

Introduction to \LaTeX

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L^AT_EX

- What is \LaTeX ?
Typesetting software; not a word processor
- What kinds of documents can be produced?
Articles, reports, memos, letters, theses, books, ...
- What are its key features?
Flexibility; mathematical typesetting; community support
- What are the primary benefits?
Extremely stable; quality of output
- Where do I get the software?
Commercial vs. free
- How do I learn to use it?
Reference manuals/books, online sources, ...

- Origins in late 1970's
- Markup language
- Free; popular in academia
- Initially intended primarily for typesetting technical books with mathematics; many other uses
- Documents created in 1980 look exactly the same when processed in 2007
- It doesn't matter what computer is used
- Documents begin life as plain text; multiple output formats

Kinds of Documents

- Course materials: slides, syllabi, exams, etc.
- Books, articles, reports
- Memos, letters, letters with custom letterheads
- PDF documents with internal/external hyperlinks
- Brochures, booklets, and pamphlets

Primary Benefits

- Staged learning
- Allows primary focus on **logical content**, not **visual format**
- Beautiful output possible with minimal knowledge
- Reliability
- Portability: mainframe, Mac, Windows, Unix, Linux

- Kopka and Daly, *Guide to L^AT_EX, 4th Edition*, Addison-Wesley, 2003.
- Lamport, *L^AT_EX: A Document Preparation System*, Addison-Wesley, 1994.
- Oetiker, Partl, et. al, *The Not So Short Introduction to L^AT_EX2e*, 2006. www.ctan.org/tex-archive/info/lshort/english/lshort.pdf
- www.tug.org/begin.html

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

```
  preamble
```

```
\begin{document}
```

```
  body of document
```

```
\end{document}
```


A sample document with page margins

```
\documentclass[11pt]{article}
\usepackage[left=1in,
             right=1in,
             top=0.75in,
             bottom=0.5in]{geometry}
\begin{document}
  Hello, world!
\end{document}
```

Try it now.

Special characters

These characters have special meaning:

\$ & _ % { }

A `\` prefix avoids this special meaning:

\# \\$ \& _ \% \{ \}

```
\command[optional]{required}
```

or

```
\command[optional]{required}{required}
```

Examples:

```
\section{Introduction}
```

```
\hspace{2in}
```

```
\rule[0.5in]{1in}{2in}
```

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

Examples of L^AT_EX environments include:

- `quote`
- `enumerate`
- `itemize`
- `tabular`

The itemize environment

\LaTeX code

```
\begin{itemize}
  \item Planes
  \item Trains
  \item Automobiles
\end{itemize}
```

Typeset result

- Planes
- Trains
- Automobiles

Try it now.

The enumerate environment

\LaTeX code

```
\begin{enumerate}  
  \item Planes  
  \item Trains  
  \item Automobiles  
\end{enumerate}
```

Typeset result

1. Planes
2. Trains
3. Automobiles

Try it now.

Adjusting font attributes

L^AT_EX code

```
...normal, \emph{emphasized}, \textbf{bold},  
\texttt{typewriter}, normal...
```

Typeset result

...normal, *emphasized*, **bold**, typewriter, normal...

Formatting tables

L^AT_EX code

```
\begin{tabular}{l|c|r}  
President      & Party      & Term \\ \hline \hline  
Jimmy Carter  & Democrat   & 1977--1981 \\ \hline  
Abraham Lincoln & Republican & 1861--1865 \\ \hline  
\end{tabular}
```

Typeset result

President	Party	Term
Jimmy Carter	Democrat	1977–1981
Abraham Lincoln	Republican	1861–1865

- In-line mathematics: mixed with text

...\$ mathematics text \$...

From algebra, we know $(a + b)^2 = a^2 + 2ab + b^2$ for any two real numbers a and b .

- Displayed mathematics: set off from text

...\$\$ mathematics text \$\$...

From algebra, we know

$$(a + b)^2 = a^2 + 2ab + b^2$$

for any two real numbers a and b .

Subscripts and superscripts

\LaTeX code

```
$x^2 + y^2$
```

```
$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
```

```
$$\int_0^\pi x^2 dx$
```

```
$$\displaystyle \int_0^\pi x^2 dx$
```

Typeset result

$$x^2 + y^2$$

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\int_0^\pi x^2 dx$$

$$\int_0^\pi x^2 dx$$

More about subscripts and superscripts

\LaTeX code

```
 $2^{a + b}$ 
```

```
 $A_{i + 1, j}$ 
```

```
 $2^{2^{2^n}}$ 
```

```
 $A_{i, j}^k$ 
```

Typeset result

$$2^{a+b}$$
$$A_{i+1,j}$$
$$2^{2^{2^n}}$$
$$A_{i,j}^k$$

Try one of these now.

Aligning multi-line equations

L^AT_EX code

```
\begin{eqnarray*}  
(a+b)(a-b) & = & a^2 - ab + ab - b^2 \\ & & & & & \\ & = & a^2 - b^2 \\ \end{eqnarray*}
```

Typeset result

$$\begin{aligned}(a + b)(a - b) &= a^2 - ab + ab - b^2 \\ &= a^2 - b^2\end{aligned}$$

Typesetting matrices with arrays

L^AT_EX code

```
$$  
  \left [  
  \begin{array}{ccc}  
    18 & 3 & 5 \\  
    1  & 2 & 3 \\  
    0  & 3 & 6  
  \end{array}  
  \right ]  
$$
```

Typeset result

$$\begin{bmatrix} 18 & 3 & 5 \\ 1 & 2 & 3 \\ 0 & 3 & 6 \end{bmatrix}$$

The need for named functions

L^AT_EX code

```
$\sin x + \ln x$
```

Typeset result

$\sin x + \ln x$

Without a hint, L^AT_EX treats such expressions as a **product**.

A few functions

`\cos` `\log` `\lim` `\ln` `\log` `\sin` `\tan`

\LaTeX code

```
$$\sin^2 x + \cos^2 x = 1$
```

Typeset result

$$\sin^2 x + \cos^2 x = 1$$

```
\frac{numerator}{denominator}
```

L^AT_EX code

```
$$\frac{a^2 - b^2}{a + b} = a - b$$
```

Typeset result

$$\frac{a^2 - b^2}{a + b} = a - b$$

A few relations

`\neq` `\leq` `\approx` `\subset` `\in` `\notin`

Typeset result

\neq \leq \approx \subset \in \notin

Sampling the Greek alphabet

\LaTeX code

`\alpha` `\beta` `\gamma` `\delta` `\epsilon`

Typeset result

α β γ δ ϵ

\LaTeX code

`\Gamma` `\Delta` `\Theta` `\Sigma` `\Omega`

Typeset result

Γ Δ Θ Σ Π Ω

Typeset the sample page.