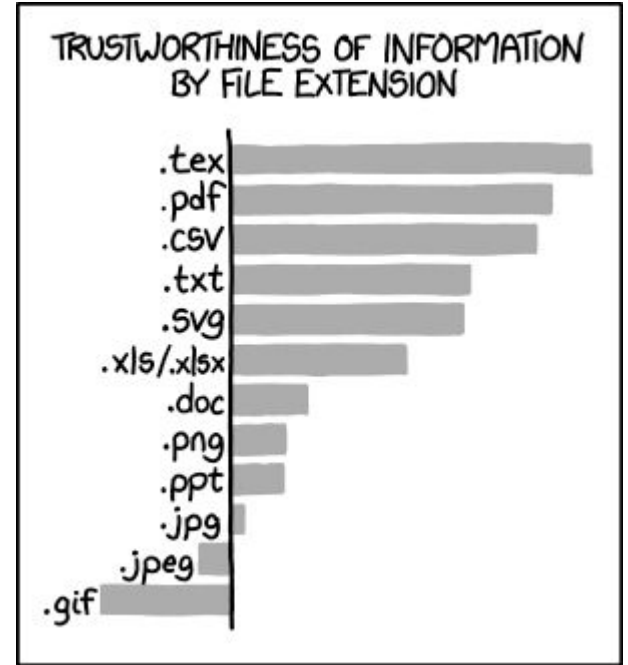


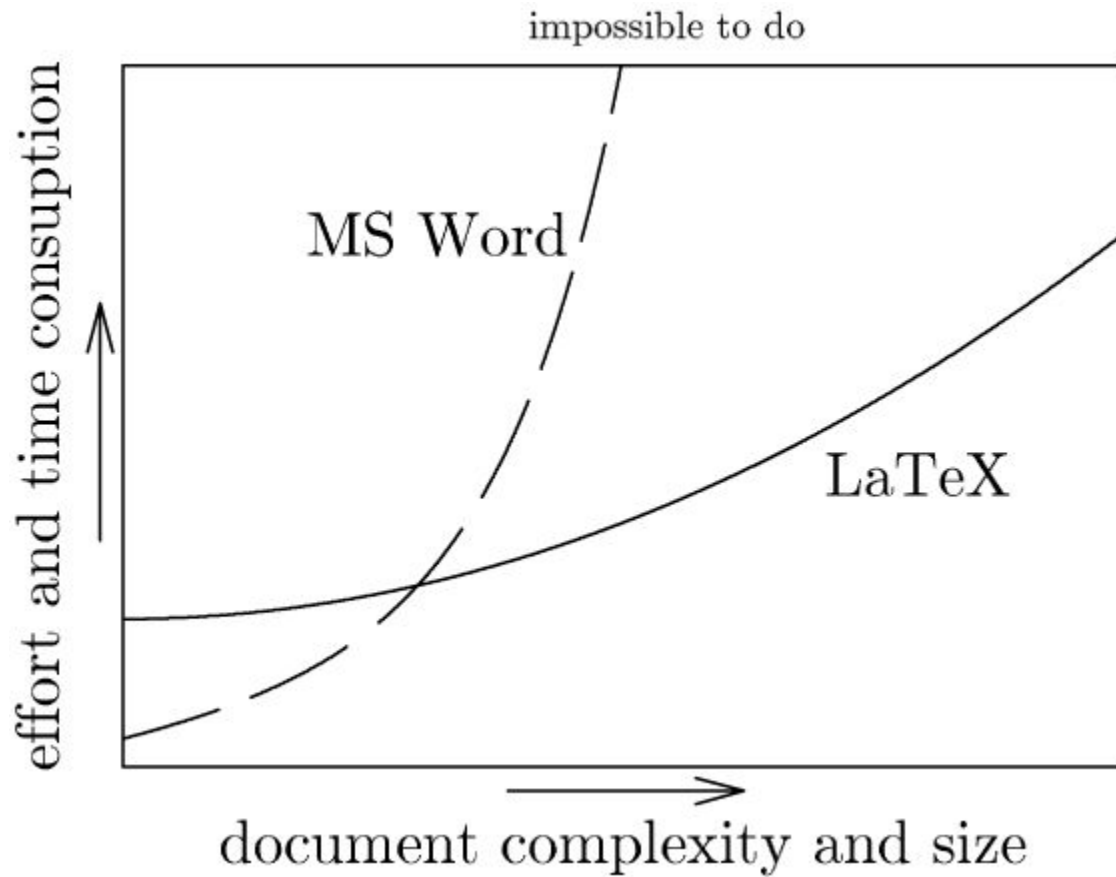
Latex

Kameswari Chebrolu



Background

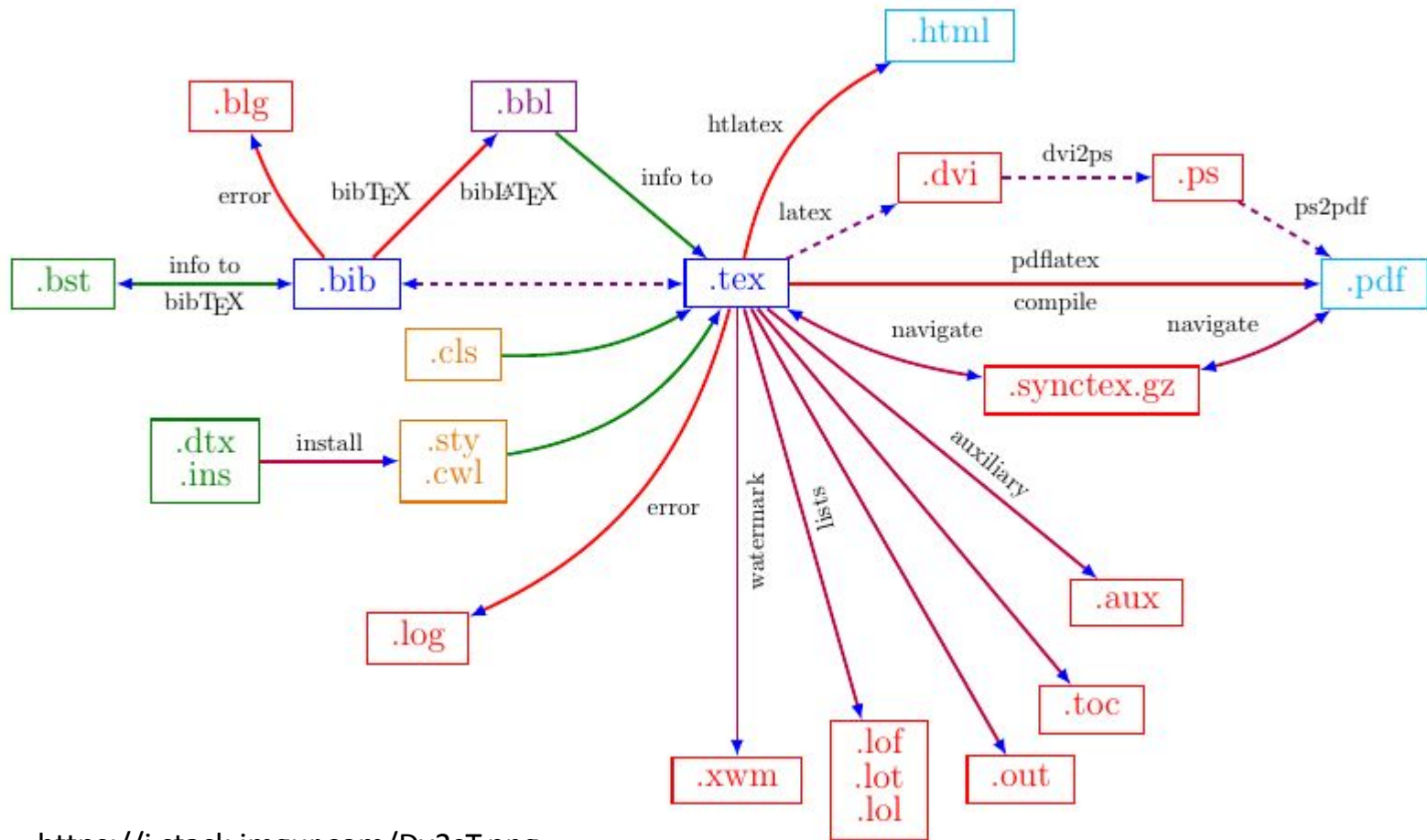
- Pronounced “lay-tech” or “lah-tech”
 - not lateks, as in gloves are made of latex
- LaTeX is a “Free” software system for document preparation
 - Provides high-quality typesetting
 - Authors can focus mostly on content/flow and not on aesthetics
 - Used to produce predominantly technical or scientific documents
 - Mathematical symbols, Equations, Footnotes, Tables, Figures, References, Table of contents, Bibliographies etc can be easily integrated



Files Used

- .tex: source document file (main file which you will edit)
- .cls: class file, loaded with the `\documentclass{...}`
 - Mandatory, appears once in latex document, often very first command
 - Most common classes: article, report, letter, book, slides, beamer etc
 - E.g. article class provides commands for typesetting articles, such as `\section`, `\tableofcontents`, `\author`

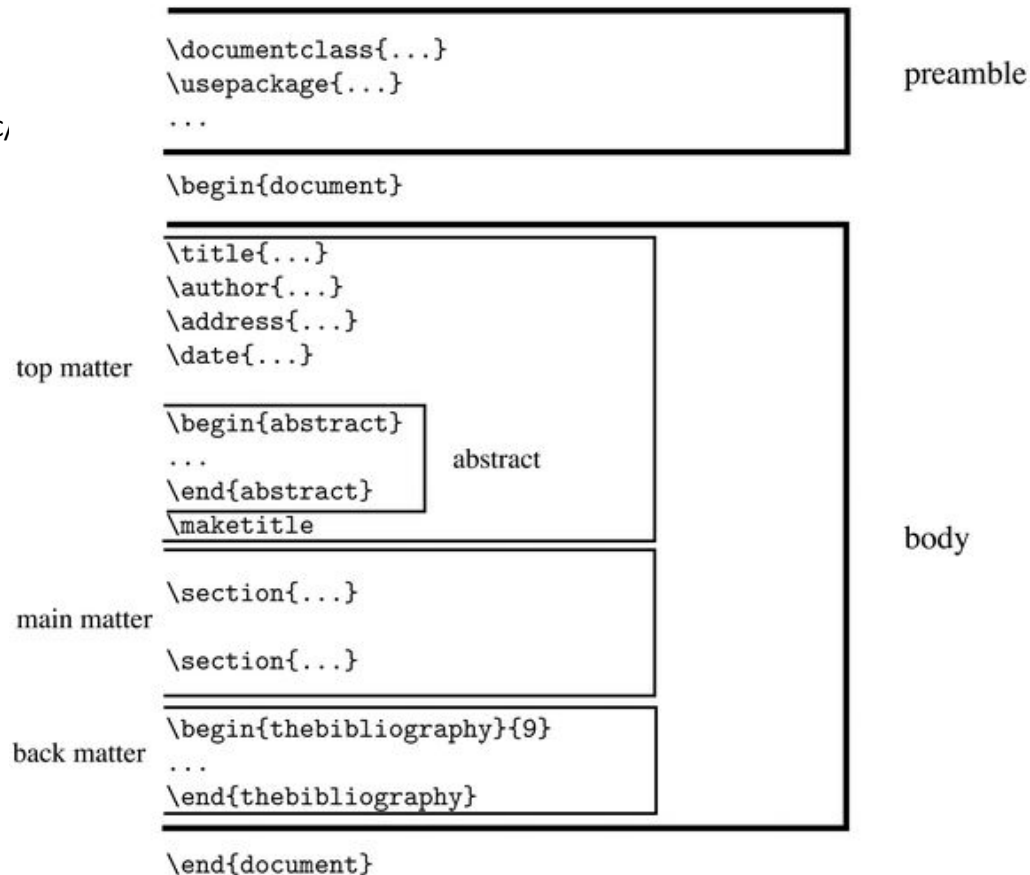
- .sty: style or packages, loaded with `\usepackage{...}`
 - packages are optional and many may be loaded
 - Often prior to the beginning of the document
 - Provide things on top of the class
 - E.g. graphicx package helps include images with graphical effects
- .bib: BibTeX Bibliographical Database file, a specially formatted text file that lists references



<https://i.stack.imgur.com/Dy2sT.png>

Format

https://media.springernature.com/lw685/springer-static,_5_En_8_Fig1_HTML.gif



Simple Example

```
\documentclass[12pt, letterpaper]{article}
```

```
\title{My first LaTeX document}
```

```
\author{Hubert Farnsworth\thanks{Funded by the Overleaf team.}}
```

```
\date{August 2022}
```

```
\begin{document}
```

```
\maketitle
```

```
We have now added a title, author and date to our first \LaTeX{} document!
```

```
% This line here is a comment. It will not be typeset in the document.
```

```
\end{document}
```


Text Formatting

- 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.
- Example:
 - Some of the `\textbf{greatest}` discoveries in `\underline{science}` were made by `\textbf{\textit{accident}}`
- `\emph{argument}`: depends on the context
 - Inside normal text, the emphasized text is italicized
 - Reversed if used inside an italicized text

Images, Captions, Labels, References

```
\documentclass{article}
\usepackage{graphicx}
\graphicspath{{images/}}

\begin{document}

\begin{figure}[h]
  \centering
  \includegraphics[width=0.75\textwidth]{mesh}
  \caption{A nice plot.}
  \label{fig:mesh1}
\end{figure}
```

As you can see in figure `\ref{fig:mesh1}`, the function grows near the origin. This example is on page `\pageref{fig:mesh1}`.

```
\end{document}
```

Lists

```
\documentclass{article}
```

```
\begin{document}
```

```
\begin{itemize}
```

```
\item The individual entries are indicated with a black dot, a so-called bullet.
```

```
\item The text in the entries may be of any length.
```

```
\end{itemize}
```

```
\begin{enumerate}
```

```
\item This is the first entry in our list.
```

```
\item The list numbers increase with each entry we add.
```

```
\end{enumerate}
```

```
\end{document}
```

Math

- Two writing modes for typesetting mathematics:
 - inline math mode: formulas inline i.e. part of a paragraph
 - display math mode: write expressions not part of a text or paragraph
 - typeset on separate lines

```
\documentclass[12pt, letterpaper]{article}
```

```
\begin{document}
```

In physics, the mass-energy equivalence is stated

by the equation $E=mc^2$, discovered in 1905 by Albert Einstein.

```
\end{document}
```

Equations typeset in display mode can be numbered or unnumbered, as in the following example:

```
\documentclass[12pt, letterpaper]{article}
```

```
\begin{document}
```

The mass-energy equivalence is described by the famous equation

$$E=mc^2$$
 discovered in 1905 by Albert Einstein.

In natural units ($c = 1$), the formula expresses the identity

```
\begin{equation}
```

$$E=mc^2$$

```
\end{equation}
```

```
\end{document}
```

Complex Math

```
\documentclass{article}
```

```
\begin{document}
```

Subscripts in math mode are written as a_b and superscripts are written as a^b . These can be combined and nested to write expressions such as

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

We write integrals using \int and fractions using $\frac{a}{b}$. Limits are placed on integrals using superscripts and subscripts:

```
\[ \int_0^1 \frac{dx}{e^x} = \frac{e-1}{e} \]
```

Lower case Greek letters are written as ω δ etc. while upper case Greek letters are written as Ω Δ .

Mathematical operators are prefixed with a backslash as $\sin(\beta)$, $\cos(\alpha)$, $\log(x)$ etc.

```
\end{document}
```

Sections

- `\section{section}`
- `\subsection{subsection}`
- `\subsubsection{subsubsection}`
- `\paragraph{paragraph}`
- `\subparagraph{subparagraph}`

Tables

```
\begin{center}  
\begin{tabular}{c c c}  
cell1 & cell2 & cell3 \\  
cell4 & cell5 & cell6 \\  
cell7 & cell8 & cell9  
\end{tabular}  
\end{center}
```

```
\begin{center}  
\begin{tabular}{|c|c|c|}  
\hline  
cell1 & cell2 & cell3 \\  
cell4 & cell5 & cell6 \\  
cell7 & cell8 & cell9 \\  
\hline  
\end{tabular}  
\end{center}
```


References

- `\bibitem` (not recommended)

```
%%%%%%%%%% Example 1%%%%%%%%%%
\begin{thebibliography}{100} % 100 is a random guess of the total number of
%references
\bibitem{Boney96} Boney, L., Tewfik, A.H., and Hamdy, K.N., ``Digital
Watermarks for Audio Signals," \emph{Proceedings of the Third IEEE
International Conference on Multimedia}, pp. 473-480, June 1996.
\bibitem{MG} Goossens, M., Mittelbach, F., Samarin, \emph{A LaTeX
Companion}, Addison-Wesley, Reading, MA, 1994.
\bibitem{HK} Kopka, H., Daly P.W., \emph{A Guide to LaTeX},
Addison-Wesley, Reading, MA, 1999.
\bibitem{Pan} Pan, D., ``A Tutorial on MPEG/Audio Compression," \emph{IEEE
Multimedia}, Vol.2, pp.60-74, Summer 1998.
\end{thebibliography}
%%%%%%%%%% end %%%%%%%%%%
```

- Tough to accurately format each `\bibitem` based on the reference style you're asked to use
 - Should the year come immediately after the authors, or at the end of the entry?
 - Given names first, or last names first?
 - For different manuscripts or documents that use different reference styles you'll need to rewrite the `\bibitem` for each reference.

Bibtex

Maintain a bibliography database file (e.g. sample.bib) which contains format-independent information about our references

```
@book{texbook,  
  author = {Donald E. Knuth},  
  year = {1986},  
  title = {The {\TeX} Book},  
  publisher = {Addison-Wesley Professional}  
}
```

```
@book{latex:companion,  
  author = {Frank Mittelbach and Michel Gossens  
    and Johannes Braams and David Carlisle  
    and Chris Rowley},  
  year = {2004},  
  title = {The {\LaTeX} Companion},  
  publisher = {Addison-Wesley Professional},  
  edition = {2}  
}
```

```
\bibliographystyle{plain} % We choose the "plain" reference style  
\bibliography{sample} % Entries are in the sample.bib file
```

This is processed with the following sequence of commands, assuming our LATEX document is in a file named sample.tex (and that we are using pdflatex):

```
pdflatex sample  
bibtex sample  
pdflatex sample  
pdflatex sample
```

Why 4 runs?

- First pdflatex run: pdflatex sees `\bibliographystyle{...}` and a `\bibliography{...}`
 - Doesn't know what all the `\cite{...}` commands are about
 - Consequently, within output PDF, all the `\cite{...}` commands are simply rendered as `[?]` and no reference list appears
 - pdflatex writes information about the bibliography style and .bib file, as well as all occurrences of `\cite{...}`, to the file `sample.aux`
- Bibtex sample now looks at `sample.aux`
 - Notes the .bib file indicated by `\bibliography{...}`
 - Looks up all the entries with keys that match the `\cite{...}` commands used in the .tex file
 - Uses the style specified with `\bibliographystyle{...}` to format the cited entries, and writes a formatted thebibliography list into the file `sample.bbl`
 - no changes are made to the output PDF

Why 4 runs?

- pdflatex run again: sees sample.bbl file
 - inserts the contents of sample.bbl i.e. the `\begin{thebibliography}...\end{thebibliography}` into the LATEX source, where `\bibliography{...}` is
 - reference list appears in the output PDF formatted according to the chosen `\bibliographystyle{...}`, but the in-text citations are still [?]
- pdflatex run again: `\cite{...}` commands are replaced with the corresponding numerical labels in the output PDF!

Common mistakes

- “end” doesn’t follow “begin”
- \$ doesn’t follow \$
- Using commands from packages not defined in the preamble
- Forgetting to escape i.e. “\”s.
- Forgetting bibliography{filename}
 - bibtex file is saved in the same location where the sample tex file is saved.
- Forgetting end{document}

References

- https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes (brief)
- https://www.overleaf.com/learn/latex/Bibliography_management_with_bibtex
- https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes (in-depth)
- <https://www.andrew.cmu.edu/course/15-251/misc/LaTeX%20Primer.pdf>
- <https://www.overleaf.com/learn/latex/Errors> (errors)