A LaTeX Tutorial

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What is LaTeX

- LaTeX is a typesetter. It is not WYSIWYG. It is not a word processor.

- Author specifies the structure of the document symbolically (in a mark-up language), without worrying about the formatting (like XML)

- LaTeX takes care of the formatting of the document according to the specified document style

- LaTeX files are text files, with mark-up for sectioning, equations, tables and figures.

Why is LaTeX better than Microsoft Word for theses and papers?

- Professional quality typesetting of documents, and, in particular, equations

- Automatic numbering and crossreferencing of
  - references
  - figures and tables
  - equations
  - sections and pages

- Document style change from thesis to conference or journal paper is more or less trivial.

- Baseline font size change is trivial, and scales headings and equations, too.

- Automatic placement of floating objects (figures and tables)

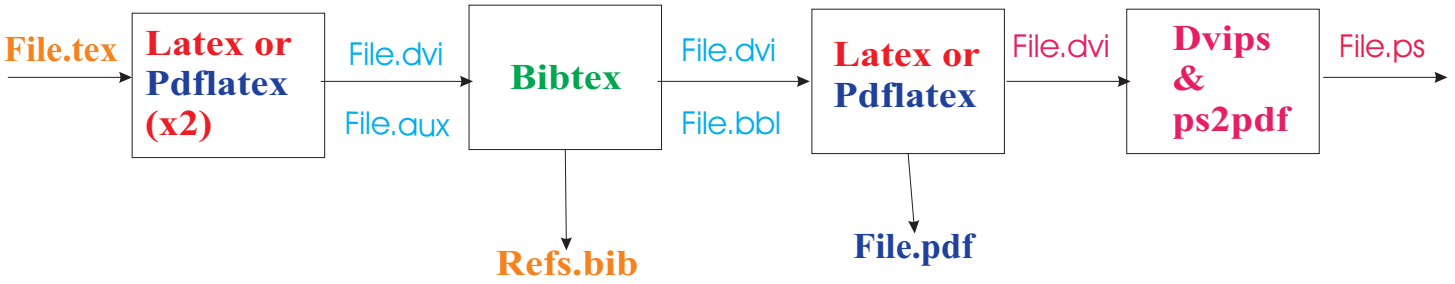
- Equations are not graphics. They are an integral part of the text.

- Automatic generation of
  - table of contents
  - list of figures
  - list of tables
  - index
- Archival: LaTeX files can be processed and printed *decades* later. LaTeX files cannot be corrupted!
- *De facto* standard for publishing scientific documents, especially medium-to-large ones.
- WYSIWYG products running on top of LaTeX exist, but they are expensive (US$450/single user). See: `http://www.mackichan.com/` → products → Scientific Word.

The LaTeX process

- Option 1 (open source):
  - The LaTeX file is processed with **latex** to generate a DVI file
  - The DVI file is processed with **dvips** to generate a Postscript file
  - The Postscript file can be:
    * previewed using Ghostview
    * printed
    * converted to pdf format using command **ps2pdf** or **Acrobat Distiller**.
- Option 2: The LaTeX file is processed with **pdflatex** to produce a **pdf** file directly.

The LaTeX process



- User provides: File.tex, Refs.bib
- Files using **latex**: File.dvi, File.bbl, File.aux, File.ps
  Printable file: File.ps or convert to **pdf** via **ps2pdf**(UNIX) or Acrobat Distiller (Win))
- Files using **pdflatex**: File.bbl, File.aux, File.pdf

How to get started with LaTeX

- Get hold of a thesis or paper in LaTeX
- Use it as a **template**
- Use
  - **MikTeX** for Windows
  - **gnuemacs LaTeX editing mode** on Unix, and the **latex, bibtex, dvips, ps2pdf or pdflatex, bibtex** commands

A very simple LaTeX file

From "Getting Started with LaTeX", by David R. Wilkins
http://www.maths.tcd.ie/~dwilkins/LaTeXPrimer/Index.html

```
\documentclass[12pt]{article}
\begin{document}

The foundations of the rigorous study of \emph{analysis} were laid in the nineteenth century,
notably by the mathematicians Cauchy and Weierstrass. Central to the study of this subject
are the formal definitions of \emph{limits} and \emph{continuity}.

Let $D$ be a subset of $\bf R$ and let $f \colon D \to \mathbf{R}$ be a real-valued function on
$D$. The function $f$ is said to be \emph{continuous} on $D$ if, for all $\epsilon > 0$ and
for all $x \in D$, there exists some $\delta > 0$ (which may depend on $x$) such that if
$y \in D$ satisfies
\[ |y - x| < \delta \]
then
\[ |f(y) - f(x)| < \epsilon. \]

One may readily verify that if $f$ and $g$ are continuous functions on $D$ then the functions
$f+g$, $f-g$ and $f.g$ are continuous. If in addition $g$ is everywhere non-zero then $f/g$
is continuous.

\end{document}
```

And the file after typesetting

The foundations of the rigorous study of *analysis* were laid in the nineteenth century, notably by the mathematicians Cauchy and Weierstrass. Central to the study of this subject are the formal definitions of *limits* and *continuity*.

Let D be a subset of $\mathbf{R}$ and let $f\colon D \to \mathbf{R}$ be a real-valued function on D. The function f is said to be *continuous* on D if, for all $\epsilon > 0$ and for all $x \in D$, there exists some $\delta > 0$ (which may depend on x) such that if $y \in D$ satisfies

$$|y - x| < \delta$$

then

$$|f(y) - f(x)| < \epsilon.$$

One may readily verify that if f and g are continuous functions on D then the functions $f + g$, $f - g$ and $f.g$ are continuous. If in addition g is everywhere non-zero then f/g is continuous.

Figures (photographs or diagrams) in LaTeX

- Must be in *encapsulated postscript* (eps) (for latex) or pdf or jpeg format (for pdflatex)

- Diagrams can be generated with a drawing program that can export into encapsulated postscript, e.g. CorelDraw, Dia, Powerpoint (Windows), Xfig (Unix), or print into pdf format.

- Eps file is "included" into a LaTeX file using *includegraphics*

- Size and orientation can be adjusted with *includegraphics*

Example: Previous Figure made in CorelDraw, exported into eps/pdf, included in latex file as: `\includegraphics[scale=0.7]{./LatexProcessing}` latex will use the eps version, pdflatex will use the pdf version.

Structure of a LaTeX file: preamble

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

\pagestyle{plain}
\usepackage{graphicx}      % include macros for including eps or pdf figure files
\usepackage{setspace}
\onehalfspacing
%\newcommand{\comment}[1]{ {\tiny {#1} } } % show comments, for editing
\newcommand{\comment}[1]{ } %hide comments, for final version
\long\def\invis#1{}      % make text invisible

\begin{document}}
\title{Blah Blah ...}

\author{
{\em Student name, Evangelos Milios}\\
Faculty of Computer Science,
{\tt \{eem\}@cs.dal.ca}}

\date{}   % no date

\maketitle   % make the title page here

\begin{abstract}
blah, blah, ...
\end{abstract}
```

Structure of a LaTeX file: body

```
\section{Introduction} \label{introduction}

blah, blah, ... In Section \ref{bodyofwork},.... In Section \ref{discussion}...

\section{Body of work} \label{bodyofwork}

blah, blah, ...

\section{Discussion} \label{discussion}

\paragraph{Acknowledgements}
blah, blah,...

\bibliographystyle{plain}
\bibliography{reference}   % reference.bib contains the references

\appendix
\section{My code}
\section{Excruciating details about my experiments}

\tableofcontents

\end{document}
```

References

- Placed in a bibliography file (.bib)
- Each reference has a key
- Cited in the text by `\cite{key}`
- Bibliography section constructed and formatted automatically
- Items are numbered and correct numbers are placed in the text automatically

Example of a bib file

```
@BOOK{Lewis1998,
    AUTHOR = "H. Lewis and C. Papadimitriou",
    TITLE = "Elements of the Theory of Computation",
    PUBLISHER = "Prentice-Hall",
    YEAR = "1998",
    ADDRESS = "Upper Saddle River, NJ 07458"
    }

@ARTICLE{Muslea2001,
    AUTHOR = "I. Muslea and S. Minton and C. Knoblock.",
    TITLE = "Hierarchical Wrapper Induction for Semistructured Information Sources",
    JOURNAL = "Journal of Autonomous Agents and Multi-Agent Systems",
    VOLUME = "4",
    YEAR = "2001",
    PAGES = "93-114"
    }
```

Other types are available, too: INBOOK, TECHREPORT, INPROCEEDINGS, ...

Slides in LaTeX

Recommended when you have equations and figures already in LaTeX (simple cutting and pasting between slides and thesis/paper)

The *slides* class:

- Formats appropriately for slides
- No floating bodies (figure, table)
- Allows colours and overlays

Powerpoint-like effects are possible.

For Display, convert to **pdf** format and use **Acrobat**.

History of LaTeX

TeX was created by Donald Knuth in the late seventies.

LaTeX was written by Leslie Lamport as a more or less self-contained set of macros for TeX in the early eighties (1983).

At the same time (early eighties), the American Mathematical Society developed AMS-TeX, causing a split in the mathematical community.

In 1990, the AMS introduced AMS-LaTeX, splitting the community even further.

LaTeX2e was introduced in 1993, unifying LaTeX and AMS-LaTeX.

In 1995, the AMS released version 1.2 of AMS-LaTeX built on top of LaTeX2e.

Just what is TeX? `http://www.tug.org/whatis.html`

Summary

When to use LaTeX?

- For a scientific document such as a thesis, textbook, monograph, or paper
- For a document with a complex structure, bibliography and cross-references that will be revised several times
- When typesetting of professional quality is required
- Any document that you want to be able to read many years later

When not to use LaTeX?

- For a letter or short memo of a short lifespan
- For a short document with a simple structure and few and simple, or no, equations
- Foreign language support may be limited. There is support for greek, arabic (arabtex), and Chinese.

What is LaTeX not good at?

- Very small selection of fonts
- Lack of control over the precise layout of the document (if you need it).

References

1. Tim Love: "Why LaTeX?", September 2000, University of Cambridge, Department of Engineering
`http://www-h.eng.cam.ac.uk/help/tpl/textprocessing/latex_advocacy.html`
(compares LaTeX, Microsoft Word and Framemaker).

2. Allin Cottrell: "Word Processors: Stupid and Inefficient", June 1999, `http://www.ecn.wfu.edu/~cottrell/wp.html`

3. Leslie Lamport: "A Document Preparation System, LaTeX: User's Guide and Reference Manual", Addison-Wesley, 1986.