Learning LaTeX for Homeworks and Presentations

An Introduction

Mitchell Scott

Department of Mathematics, Emory University

November 20, 2024

Table of Contents

1. LaTeX Introduction
2. Prettifying Documents
3. Beamers
4. Math Talks
5. Conclusions

What is LaTeX ?

- pronounced “LAY - tek”, not latex.

What is LaTeX ?

- pronounced “LAY - tek”, not latex.
- typesetting technical documents.

What is LaTeX ?

- pronounced “LAY - tek”, not latex.
- typesetting technical documents.
- easier for making math equations look nice compared to Microsoft products:
  - Word
  - Powerpoint

What is LaTeX ?

- pronounced "LAY - tek", not latex.
- typesetting technical documents.
- easier for making math equations look nice compared to Microsoft products:
  - Word
  - Powerpoint
- Needs a TeX compiler installed. This is confusing to get figured out...

What is LaTeX ?

- pronounced “LAY - tek”, not latex.
- typesetting technical documents.
- easier for making math equations look nice compared to Microsoft products:
  - Word
  - Powerpoint
- Needs a TeX compiler installed. This is confusing to get figured out...
- so we will stick with online TeX resources like Overleaf.com.

What is LaTeX ?

- pronounced “LAY - tek”, not latex.
- typesetting technical documents.
- easier for making math equations look nice compared to Microsoft products:
  - Word
  - Powerpoint
- Needs a TeX compiler installed. This is confusing to get figured out...
- so we will stick with online TeX resources like Overleaf.com.
- Emory pays to have overleaf premium, so you get a lot of really cool features for free!

Why learn LaTeX ?

- Professors may request homework be typeset, or give you extra credit if you do.

Why learn LaTeX ?

- Professors may request homework be typeset, or give you extra credit if you do.
- Makes typing equations, tables, footnotes, referencing, and cross-referencing very easy.

Why learn LaTeX ?

- Professors may request homework be typeset, or give you extra credit if you do.
- Makes typing equations, tables, footnotes, referencing, and cross-referencing very easy.
- Great resources out there, templates galore, so you can make it basic or with as much customization as you wish.

Minimal Working Example of a .tex file

See below the minimum amount of code needed to get a document to compile (this is what happens when you click 'new project' in Overleaf):

```
\documentclass{article}
\begin{document}
First document. This is a simple example, with no extra parameters or packages included.
\end{document}
```

First document. This is a simple example, with no extra parameters or packages included.

Figure 1: The output of our compiled LaTeX code

Preamble

- The Preamble is everything before the \begin{document}
- This is where you can define what type of document you are preparing, what packages to include, and define any functions that you use regularly (shortcuts).
- \documentclass[12pt, letterpaper]{article}
  \usepackage{graphicx}
- This defines the overall class (type) of document. In this case, it is 'article'.
- The default font size is 10pt, but 9pt, 11pt, 12pt, can also be used.
- As for the paper size, other possible values are a4paper and legalpaper.
- You might also want to use \title{...}, \author{...}, and \date{...}

Table of Contents

1 LaTeX Introduction

2 Prettifying Documents

3 Beamers

4 Math Talks

5 Conclusions

EMORY UNIVERSITY

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.

EMORY UNIVERSITY

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.
- For the above example we would write \$ \alpha ^2 + \beta ^2 = \gamma ^2 \$.

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.
- For the above example we would write \$ \alpha ^2 + \beta ^2 = \gamma ^2 \$.
- Additionally \(... \) or \begin{math} ... \ end{math} work for in-line math

EMORY UNIVERSITY

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.
- For the above example we would write \$ \alpha ^2 + \beta ^2 = \gamma ^2 \$.
- Additionally \(... \) or \begin{math} ... \ end{math} work for in-line math
- If we want to have math equations, out of line, which is called "display math mode", we can use
  - \$\$ math \$\$
  - \[math \]
  - a different environment such as gather, align, equation, but these require packages in the preamble.

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.
- For the above example we would write \$ \alpha ^2 + \beta ^2 = \gamma ^2 \$.
- Additionally \(... \) or \begin{math} ... \ end{math} work for in-line math
- If we want to have math equations, out of line, which is called "display math mode", we can use
  - \$\$ math \$\$
  - \[math \]
  - a different environment such as gather, align, equation, but these require packages in the preamble.
- Display math mode looks like

$$E = mc^2.$$

Typesetting Math in LaTeX

- If you want math to be inline, such as $\alpha^2 + \beta^2 = \gamma^2$, then you just need a \$ before and \$ after the math.
- For the above example we would write \$ \alpha \^2 + \beta \^2 = \gamma \^2 \$.
- Additionally \(... \) or \begin{math} ... \ end{math} work for in-line math
- If we want to have math equations, out of line, which is called "display math mode", we can use
  - \$\$ math \$\$
  - \[math \]
  - a different environment such as gather, align, equation, but these require packages in the preamble.
- Display math mode looks like

$$E = mc^2.$$

- You can also get numbered equations using the align environment.

$$F + V = E + 2 \tag{1}$$

EMORY UNIVERSITY

More Complex Math

- To make a sub script like a_b, you simply write \$ a_b \$.
- To make a super script, like a^b, you simply write \$ a^b \$.
- They can be combined if you have both a sub and super script, as seen in

$$T^{i_1 i_2 \dots i_p}_{j_1 j_2 \dots j_q} = T(x^{i_1}, \dots, x^{i_p}, e_{j_1}, \dots, e_{j_q})$$

- We can also write integrals and other special math functions using \int, or \cos(x), \sin(x), and \log(x).
- Fractions are also written as \frac{num}{den}.
- Lower case Greek letters are written as ω by \omega etc. while upper case Greek letters are written as Ω by \Omega.

Prettifying Fonts

- Sometimes we want text to stand out, so how do we make bold, underlined, or italicized text?
- **Bold**: bold text in LaTeX is typeset using the `\textbf{...}` command.
- *Italics*: italicised text is produced using the `\textit{...}` command.
- Underline: to underline text use the `\underline{...}` command.
- *Emphasize*: emphasizing text makes it stand out, using the `\emph{...}` command.
- Comments: comments let you make notes to yourself by using %.

Figures

- Figures are a great way to spruce up presentations.
- They have captions (like introducing Swoop) and labels to cross-reference them later.

Figure 2: Swoop, one of Emory's mascots.

Tables

- Sometimes tables are the best way to convey information.
- You can use the \begin{tabular} environment.
- You say how many columns you want by putting the number of columns in curly braces.
  - if you want 3 columns, you'd put {ccc}, and if you want lines between columns you'd put {c | c | c}
  - To put lines between rows (including top and bottom) , we use the command \hline
- & separates cells in the same row
- \\ separates rows from each other.

AND	0	1
0	0	0
1	0	1

Table 1: A logic table for the AND function, where "0" is `false`, "1" is `true`

EMORY UNIVERSITY

Cross-Referencing

- Sometimes you want to write about the results in a figure, table, or equation.
- You should not hard code what figure, table, or equation it is.
- For example, Figure 2 is a picture of Swoop, but if I added another figure before, the figure number would change.
- This is where `\label{key}` comes in handy. You label the figure, table, etc. and then `\ref{key}`, to match them up.
- I personal find setting your label to something like `\label{fig:}`, `\label{tab:}` and `\label{eqn:}` with a helpful variable name to be helpful.
- E.g. I used
  - `\label{fig:swoop}` for Swoop
  - `\label{eqn:genrel}` for $E = mc^2$
  - `\label{tab:andlogtab}` for the logic table

Document Structure

- Structuring documents helps organize your thoughts and keeps everything on track.
- Most techincal documents start with an abstract, which can be done by the "abstract" environment, namely \begin{abstract} ... \end{abstract}
- We do this using Chapters and sections:
  - \part{part}, \chapter{chapter} (only in report and book class/type)
  - \section{section}
  - \subsection{subsection}
  - \subsubsection{subsubsection}
  - \paragraph{paragraph}
  - \subparagraph{subparagraph}
- If you just want a title and not the number before hand, you can use an asterisk (*) before the title, i.e. \section*{unnamed section title}

Table of Contents

1 LaTeX Introduction

2 Prettifying Documents

3 Beamers

4 Math Talks

5 Conclusions

Beamer Basics

- Remember when we had \documentclass[12pt, letterpaper]{article} to start our document? This works great for starting an article, but what if we want to make a powerpoint?
- in LaTeX, powerpoints are called Beamers, and you start with \documentclass[12pt]{beamer}
- The atomic unit of a beamer is the frame, which can be invoked by using the frame environment, \begin{frame}...\end{frame}
- You can get a frame to have a title by
  - using the command \frametitle{title} after invoking the frame
  - Or you can include it after beginning the frame like \begin{frame}{Frame Title}

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.

- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.
  - You use the itemize environment by

- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.
  - You use the itemize environment by
    - `\begin{itemize}` to start the environment
    - `\item` to designate your bullet points
    - `\end{itemize}`
    - you can also invoke the itemize environment within the itemize environment (like I did here)
- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.
  - You use the itemize environment by
    - `\begin{itemize}` to start the environment
    - `\item` to designate your bullet points
    - `\end{itemize}`
    - you can also invoke the itemize environment within the itemize environment (like I did here)
- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

1. Sometimes you want ordered lists, so you will use the enumerate environment

2. You can also put itemizes in enumerates and visa versa

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.
  - You use the itemize environment by
    - `\begin{itemize}` to start the environment
    - `\item` to designate your bullet points
    - `\end{itemize}`
    - you can also invoke the itemize environment within the itemize environment (like I did here)
- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

1. Sometimes you want ordered lists, so you will use the enumerate environment
   1. This is almost identical to the itemize environement
   2. this is another enumerate subitem
2. You can also put itemizes in enumerates and visa versa

Bullet Points and Numbered Lists

- So far I have used bullet points, but not shown how to use them.
  - You use the itemize environment by
    - `\begin{itemize}` to start the environment
    - `\item` to designate your bullet points
    - `\end{itemize}`
    - you can also invoke the itemize environment within the itemize environment (like I did here)
- You can use bullet points in documents or beamers, but more commonly in beamers, I feel.

1. Sometimes you want ordered lists, so you will use the enumerate environment
   1. This is almost identical to the itemize environement
      1. `\begin{enumerate}` to start the environment
      2. `\item` to designate your numbered list
      3. `\end{enumerate}`
      4. you can also invoke the enumerate environment within the enumerate environment (like I did here)
   2. this is another enumerate subitem
2. You can also put itemizes in enumerates and visa versa

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`
- Text visible on slide 2 and slide 3 by writing `\item<2-3>`

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`
- Text visible on slide 2 and slide 3 by writing `\item<2-3>`
- Text visible on slide 3 only by

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`
- Text visible on slide 2 and slide 3 by writing `\item<2-3>`
- Text visible on slide 3 only by `\item<3>`

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`

- Text visible on slide 4

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`

- Text visible on slide 4 by `\item<4->`

EMORY UNIVERSITY

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`

- Text visible on slide 4 by `\item<4->`
- I fibbed a bit, because putting the question and answer, I actually introduced more transitions by using `\visible<6->`{answer to the last question}

Putting Pizzazz in your Presentation

You might want to stagger the bullet points so that they don't all appear at once, in a block of text. I will now show you how to do this

- Text visible on slide 1 until the end by writing `\item<1->`

- Text visible on slide 4 by `\item<4->`
- I fibbed a bit, because putting the question and answer, I actually introduced more transitions by using `\visible<6->`{answer to the last question}
- This is another way to slowly introduce more text.

More Pizzazz

The last way

More Pizzazz

The last way
to slowly increment text

More Pizzazz

The last way
to slowly increment text
is by using \pause.

Multi-page frames I

- Sometimes what you want to say cannot fit on just one slide.
- This is where we use "allowframebreaks" as an optional argument to the framem, by \begin{frame}[allowframebreaks]
- I am an item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.

Multi-page frames II

- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item.
- I am another item..
- Yes, this is a silly example.

Two-column slide

This is a text in first column.

$$E = mc^2$$

- We do this by using the \begin{columns} environment
- Then we specify how many columns we want with the \columns command
- \columns{0.5\textwidth} will make a column take up half of the slide horizontally (excluding the margins).

To make the next column, you call \columns{0.5\textwidth} again.

Remember, 0.5 is a parameter, so you can make columns 0.6 and 0.4. They don't even have to add up to 1!

This text will be in the second column and on a second thoughts, this is a nice looking layout in some cases.

EMORY UNIVERSITY

Blocks in LaTeX Beamer

In this slide, some important text will be highlighted because it's important. We use this by \alert{highlighted}.
Please, don't abuse it.

Remark

Using the \begin{block}{title} ... \end{block} paradigm, you are able to have text in a block.

Important theorem

You can use \begin{alertblock}{title} ... \end{alertblock} instead to get the "alerted" color block.

Examples

Lastly, there is an "examples" block by \begin{examples}{title} ... \end{examples} to get text in a green block.

EMORY UNIVERSITY

Theorems, Etc

This template also allows for Theorems and Proof blocks. They are very similar to the blocks on the last slide.

Theorem (S., 2024)

To use the Theorem Block `\begin{theorem} ... \end{theorem}`*. . We can include whose theorem it is by [S., 2024] after the declaring the theorem environment.*

Proof.

The Proof environment code is left as an exercise to the reader. □

Table of Contents

1 LaTeX Introduction

2 Prettifying Documents

3 Beamers

4 Math Talks

5 Conclusions

Basics of Math Research Talks

- Tell a story!
  1. Introduction: set up the problem, why should we care?
  2. Rising Action: What is the current methods and what is the problem with them
  3. Climax: What was your solution and show why it achieves the goals
  4. Conclusion: No method is perfect, so how do you plan to make your research more perfect.
- Easier to start with what you want to show off, and work backwards to fill in the gaps.
- Be very careful about the details that you include.
- Sell your method *and yourself!*

Timing Logistics

- Learn your timing (1 minute for text heavy slides, two minutes for dense theorem, figure, equation, etc.)
- Have back-up material. In case you finish early you can add extra details.
- **DO NOT GO OVER TIME!** It is better to end a few minutes early then to go a few minutes over.
- Practice, practice, practice.

Accessibility

- Be cognizant of the colors that you use compared to the background. **This might be hard to read.**
- When presenting graphs and figures, make sure to use two distinct discrepancies in each plot. For example, green triangles and blue circles.
- Be aware that red/green colorblindness is common, but shades of the same color can be differentiated easily.

Table of Contents

1 LaTeX Introduction

2 Prettifying Documents

3 Beamers

4 Math Talks

5 Conclusions

This is (not) the end

1. LaTeXis not learned in a day. You pick up things all the time.
2. "Math is not a spectator sport" - Prof. Borthwick, and TeX is no different. You have to try and play with it to figure things out.
3. Resources Galore
   - *Overleaf!*
   - Stack Exchange
   - Professors and other students

EMORY UNIVERSITY

Thank you!

Questions? $\Omega\omega\Omega$