

Written & Oral Presentation: Computer Tools: LaTeX

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What is LaTeX?

Some content taken from Wikipedia.

- TeX is a **typesetting** system: “allow anybody to produce high-quality books using minimal effort, and to provide a system that would give exactly the same results on all computers, at any point in time.”
Knuth had the idea to use mathematics to typeset mathematics!
- LaTeX is a **markup language** for technical writing, with special emphasis on math-heavy writing, built on top of TeX:
“TeX handles the layout side, while LaTeX handles the content side for document processing.”
- What's a markup language and how does it differ from WYSIWYG ("what you see is what you get") word processors like Microsoft Word? Compare to html, and contrast interpreted versus compiled languages.
- Using LaTeX: **write-format-preview** (compare to code-compile-execute).

Why LaTeX?

- Advantages of LaTeX: (interactive)
 - Abstract: Separate presentation from content: **focus on the content** and not visual appearance.
 - Portable: LaTeX files are **simple text files** so perfectly portable and easy to open/edit/share/diff.
 - Flexible: Change appearance/format by changing one word, e.g., the **document class**.
 - Extensible: **macros** allow one to add new functionality.
- Any advantages of WYSIWYG? (interactive)
- **LyX** is a combination of the two: Focus on content but also see it on your screen! (Lyx Demo, including **change tracking**).
LyX files are still text files, in yet another markup language.
- **Overleaf** is an alternative that is less visual (Overleaf demo)
Think of google docs versus Word.

How to LaTeX

- Just like code, LaTeX files need to be formatted to be **organized, clear, readable by others**:

Yes, there is such a thing as bad LaTeX just like there is bad code!

- If not using LyX/Overleaf, find a good **LaTeX editor** (same as coding!):

Use **TexMaker** or **TexStudio** to get started, or follow links from course homepage to programmer's editors atom and sublime with LaTeX plugins, or xemacs for “experts”

- What does a good editor provide? (interactive)?
 - **Syntax highlighting**
 - **Indentation** tools (automatic, select and indent, etc.)
 - **Delimiter+block matching**
 - Sophisticated **find/replace** with **regular expression matching**
 - Shortcuts/sub-windows to **compile/preview**

Producing PDF output from LaTeX

- Install a **LaTeX engine** ASAP (see links on homepage)
 - For Windows/linux use TexLive (usually pre-installed on linux)
 - For OS X use MACTex and consider installing homebrew
- Use *pdflatex* to compile/typeset (why?) and not *latex*
- Add `\usepackage{hyperref}` to enable hyperlinks for references/citations.
- Beware of **font issues** (PDF not actually as portable as dvi). Recommend inserting `\usepackage{ae,aecompl}` in latex preamble so PostScript->PDF looks nice also.

Producing PDF output from LaTeX

- Learn how to use **BibTex**+**Mendeley** (demo, google scholar).
- For presentations in LaTeX, use the **beamer class** with the **multimedia** package (demo).
- How about **PowerPoint** or **keynote**?
Use **LatexIt** or **IguanaTex** to format equations in latex as images.
- In LyX/Overleaf use **templates** to get started. Read **documentation**!
- What is **github** and **git/svn** all about? (demo and discussion)
git is a distributed **version control system**; github is to git what Overleaf is to latex

Assorted LaTeX tips #1

- Use **scalable vector graphics** for graphs (**EPS, SVG**) and not rasterized/pixelized formats!
If you must (e.g., huge figures), **use PNG** for line graphics and not JPG, as wavelets do not compress lines well.
- Use **indentation and spacing** liberally to improve readability
- Do not insert manual line breaks (editor handles splitting lines for you)
- Use **macros** to emphasize logical structure in the source, e.g:
 - Shortcuts: `\def\R{\mathcal{R}}`
 - Bold for vectors: `\def\V#1{\boldsymbol{#1}}`
 - Norm of a vector: `\def\norm#1{\left| \text{Vert } #1 \right|}`

Assorted LaTeX tips #2

- Number all formulas or only those you wish to reference later.
- Add **labels** at the end or beginning of equations consistently to make it easy to find them.
- Place labels for figures at the beginning of the **caption**.
- Use **label prefixes** (eq:, fig:, tab:, sec:, subsec:, etc.) in order to be able to distinguish (this is done in LyX).
- Use `\eqref` for referencing equations, `\ref` for figures/sections/etc.
- AMS packages: `\usepackage{amssymb,amsmath}`
- AMS Short Math Guide for LaTeX from <http://tug.ctan.org/info/short-math-guide/short-math-guide.pdf>

Assorted LaTeX tips #3

- Use `\text{}` from package `amsmath` for inserting text into equations (not `\mbox` or `\mathrm`).

For example, `x_{\text{sub}}` vs `x_{\mbox{sub}}`

$$x_{\text{sub}} \quad \text{VS} \quad x_{\text{sub}}.$$

- Use `\boldsymbol` from `bm` package for bolding letters to get italic letters instead of upright letters as with `\mathbf`!
 - `\boldsymbol{x}=\boldsymbol{\theta}`: $\mathbf{x} = \boldsymbol{\theta}$
 - `\mathbf{x}=\mathbf{\theta}`: $\mathbf{x} = \theta$
- Always use `\operatorname` and not `\mathrm{operatorname}`:
 - `a\sin x` is typeset correctly with spacing $a \sin x$, but even better as `'a\sin{x}'` ($a \sin x$)
 - `a\mathrm{sin}x` gives no spacing $asinx$
 - AMS packages let you define your own operator, e.g.,
`\DeclareMathOperator{rank}{rank}`

Assorted LaTeX tips #4

- Insert **spaces in formulas** for readability using `\,` or `\thinspace`, `\:` or `\medspace`, `\;` or `\thickspace`, or `\quad` and `\qquad` for wider spaces.
- Use **wide accents** `\widetilde` (\tilde{x} and \tilde{X}) and `\widehat` (\hat{x} and \hat{X}) instead of the narrow `\tilde` (\tilde{x} and \tilde{X}) and `\hat` (\hat{x} and \hat{X}) for capital letters.
- For **matrices** use `pmatrix` (parenthesis) or `bmatrix` (brackets) environments.
- Use `\left` and `\right` for delimiters to get automatic sizing, even if larger than strictly necessary.
 - `\left(\sum_{i=1}^n\right)` gives $\left(\sum_{i=1}^n\right)$
 - `\left(\sum_{i=1}^n\right)^{\wedge\{n\}}` gives $\left(\sum_{i=1}^n\right)^{\wedge\{n\}}$
- For single delimiter (multiline equation), use a matching **period as a ghost delimiter**:
`\left(\right.` produces

$$\left(\sum_{i=1}^n \quad \text{versus} \quad \left(\sum_{i=1}^n\right.$$

Assorted LaTeX tips #5

- To ensure things don't get broken across lines use a **tie** \sim , e.g., `Knuth\sim\cite{knuth}`.
- For a period different than a full stop, add control space e.g., `'p.\ 12'`
- Use `-` for **hyphen** (open-access repository), double dash `--` for **en-dash** – (Moore–Penrose inverse), triple dash `---` for sentence delimiter **em-dash** —.
- Put **numbers inside math** to properly format signs, e.g., not `-3` but `-3`.
- For **quotes** use `"text"` and not double quotes.
- Watch out: **no blank lines** after lists, quotations, and mathematical display formulas — this starts a new paragraph!
Instead, add a blank comment line beginning with `%`

Assorted LaTeX tips #6

- Put **multiple citations together**, so `\cite{Ref1,Ref2}` and not `\cite{Ref1}\cite{Ref2}`.
They will be grouped accordingly, e.g., [1-5] and not [1][2][3][4][5].
- In math use `\colon` to get punctuation, e.g., $A(1\colon r)$ to get $A(1: r)$.
- Use `\dots` (or `\cdots`) and not `...` for **ellipses**
- Lesson: The “right” way to do things in LaTeX may seem obvious sometimes but it's not, so **look at documentation** (web), e.g.

$$\int \int \int \quad \text{versus} \quad \iiint$$

- Any others? (discussion?)