. Look at the “Workshop” section
3. Open the “minimal template” link (if it automatically downloads, open it using a text editor)
4. Copy everything to your ShareLaTeX project
5. Make sure it compiles!
6. Once you’re done, look at me.

Important note!

LaTeX is a programming language.

It has specific syntax and rules you must follow.

Make sure to check for errors!

Source code

```
A series of consecutive lines is considered to be a paragraph.  
This line is a part of the previous paragraph, for example.
```

```
Now this is a second paragraph.
```

```
    Whitespace within a line (including  
indentation!) is ignored.
```

Expected output

A series of consecutive lines is considered to be a paragraph.
This line is a part of the previous paragraph, for example.

Now this is a second paragraph.

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Other quirks

Special characters (must be escaped):

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Force newlines with `\\`
two double slashes.

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Newlines:

Force newlines with `\\`
two double slashes.

This is different from a paragraph break.

Single and double quotes:

Use ```two backticks"` for starting double quotes and a regular quotation mark to end.

Use a ``single backtick'` for single quotes.

Source code

```
Boyle's Law states that the product of the pressure and volume  
of an ideal gas within some closed system is always constant.  
That is, if  $P$  is the pressure,  $V$  is the volume, and  $k$   
is a constant,  $PV = k$ .
```

Expected output

Boyle's Law states that the product of the pressure and volume of an ideal gas within some closed system is always constant. That is, if P is the pressure, V is the volume, and k is a constant, $PV = k$.

Display mode

Source code

Given a quadratic equation $0 = ax^2 + bx + c$, there are two possible values of x :

$\$$ $\$$

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

$\$$ $\$$

This formula is known as the **quadratic formula**.

Expected output

Given a quadratic equation $0 = ax^2 + bx + c$, there are two possible values of x :

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

This formula is known as the **quadratic formula**.

Using text within math or display mode

Source code

```
$$  
\text{speed} = \frac{\text{distance traveled}}{\text{time}}  
$$
```

Expected output

$$\text{speed} = \frac{\text{distance traveled}}{\text{time}}$$

Commands

A command with...

Zero arguments: `\commandName`

Example: `$\pm \alpha \beta$` becomes $\pm\alpha\beta$

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Example: `$\pm \alpha \beta$` becomes $\pm\alpha\beta$

One argument: `\commandName{argument}`

Example: `\textbf{foo}` becomes **foo**

Many arguments: `\commandName{a1}{a2}{a3}`

Example: `$\frac{1}{2}$` becomes $\frac{1}{2}$

Commands

A command with...

Zero arguments: `\commandName`

Example: `$\pm \alpha \beta$` becomes $\pm\alpha\beta$

One argument: `\commandName{argument}`

Example: `\textbf{foo}` becomes **foo**

Many arguments: `\commandName{a1}{a2}{a3}`

Example: `$\frac{1}{2}$` becomes $\frac{1}{2}$

Optional arguments (and some mandatory ones)

`\commandName[opt1,opt2]{arg1}{arg2}`

Exercise!

Your turn!

1. Work with the people around you to solve question 1 (this should require only basic algebra).
2. Within your ShareLaTeX project, typeset an answer! Practice using math mode, display mode, and commands.
3. Make sure your code compiles without error.

Finished early? Try experimenting with the other commands on your cheat sheet!

Check out [detexify](#) and try and typeset the craziest-looking equation you can.

Interlude: switching templates

Problems:

1. Your document looks a little plain.
2. What if we want to include multiple questions/questions with multiple parts?

Solution:

1. Use Adam's nicer template!

A normal environment:

```
\begin{part}  
  % Content here  
\end{part}
```

A normal environment:

```
\begin{part}  
  % Content here  
\end{part}
```

An environment with arguments:

```
\begin{question}{Argument: question name here}  
  % Content here  
\end{question}
```

Formatting lists

Source code

```
\begin{itemize}
  \item This is an
  \item unordered
  \item list
\end{itemize}
```

Expected output

- ▶ This is an
- ▶ unordered
- ▶ list

Source code

```
\begin{enumerate}
  \item This is a
  \item numbered
  \item list
\end{enumerate}
```

Expected output

1. This is a
2. numbered
3. list

Nesting Lists

Source code

```
\begin{enumerate}
  \item A single item can
    span multiple lines.

    It can also contain
    multiple paragraphs.

  \item Math is ok:
     $a = b$ 

  \item You can also
    nest lists.

    \begin{enumerate}
      \item Hello
      \item World
    \end{enumerate}
\end{enumerate}
```

Expected output

1. A single item can span multiple lines.
It can also contain multiple paragraphs.
2. Math is ok: $a = b$
3. You can also nest lists.
 - 3.1 Hello
 - 3.2 World

Source code

```
\begin{tabular}{lcr}  
  Food    & Color  & Rating \\  
  \hline  
  Onions  & Purple & 2 \\  
  Apples  & Red    & 5 \\  
  Bananas & Yellow & 4 \\  
  Lettuce & Green  & 3 \\  
\end{tabular}
```

Expected output

Food	Color	Rating
Onions	Purple	2
Apples	Red	5
Bananas	Yellow	4
Lettuce	Green	3

Exercise!

Your turn!

1. Work with the people around you to solve problems 2a and 2b.
2. Practice using Adam's **question** and **part** environments, as well as using lists and tables!
3. Make sure your code compiles without errors.

Finished early? Try using definition lists for (2a), and try making your table in (2b) fancier. For example, can you add colors to make it easier to distinguish between “T” and “F”?

You will need to do some googling to figure out how to do these things.

Embedding images

Assuming you have files named “foo.jpg” and “bar.png” in the same folder as your LaTeX code...

```
\documentclass{article}

% Lets you embed graphics!
\usepackage{graphicx}

\begin{document}
  % Scales image so it's 5 cm wide
  \includegraphics[width=5cm]{foo}

  % Scales image so it's as wide as the entire page
  \includegraphics[width=\textwidth]{bar}
\end{document}
```


Formatting code

Option 1: minted

Note: requires Python and the pygmentize library.
Works automatically in ShareLaTeX.

```
\usepackage{minted}

% ...snip...

\begin{minted}{java}
  \\ Your Java code here
\end{minted}
```

Option 2: verbatim

Doesn't require any setup,
but no syntax highlighting

```
\begin{verbatim}
\\ Your Java code here
\end{verbatim}
```

*Option 3: Use lstlisting. (I don't know how to use this one).

Exercise!

Your turn!

1. Work on problems 2c and 2d with the people around you.
2. Typeset solutions to 2c and 2d!
 - 2.1 For problem 2c, create an image of the circuit outside of LaTeX, upload your image to ShareLaTeX, and embed it.
 - 2.2 If you want a challenge, use Circuitikz instead!
3. Make sure your LaTeX compiles without any errors.

Finished early? Your table and circuit take up a lot of vertical space. Can you find a way to display them side-by-side?

Aligning math

How do you do this? Display mode doesn't seem enough...

$$ax^2 + bx + c = 0$$

Given

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

Divide both sides by a

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$

Subtract $\frac{c}{a}$ from both sides

$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

Add $\left(\frac{b}{2a}\right)^2$ to both sides

$$\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

Complete the square

$$x + \frac{b}{2a} = \pm \sqrt{-\frac{c}{a} + \left(\frac{b}{2a}\right)^2}$$

Square root both sides

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

Rearrange and simplify

Aligning math

Source code

```
\begin{align*}
  y(x+1)(x+1) + y
    &= y(x^2 + 2x + 1) + y && \text{\text{Multiply}} \\
    &= x^2y + 2xy + y + y && \text{\text{Distribute } \$y\$} \\
    &= x^2y + 2xy + 2y && \text{\text{Combine } \$y\$} \\
\end{align*}
```

Source code

$$\begin{aligned} y(x+1)(x+1) + y &= y(x^2 + 2x + 1) + y && \text{Multiply} \\ &= x^2y + 2xy + y + y && \text{Distribute } y \\ &= x^2y + 2xy + 2y && \text{Combine } y \end{aligned}$$

Your turn!

1. Do problem 3. If you'd like a challenge, try problem 2e with your neighbors!
2. Practice using the `align*` environment.
(What happens if you use `align` instead?)
3. Make sure your code compiles without errors.

Finished early? Try tackling the other questions.

Suggested workflow

Note: everybody has a different workflow. Find one that works for you.

1. Brainstorm solutions on paper/on the whiteboard.
2. Once you're confident, start typesetting using LaTeX.
3. Don't start your homework at the last minute – LaTeX-ing will take some time.
4. When LaTeX-ing, compile frequently and often. Make sure your code never has any errors! Warnings are usually ok.
5. Use custom commands to make tex-ing less tedious

Custom commands

Source code

```
\documentclass{article}

% Is something too long? Abbreviate it!
\newcommand{\bic}{\leftrightharrow}

% This command takes in two arguments:
\newcommand{\f}[2]{\frac{#1}{#2}}

\begin{document}
  $$
  \f{x}{2} = 2 \ \bic \ x = 4
  $$
\end{document}
```

Expected output

$$\frac{x}{2} = 2 \leftrightarrow x = 4$$

Tips for debugging

Core idea: compile frequently and often.

1. Try googling error messages
2. Not sure which line is causing an error? Steadily comment out more and more of your document to isolate the problem.
3. Using a new package? Skimming through the manual can be helpful.

Resources

1. Figuring out names of symbols:
<http://detexify.kirelabs.org/classify.html>
2. Adam's tutorial:
<http://countablethoughts.com/documents/HowToLaTeX.pdf>
3. Very comprehensive tutorial:
<https://www.sharelatex.com/learn>
4. For general questions:
<http://tex.stackexchange.com/>
5. Everything from this workshop:
<http://courses.cs.washington.edu/courses/cse311/17sp/latex/>

Getting help with LaTeX

1. Ask during office hours!
2. Ask on Piazza!
3. Ask your friends!
4. Ask Google! (Liberally copying LaTeX examples you find is totally fine)

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Some things you should probably know...

Engines (e.g. “compilers”):

1. **TeX**: The core program that does typesetting.
2. **pdfTeX**: like TeX, but produces PDFs.
3. **XeTeX, ConTeXt, LuaLaTeX...:** Engines that accept variants of LaTeX. You aren't using these.

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Languages:

1. **Plain TeX**: the basic set of commands for typesetting
2. **LaTeX (aka LaTeX2e)**: Plain TeX + a set of generalized macros and commands to make things less tedious. This is what you've been using!
3. The other TeX engines accept variants (supersets?) of LaTeX.

Things we didn't cover

In your free time, try researching:

1. Fancier math (limits? summations? matrices? emphasizing or labeling parts of equations?)
2. Adding sections to your paper, and auto-generating a table of contents
3. Auto-generating a table of figures
4. Auto-generating an index using `makeidx`?
5. Manage a bibliography using `bibtex`.
6. Using document classes other than `article` (`book`? `memoir`?)
7. Making slides with `beamer`.
8. Drawing diagrams using `tikz`.

What now?

1. You could work on the other problems on the handout (more challenging/sneak peek of upcoming material).
2. Even more challenging: try replicating some part of the cheatsheet in LaTeX!
3. You could hang around, experiment, ask questions.
4. You could leave.
5. Something else?