Introduction to LaTeX

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The Logo

LaTeX

Overview

- 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, ...

TeX and LaTeX

- 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

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

LaTeX document structure

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

\begin{document}
  body of document
\end{document}
```


A sample document

```
\documentclass[11pt]{article}
\begin{document}
    Hello, world!
\end{document}
```


Special characters

These characters have special meaning:

```
#       $       &       _       %       {       }
```

A \ prefix avoids this special meaning:

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

LaTeX environments

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

Examples of LaTeX 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

The enumerate environment

LaTeX code

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

Typeset result

1. Planes
2. Trains
3. Automobiles

Adjusting font attributes

LaTeX code

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

Typeset result

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

Formatting tables

LaTeX 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

Typesetting mathematics

- 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

$x^2 + y^2$

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

$\int_0^\pi x^2 dx$

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

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}

$A_{i+1,j}$

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

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

Aligning multi-line equations

LaTeX code

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

Typeset result

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

The need for named functions

LaTeX code

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

Typeset result

$sinx + lnx$

Without a hint, LaTeX 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

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

Fractions

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

LaTeX 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    \not\in
```

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