

Jumpstart LaTeX

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Abstract

A quick intro by examples to the document preparation language \LaTeX .

1 Overview

LaTeX is essentially a *programming language* that, when executed, produces a document (usually a pdf). Think of it as similar to HTML in that the file you write is not the same as the end result file you see, but rather is a series of instructions for how to display that end result.

1. You write a plain text *source code* file “myfile.tex”.
2. You use LaTeX to *compile* this file into a document “myfile.pdf”.

The source file uses some general style commands (e.g. sans-serif font, size 12, article format, reasonable margins) along with specific line-by-line commands (make *this* text italic and **that** text bold; put a section header here and a table there).

2 Installation

2.1 All-In-One Editors

“All-in-one” editors help you combine the two steps I mentioned above into a single workflow. They show you the text source file and help you edit it, and also provide (for instance) a “compile” button that executes the command to create the pdf document. When this command finds an error or mistake, the editor might help you find the line in your file that contains the mistake and suggest fixes. etc.

To get started ASAP from scratch:

- Mac: Install MacTeX, <http://www.tug.org/mactex/>. Then open up the TexWorks editor.
- Windows: Install proTeXt, <http://www.tug.org/protext/>. Then open up the MiKTeX editor.
- Linux: Install TeX Live by running “apt-get install texlive” on the command line (substituting your package manager as necessary). Then install kile (“apt-get install kile”) and run it.

If you are not in quite as much of a hurry, you might want to search around to see what your options are. The above options help you out by installing LaTeX and an editor all together. But you can always install LaTeX by itself, then look around for an editor you like. One solid choice is to install Texmaker, which is compatible with **Windows, Mac, and Linux**. <http://www.xmlmath.net/texmaker/>.

As a side note, let me mention Lyx, a what-you-see-is-what-you-get approach to LaTeX. Many people find it easier and/or faster and/or more convenient. However, in my opinion it is suboptimal for *learning* LaTeX because you don’t see as clearly how the underlying plain text source code connects to the document you create, and in the long run you need to understand this to make sense of error messages or so on. But, you can find Lyx at <http://www.lyx.org/>.

2.2 Command-Line / Minimalist Approach

All you need to write LaTeX is a text editor and the latex compiler tools like pdflatex. I'll give instructions here for Linux, but you should be able to adapt them to your operating system. This is how I write tex: I edit "myfile.tex" using vim, then on the Linux command line, execute

```
$ pdflatex myfile.tex
```

This produces "myfile.pdf".

You can install latex, including/especially the pdflatex tool, from the LaTeX project homepage: <http://www.latex-project.org/>.

Or on Linux, install using

```
$ apt-get install texlive
```

(substituting the appropriate package manager for apt-get).

If you want to be sure you have almost every piece of latex you'll ever need, you can be sure to install the base, extras, and bibtex (but installation of the above should be sufficient for now):

```
$ apt-get install texlive-full
```

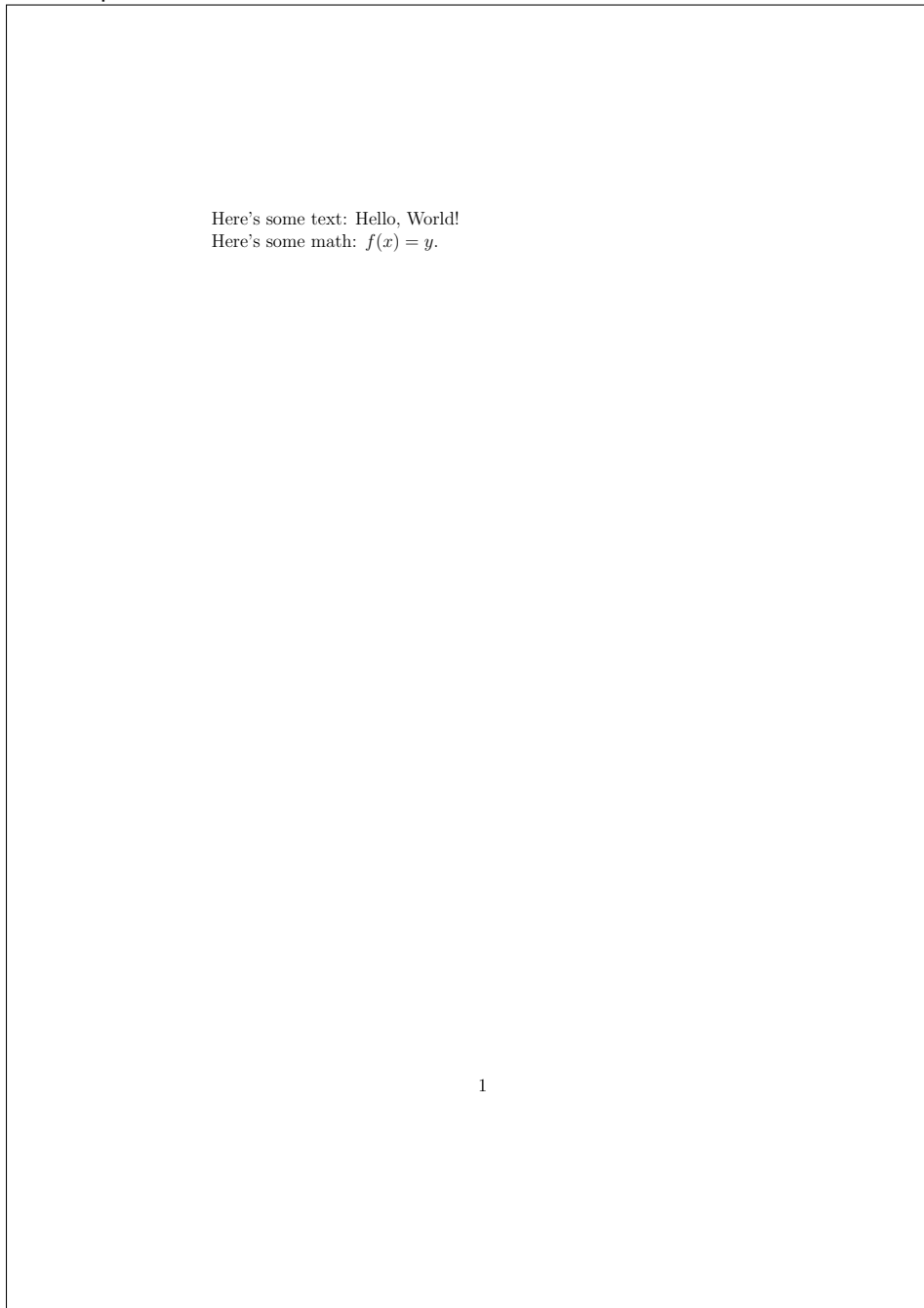
3 Example 0

The file:

```
\documentclass[12pt]{article}
\begin{document}
Here's some text: Hello, World!    % tell the world we love it

Here's some math:  $f(x) = y$ .    % ditto
\end{document}
```

The output:



We already see some key features of LaTeX:

- **The syntax of a command** is `\commandname[options]{stuff}`. For instance, we could have just said `\documentclass{article}`, but we chose to add the option of 12pt font.
- **Comments** start with a % sign and go to the end of the line. Anything written in a comment is totally ignored by LaTeX.
- **Math mode** is surrounded by \$ symbols. (When not in math mode, *i.e.* most of the document, it is called “text mode”.)

4 Example 1

The file:

```
\documentclass[12pt]{article}
\usepackage{amsmath,amssymb,amsfonts,amsthm} % some nice default packages

\begin{document}
\title{Example 1}
\author{Archer Me Dees}
\date{\today} % the command \today inserts today's date
\maketitle % if you omit this line, the title won't appear!

\section{First Section}
Let's talk about the quantity  $c^2$ . I'm pretty sure that
\begin{equation}
c^2 \geq b^2 . % equation and align environments automatically enter math mode
\end{equation}
In fact, my countryman showed that
\begin{align}
c^2 &= a^2 + b^2 \\
&= 3^2 + 4^2 \\
&= 25
\end{align}
when  $a = 3$  and  $b = 4$ .

\section{Second Section}
In this paragraph, we notice how  $n^{a+b}$  differs from  $n^a + b^n$ .
And how  $X_1$  is the same as  $X_{1}$ , but  $X_{1+2}$  differs from  $X_1 + 2$ .
Also that, in tex files, line breaks between sentences or
even words
    or even weird whitespace don't matter.

A \emph{double} line break gives a \textbf{paragraph} break.

\end{document}
```

The output:

Example 1

Archer Me Dees
February 24, 2014

1 First Section

Let's talk about the quantity c^2 . I'm pretty sure that

$$c^2 \geq b^2. \tag{1}$$

In fact, my countryman showed that

$$c^2 = a^2 + b^2 \tag{2}$$
$$= 3^2 + 4^2 \tag{3}$$
$$= 25 \tag{4}$$

when $a = 3$ and $b = 4$.

2 Second Section

In this paragraph, we notice how n^{a+b} differs from $n^a + b$. And how X_1 is the same as X_1 , but X_{1+2} differs from $X_1 + 2$. Also that, in tex files, line breaks between sentences or even words or even weird whitespace don't matter.

A *double* line break gives a **paragraph** break.

1

5 Example 2

The file:

```
\documentclass[12pt]{article}
\usepackage{amsmath,amssymb,amsfonts,amsthm}
\def\thebestsuperhero{\textbf{Flash GORDON}}
\newcommand{\bestin}[2]{#1 is the best superhero in #2!}
\newcommand{\parenfrac}[2]{\left(\frac{#1}{#2}\right)}

\begin{document}

\section{Using \textbackslash def and \textbackslash newcommand}
\label{section-of-def-and-newcommand}

Facts:
\begin{enumerate} % use itemize instead of enumerate for bullet points
\item My favorite superhero is \thebestsuperhero.
\item \bestin{Spiderman}{Gotham City}
\item We are currently in Section \ref{section-of-def-and-newcommand}.
\item We will later see Equation \ref{eqn:ab}.
\end{enumerate}

\vspace{36pt}

\section{More Math}
Here's an equation that is \emph{labeled}: It is assigned a number,
\ref{eqn:ab}, that we can use to refer to it at any time.
\begin{equation}
(\frac{a+b}{a})^n \leq e^{nb/a} . \label{eqn:ab}
\end{equation}

Here's an unlabeled one:
\[\left(1-\frac{x}{y}\right)^n \leq e^{n\frac{x}{y}} . \]

An array of equations that have optional labels, including Equation \ref{eqn:rs}:
\begin{align}
\sum_{j=0}^{n-1} ar^j
&= a\left(1 + r + r^2 + \dots\right) \nonumber \\
&= a\frac{1-r^n}{1-r} . \label{eqn:rs}
\end{align}

An array of unlabeled equations as a Valentine's poem:
\begin{align*}
x &= y && \&\text{(given)} \\
y &= z && \&\text{(inferred)} \\
z &= \text{you} && \&\text{(by Equation \ref{eqn:ab})} \\
\text{you} & \&\heartsuit \text{me} . && \&\text{(Lemma in \emph{The Heart Handbook})}
\end{align*}

\end{document}
```

The output:

1 Using `\def` and `\newcommand`

Facts:

1. My favorite superhero is **Flash GORDON**.
2. Spiderman is the best superhero in Gotham City!
3. We are currently in Section 1.
4. We will later see Equation 1.

2 More Math

Here's an equation that is *labeled*: It is assigned a number, 1, that we can use to refer to it at any time.

$$\left(\frac{a+b}{a}\right)^n \leq e^{nb/a}. \tag{1}$$

Here's an unlabeled one:

$$\left(1 - \frac{x}{y}\right)^n \leq e^{n\frac{x}{y}}.$$

An array of equations that have optional labels, including Equation 2:

$$\begin{aligned} \sum_{j=0}^{n-1} ar^j &= a(1 + r + r^2 + \dots) \\ &= a\left(\frac{1-r^n}{1-r}\right). \end{aligned} \tag{2}$$

An array of unlabeled equations as a Valentine's poem:

$x = y$	(given)
$y = z$	(inferred)
$z = \text{you}$	(by Equation 1)
you♥me.	(Lemma in <i>The Heart Handbook</i>)

1

One thing to note: Now that we're using references and labels (`\label`, `\ref`), we may have to compile the file twice (or possibly even more!). On the first pass, LaTeX will note all of the labels you create. On the second pass, it will fill in the references according to those labels. Another: Notice that using "(" and ")" in math mode results in standard-size parentheses, while `\left(` and `\right)` produce matching parentheses that expand in size as needed.

6 Bibliographies with Bibtex

The Tex file bibexample.tex:

```
\documentclass[12pt]{article}

\bibliographystyle{plain}
\begin{document}
In spite of \cite{gct1994}, against the recommendation of \cite{zd1979},
and over the protestations of \cite{qb1972}, I decided to add a drum solo.

\bibliography{bibexample.bib}
\end{document}
```

The bibliography file bibexample.bib:

```
@article{gct1994,
  author="Johnny B. Goode and Sweet Caroline and Ruby Tuesday",
  title="How to Win and Friend Enemies Under the Influence",
  journal="Applied Microtunes",
  volume="1",
  issue="1",
  pages="1-1003",
  year="1994"
}

@inproceedings{zd1979,
  author="Zeppelin, Led and Doors, The",
  title="Oops I Brought The Music But Forgot The Soul (pt. 2)",
  booktitle="Proceedings of the 200,000th Joint Conference",
  publisher="The Human Spirit LLC",
  pages="21-24",
  year="1979",
}

@book{qb1972,
  author="Queen and The Beach Boys",
  title="Har-Mo-Nius",
  publisher="Key of B",
  year="1972"
}
```

To compile with a bibliography uses the program *bibtex* (which comes with LaTeX). If you're using an IDE, it should have instructions on how to do this (and it should be easy/obvious!). Like with labels, we have to run several times for LaTeX to get it all together, so on the Linux command line, I compile with:

```
$ pdflatex bibexample.tex
$ biblatex bibexample.aux      # this file is created by pdflatex
$ pdflatex bibexample.tex
$ pdflatex bibexample.tex
```

The output:

In spite of [1], against the recommendation of [3], and over the protestations of [2], I decided to add a drum solo.

References

- [1] Johnny B. Goode, Sweet Caroline, and Ruby Tuesday. How to win and friend enemies under the influence. *Applied Microtunes*, 1:1–1003, 1994.
- [2] Queen and The Beach Boys. *Har-Mo-Nius*. Key of B, 1972.
- [3] Led Zeppelin and The Doors. Oops i brought the music but forgot the soul (pt. 2). In *Proceedings of the 200,000th Joint Conference*, pages 21–24. The Human Spirit LLC, 1979.

7 LaTeX Resources

Here are some useful resources:

- Detexify: You draw a symbol, and it tells you what LaTeX command produces that symbol. <http://detexify.kirelabs.org/classify.html>.
- Tikz: package for professional diagrams/pictures. Install on Linux with “apt-get install pgf” or equivalent. <http://www.texample.net/tikz/>.