LaTeX in a Nutshell

Master on Libre Software 2011-12

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GSyC

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What is TeX

- A computer program (language and interpreter) created by Donald Knuth in 1977.
- Knuth wrote the TeX typesetting engine to explore potential of the digital printing equipment.
- He aimed to revert trend of deteriorating typographical quality that affected his own books and articles.
- Two main aims: highest quality and highest durability.

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What is TeX

- TeX as we use it today was released in 1982, with some slight enhancements added in 1989 (8-bit characters support).
- One of the most sophisticated digital typographical systems ("The greatest contribution in the printing world since Gutenberg").
- Popular in academia, especially in mathematics, computer science, engineering, and physics.
- Open Source Software ("public domain" dedication): but any modified version must not be called TeX!

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What is TeX

- TeX understands about 300 low-level commands ("primitives"). Primitives are rarely used directly by users.
- The smallest unit of length handled by TeX is 0,000005356mm! (*scaled point*, 1 mm = 186712sp)
- Functionality is provided by format files (predumped memory images of TeX after large macro collections have been loaded).

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What is TeX

- Written in a 'literate' programming language called Web.
- TRIP and TRAP tests ("conformance test"): portable, same output with all versions.
- The design was frozen (and dedicated to Public Domain) in October 1990 (v3.1* −π−, no new features, only bug fixes).

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METAFONT

- Font description language to describe characters (glyphs) algorithmically with geometrical equations.

- It uses Bézier curves (vector graphics).

- Also created by Knuth but not strictly part of TeX.

- It is possible to use TeX and LaTeX without METAFONT. Adobe PostScript fonts may be used instead.

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What is LaTeX

- Set of macros from TeX primitives that abstracted away many of the TeX complexities.

- A "format" originally developed by Leslie Lamport.

- It incorporates document styles for books, letters, slides, etc.

- The current version is LaTeX2e.

- LaTeX is Open Source Software (LaTeX Project Public License - LPPL), OSI-compliant.

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How to pronounce and spell "LaTeX"

- "TeX", "LaTeX", or "LaTeX" (ASCII), no "Latex".
- Pronounced /látej/ or /látek/, no 'latex'!
- It derives from the Ancient Greek: $\tau\epsilon\chi\nu\eta$ (*tej*né: "skill, art, technique")
- χ: *Ji* letter (voiceless velar fricative, as "ojo" or "Bach"), *Chi* /kai/ in English.
- IPA (International Phonetic Alphabet): [x] phonem

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Advantages

- Control
- Quality
- Flexibility
- Portability
- Scalability
- Stability

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Advantages (2)

- Typesetting, not "word processing" (LibreOffice, MS Office, etc.).
- Accurate, precise output (device independent).
- It prevents formatting errors (by forcing to declare logical structure).
- Separate content and styling.

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Advantages (3)

- Modular (add-on packages), powerful and highly portable (text files).
- Easy to make global changes; encourage content reuse.
- Complex structures (footnotes, references, table of contents, and bibliographies) can be generated easily.
- Professional output: look as if "printed".

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Caveats

- Not WYSIWIG.

- Hard learning curve.

- Absolute space/positioning is tricky (it's very hard to write disorganized documents).

- Design of a whole new layout is difficult and takes a lot of time.

- Need to be compiled.

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MS Word vs LaTeX

Compare kerning:

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Compare kerning:

Compare Small Caps:

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Compare kerning:

Compare Small Caps:

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MS Word vs LaTeX

Table

MS Word (*wrong* default kerning)

Table

LaTeX (correct kerning)

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Table

MS Word (*wrong* default kerning)

Table

LaTeX (correct kerning)

AAa AB Bc Cd

MS Word (*fake* small caps)

AAa AB Bc Cd

LaTeX (real small caps)

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LaTeX (real small caps)

Source images: Dario Taraborelli
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MS Word vs LaTeX: ligatures

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MS Word vs LaTeX: ligatures

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MS Word vs LaTeX: ligatures

MS Word (*wrong* use of ligatures)

LaTeX(correct use of ligatures)

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MS Word vs LaTeX: ligatures

MS Word (*wrong* use of ligatures)

LaTeX(correct use of ligatures)

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Installing LaTeX

For using LaTeX you need:

- A text editor for editing your LaTeX source files.
- A LaTeX distribution for processing (compiling) your LaTeX source files into PDF or DVI documents.
- A PDF/DVI viewer for previewing and printing documents.

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The simplest document

```
% Example #1
\documentclass{article}
\begin{document}
Hello World! This is a minimal \LaTeX{} document.
\end{document}
```

Hello World! This is a minimal LaTeX document.

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Document workflow

Editor ('foobar.tex') → LATeX processor ('foobar.dvi') →
display (viewer/screen) → drivers ('foobar.ps', printer)

```
$ latex foobar.tex ('tex &latex foobar.tex')
$ dvips -o foobar.ps foobar.dvi (ps output)
$ pdflatex foobar.tex (pdf output)
$ hevea foobar.tex  (html output)
```

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DVI Output

- Device independent file format (`.dvi`)
- Binary data independent on any specific image format, display hardware or printer.
- A LaTeX distribution for processing (compiling) your LaTeX source files into PDF or DVI documents.
- DVI is not a document encryption format.
- Not support embedded fonts (fonts must be already installed).

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xdvi: DVI Previewer

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LaTeX Distributions

There are pre-compiled LaTeX distributions for different OS:

- TeX Live (Unix-like systems): Linux, BSD, Solaris, etc.
- MacTeX (TeX Live with the addition of Mac specific programs): `http://www.tug.org/mactex`
- MiKTeX (Windows): `http://www.miktex.org`

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Document Structure

Two main environments:

- Preamble: commands and macros that affect the entire document.
    - Top matter: author, title, date, institution, etc.
- Document environment: body text

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Preamble

- Everything from the start of the LaTeX source file until the `begin{document}` command

- It normally contains global commands that affect the entire document.

```
\documentclass[options]{class}
\usepackage[options]{package}
```

class (mandatory): book, article, report
package (optional): to utilize external macros (`inputenc`, `amssymb`...)

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Top Matter

- Title, date
- Information about the authors, such as name, address, email etc.

```
\documentclass[11pt,a4paper,oneside]{report}
\usepackage[utf8]{inputenc} % utf-8 encoding
\usepackage{amssymb}  % math symbols

\begin{document}
\title{How to Structure a LaTeX Document}
\author{Andrew Roberts}
\date{December 2004}
\maketitle
\end{document}
```

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Body text

- Abstract
- Parts, chapters, sections, subsections,
- Appendices, Bibliography...

```
\begin{document}
  ... text mixed with local commands ...
\end{document}
```

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How to Structure a LaTeX Document

LaTeX allows to structure documents with a variety of hierarchical constructs:

```
\part{Part Title}
\chapter{Chapter Title} %only books and reports
\section{Section Title}
\subsection{Subsection Title}
\subsubsection{Subsubsection Title}
```

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Font Styles

```
\textit{...} % italics
\textbf{...} % bold
\texttt{...} % monospace - teletype
\textsc{...} % small capitals
```

Example:

```
\LaTeX{} was \texttt{originally} written in
\textbf{1984} by \textsc{Leslie Lamport} and has become
the \textit{dominant} method for using \TeX.
```

Output:

LaTeX was `originally` written in **1984** by Leslie Lamport and has become the *dominant* method for using TeX.

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Font Sizes

```
\tiny
\scriptsize
\footnotesize
\small
\normalsize
\large
\Large
\LARGE
\huge
\Huge
```

Size related to font size default, declared in preamble (documentclass)

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Font Sizes. Example

```
\LaTeX{} was \tiny originally written
\normalsize in \large 1984 \normalsize by
\LARGE Leslie Lamport \normalsize and has
become the \footnotesize dominant method
\normalsize for using \huge \TeX.
```

Output:

LaTeX was originally written in 1984 by Leslie Lamport and has

become the dominant method for using TeX.

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Some special features

- Text aligned
- $n > 1$ blank lines and empty spaces: one line or one space
- Start a new paragraph: `\\`
- Hyphenate the word (exceptional cases): `man\-u\-script`
- `\newline`, `\newpage`

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Environments

```
\begin{environment name}
\end{environment name}
```

Environments: center, itemize, enumerate, figure, flushright, quotation...

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Environments: example

```
Some FOSS Licenses:
\begin{enumerate}
\item BSD license
\item GPL license
\item CDDL license
\end{enumerate}
```

Output:

Some FOSS Licenses:

1. BSD license

2. GPL license

3. CDDL license

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```
\usepackage[utf8]{inputenc}
\title{The beauty of \TeX}
\author{Donald E. Knuth}
\date{\1979}

\begin{document}
  \maketitle

% This is the comment body.
''Mathematical books and journals do not look as
beautiful as they used to. It is not that their
mathematical content is unsatisfactory, rather that the
old and well-developed traditions of typesetting have
become too expensive. Fortunately, it now appears that
mathematics itself can be used to solve this problem.''

\end{document}
```

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The beauty of TEX

Donald E. Knuth

1979

"Mathematical books and journals do not look as beautiful as they used to. It is not that their mathematical content is unsatisfactory, rather that the old and well-developed traditions of typesetting have become too expensive. Fortunately, it now appears that mathematics itself can be used to solve this problem."

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