Written & Oral Presentation: Computer Tools: LaTex

Aleksandar Donev
Courant Institute, NYU[1]
donev@courant.nyu.edu

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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{\M{\mathcal{R}}}
  - Bold for vectors: \def\V#1{**boldsymbol**{#1}}
  - Norm of a vector: \def\norm#1{\left\Vert #1\right\Vert }

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}}

$$x_{\text{sub}} \quad \text{vs} \quad x_{\mbox{sub}}.$$

- Use **\emph** to make text "italic" and not \textit.
- Use **\boldsymbol from bm** package for bolding letters to get italic letters instead of upright letters as with \mathbf!
  - \boldsymbol{x}=\boldsymbol{\theta}: $\boldsymbol{x} = \boldsymbol{\theta}$
  - \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 $a\mathrm{sin}x$
  - 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 ($\widetilde{x}$ and $\widetilde{X}$) and \widehat ($\widehat{x}$ and $\widehat{X}$) 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}\right) gives $\left(\sum_{i}\right)$
  - (\sum_{i=1}^{n}) gives $(\sum_{i=1}^{n})$
- For single delimiter (multiline equation), use a matching **period as a ghost delimiter**:
  \left(\right. produces

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

Assorted LaTex tips #5

- To ensure things don't get broken across lines use a **tie** ~, e.g., Knuth~\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 sings, 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 $A(1\colon r)$.
- 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?)