A Tutorial for LaTeX

Getting Started

Brian Guadalupe

February 11, 2019

Introduction

– LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation.

– It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout, bibliographies, and much more.

Installation and Setup

Installing LaTeX

LaTeX is supported in all major operating systems. You can get it through these websites:

- Windows
    - MiKTeX (`https://miktex.org/`)
- Mac OS X
    - MacTeX (`https://www.tug.org/mactex/`)
- Linux/Unix
    - TeX Live (`https://www.tug.org/texlive/`)
        - Also available for both Windows and Mac OS X
- Online (if you want to get started right away)
    - ShareLaTeX (`https://www.sharelatex.com/`)
    - Overleaf (`https://www.overleaf.com/`)
    - and many others…

Packages

- Add-on features for LaTeX are known as **packages**.
- A **package** is a file or collection of files containing extra LaTeX commands and programming which add new styling features or modify those already existing.
- Packages help extend functionality by adding new special features, like graphics, fancy document elements, bibliography, and more!

Installing Packages

- You can find the packages you need in the Comprehensive TeX Archive Network (CTAN) at `https://www.ctan.org/`.
- Assuming that you chose the default options when LaTeX is first installed, all missing packages are downloaded and installed automatically.
    - Although in Windows, a User Account Control dialog box will pop up (just accept it to continue the installation).
- Import the package by typing \usepackage{*packagename*} at the preamble.

Some Useful Packages

- `amsmath`: Essential for math typesetting
- `amssymb`: Math symbols you never knew existed
- `amsthm`: Theorems and proofs
- `pgf`,`tikz` or `asymptote`: Graphics
- `hyperref`: Hyperlinks and cross-references
- `biblatex`: Bibliography
- `graphicx`: Include figures, rotate or scale text
- `multicol`: Multiple columns
- `listings`: Code snippets and algorithms
- `fancyhdr`: Fancy headers

Basics

Syntax

- LaTeX uses a markup language in order to describe document structure and presentation.
- It converts your source text, combined with the markup, into a *high-quality* document.

Parts of a LaTeX File

A LaTeX file simply consists of two parts.

1. The *preamble* consists of all the lines before the \begin{document} command.
   - You should put all your usepackage and documentclass commands here.
2. The *document body* is enclosed within the \begin{document} and \end{document} commands.
   - You put all your actual stuff here.

Spaces

- The LaTeX compiler *equally* treats all whitespace characters as a "space"
- However, a double line break (an empty line) defines the end of a paragraph; multiple empty lines are also treated as the end of a paragraph.

Spaces

Code

```
It does not matter whether you
enter one or several            spaces
after a word.

An empty line starts a new
paragraph.
```

Output

It does not matter whether you enter one or several spaces after a word.

An empty line starts a new paragraph.

Reserved Characters

- The following symbols are *reserved characters* that either have a special meaning under LaTeX or are unavailable in all the fonts.

    - # \$ % ^ & _ { } ~ \

- If you enter them directly in your text, they will normally not print but rather make LaTeX do things you did not intend.

- But you can actually use these characters by *escaping* them with a prefix backslash.

    - \# \\$ \% \^{} \& _ \{ \} \~{} \textbackslash{}

Reserved Characters

- The backslash character \ cannot be entered by adding another backslash in front of it (\\); this sequence is used for line breaking.
- The commands \~{} and \^{} produce respectively a tilde and a hat which is placed over the next letter.
  - \~n gives ñ
- Non-ASCII characters (e.g. accents, diacritics) can be typed in directly for most cases. However you must configure the document appropriately.

Environments

- *Environments* in LaTeX have a role that is quite similar to commands, but they usually have effect on a wider part of the document.

Code

```
\begin{environmentname}
text to be influenced
\end{environmentname}
```

Environments

- Between the `\begin` and the `\end` you can put other commands and nested environments. The internal mechanism of environments defines a group, which makes its usage safe (no influence on the other parts of the document).
- In general, environments can accept arguments as well, but this feature is not commonly used and so it will be discussed in more advanced topics.

Commands

- LATEX commands are case sensitive, and take one of the following two formats:
  1. They start with a backslash and then have a name consisting of letters only. Command names are terminated by a space, a number or any other "non-letter."
  2. They consist of a backslash and exactly one non-letter.
- Some commands need an argument, which has to be given between curly braces after the command name.
- Some commands support optional parameters, which are added after the command name in square brackets.

Code

```
\commandname[opt1,opt2,...]{arg1}{arg2}...
```

Commands

- Most standard LaTeX commands have a switch equivalent.
- Switches have no arguments but apply on the rest of the scope, i.e. the current group or environment.
- A switch should (almost) never be called outside of any scope, otherwise it will apply on the rest of the document.

Warning

Commands with arguments and switches should not be confused. This is a very common error!

Commands

Code

```
% \emph is a command with argument, \em is a switch.
\emph{emphasized text}, this part is normal % Correct
{\em emphasized text}, this part is normal % Correct

\em emphasized text, this part is normal % Incorrect
\em{emphasized text}, this part is normal % Incorrect
```

Comments

- When LaTeX encounters a % character while processing an input file, it ignores the rest of the current line, the line break, and all whitespace at the beginning of the next line.

Let's Dive In!

Open your favorite text editor and type the following code:

Code

```
\documentclass{article}
\begin{document}
Hello world!
\end{document}
```

Then, save the file as hello.tex.

Let's Go Line-by-Line

Code

```latex
\documentclass{article}
\begin{document}
Hello world!
\end{document}
```

This line is a command and tells LaTeX to use the `article` document class. A document class file defines the formatting, which in this case is a generic article format. The handy thing is that if you want to change the appearance of your document, substitute article for another class file that exists.

Code

```latex
\documentclass{article}
\begin{document}
Hello world!
\end{document}
```

This line is the beginning of the environment called `document`; it alerts LaTeX that content of the document is about to commence. Anything above this command is known generally to belong in the preamble.

> **Code**
>
> ```
> \documentclass{article}
> \begin{document}
> Hello world!
> \end{document}
> ```

This was the only actual line containing real content — the text that we wanted displayed on the page.

Code

```latex
\documentclass{article}
\begin{document}
Hello world!
\end{document}
```

The document environment ends here. It tells LaTeX that the document source is complete, anything after this line will be ignored.

Compiling LaTeX Files

- **Compiling** is the process of transforming a `.tex` file into a publishable format (like PDF). This is done using a *compiler*.
- For now, we will only use the `pdflatex` compiler, which outputs a `.pdf` document from a `.tex` source file.
- If you use TeXWorks, you can just press the green "play" button to compile.
- If you opt to use the console you can type `pdflatex hello.tex`.
- After compilation, you should be able to open the `hello.pdf` file.

Getting (More) Help

Further Resources

1. The LaTeX Wikibook (https://en.wikibooks.org/wiki/LaTeX)
2. The Not So Short Introduction to LaTeX 2_ε
   (https://tobi.oetiker.ch/lshort/lshort.pdf)
3. LaTeX for Complete Novices
   (http://www.dickimaw-books.com/latex/novices/)

When Problems Arise

If you've encountered some problems, feel free to ask around on web forums such as:

- TeX Stack Exchange (`https://tex.stackexchange.com/`)
- LaTeX Community (`http://latex.org/forum/`)

In any case, you are strongly encouraged to produce a *minimal working example* that reproduces your issue, which will give helpers the perfect starting point for your problem.

Any questions?