An Introduction to TeX and LaTeX:

Lecture 1: The Basics

Thursday 19 October 2017

- Background
- Getting equipped
- Getting started in LaTeX
- Basics of TeX

The background

TEX is a typesetting system

Designed with mathematics particularly in mind

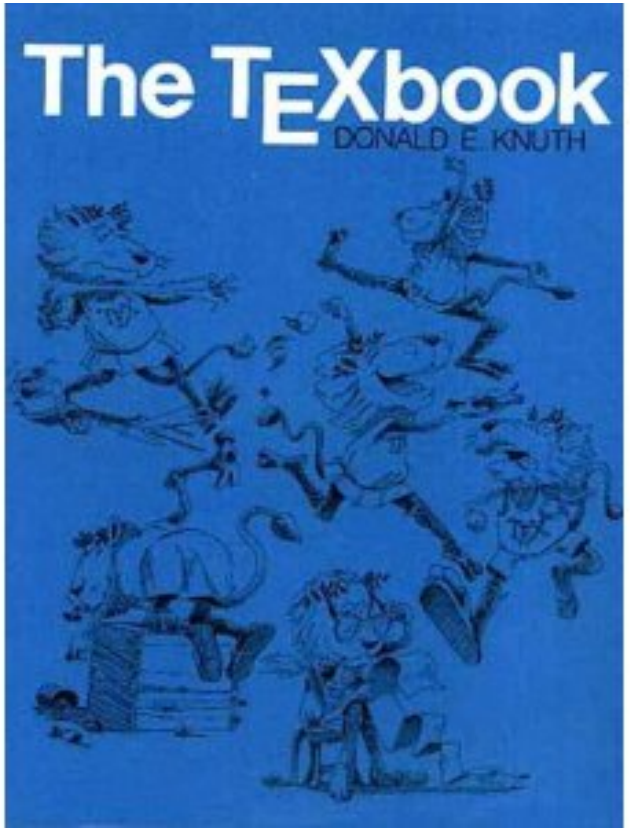
Excellent for text, but also typesets formulae to the highest standards of mathematical typography

Created by the great Donald Knuth

Published in his beautiful The TEXbook (1984)

Knuth and his book

Donald Knuth of Stanford U.



The TeXbook (1984)

Dialects of TEX

TEX calls on style files, font packages, other packages, etc. to produce desired style

Main dialects: PlainTEX, AMSTEX, LATEX

LATEX created by Leslie Lamport (1985)

LATEX is perhaps more than just a dialect: it is an overlay of TEX designed for organising documents as preprints, articles, books, letters, etc.

LATEX has become industry standard; most publishers require authors to submit LATEX source material; as does Oxford Mathematics Department

Type-setting mathematics: background

1439–50: Gutenberg invents printing from movable type

1885: Monotype machine casts hot lead in whole pages

Photosetting replaces hot metal from 1960s

Computer-setting + laser-printing from 1980s

Now: we do our own type-setting using TEX and LATEX.

Learn their proper use: don't make a mess of it!

Getting equipped

You need an editor for plain-text input file

You need a compiler

You need a source of advice

All available in the Mathematical Institute:

https://www.maths.ox.ac.uk/members/it/faqs/latex

Personal TEX equipment

Several TEX systems available free of charge for download from the web—see cited web-page, especially CTAN

Myself, I use TeXLive as my TEX system and Texmaker as a front end

Front end = editor into which to type my plain-text
together with click-buttons to compile and view documents

All such systems are available for MS-Windows, Apple Mac, Linux etc.

Web-based LATEX systems, such as ShareLaTeX and Overleaf provide immediate compilation and permit collaborative editing

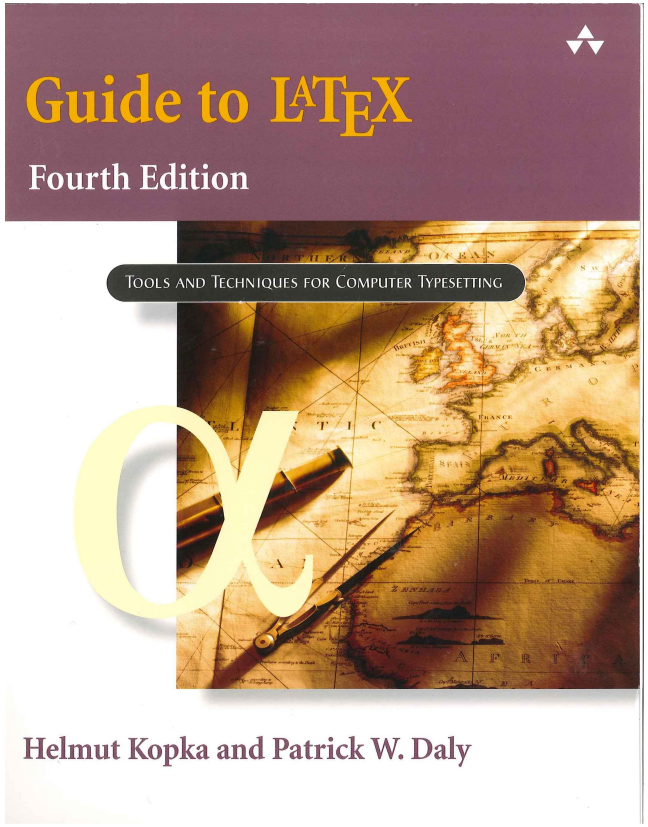
A recommended manual

Helmut Kopka &
Patrick W. Daly

A Guide to LaTeX

(4th ed.) Addison-Wesley 2003

Comes with TeX Live 2003 CD
(free TeX software)



Getting started in LaTeX

TEX and LATEX are programming languages

Commands are introduced with a backslash \

Example: `\TeX` tells the compiler (type-setter) to produce TEX

Example: `\noindent` at the start of a paragraph ensures that the paragraph is not indented

An important fact

Commands have form `\string` where '`string`' is a string of letters

Compiler seeks first non-letter key-stroke after backslash and stops there

Non-letter key-stroke might be a space, a numeral, a punctuation mark—anything non-literal

TEX takes this literally: spaces after a command are taken simply as command terminator, so do not appear as a space

Example:

```
\LaTeX is a wonderful system
```

produces LaTeXis a wonderful system

LaTeX input file

The basic structure of a LaTeX input file consists of just three command lines with lines of other material between them:

```
\documentclass[X]{Y}
```

[Preamble]

```
\begin{document}
```

Your text

```
\end{document}
```

Here **X** is optional, **Y** is not; preamble material is optional

The document class

Options X available to \documentclass tell compiler about font size, paper size, etc.: see any LaTeX manual

Class Y tells compiler what kind of document is to be produced;

it is a name for a class file such as book, article, report, letter;

most publishers have their own class file filename.cls or filename.sty which they require their authors to use

Thus the first line of my lecture-notes file is

```
\documentclass[a4paper,11pt]{article}
```

The preamble

Preamble follows the 'documentclass' line to give further information about preferences

Example: the two next lines in my file are

```
\usepackage{latexsym,amssymb}
\usepackage{graphicx}
```

First tells system to summon up LaTeX and AMS special symbol files and commands; second requests one of the packages permitting me to insert pictures

The rest of my preamble contains my definitions of commands that I personally find useful

The basics of TEX

TEX program distinguishes text mode from math mode

Text is the natural mode—the compiler sets your typing into the specified type-fount, computes optimal line-breaks, computes optimal page-breaks, etc.

Important: When compiling, the system treats any positive number of inter-word spaces in your input file as just one space; it treats a single line break as an inter-word space

But when it meets one or more blank lines it takes this as an instruction to start a new paragraph

Therefore if you really want extra horizontal or vertical space you must use explicit commands (to be discussed later) to impose your will

Math mode, I

Mathmode comes in two forms, textstyle and displaystyle

Textstyle is for setting formulae such as $ax^2 + bx + c$ within text

Displaystyle is for complicated or lengthy formulae such as

$$f(a) = \int_{\Gamma_r(a)} \frac{f(z)}{z-a}\,\mathrm{d}z$$

or

$$f(a) = f(0) + f'(0)a + \frac{f''(0)}{2!}a^2 + \cdots + \frac{f^{(n-1}(0)}{(n-1)!}a^{n-1} + R_n(f,a),$$

which can be too cramped or hard to read if embedded in text

Math mode, II: textstyle

Textstyle mathmode is created by enclosing the required formulae between dollar symbols.

The quadratic formula above came from `$ax^2 + bx + c$`.

In LaTeX one has alternative versions

```
\(ax^2 + bx + c\)
```

```
\begin{math}ax^2 + bx + c\end{math}
```

I do not know why

Math mode, III: displaystyle

Displaymath is created by enclosing the required formula-describing text between double dollar signs
(there are alternatives to be mentioned later)

Examples:

```
$$
 f(a) = \int_{\Gamma_r(a)} {f(z)\over z - a}\ \mathrm{d}z
$$


$$
 f(a) = f(0) + f'(0)a + {f''(0) \over 2!}a^2 + \cdots
 + {f^{(n-1}(0) \over (n-1)!} a^{n-1} + R_n(f,a),
$$
```

Important note: Modern LaTeX has `\[ \]` replacing `$$ $$`

Two further lectures

Lecture 2: The interior and the exterior of documents

The interior: how to get TEX to give you what you want in text and mathematical formulae

The exterior: how to format a document in LATEX—including how to control your bibliography

Lecture 3: Sense and sensibility

Errors to avoid: how not to use LATEX

Style: some pointers about typography