

An Introduction to TeX and LaTeX:

Lecture 1: The Basics

Tuesday 11 October 2016

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

The background

T_EX is a typesetting system

Designed with mathematics particularly in mind

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

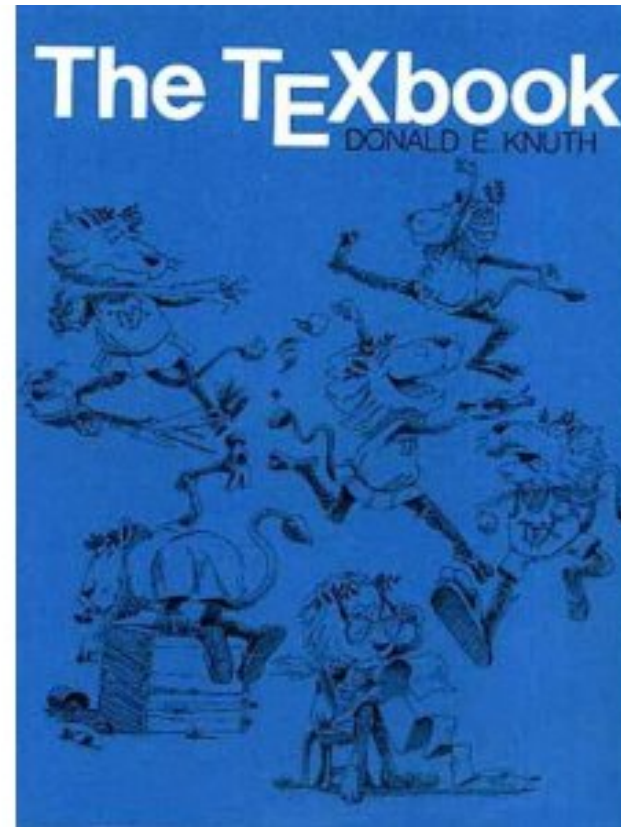
Created by the great **Donald Knuth**

Published in his beautiful **The T_EXbook** (1984)

Knuth and his book



Donald Knuth of Stanford U.



The TeXbook (1984)

Dialects of T_EX

In use T_EX calls on style files, font packages, other packages, etc. to produce desired style

Main dialects: PlainT_EX, AMST_EX, L^AT_EX

L^AT_EX created by [Leslie Lamport](#) (1985)

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

L^AT_EX has become industry standard; most publishers require authors to submit L^AT_EX 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 $\text{T}_{\text{E}}\text{X}$ and $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$.

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 T_EX equipment

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

Myself, I use [TeXLive](#) as my T_EX 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.

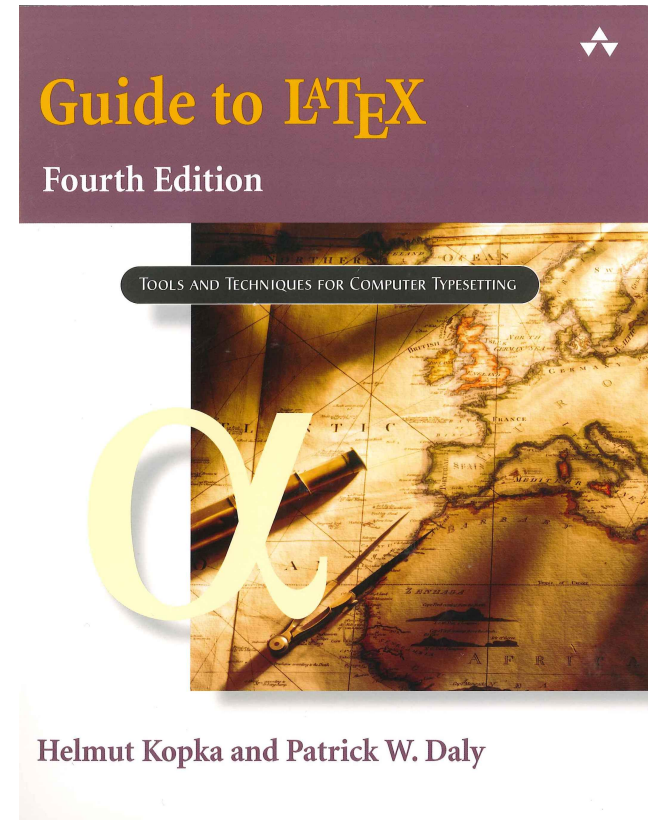
A recommended manual

Helmut Kopka &
Patrick W. Daly

A Guide to L^AT_EX

(4th ed.) Addison-Wesley 2003

Comes with T_EX Live 2003 cd
(free T_EX software)



Getting started in LaTeX

$\text{T}_{\text{E}}\text{X}$ and $\text{L}\text{A}\text{T}_{\text{E}}\text{X}$ are programming languages

Commands are introduced with a backslash `\`

Example: `\TeX` tells the compiler (type-setter) to produce $\text{T}_{\text{E}}\text{X}$

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

$\text{T}_{\text{E}}\text{X}$ 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 $\text{L}\text{A}\text{T}_{\text{E}}\text{X}$ is 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**; 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 T_EX

T_EX program distinguishes **text mode** from **math mode**

Text is the natural mode—the compiler sets your typing into the specified type-fount, chooses line-breaks, chooses 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

$$f(a) = \int_{\Gamma_r(a)} \frac{f(z)}{z - a} dz$$

or

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

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:

\$\$

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

\$\$

\$\$

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

\$\$

Important note: Modern \LaTeX has $\left[\right]$ replacing $\$ \$$

Two further lectures

Lecture 2: The interior and the exterior of documents

The interior: how to get $\text{T}_{\text{E}}\text{X}$ to give you what you want in text and mathematical formulae

The exterior: how to format a document in $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ —including how to control your bibliography

Lecture 3: Sense and sensibility

Errors to avoid: how not to use $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$

Style: some pointers about typography