

A Short Introduction to L^AT_EX

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1 Introduction

T_EX, written by Donald Knuth, is a very powerful computer typesetting program. L^AT_EX, originally written by Leslie Lamport, is a large set of macros (essentially, shortcuts) for T_EX. Most people use L^AT_EX rather than “plain” T_EX. If you want to know, T_EX is pronounced “tech” rather than “tex” (that’s a Greek Chi on the end).

Typesetting with L^AT_EX can get as sophisticated as you like—it can be used to produce printed copy that is better than most books being published these days—but we will stick to the basics here.

The basic idea with T_EX and L^AT_EX is that you start with a plain text (ascii) file containing the text you want to typeset. You indicate the way you want the typesetting done by means of certain special codes, most of which begin with a backslash (\backslash). When the text file is ready, you “compile” it using the T_EX processor, then preview the product on screen. If it is OK you can go ahead and print it, otherwise you go back to the editing stage, re-compile the file, preview it again, and so on.

Superficially, L^AT_EX looks more difficult to use than a standard word processor, because it is not WYSIWYG (“What you see is what you get”). As you are typing your basic text file with the typesetting commands included, you do not see what it will look like after compilation. But after a little practice you will find this is not really a problem. Also, when you get to the preview stage, “what you see” is a considerably more accurate representation of “what you’ll get” at the printer than with ordinary word processors. The great advantages of L^AT_EX over word processors are:

- You don’t have to fuss with the detailed appearance of your document. You concentrate on (a) getting the text right and (b) the overall logical structure of the piece. T_EX takes care of the detailed formatting.

- The support for the typesetting of mathematics is unrivaled.
- Input files for T_EX are entirely portable. If I have a document in the form of a L^AT_EX file I can email it to anyone who has access to the T_EX processor—whether on the PC, the Mac, or a Unix system—and they will be able to reproduce the same printed document.

2 Document skeleton

The skeleton of a L^AT_EX document looks like this:

```
\documentclass{article}

\begin{document}

Blahblahblah... etc.

\end{document}
```

Note the backslashes at the beginning of every special command line.

The first line specifies the type or class of the document, in this case an article. This is the class you are mostly likely to use (other classes include report, book and letter). The default print size for an article is 10-point type. If you find this a bit too small you can use the 11-point (or even the 12-point) option:

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

Beyond that, the `\begin{document}`, `\end{document}` pair constitutes the minimal set of special commands for a “legal” L^AT_EX document. In between these commands goes your text.

Moving beyond the minimal involves learning a little about these topics:

- Document-structuring commands
- Typeface-changing commands
- Special characters
- L^AT_EX math mode

We will examine these in turn.

3 Document-structuring commands

3.1 Lines and paragraphs

You needn't pay much attention to the line breaks in your source file; \LaTeX will make its own decisions on where to break lines in order to produce properly justified text (unless you specify `\raggedright`, in which case the processor will still make its own decisions, but will not adjust line lengths for a smooth right margin). The only important thing to remember is that if you want a paragraph break, insert a blank line, or in other words hit the Enter key twice in your source file.

3.2 Author, title, date

The title and author's name can be inserted at the beginning of a document thus:

```
\title{Pride and Prejudice}  
\author{Jane Austen}  
\maketitle
```

Coding the elements in this way will automatically put them into a centered format, using a larger font than the basic text. The `\maketitle` command also inserts the date on which the document is compiled. Since this is inappropriate for *Pride and Prejudice* it can be overridden by specifying a date...

```
\date{1813}
```

before `\maketitle`.

3.3 Sectioning

Couldn't be easier: Just type `\section{<text>}`, replacing `<text>` with the specific section-heading you want to use. The section-heading text will be automatically formatted, put in boldface type, and given a number. The numbers will be recalculated if you move text around. For example, the section-heading above was produced using

```
\section{Document-structuring commands}
```

Variations: If you want an unnumbered section heading, do

```
\section*{Example of unnumbered heading}
```

That is, adding a `*` turns off the numbering. If you want a subsection heading, use `\subsection{}`. You turn off the numbering for subsections in the same way.

3.4 Footnotes

To insert a footnote, just type (in the text itself, where you want the footnote-marker to appear) `\footnote{<text>}`, where `<text>` is replaced by the text of the footnote. The notes will be typeset at the foot of the page in a smaller type-size, and will be automatically numbered.

3.5 Itemized lists

To get a bulleted list, just do

```
\begin{itemize}
\item This is a first item.
\item And this is a second one.
\item And so on...
\end{itemize}
```

To have the list enumerated rather than bulleted, use `\begin{enumerate}` and `\end{enumerate}` instead. The numbering will be taken care of automatically.

4 Typeface-changing commands

You will need less of these than with a standard word processor, because \LaTeX is smart enough to change the typeface itself, in a consistent and pleasing manner, for section-headings, footnotes and other special features of the text. But sometimes you want italics for a book-title or for emphasis, boldface for emphasis or definitions, or whatever. Here is how to do it:

This <i>word</i> is in italics:	This <code>{\it word}</code> is in italics
These words in boldface:	<code>{\bf These words}</code> in boldface
Here's one in typewriter:	Here's one in <code>{\tt typewriter}</code>
And some SMALL CAPS:	And some <code>{\sc Small Caps}</code>

That is, put braces ‘{’ and ‘}’ around the text the typeface of which you wish to change, and insert the readily memorable code for the type-style you want.

5 Special characters

The issue of special characters (outside of math mode, which is discussed below) arises in two instances:

- When you want a character that is not in the ASCII character set (and not on the computer keyboard).
- When you want to use in your text a character that has a special meaning to \TeX .

Take the non-ASCII characters first. You can consult one of the standard \LaTeX references (at the end of this document) for a full listing, but here are a few of the most common ones.

- Left-hand curly double-quote (“): type two accent graves or whatever you want to call them (up at the top left of the keyboard, next to the number ‘1’). Type just one of these for a single left-hand quote (‘).
- Right-hand curly double-quote (”): type two single straight quotes (next to the ‘Enter’ key). Type just one for a single right-hand quote (’).
- Endash: This is properly used in place of a hyphen in giving number ranges (pp. 121–34; the war of 1914–18). Type two hyphens in succession (1914--18).
- Emdash: The proper “dash” to use in punctuating text—like this. Type three hyphens in succession.

Getting the above-mentioned symbols right is a matter of good style. But dealing correctly with the symbols that have a special meaning to \TeX is essential if your file is to compile correctly. Watch out for the following in particular:

- The dollar sign (\$): This is used as the delimiter for \LaTeX ’s math mode (see below). If you want a regular dollar sign in your text (like this: \$9.99) you must prefix it with a backslash (like this: \backslash \$9.99).

- The percent sign (%): This is used as the comment character in $\text{T}_{\text{E}}\text{X}$: Anything following this sign on a given line of a $\text{T}_{\text{E}}\text{X}$ input file is ignored by the processor. If you want one in your text, use $\%$.
- The ampersand (&): This is used as the tab character in $\text{T}_{\text{E}}\text{X}$: Type $\&$ if you want an ampersand to appear in the text.

6 $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ math mode

As mentioned above, the ability to typeset math accurately is one of the principal attractions of $\text{T}_{\text{E}}\text{X}$ and $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$. To get started at this, you need to know the way into the two math modes. To get into inline math mode, type a dollar sign, $\$$. Type another one to exit. By “inline math” I mean mathematical symbols that appear as part of the regular text. To get into display math mode (for equations that are set off on lines by themselves), type $\$$ (or $\backslash[$). To terminate this mode, close with $\$$ again, or $\backslash]$ if you started with $\backslash[$. One other variant should be mentioned: if you want an automatically numbered equation, enter math mode with $\backslashbegin{equation}$ and exit with $\backslashend{equation}$.

Once in math mode, you don’t have to worry about the spacing of what you type; $\text{T}_{\text{E}}\text{X}$ will take care of that. You do have to remember (or look up) some fairly simple codes for symbols that do not appear on the keyboard, and for special mathematical ways of arranging symbols. The standard references will give you all the details. For now, you can learn some of the basics by example.

$y = f(x)$	$\$y=f(x)\$$
$y_t = \alpha + \beta x_t + \epsilon_t$	$\$y_t=\backslashalpha + \backslashbeta x_t + \backslashepsilon_t\$$
$\frac{1}{3} = 0.333\dots$	$\$\frac{1}{3}=0.333\backslashdots\$$
$\frac{\partial x}{\partial y} = h(x)$	$\$\frac{\backslashpartial x}{\backslashpartial y}=h(x)\$$
$8 \times 9 = 72$	$\$8 \backslashtimes 9 = 72\$$
$MV \equiv PT$	$\$MV \backslashequiv PT\$$
$y = x^2$	$\$y=x^2\$$

As you can see, in math mode the Greek letters are obtained simply by spelling them out in English, preceded by a backslash. To get the uppercase versions, just capitalize the first letter (for instance $\$Delta\$$ gives Δ).

Subscripts and superscripts are obtained in math mode by means of `_` and `^` respectively. For complex subscripts and superscripts, enclose the argument in braces (for instance `$K^{\alpha + \beta}$` gives $K^{\alpha+\beta}$).

7 Files and filenames

At this point it may also be useful to learn about the file-naming conventions in the \TeX world. Your input file (text plus formatting commands) is typically given a `.tex` extension (for example `myfile.tex`). The \TeX processor takes this as input and outputs a `.dvi` file (e.g. `myfile.dvi`). This extension indicates that the file is “Device Independent”—it contains all the typesetting information, but in a generic format. The task of the previewer and/or printing program is to transform the `dvi` file into something understandable by your particular video display and/or printer. In the process of creating a `dvi` file, the processor also writes a `log` file and an `aux` file. Generally you won’t be much concerned with these, but if things go wrong the `log` file may contain some useful information.

8 About the software

Although these pieces of software may be bundled together in a package, you need three or four distinct programs to constitute a fully functional \LaTeX system.

1. A suitable editor for preparing and modifying your input files.
2. The \TeX processor itself.
3. A program to display the compiled version of your file on screen.
4. A program to convert the compiled file into a form suitable for sending to your printer (may be the same program as 3).

The wonderful thing about all this software is that it is in the public domain. You can download it for free from any one of many archive sites maintained at both academic institutions and commercial Internet servers around the world. In the USA, one such site is `ftp.cdrom.com`. At this site, you’ll find a huge amount of \TeX stuff for all different operating systems in the directory `/pub/tex/ctan` and its subdirectories.

Further reading

The basic source on \LaTeX is Leslie Lamport's *\LaTeX , A Document Preparation System*, Second Edition, Addison-Wesley, 1994. Another useful reference is Goossens *et al.*, *The \LaTeX Companion*, Addison-Wesley, 1994. For anyone who gets an urge to do some serious \TeX hacking (unlike a word processor, you can customize *any* aspect of \TeX 's operation if you're willing to learn a bit of the language) the essential reference is Donald Knuth, *The \TeX Book*, also Addison-Wesley 1994.