An Introduction to LaTeX

Alison Ramage
Dept of Mathematics
University of Strathclyde
Glasgow, Scotland

University of Strathclyde
Glasgow

- *LaTeX : A Document Preparation System*
  Lamport, Addison-Wesley 1994

- *Learning LaTeX*
  Griffiths and Higham, SIAM 1997

- *The LaTeX Companion*
  Mittelbach and Goossens, Addison-Wesley 2004

Basics

- based on the TEX program by Don Knuth

Basics

- based on the TEX program by Don Knuth

- LATEX written by Leslie Lamport specifically for maths
  "a house built with wood and nails of TEX"

Basics

- based on the $\TeX$ program by Don Knuth

- $\LaTeX$ written by Leslie Lamport specifically for maths
    "a house built with wood and nails of $\TeX$"

- typesetting package (not WYSIWYG)

Basics

- based on the TEX program by Don Knuth

- LATEX written by Leslie Lamport specifically for maths
  "a house built with wood and nails of TEX"

- typesetting package (not WYSIWYG)

- cross-references and citations done automatically

Basics

- based on the TEX program by Don Knuth

- LATEX written by Leslie Lamport specifically for maths
  "a house built with wood and nails of TEX"

- typesetting package (not WYSIWYG)

- cross-references and citations done automatically

- convenient for electronic publication

Basics

- based on the T_EX program by Don Knuth

- LaT_EX written by Leslie Lamport specifically for maths
  "a house built with wood and nails of T_EX"

- typesetting package (not WYSIWYG)

- cross-references and citations done automatically

- convenient for electronic publication

- public domain software (i.e. free!)

Basics

- based on the T_EX program by Don Knuth

- $\LaTeX$ written by Leslie Lamport specifically for maths
  "a house built with wood and nails of T_EX"

- typesetting package (not WYSIWYG)

- cross-references and citations done automatically

- convenient for electronic publication

- public domain software (i.e. free!)

"Although you can format an equation almost any way you want with $\LaTeX$, you have to work harder to do it wrong."

Overview

create a L^AT_EX .tex file
kepler$ emacs doc.tex

Overview

create a L^AT_EX .tex file
kepler$ emacs doc.tex

process the .tex file
kepler$ latex doc

Overview

create a LaTeX .tex file
kepler$ emacs doc.tex

correct any
LaTeX errors

process the .tex file
kepler$ latex doc

Overview

create a LaTeX .tex file
kepler$ emacs doc.tex

correct any
LaTeX errors

process the .tex file
kepler$ latex doc

preview the .dvi file
kepler$ xdvi doc

Overview

create a LaTeX .tex file
kepler$ emacs doc.tex

correct any
LaTeX errors

correct any
style, layout,
content errors

process the .tex file
kepler$ latex doc

preview the .dvi file
kepler$ xdvi doc

Overview

create a LaTeX .tex file
kepler$ emacs doc.tex

correct any
style, layout,
content errors

correct any
LaTeX errors

process the .tex file
kepler$ latex doc

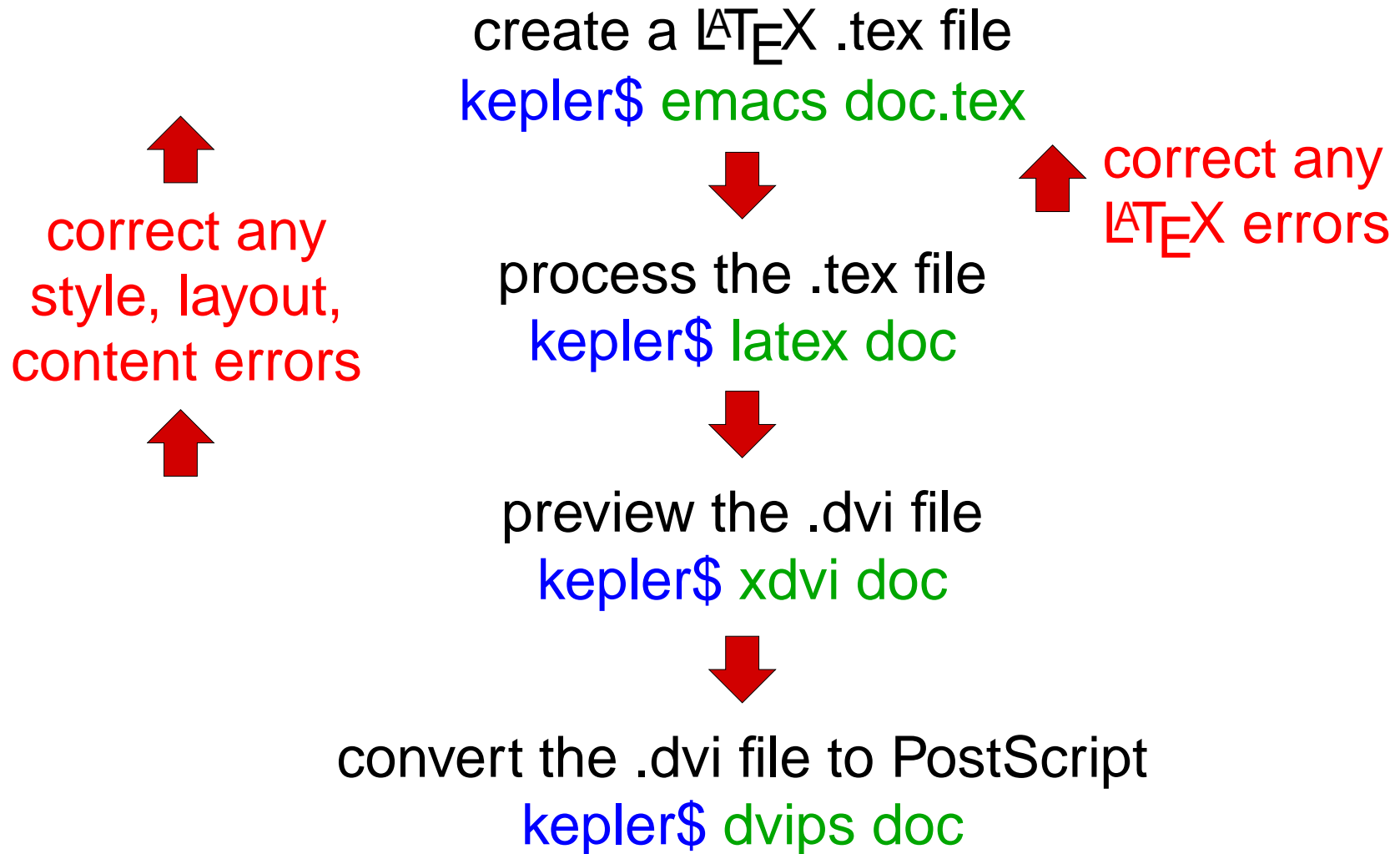preview the .dvi file
kepler$ xdvi doc

convert the .dvi file to PostScript
kepler$ dvips doc

Overview

create a LaTeX .tex file
kepler$ emacs doc.tex

correct any
style, layout,
content errors

correct any
LaTeX errors

process the .tex file
kepler$ latex doc

preview the .dvi file
kepler$ xdvi doc

convert the .dvi file to PostScript
kepler$ dvips doc

print the .ps file
kepler$ lpr doc.ps

Observations

- If you are using internal references, you may get the message

  `LaTeX Warning:  Label(s) may have changed.  Rerun to get cross-references right.`

  You must then recompile the file by using the latex command again.

Observations

- If you are using internal references, you may get the message

  `LaTeX Warning: Label(s) may have changed. Rerun to get cross-references right.`

  You must then recompile the file by using the latex command again.

- The previewing stage is very important: printing is expensive!

Observations

- If you are using internal references, you may get the message

  `LaTeX Warning:  Label(s) may have changed.  Rerun to get cross-references right.`

  You must then recompile the file by using the latex command again.

- The previewing stage is very important: printing is expensive!

- The dvips command can be used to print selected pages, e.g.

  kepler\$ dvips -p29 -l34 thesis

  prints pages 29-34 of the document thesis.dvi.

In your .tex file

- ALL LaTeX commands begin with a $\backslash$ and are case-sensitive.

In your .tex file

- ALL LATEX commands begin with a $\backslash$ and are case-sensitive.

- Special characters:

$$\% * \$ \& \_ \{ \} \char`~ \char`^ \backslash$$

will be interpreted as LATEX control characters.

In your .tex file

- ALL LaTeX commands begin with a $\backslash$ and are case-sensitive.

- Special characters:

$$\% * \$ \& \_ \{ \} \tilde{} \hat{} \backslash$$

will be interpreted as LaTeX control characters.

- % acts as a 'comment' symbol: anything on the line after a % sign is ignored.

In your .tex file

- ALL LaTeX commands begin with a `\` and are case-sensitive.

- Special characters:

$$\% \ast \$ \& \_ \{ \} \; \char`\~ \; \char`\^ \; \backslash$$

will be interpreted as LaTeX control characters.

- % acts as a 'comment' symbol: anything on the line after a % sign is ignored.

- Some commands have arguments:

enclosed in { }: compulsory

enclosed in [ ]: optional

Document structure

Each document has two parts:

- PREAMBLE
  This sets up the document style, type size, page settings etc. The first line must be

  `\documentclass{STYLE}`

  where STYLE is one of
    - article (includes sections and subsections)
    - report (includes chapters)
    - book (includes volumes)
    - letter
    - slides
    - . . .

Preamble (cont.)

The preamble may also contain

- commands which define page size, margins etc, e.g.
  ```
  \setlength{\textheight}{18.0cm}
  \setlength{\topmargin}{1.2in}
  \pagestyle{empty}
  ```

Preamble (cont.)

The preamble may also contain

- commands which define page size, margins etc, e.g.
  `\setlength{\textheight}{18.0cm}`
  `\setlength{\topmargin}{1.2in}`
  `\pagestyle{empty}`

- inclusion of any packages, e.g.
  `\usepackage{amssymb}`

Preamble (cont.)

The preamble may also contain

- commands which define page size, margins etc, e.g.
  `\setlength{\textheight}{18.0cm}`
  `\setlength{\topmargin}{1.2in}`
  `\pagestyle{empty}`

- inclusion of any packages, e.g.
  `\usepackage{amssymb}`

- user-defined new commands, e.g.
  `\newcommand{\fe}{finite element method}`

Preamble (cont.)

The preamble may also contain

- commands which define page size, margins etc, e.g.
  ```
  \setlength{\textheight}{18.0cm}
  \setlength{\topmargin}{1.2in}
  \pagestyle{empty}
  ```

- inclusion of any packages, e.g.
  ```
  \usepackage{amssymb}
  ```

- user-defined new commands, e.g.
  ```
  \newcommand{\fe}{finite element method}
  ```

- user-defined changes to default style, e.g.
  ```
  \renewcommand{\baselinestretch}{1.5}
  ```

Document structure (cont.)

- DOCUMENT BODY
  This contains the LaTeX commands to produce the document text.

```
\begin{document}
THE DOCUMENT TEXT GOES HERE.
\end{document}
```

Document structure (cont.)

- DOCUMENT BODY
  This contains the LaTeX commands to produce the document text.

```
\begin{document}
THE DOCUMENT TEXT GOES HERE.
\end{document}
```

- A document can be subdivided using

```
\chapter{...}
\section{...}
\subsection{...}
\subsubsection{...}
\Appendix
```

Document structure (cont.)

- Separate LaTeX input files can be included using

  `\input{`*filename*`}`

- A table of contents can be included using

  `\tableofcontents`

  Sample document body:

  ```
  \tableofcontents
  \newpage
  \input{chapter1}
  \newpage
  \input{chapter2}
  ```

SUMMARY

- A valid LaTeX document:

  ```
  \documentclass{article}
  \begin{document}
  This is my first document.
  \end{document}
  ```

SUMMARY

- A valid LaTeX document:

```
\documentclass{article}
\begin{document}
This is my first document.
\end{document}
```

This is all you need, but...

SUMMARY

- A valid LaTeX document:

```
\documentclass{article}
\begin{document}
This is my first document.
\end{document}
```

This is all you need, but…

…hopefully your thesis will be a little more sophisticated!

Document style

- A title can be created with `\maketitle` which uses

  `\title{...}`   `\author{...}`   `\date{\today}`

Document style

- A title can be created with `\maketitle` which uses

  `\title{...}`   `\author{...}`   `\date{\today}`

- Varying text font:

  \textit{...}   \TEXTSC{...}   \textsf{...}
  \textbf{...}   `\texttt{...}`

Document style

- A title can be created with `\maketitle` which uses

  `\title{...}`   `\author{...}`   `\date{\today}`

- Varying text font:

  \textit{...}   \TEXTSC{...}   \textsf{...}
  \textbf{...}   `\texttt{...}`

- Varying text size:

  `\tiny`   `\scriptsize`   `\footnotesize`

  `\normalsize`   `\large`   `\Large`

  `\LARGE`   `\huge`

  `\Huge`

Some useful LaTeX concepts (1)

- environments

```
\begin{center}...\end{center}
\begin{itemize}...\end{itemize}
\begin{enumerate}...\end{enumerate}
\begin{description}...\end{description}
\begin{tabbing}...\end{tabbing}
\begin{tabular}...\end{tabular}
\begin{table}...\end{table}
\begin{figure}...\end{figure}
\begin{quote}...\end{quote}
\begin{verse}...\end{verse}
```

Some useful LATEX concepts (2)

- math mode
  All mathematics must be typeset in math mode. This can be done using dollar signs $...$, e.g.

  ```
  Let $x$ be a real number.
  ```

  Let x be a real number.

Some useful LATEX concepts (2)

- math mode

  All mathematics must be typeset in math mode. This can be done using dollar signs $...$, e.g.

  ```
  Let $x$ be a real number.
  ```

  Let x be a real number.

- environments in math mode

  ```
  \begin{displaymath}...\end{displaymath}
       \begin{equation}...\end{equation}
           \begin{array}...\end{array}
       \begin{eqnarray}...\end{eqnarray}
      \begin{eqnarray*}...\end{eqnarray*}
  ```

Examples of maths commands (1)

- maths fonts:

$$\mathcal{A} \quad \mathrm{A} \quad \mathit{A} \quad \mathsf{A} \quad \mathbf{A} \quad \mathtt{A}$$

```
\mathcal{A}, \mathrm{A}, \mathit{A},
 \mathsf{A}, \mathbf{A}, \mathtt{A}
```

Examples of maths commands (1)

- maths fonts:

$$\mathcal{A} \quad \mathrm{A} \quad \mathit{A} \quad \mathsf{A} \quad \mathbf{A} \quad \mathtt{A}$$

```
\mathcal{A}, \mathrm{A}, \mathit{A},
  \mathsf{A}, \mathbf{A}, \mathtt{A}
```

- Greek letters: $\alpha, \quad \beta, \quad \gamma, \quad \Gamma, \quad \sigma, \quad \Sigma$

```
\alpha,\beta,\gamma,\Gamma,\sigma,\Sigma
```

Examples of maths commands (1)

- maths fonts:

$$\mathcal{A} \quad \mathrm{A} \quad \mathit{A} \quad \mathsf{A} \quad \mathbf{A} \quad \mathtt{A}$$

```
\mathcal{A}, \mathrm{A}, \mathit{A},
 \mathsf{A}, \mathbf{A}, \mathtt{A}
```

- Greek letters: $\alpha, \quad \beta, \quad \gamma, \quad \Gamma, \quad \sigma, \quad \Sigma$

```
\alpha,\beta,\gamma,\Gamma,\sigma,\Sigma
```

- symbols: $\ne, \quad \Leftrightarrow, \quad \in, \quad \sim, \quad \nabla$

```
\ne,\Leftrightarrow,\in,\sim,\nabla
```

Examples of maths commands (1)

- maths fonts:

$$\mathcal{A} \quad \mathrm{A} \quad \mathit{A} \quad \mathsf{A} \quad \mathbf{A} \quad \mathtt{A}$$

```
\mathcal{A}, \mathrm{A}, \mathit{A},
\mathsf{A}, \mathbf{A}, \mathtt{A}
```

- Greek letters: $\alpha, \quad \beta, \quad \gamma, \quad \Gamma, \quad \sigma, \quad \Sigma$

```
\alpha,\beta,\gamma,\Gamma,\sigma,\Sigma
```

- symbols: $\ne, \quad \Leftrightarrow, \quad \in, \quad \sim, \quad \nabla$

```
\ne,\Leftrightarrow,\in,\sim,\nabla
```

- variable-sized symbols: $\int, \quad \oint, \quad \sum, \quad [, \quad]$

```
\int, \oint, \sum, \left[,  \right]
```

Examples of maths commands (2)

- subscripts and superscripts:

$$x_1, \quad y_{ij}, \quad z^{n+1}, \quad \lim_{x \to -1}, \quad \int_1^\infty$$

```
x_1,  y_{ij},  z^{n+1},
\lim_{x\rightarrow -1},  \int_1^\infty
```

Examples of maths commands (2)

- subscripts and superscripts:

$$x_1, \quad y_{ij}, \quad z^{n+1}, \quad \lim_{x \to -1}, \quad \int_1^\infty$$

```
x_1,  y_{ij},  z^{n+1},
\lim_{x\rightarrow -1},  \int_1^\infty
```

- fractions:

$$x = \frac{3 + \sin t}{t^2}, \qquad y = \frac{\partial x}{\partial t}$$

```
x=\frac{3+\sin{t}}{t^2}
y=\frac{\partial x}{\partial t}
```

Arranging formulae

- arrays:

$$A = \begin{bmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{bmatrix}$$

```
A=\left[\begin{array}{ccc}
1 & 1 & 1\\x & y & z\\x^2 & y^2 & z^2
\end{array} \right]
```

Arranging formulae

- arrays:

$$A = \begin{bmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{bmatrix}$$

```
A=\left[\begin{array}{ccc}
1 & 1 & 1\\x & y & z\\x^2 & y^2 & z^2
\end{array} \right]
```

- equation arrays:

$$
\begin{aligned}
x &= 17 + p^2 - 3p^5 \\
y &= \alpha - \theta
\end{aligned}
\tag{1}
$$

```
\begin{eqnarray}
x&=&17+p^2-3p^5\\
y&=&\alpha - \theta\nonumber
\end{eqnarray}
```

A simple table

Team	Played	W	D	L	Goals	Points
Aberdeen	2	2	0	0	+10	6
Celtic	2	0	1	1	-5	1
Rangers	2	0	1	1	-5	1

```
\begin{center}
\begin{tabular}{||l||c|c|c|c|c|c|}
\hline
Team & Played & W & D & L & Goals & Points\\
\hline\hline
Aberdeen & 2 & 2 & 0 & 0 & +10 & 6\\\hline
Celtic & 2 & 0 & 1 & 1& -5 & 1 \\\hline
Rangers & 2 & 0 & 1 & 1& -5 & 1 \\\hline
\end{tabular}
\end{center}
```

Cross-referencing

$\LaTeX$ can automatically number equations, references etc

- to label an equation: `\label{...}`

  (1) $x = 1$

  ```
  \begin{equation}
  \label{eq1}
  x=1
  \end{equation}
  ```

Cross-referencing

LaTeX can automatically number equations, references etc

- to label an equation: `\label{...}`

(1)
$$x = 1$$

```
\begin{equation}
\label{eq1}
x=1
\end{equation}
```

- to refer to a label: `\ref{...}`

Using equation (1), we see that…

```
Using equation (\ref{eq1}), we see that...
```

Citing reference texts

- bibliography:

```
\begin{thebibliography}{99}
BIBLIOGRAPHY ITEMS
\end{thebibliography}
```

Citing reference texts

- bibliography:

  `\begin{thebibliography}{99}`
  `BIBLIOGRAPHY ITEMS`
  `\end{thebibliography}`

- sample bibliography entry:

  `\bibitem{Ramage04} {`
  `A. Ramage, Famous Book, OUP, 2004.`
  `}`

Citing reference texts

- bibliography:

```
\begin{thebibliography}{99}
BIBLIOGRAPHY ITEMS
\end{thebibliography}
```

- sample bibliography entry:

```
\bibitem{Ramage04} {
A. Ramage, Famous Book, OUP, 2004.
}
```

- to refer to a reference text: `\cite{...}`

```
In \cite{Ramage04} we see that ...
```

Citing reference texts

- bibliography:

```
\begin{thebibliography}{99}
BIBLIOGRAPHY ITEMS
\end{thebibliography}
```

- sample bibliography entry:

```
\bibitem{Ramage04} {
A. Ramage, Famous Book, OUP, 2004.
}
```

- to refer to a reference text: `\cite{...}`

```
In \cite{Ramage04} we see that ...
```

- fancier methods available, e.g. bibtex

Including pictures

- most commonly, plots are in PostScript (.ps) or Encapsulated PostScript (.eps) files

Including pictures

- most commonly, plots are in PostScript (.ps) or Encapsulated PostScript (.eps) files

- many packages available, e.g. psfig, epsf etc

Including pictures

- most commonly, plots are in PostScript (.ps) or Encapsulated PostScript (.eps) files

- many packages available, e.g. psfig, epsf etc

- EXAMPLE
  - in preamble:
    ```
    \usepackage[dvips]{graphics}
    ```
  - in text:
    ```
    \begin{figure}[ht]
    \begin{center}
    \scalebox{0.3}{\includegraphics{fig.eps}}
    \end{center}
    \caption{An example of including a
    picture.  \label{fig1}}
    \end{figure}
    ```

Slides and presentations

- slides document style

$$\backslash\texttt{documentclass}\{\texttt{slides}\}$$

$$\backslash\texttt{begin}\{\texttt{slide}\}\texttt{...}\backslash\texttt{end}\{\texttt{slide}\}$$

Slides and presentations

- slides document style

$$\texttt{\textbackslash documentclass\{slides\}}$$

$$\texttt{\textbackslash begin\{slide\}...\textbackslash end\{slide\}}$$

- many more sophisticated packages available, e.g.

prosper

$$\texttt{http://prosper.sourceforge.net}$$

$$\texttt{http://www.ma.man.ac.uk/\textasciitilde mheil/Prosper/}$$

Packages and style files

- .sty, .cls files available from many sources:

  - colleagues and fellow students

  - publishers, e.g. siamltex, elsart

  - American Mathematical Society, e.g. amsfonts, amsmath, amssymb

$$\mathbb{R}, \mathbb{Z}, \mathbb{C}$$

```
$\mathbb{R}$, $\mathbb{Z}$, $\mathbb{C}$
```

  - UKTeX archive   `http://www.tex.ac.uk`

  - Google search!

Support Material

Available from:

`http://www.maths.strath.ac.uk`
`/~caas63/latex_course`

- LaTeX notes   `wpnotes.tex`
- sample file   `wpdoc.tex`
- sample figure   `fig1.eps`
- slides from this talk   `latex_talk.tex`
- Prosper document class   `prosper.cls`
- sample Prosper style file   `PPRramage.sty`