



Scientific Computing 372

L^AT_EX: Section 1

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Schedule

- 1 Introduction and setting text
 - 2 Setting mathematics
 - 3 Standard environments
 - 4 Tables and figures
 - 5 Boxes and new environments
 - 6 $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX
 - 7 Beamer and PGF
-
- Some wonderful and advanced things are possible with \LaTeX
 - Click [here](#) to see an example of a drawing
 - But first, the introductory stuff....

Introduction

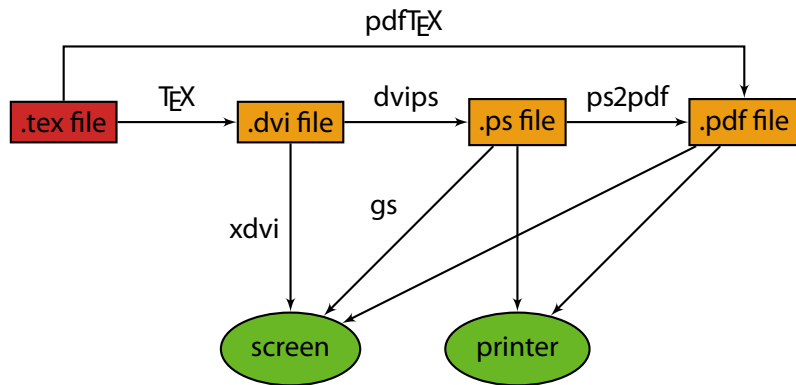
\LaTeX , whence came you, good sirrah?

- In the 1970s, Don Knuth, author of *The Art of Computer Programming*, was unhappy with the typographical quality of his books
- He wrote \TeX , a computer typesetting system to produce beautiful books—especially those full of mathematics
- \LaTeX is a collection of macros, by Leslie Lamport, to make using \TeX easier
- $\mathcal{A}\mathcal{M}\mathcal{S}\text{\LaTeX}$ is a collection of document classes and packages, supported by the American Mathematical Society
- All of these are open-source and free to use
- $\text{\TeX}/\text{\LaTeX}/\mathcal{A}\mathcal{M}\mathcal{S}\text{\LaTeX}$ is the international standard to create mathematics documents, journal articles, and so on

The philosophy of \LaTeX

- WYSIWYG: What You See Is What You Get.
Unfortunately, what you see is all you get....
- \LaTeX takes logical approach to document preparation:
 - Logical subparts of documents identified, e.g., chapters, sections, definitions, theorems, figures
 - All formatting done by style sheets
- \TeX is your typesetter; \LaTeX is your typographer
- Automatic (and adaptable)
 - Numbering of equations, chapters, sections, tables, figures, pages, theorems, and references
 - Layout, inclusion and numbering of bibliography
 - Margins, paragraphing, headings, captions, and layout of tables
- You can still design document styles yourself ... but out of the box, \LaTeX makes good decisions 95% of the time

\LaTeX processing flowchart



```
\documentclass{<class>}
```

The **preamble** contains commands and package references, but no text or mathematics. The first command is always `\documentclass`, and `<class>` determines the kind of document being produced.

```
\begin{document}
```

The **body** contains the contents of the document.

```
\end{document}
```

L^AT_EX: the input character set

Alphanumerical characters

Upper- and lowercase letters and the ten digits 0 to 9 are set as they appear in the input file.

Punctuation characters

Sixteen punctuation characters are also set as they appear:

. : ; , ? ! ' ' () [] - / * @

Special characters

The ten special characters are used only L^AT_EX commands:

\$ % & ~ _ ^ \ { }

Most L^AT_EX commands begin with a **backslash**.

The rest

+, =, |, <, and > are used mainly in mathematical formulae, although + and = can be used in ordinary text. The character " is used rarely.

L^AT_EX: spaces and paragraphs

“Invisible” characters

- Space characters, e.g., entered by the space bar or `<Tab>` key
- End-of-line, entered by the `<Enter>` key
- Considered the same by L^AT_EX

Spaces

Any sequence of space characters is handled the same as one space.

Paragraphs

A blank line, containing nothing but space characters is interpreted as the end of a paragraph. Rule-of-thumb: Start a new paragraph by pressing `<Enter>` `<Enter>`.

The document class

```
\documentclass[<options>]{<class>}
```

- \LaTeX documents must start with this command
- `<class>` specifies the type of document; available classes include `article`, `book`, and `letter`
- `<options>` pass optional settings to the class; for example, the options `10pt`, `11pt`, and `12pt` specifies the normal text size (`10pt` is the default)
- Classes are stored in files with names that end in `.cls`, but in \LaTeX we type their names without the extension

\LaTeX convention for command arguments

- Arguments between (curly) braces are mandatory
- Arguments between (square) brackets are optional
- This applies to all \LaTeX commands

```
\usepackage[<options>]{<package>}
```

- Packages provide extra functionality or override default L^AT_EX settings
- They are declared in the preamble
- Package filenames end in .sty, but in L^AT_EX we type their names without the extension
- Packages in common use include
 - `graphicx` to include graphics
 - `amsmath` for more advanced, but easier to use, math
 - `booktabs` for professional quality tables
 - `tikz` to draw beautiful graphics
 - `babel` to handle languages other than English
- There are even packages to typeset music ... but Lilypond is better

Setting text

\LaTeX modes

- Two modes: (1) text mode, and (2) math mode
- Text is typed normally in the document body
- We cover math mode in the next lecture

Example

The end of a word is indicated with a space.

One
is treated the same as
more.

One or more blank
lines start
a new paragraph.

The end of a word is indicated with a space. One is treated the same as more.

One or more blank lines start a new paragraph.

Setting text

Example (Quotation marks)

`‘‘I am Trogdor, ‘The Burninator’,’’ he said.
Yeah, and \LaTeX\ is fun.`

“I am Trogdor, ‘The Burninator’,” he said. Yeah, and L^AT_EX is fun.

Example (Special characters)

Seven of the special characters can produced with a backslash before the character: `\$, \&, \%, \#, _, \{, and \}`.

Seven of the special characters can produced with a backslash before the character: \$, &, %, #, -, {, and }.

Example (Dashes)

An intra-word dash, or hyphen, as in X-ray. A medium (en) dash for number ranges, like 13--17. A punctuation (em) dash---like this.

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Font sizes

Example (Text size)

- We don't set numeric sizes; choose from predefined settings
- A size setting stays in effect until it is changed explicitly
- Alternatively, enclose the setting and affected text in braces

`{\huge Prolixity}`

Prolixity

`{\LARGE Prolixity}`

Prolixity

`{\Large Prolixity}`

Prolixity

`{\large Prolixity}`

Prolixity

`{\normalsize Prolixity}`

Prolixity

`{\small Prolixity}`

Prolixity

`{\footnotesize Prolixity}`

Prolixity

`{\scriptsize Prolixity}`

Prolixity

`{\tiny Prolixity}`

Prolixity

Font weight and style

Command (PREFERRED)	Declaration/Modal	Style
<code>\textit{italics}</code>	<code>{\itshape italics}</code>	<i>italics</i>
<code>\textbf{bold}</code>	<code>{\bfseries bold}</code>	bold
<code>\textsl{slanted}</code>	<code>{\slshape slanted}</code>	<i>slanted</i>
<code>\textsc{Small Caps}</code>	<code>{\scshape Small Caps}</code>	SMALL CAPS
<code>\textrm{roman}</code>	<code>{\rmfamily roman}</code>	roman
<code>\textsf{sans serif}</code>	<code>{\sffamily sans serif}</code>	sans serif
<code>\texttt{typewriter}</code>	<code>{\ttfamily typewriter}</code>	typewriter

- Roman (or serif) is the normal typeface (`\upshape` and `\mdseries`)
- Do not use L^AT_EX 2.09 declarations, e.g., `\bf` or `\sc`
- Use `\emph{⟨text⟩}`, not `\textit{⟨text⟩}`, to emphasise text; its modal is `\em`
- The concept of emphasising changes with the context: On paper, italics is deemed best; on screen, boldface may work better
- Never, ever use `\underline{⟨formula⟩}` to emphasise text; reserve its use for math mode

Spacing

Rubber lengths

- Rubber lengths grow and shrink to fill available space
- Horizontal (`\hfill`) and vertical (`\vfill`)
- Use starred versions, `\hspace*{\fill}` and `\vspace*{\fill}`, for the beginning and ending of lines and pages, respectively
- Note how `\\` produces a break

Example

A normal line. `\\`
Filled `\hfill` space. `\\`
More `\hfill` than `\hfill`
one `\hfill` space. `\\`
Filled with `\dotfill`
dots. `\\` Filled with a
`\hrulefill` rule.

A normal line.
Filled space.
More than one space.
Filled withdots.
Filled with a _____rule.

Spacing

End of sentence spacing

- A period, question or exclamation mark is considered to end a sentence unless it follows an uppercase letter
- `\@` **before** a punctuation character forces T_EX to treat it as the end of a sentence
- `_` **after** a punctuation character produces an inter-word space

Example

Apples, pears, etc. were
on sale. \\
Apples, pears, etc.\ were
on sale. \\
Narga H. Where we work. \\
Narga H\@. Where we work.

Apples, pears, etc. were on sale.
Apples, pears, etc. were on sale.
Narga H. Where we work.
Narga H. Where we work.

Spacing

Example (Keeping it together)

The word sesquipedalian means “polysyllabic” and is used to describe long words.

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The word sesquipedalian means~“polysyllabic” and is used to describe long words.

The word sesquipedalian means “polysyllabic” and is used to describe long words.

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The word sesquipedalian means “polysyllabic” and is used to describe long words.

- `\mbox{<text>}` sets `<text>` in an LR box and thus prevents hyphenation
- `~` prevents a line break and forces a normal inter-word space
- Typically used to connect a title to a name or surname, or a number to the thing being numbered, e.g., Prof .~Bester and Math~314
- The last example results in an “Underfull `\hbox`” complaint

Miscellaneous

Example (Footnotes)

Mosquitoes\footnote{Small insects that really suck.} are everywhere in Stellenbosch.

Mosquitoes¹ are everywhere in Stellenbosch.

¹ Small insects that really suck.

Example (Ellipses)

Ellipses are \ldots \\
Ellipses are ...

Ellipses are ... correct
Ellipses are ... note spacing

Comments

Everything after % to the end of that line is ignored by \LaTeX

Hyphenation

- In the preamble, use `\hyphenation{ther-apist re-ify}`
- In the document body, use `\-`, e.g., `ther\-\apist`

Document title

- In the preamble:
 - `\title{<document title>}`
 - `\author{<authors>}` (different authors separated by `\and`)
 - `\date{<date>}` (optional)
- In the body, use `\maketitle`
- If `\date{<date>}` is not used, `\maketitle` defaults to the current date; be careful, it is formatted in the American way

Example

```
\documentclass{...}  
\title{Something Clever}  
\author{Don Knuth \and  
Leslie Lamport}  
\date{29 February 2012}  
\begin{document}  
\maketitle  
...  
\end{document}
```

Something Clever

Don Knuth Leslie Lamport

29 February 2012

Sectioning

- Hierarchical sectioning, in order of particularity: `\part`, `\chapter1`, `\section`, `\subsection`, `\subsubsection`, `\paragraph2`, `\subparagraph2`
- Normal versions output the argument with numbering and add an entry to the table of contents
- Starred versions suppress the numbering and do not include an entry in the table of contents

Example

```
\chapter{Writing Well}  
\section{Introduction}
```

Chapter 1

Writing Well

1.1 Introduction

¹Not available in article

²Usually unnumbered and not in the table of contents

Automatic references

Table of contents

Most unstarred sectioning commands generate automatic entries for the table of contents. Use `\tableofcontents` to insert the table of contents.

Cross-references

Assign a **key** of your choice to a sectional unit (and others) with `\label{⟨key⟩}`. Print the number (or reference value) with `\ref{⟨key⟩}`.

Example

```
\section{Introduction}
\label{intro}
...
...
```

```
\section{Detail}
For an overview, see
Section~\ref{intro}.
```

1 Introduction

2 Detail

For an overview, see Section 1.

Diacritics and other symbols

Diacritics

ó	\' {o}	õ	\~ {o}	ö	\v {o}	ç	\c {o}
ò	\' {o}	ō	\= {o}	ö	\H {o}	ø	\d {o}
ô	\^ {o}	ô	\, {o}	ôo	\t {oo}	ü	\b {o}
ö	\" {o}	ö	\u {o}				

Non-English symbols

œ	\oe	å	\aa	ł	\l	¿	?
Œ	\OE	Å	\AA	Ł	\L	¡	!
æ	\ae	ø	\o	ß	\ss		
Æ	\AE	Ø	\O				

Punctuation

†	\dag	§	\S	©	\copyright
‡	\ddag	¶	\P	£	\pounds

Drawing with TikZ

