

Introduction to L^AT_EX

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L^AT_EX is a document typesetting system

- ▶ Where and how to display text
 - ▶ **bold** or *italics*
 - ▶ How much space

L^AT_EX is a document typesetting system

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 - ▶ **bold** or *italics*
 - ▶ How much space
- ▶ Relieves the writer from formatting the document
 - ▶ Typesetting is a craft

L^AT_EX is a document typesetting system

- ▶ Where and how to display text
 - ▶ **bold** or *italics*
 - ▶ How much space
- ▶ Relieves the writer from formatting the document
 - ▶ Typesetting is a craft
- ▶ Consistent, professional style

A letter usually contains

- ▶ address
- ▶ date
- ▶ opening line
- ▶ body
- ▶ closing line
- ▶ signature

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- ▶ address
- ▶ date
- ▶ opening line
- ▶ body
- ▶ closing line
- ▶ signature

How should we typeset these on a page?

A letter in L^AT_EX

The writer only specifies the content, L^AT_EX typesets

L^AT_EX source code for a letter

```
\documentclass{letter}
\address{Belo Horizonte}
\date{August 27, 2012}
\signature{Italo Cunha}
\begin{document}
\opening{Dear Sir or Madam,}
Letter body goes here.
\closing{Sincerely,}
\end{document}
```

L^AT_EX versus the competition

Compared to WYSIWYG typesetters, L^AT_EX has advantages

- ▶ no need for typesetting
- ▶ professional layouts available, better looking documents
- ▶ support for mathematical formulae
- ▶ easy footnotes, cross-referencing

L^AT_EX versus the competition

Compared to WYSIWYG typesetters, L^AT_EX has advantages

- ▶ no need for typesetting
- ▶ professional layouts available, better looking documents
- ▶ support for mathematical formulae
- ▶ easy footnotes, cross-referencing

And disadvantages

- ▶ steeper learning curve
- ▶ difficult to create unstructured documents
- ▶ hard to create a whole new layout

L^AT_EX features *still* unavailable in mainstream typesetters

- ▶ Ligatures

- ▶ finite, float

- ▶ Paragraph-wide kerning and justification

- ▶ Copied by Adobe InDesign

- ▶ Mathematical typesetting

Setting up L^AT_EX

L^AT_EX is distributed as a collection of packages

- ▶ Package incompatibility among distributions
 - ▶ Missing packages
 - ▶ Wrong version
 - ▶ Stick to well-known packages
- ▶ You may need to install new packages
- ▶ This is why Windows users *may* have problems compiling L^AT_EX sources from Mac users, and vice-versa

Recommended L^AT_EX distributions

Linux

- ▶ T_EXLive

MacOS

- ▶ MacT_EX

Windows

- ▶ MiK_TE_X

Commands start with a backslash

- ▶ `\LaTeX`

Commands may receive arguments inside `{}`

- ▶ `\documentclass{article}`

Commands may receive *optional* arguments inside `[]`

- ▶ `\usepackage[american]{babel}`

Commands end with the first non-letter character

- ▶ You can add `{}` after a command to terminate it
 - ▶ You can write “`\TeX{}Live`” to get “`TEXLive`”

Commands are case-sensitive

```
\documentclass[a4paper]{article}  
\usepackage[american]{babel}  
\begin{document}  
Hello World!  
\end{document}
```

Informs L^AT_EX that this document is an article, using A4 paper

```
\documentclass[a4paper]{article}
\usepackage[american]{babel}
\begin{document}
Hello World!
\end{document}
```

Packages add functionality to L^AT_EX

- ▶ Loading babel with hyphenation rules for American English

L^AT_EX: Hello World!

```
\documentclass[a4paper]{article}
\usepackage[american]{babel}
\begin{document}
Hello World!
\end{document}
```

Document body, with L^AT_EX commands as necessary

Paragraphs are delimited by empty lines and redundant whitespace in a paragraph is ignored

Input

```
This is one paragraph.  It is followed by an empty  
line.  The next paragraph starts below.
```

```
This is another          paragraph.  
  Redundant  whitespace  will be  
           removed by \LaTeX.
```

Output

This is one paragraph. It is followed by an empty line. The next paragraph starts below.

This is another paragraph. Redundant whitespace will be removed by L^AT_EX.

Special characters in \LaTeX files

The following characters have special meaning in \LaTeX

\$ % ^ & _ { } ~ \

You need to escape them with a backslash

Document classes in L^AT_EX

The document class declaration has the following format:

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

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Document classes

```
article proc minimal report book slides letter
```

Document classes in L^AT_EX

The document class declaration has the following format:

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

Document classes

```
article proc minimal report book slides letter
```

Options

```
10pt/11pt/12pt a4paper/letterpaper fleqn leqno  
titlepage/notitlepage onecolumn/twocolumn  
twoside/oneside landscape openright/openany
```

Document classes in L^AT_EX

The document class declaration has the following format:

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

Document classes

```
article proc minimal report book slides letter
```

Options

```
10pt/11pt/12pt a4paper/letterpaper fleqn leqno  
titlepage/notitlepage onecolumn/twocolumn  
twoside/oneside landscape openright/openany
```

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

Common and useful packages

`inputenc` Choose input file encoding (utf8, latin1)

`babel` Hyphenation (brazilian, american)

`graphicx` Import figures

`caption` Control figure and table captions

`subcaption` Support for subfigures

`multicol` Create cells spanning multiple columns

`multirow` Create cells spanning multiple rows

`cite` Sort citations

`url` Easy typing of URLs

`setspace` Control spacing

`geometry` Set margins

`color` Change text color

`minitoc` Create table of contents

L^AT_EX font faces and styles

<code>\textrm{roman}</code>	roman
<code>\textsf{sans serif}</code>	sans serif
<code>\texttt{typewriter}</code>	typewriter

<code>\textrm{roman}</code>	roman
<code>\textsf{sans serif}</code>	sans serif
<code>\texttt{typewriter}</code>	typewriter
<code>\textmd{medium}</code>	medium
<code>\textit{italics}</code>	<i>italics</i>
<code>\textsl{slanted}</code>	<i>slanted</i>
<code>\textbf{bold}</code>	bold
<code>\textsc{small caps}</code>	SMALL CAPS

L^AT_EX font faces and styles

<code>\textrm{roman}</code>	roman
<code>\textsf{sans serif}</code>	sans serif
<code>\texttt{typewriter}</code>	typewriter
<code>\textmd{medium}</code>	medium
<code>\textit{italics}</code>	<i>italics</i>
<code>\textsl{slanted}</code>	<i>slanted</i>
<code>\textbf{bold}</code>	bold
<code>\textsc{small caps}</code>	SMALL CAPS

`\tiny{tiny}` `\scriptsize{scriptsize}`
`\small{small}` `\large{large}` `\huge{huge}`

tiny, scriptsize, small, large, **huge**

Title generation

```
\documentclass[a4paper,12pt]{article}  
\title{\LaTeX{}Practice}  
\author{Agent Smith}  
\date{\today}  
\begin{document}  
\maketitle  
\end{document}
```

Title generation

```
\documentclass[a4paper,12pt]{article}
\title{\LaTeX{}Practice}
\author{Agent Smith}
\date{\today}
\begin{document}
\maketitle
\end{document}
```

Create an article

Title generation

```
\documentclass[a4paper,12pt]{article}  
\title{\LaTeX{}Practice}  
\author{Agent Smith}  
\date{\today}  
\begin{document}  
\maketitle  
\end{document}
```

Set paper size to A4 and font size to 12 points

Title generation

```
\documentclass[a4paper,12pt]{article}
\title{\LaTeX{}Practice}
\author{Agent Smith}
\date{\today}
\begin{document}
\maketitle
\end{document}
```

Set title

Title generation

```
\documentclass[a4paper,12pt]{article}
\title{\LaTeX{}Practice}
\author{Agent Smith}
\date{\today}
\begin{document}
\maketitle
\end{document}
```

Set author

- ▶ Syntax inside the author command varies significantly depending on the document template

Title generation

```
\documentclass[a4paper,12pt]{article}
\title{\LaTeX{}Practice}
\author{Agent Smith}
\date{\today}
\begin{document}
\maketitle
\end{document}
```

Set document date

Title generation

```
\documentclass[a4paper,12pt]{article}
\title{\LaTeX{}Practice}
\author{Agent Smith}
\date{\today}
\begin{document}
\maketitle
\end{document}
```

Draw the title

Compilation and visualization

```
$ latex file.tex
$ latex file.tex
$ xdvi file.dvi
$ dvips file.dvi && gv file.ps
$ dvi2pdf file.dvi && evince file.pdf
```

- ▶ \LaTeX performs only a single pass in the file
- ▶ Run twice to resolve undefined references

Sections, subsections, and paragraphs

`\section{Sections}\label{sec:sections}`

`\LaTeX{}` typesets structured documents, as defined through the `\verb|\section{}` family of commands. Inside each section, the text is structured in paragraphs. Paragraph breaks are inserted at empty lines in the input file.

This is a new (very short) paragraph.

`\subsection{Subsections}\label{sec:sections}`

Writers can nest `\verb|\subsubsection{}` inside `\verb|\subsection{}`, and `\verb|\subsection{}` inside `\verb|sections{}`, just like here.

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Declare a figure

Adding a figure

```
\begin{figure} [h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Tell \LaTeX to place it here

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Center-align everything

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Add the figure (width is half the text width)

- ▶ Common options: width height scale keepaspectratio

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Set figure caption

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

Set figure label

Adding a figure

```
\begin{figure}[h]
\begin{center}
\includegraphics[
width=0.5\textwidth]{
graph.eps}
\caption{Example figure.}
\label{fig:example}
\end{center}
\end{figure}
```

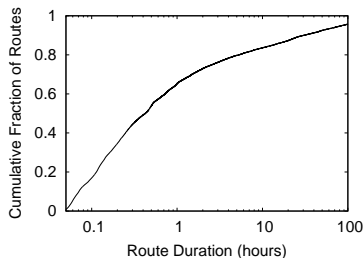


Figure: Example figure.

- ▶ Use figures in vector format (EPS, SVG)
 - ▶ Otherwise they may come out blurry in print

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Subfigures

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\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
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\end{figure}
```

Required packages

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
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\end{subfigure}
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...
\end{subfigure}
\caption{Figure with subfigures.}
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\end{figure}
```

Declare a figure

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
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...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Tell L^AT_EX to place it here

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Declare the first subfigure

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Vertical alignment can be *top*, *bottom*, or *center*

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Choose subfigure width

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Include the figure, note that width is relative to the subfigure

Subfigures

```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

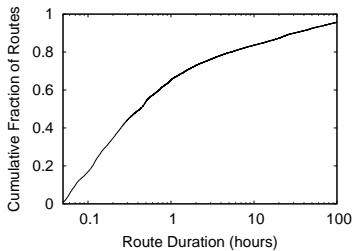
Define subfigure's caption and label

Subfigures

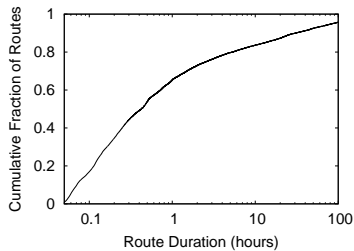
```
\usepackage{caption}\usepackage{subcaption}
\begin{figure}[h]
\begin{subfigure}[t]{0.45\textwidth}
\includegraphics[width=\textwidth]{graph.eps}
\caption{Subfigure A}
\label{fig:subfiga}
\end{subfigure}
\begin{subfigure}[t]{0.45\textwidth}
...
\end{subfigure}
\caption{Figure with subfigures.}
\label{fig:subfigures}
\end{figure}
```

Define figure's (global) caption and label

Subfigures



(a) Subfigure A



(b) Subfigure B

Figure: Figure with subfigures.

```
\section{Making references}\label{sec:references}
```

`\LaTeX{}` allows us to refer to any entity in the text by its label. For example, `Sec.~\ref{sec:sections}` talked about document structure and `Fig.~\ref{fig:example}` is an example. Obviously, these numbers are recomputed every compilation.

`\section{Making references}\label{sec:references}`
`\LaTeX{}` allows us to refer to any entity in the text by its label. For example, `Sec.~\ref{sec:sections}` talked about document structure and `Fig.~\ref{fig:example}` is an example. Obviously, these numbers are recomputed every compilation.

- ▶ You have to label sections, subsections, figures, tables, and equations with `\label{}`


```
\begin{itemize}
\item \LaTeX{} supports bullet lists.
\item Another bullet.
\end{itemize}
\begin{enumerate}
\item And
\item enumerations
\item too.
\end{enumerate}
\begin{description}
\item[description lists] Useful for defining
terms, such as in a glossary.
\item[high] Anything above 2 meters.
\item[low] Anything below 20 centimeters.
\end{description}
```

```
\begin{itemize}
\item \LaTeX{} supports bullet lists.
\item Another bullet.
\end{itemize}
\begin{enumerate}
\item And
\item enumerations
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\end{enumerate}
\begin{description}
\item[description lists] Useful for defining
terms, such as in a glossary.
\item[high] Anything above 2 meters.
\item[low] Anything below 20 centimeters.
\end{description}
```

```
\begin{itemize}
\item \LaTeX{} supports bullet lists.
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\end{itemize}
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\item And
\item enumerations
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\end{enumerate}
\begin{description}
\item[description lists] Useful for defining
terms, such as in a glossary.
\item[high] Anything above 2 meters.
\item[low] Anything below 20 centimeters.
\end{description}
```

- ▶ This is a bullet list
 - ▶ Another bullet
 - ▶ Yet another bullet
1. This is an enumeration
 2. Second entry
 3. Third entry

desc lists Useful for defining terms, such as in a glossary.

high Anything above 2 meters.

low Anything below 20 centimeters.

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Declare a new table

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Tell \LaTeX to place it *here*

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Declare the tabular grid

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Declare three *centralized* columns

- ▶ Other alignment options include “l” and “r” for left and right

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Draws vertical lines between columns

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\
\hline\hline 2,1 & 2,2 & 2,3 \\
\hline\hline 3,1 & 3,2 & 3,3 \\
\hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Draws an horizontal line above the first row

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Specifies the first row's content

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Column separators

Tables

```
\begin{table}[h]
\begin{center}
\begin{tabular}{||c|c|c||}
\hline 1,1 & 1,2 & 1,3 \\ \hline
\hline 2,1 & 2,2 & 2,3 \\ \hline
\hline 3,1 & 3,2 & 3,3 \\ \hline
\end{tabular}
\end{center}
\caption{Tables have captions and labels too.}
\label{tab:simple}
\end{table}
```

Row separators

1,1	1,2	1,3
2,1	2,2	2,3
3,1	3,2	3,3

Table: Tables have captions and labels too.

- ▶ Tip: avoid lines in tables

Special table column types

```
\begin{table}[h]
\begin{center}
\caption{Some styles put table captions on top.}
\label{tab:columnntypes}
\begin{tabular}{|c|p{5cm}|r@{.}l|}
\hline Pi & fixed & 03 & 1 \\
Euler & width & 002 & 7182 \\
Golden ratio & column & 1 & 618 \\
\hline
\end{tabular}
\end{center}
\end{table}
```


Special table column types

```
\begin{table}[h]
\begin{center}
\caption{Some styles put table captions on top.}
\label{tab:columnntypes}
\begin{tabular}{|c|p{5cm}|r@{.}l|}
\hline Pi & fixed & 03 & 1 \\
Euler & width & 002 & 7182 \\
Golden ratio & column & 1 & 618 \\
\hline
\end{tabular}
\end{center}
\end{table}
```

Creates a fixed-width, justified column

Special table column types

```
\begin{table}[h]
\begin{center}
\caption{Some styles put table captions on top.}
\label{tab:columnntypes}
\begin{tabular}{|c|p{5cm}|r@{.}l|}
\hline Pi & fixed & 03 & 1 \\
Euler & width & 002 & 7182 \\
Golden ratio & column & 1 & 618 \\
\hline
\end{tabular}
\end{center}
\end{table}
```

Creates a column with constant text (just a dot)

Special table column types

```
\begin{table}[h]
\begin{center}
\caption{Some styles put table captions on top.}
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\end{tabular}
\end{center}
\end{table}
```

Cool to typeset floating-point numbers

Special table column types

Table: Some styles put table captions on top.

Pi	fixed	03.1
Euler	width	002.7182
Golden ratio	column	1.618

Equations

We can inline equations in paragraphs by toggling math mode with the dollar sign $\$$

Input

For example, `$E = mc^{2}$` is an inlined formula.

Output

For example, $E = mc^2$ is an inlined formula.

Equations

We can also use the equation environment

Input

```
For example,  
\begin{equation}  
E = mc^{2}  
\label{eqn:energy}  
\end{equation}  
is a well-known formula.
```

Output

For example,

$$E = mc^2 \tag{1}$$

is a well-known formula.

Equations

We can also use the equation environment

Input

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For example,  
\begin{equation}  
E = mc^{2}  
\label{eqn:energy}  
\end{equation}  
is a well-known formula.
```

Output

```
For example,
```

$$E = mc^2 \tag{1}$$

is a well-known formula.

Use `\begin{equation*}` if you want an unnumbered equation

Equations

- ▶ \LaTeX typesets equations automatically
 - ▶ Ignores whitespace in equations
 - ▶ $\$e=mc^{\{2\}}\$$ and $\$e = m c^{\{2\}}\$$ are equivalent

- ▶ \LaTeX typesets equations automatically
 - ▶ Ignores whitespace in equations
 - ▶ $\$e=mc^{\{2\}}\$$ and $\$e = m c^{\{2\}}\$$ are equivalent
- ▶ Some characters have special meaning
 - ▶ ‘ \wedge ’ gives superscript
 - ▶ ‘ $_$ ’ gives subscript
 - ▶ ‘ $\{$ ’ and ‘ $\}$ ’ delimit parameters
- ▶ Equations use many different special symbols and commands
 - ▶ Summations \sum_{a}^b \prod_{a}^b \int_0^1
 - ▶ Greek letters \alpha \beta \Theta \Lambda \Omega
 α β Θ Λ Ω
 - ▶ Operators \mod \div \times \forall \exists \in
 \div \times \forall \exists \in
 - ▶ Complex constructs $\text{\frac}{2}{3}$ $\text{\overline}{x^{\{2\}}}$
 $\frac{2}{3}$ $\overline{x^2}$

Complex equation example

$$P = \left\{ \frac{\sum_{\substack{1 \leq i \leq n \\ 1 \leq j \leq m}} (x_i - x)(y_j - y)}{\left[\sum_{i=1}^n (x_i - x)^2 \sum_{i=1}^m \sqrt[3]{(y_i - y)^2} \right]^{1/2}} \right\}^{3/2}$$

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Bibliography

L^AT_EX has superb support for citations

Input

```
iPlane~\cite{madhyastha06iplane} and Reverse  
Traceroute~\cite{bassett10reverse} combine  
multiple measurement techniques to monitor the  
Internet. The work of Nguyen et  
al.~\cite{nguyen09tomo} is mostly theoretical.
```

```
\bibliographystyle{plain}  
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Input




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iPlane~\cite{madhyastha06iplane} and Reverse  
Traceroute~\cite{bassett10reverse} combine  
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\bibliographystyle{plain}  
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```

Output

iPlane [2] and Reverse Traceroute [1] combine multiple measurement techniques to monitor the Internet. The work of Nguyen et al. [3] is mostly theoretical.

Bibliography

-  E. Katz-Bassett, H. Madhyastha, V. Adhikari, C. Scott, J. Sherry, P. van Wesep, A. Krishnamurthy, and T. Anderson. Reverse Traceroute.
In Proc. USENIX NSDI, 2010.
-  H. Madhyastha, T. Isdal, M. Piatek, C. Dixon, T. Anderson, A. Krishnamurthy, and A. Venkataramani. iPlane: an Information Plane for Distributed Services.
In Proc. USENIX OSDI, 2006.
-  H. Nguyen, R. Teixeira, P. Thiran, and C. Diot. Minimizing Probing Cost for Detecting Interface Failures: Algorithms and Scalability Analysis.
In Proc. IEEE INFOCOM, 2009.

We will use Bib_TE_X to manage and build bibliographic entries

- ▶ Bibliographic entries must be in the file given in the `\bibliography{}` command
 - ▶ The file extension must be `.bib`
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- ▶ We need to run L^AT_EX first, then Bib_TE_X, then run L^AT_EX again to fix the references

Compilation and visualization

```
$ latex file.tex
$ latex file.tex
$ bibtex file
$ latex file.tex
$ latex file.tex
$ xdvi file.dvi
$ dvips file.dvi && gv file.ps
$ dvi2pdf file.dvi && evince file.pdf
```

- ▶ Different entry types
 - ▶ Conference papers use `@inproceedings`
 - ▶ Journal papers use `@article`
 - ▶ Books use `@book`
 - ▶ Blog entries and other stuff may use `@misc`

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Conference paper entry example

```
@inproceedings{nguyen09tomo,  
  title = {{Minimizing Probing Cost for  
    Detecting Interface Failures:  
    Algorithms and Scalability Analysis}},  
  author = {H. Nguyen and R. Teixeira and  
    P. Thiran and C. Diot},  
  booktitle = {Proc. IEEE INFOCOM},  
  year = {2009}  
}
```

Next up

Look for these documents on Google

- ▶ The Not So Short Introduction to \LaTeX
- ▶ \LaTeX Math Symbols

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Next \LaTeX class will be more targeted

- ▶ Spacing (i.e., squeezing 13 pages in 12)
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