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Scientific Computing 372
LaTeX §1: Introduction and setting text

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Admin

Schedule

1. Introduction and setting text
2. Setting mathematics
3. Standard environments
4. Tables and figures
5. Boxes and new environments
6. $\mathcal{AMS}$-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

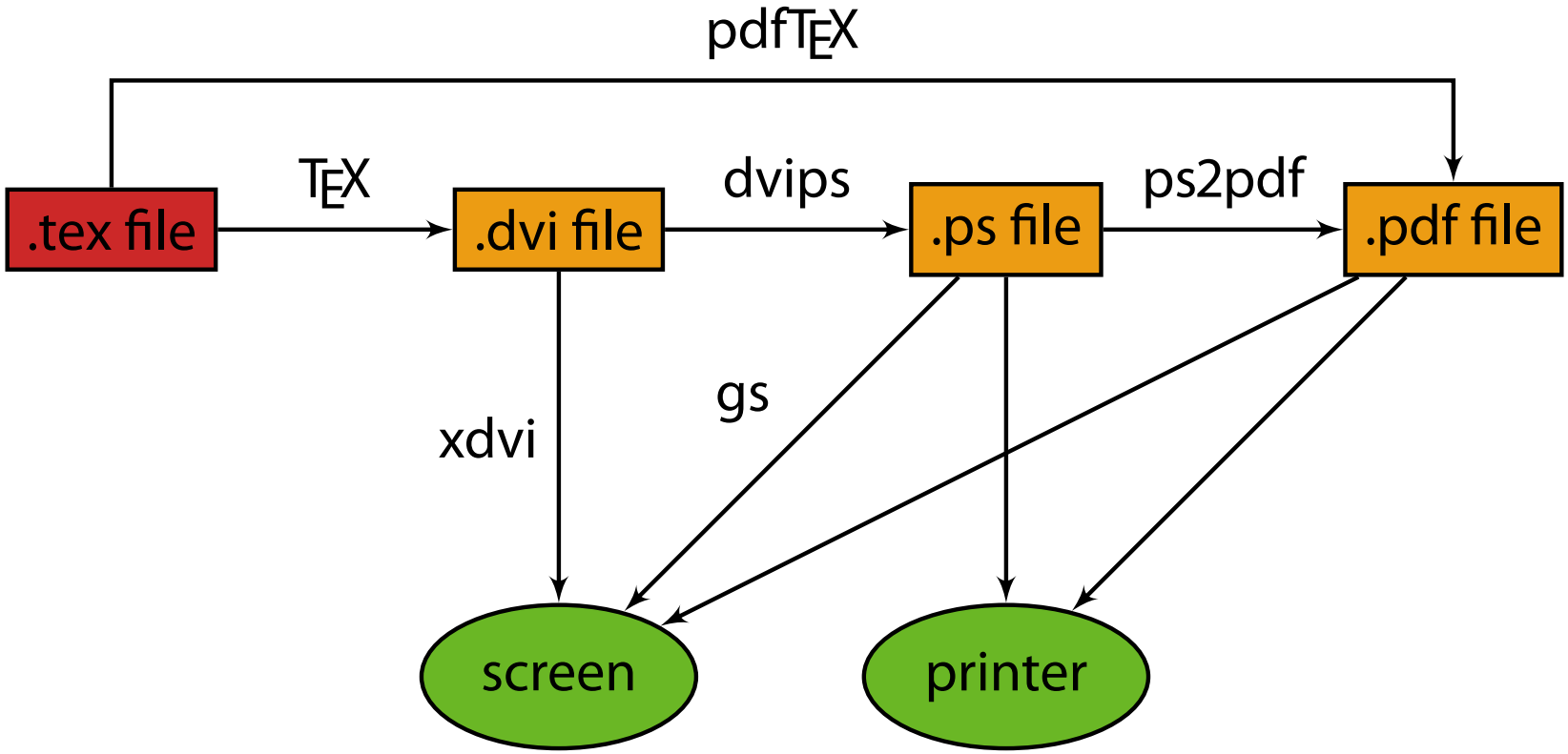
LaTeX, whence came you, good sirrah?

- 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
- $\mathcal{AMS}$-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
- TeX/LaTeX/$\mathcal{AMS}$-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



LaTeX file layout

```
\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}
```

LaTeX: 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 LaTeX commands:

`# $ % & ~ _ ^ \ { }`

Most LaTeX 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.

LaTeX: 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 LaTeX

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

LaTeX packages

`\usepackage[`⟨options⟩`]{`⟨package⟩`}`

- Packages provide extra functionality or override default LaTeX settings
- They are declared in the preamble
- Package filenames end in `.sty`, but in LaTeX 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 LaTeX 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.
```

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.

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
`\textit{italics}`	`{\itshape italics}`	*italics*
`\textbf{bold}`	`{\bfseries bold}`	**bold**
`\textsl{slanted}`	`{\slshape slanted}`	*slanted*
`\textsc{Small Caps}`	`{\scshape Small Caps}`	Small Caps
`\textrm{roman}`	`{\rmfamily roman}`	roman
`\textsf{sans serif}`	`{\sffamily sans serif}`	sans serif
`\texttt{typewriter}`	`{\ttfamily typewriter}`	`typewriter`

- Roman (or serif) is the normal typeface (`\upshape` and `\mdseries`)
- Do not use LaTeX 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

Unit	Name/Description	Relative length
`mm`	millimetre	
`cm`	centimetre	
`in`	inch	
`pc`	pica	
`pt`	point	
`ex`	± height of “x” in current font size	
`em`	± width of “M” in current font size	

- `1in = 2.54cm = 25.4mm = 72.27pt` and `1pc = 12pt`

Example (Spacing)

```
A horizontal\hspace{1cm}
space and a vertical
\vspace{0.5cm}

space. (Note the blank
line in the input.)
```

A horizontal space and a vertical

space. (Note the blank line in the input.)

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 with .....dots.
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 TEX 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.
```

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

```
The word sesquipedalian means
``polysyllabic'' and is used
to \mbox{describe} long words.
```

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

```
The word sesquipedalian
means~``polysyllabic'' and is
used to describe long words.
```

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.
```

Mosquitoes[1] 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

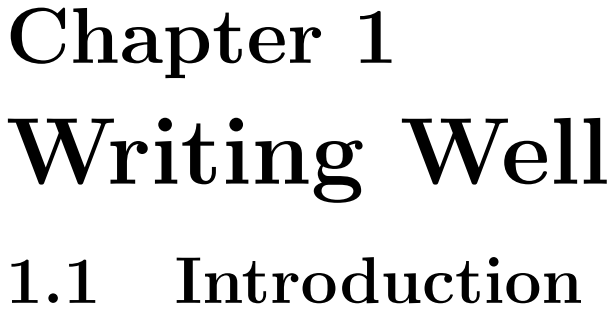
29 February 2012

Sectioning

- Hierarchical sectioning, in order of particularity: `\part`, `\chapter`[1], `\section`, `\subsection`, `\subsubsection`, `\paragraph`[2], `\subparagraph`[2]
- 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}
```



[1] Not available in `article`

[2] Usually 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}	ǒ	\v{o}	o̧	\c{o}
ò	\`{o}	ō	\={o}	ő	\H{o}	ọ	\d{o}
ô	\^{o}	ȯ	\.{o}	o͡o	\t{oo}	o̲	\b{o}
ö	\"{o}	ŏ	\u{o}				

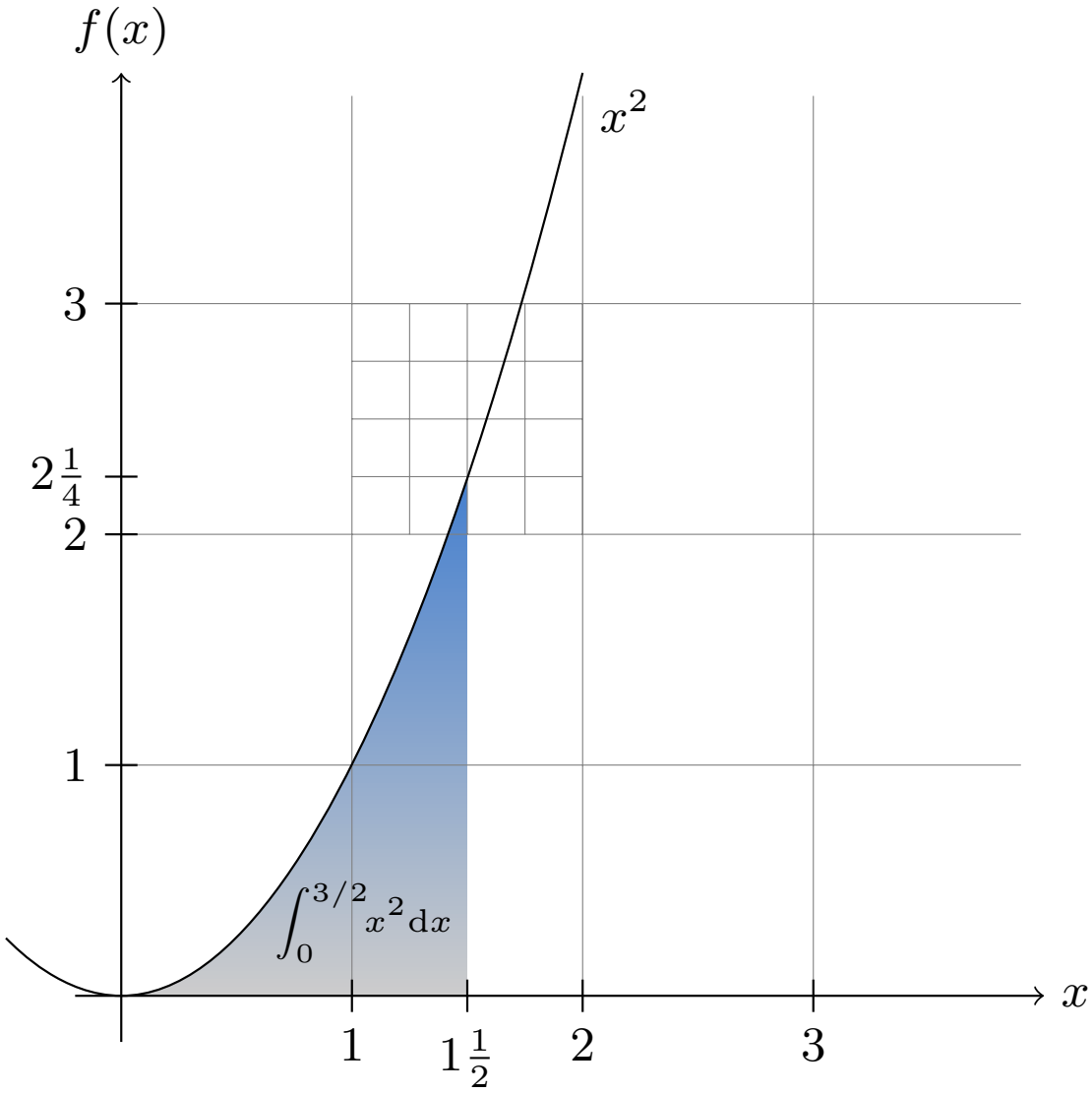
Non-English symbols

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



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