Latex - Document Preparation System
An Introduction

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Abstract

As the name signifies LaTeXis a document preparation system and is different from the conventional word processor packages like MS Word, Abiword and so on. This article gives a brief intro to the world of document preparation and leads one by hand through the first steps in LaTeX, the document preparation system very widely used in the Technical World on the Gnu/Linux Operating System.

1 Introduction

One may have come across unpteen number of word processors these days. The spread of computers and application of computers in the offices have increased the penetration of MS Office and other word processor packages like Abiword, OpenOffice etc. in homes across India.

To clearly understand the difference between a document preparation system and a word processor it is necessary that we understand what the capabilities of each are. Most of the word procesors are of the 'WYSIWYG' type, meaning 'What You See Is What You Get'. This is very handy in offices where you are formatting the docment at the same time as you are generating the contents. When the document consists of a few number of pages, the appearance of the document is as important, if not more, than the contents.

Typically any word processing application consists of two stages. The content generation stage and the document formating stage. WYSIWYG editors (how GUI word processors are otherwise called among the computing community) make it easy meat of the document formating stage as one is able to 'see' the final document taking shape, as the content generation gets completed. Time is required only for the content generation.

When the document gets bulky, keeping track of the formating of the whole document through a WYSIWYG editor is difficult and time consuming. Inserting a figure or formating the bulletting or increasing the space between the paragraphs disturbs the whole document, not to mention when one is editing a report or a book consisting of hundreds of pages.

Latex, the document preparation system is a software which does this and more with great ease. From an initial stage where one spends almost seventy five percent time on content generation and rest on formating, as one gets the experience, this ratio becomes almost ninety percent for content

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generation and the rest for formating. Most of the top notch universities and journals in the world insist on documents submitted in LaTeXformat. The default formating style of LaTeXdocuments, ie. the font size, font style, formating etc., is the standard for technical documents across the world.

LaTeXdocuments however have the flexibility to change all default settings.

The WYSIWYG equvalent of LaTeXis Lyx. The disadvantage of using Lyx is that a lot of unnecessary commands are added in the background by the software and the user really misses his control over the document. Moreover the document also gets bulky, ie. more kilobytes for each document.

LaTeXis very useful when one prepares the final project report and for preparing short papers/assignments in very beautiful eye-catching format.

2 The basic elements of a LaTeX file

To use LaTeX, begin by creating an ASCII text file with a `.tex` suffix. You can use your favorite editor to do this (xedit, emacs, and vi are some examples). The file used to create this document is called `tutorial.tex` Blank lines in your `.tex` file indicate a new paragraph and a space character indicates a new word (*duh*). Otherwise all blank space is ignored. It is a good habit to start new sentences with a new line in your `.tex` file.

Comments in a `.tex` file start with a `%` character and go the the end of the line. The `%` character is therefore a *special character* in LaTeX. If you want to actually print a percent-sign, you must type `\%` . Three other special characters that you will use often are `\$` , `\` , and `&` (more about these later). The other six special characters are: `# _ ~ ^ { }` . To actually print any of these special character, simply precede it with a `\` character.

2.1 Font-size and other required formatting commands

The first command in your `.tex` file *must* be:

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

This declares that you will be writing an article, which is the right kind of document if you are not breaking up your work into chapters. Options are included between the square brackets. You can change the point-size of your font by specifying `12pt` for 12-point font, or `11pt` for 11-point font. If you don't specify `12pt` or `11pt` , LaTeX will default to a 10-point font. Other options are shown in the LaTeX source file `tutorial.tex` . The text of your document, **must** begin with the line:

```
\begin{document}
```

and end with the line:

```
\end{document}
```

These commands tell LaTeX to start and to stop looking for text to process, and **must** be included at the beginning and end of the document. The most simple `.tex` file has these three commands:

```
\documentclass{article}
\begin{document}
    This is the only text in my file.
\end{document}
```

and will use LaTeX's default font, margins, line spacing, page numbering and paragraph indentation for the pre-defined article document class.

2.2 Margins, line-spacing, and other optional formatting commands

The group of commands in your `.tex` file which come before `\begin{document}` is called the *preamble*.

In the preamble, you can specify your margins and other options. Look in the preamble of `tutorial.tex` to see how to adjust the margins, line-spacing, paragraph spacing, paragraph indentation, equation indentation, and page numbering. If you leave these options out, then LaTeX will choose default values for you.

Many LaTeX users do not like these defaults, and choose to modify the formatting style.

Some aspects of the formatting style are easier to change than others. For example, changing the default font-size of your section headings is not trivial.

With LaTeX you definitely do not have the same flexibility in formatting that you do with Microsoft Word.

On the other hand, LaTeX has a standard format which is applied systematically and automatically to your entire document.

You can spend your time working on the *content* of your paper, and leave the *style* to LaTeX!

2.3 Sections, sub-sections, paragraphs, and new-lines

A new section starts with a `\section{ "section title" }` command.

A subsection starts with a `\subsection{ "sub-section title" }` command.

You can also use the `\subsubsection{ "sub-sub-section title" }` command if you need to.

Paragraphs are separated by a blank line.

To force LaTeX to start a new line, put two back-slashes '\\' where you want the line-break to occur.

To force LaTeX to start a new page, use the command: `\newpage`

To insert vertical blank space in your document (5 millimeters in this example), use the command:

```
\vspace{5.mm}
```

2.4 Examples of mathematical expressions

Never start a paragraph with an equation!

One frequently needs to number equations and refer to them at different parts in the document.

Equation (1) says $\alpha = \beta\gamma\delta$.

$$\alpha = \beta\gamma\delta \tag{1}$$

Equations are automatically numbered by LaTeX. You can refer to an equation by its number if you label the equation in your `.tex` file.

Equation (1) has the label `\label{eq:abc}` in the `tutorial.tex` file, and is referred to with the command `\ref{eq:abc}` .

At any point in your document you can refer to this equation by typing `\ref{eq:abc}` in your `.tex` file. Labeling equations is optional.

The equation-formatting capabilities of LaTeX are highly touted!
The following is an important equation in solid mechanics.
It also shows how to do sub-scripts, super-scripts, and fractions.

$$I_{zz} = \int_{-b/2}^{b/2} \int_{-h/2}^{h/2} y^2 dy dx = \frac{bh^3}{12}. \tag{2}$$

These equations are important for statics:

$\sum F_x = 0$, $\sum F_y = 0$, and $\sum M_z = 0$.
and shows that in-line mathematical symbols can be inserted in your text by putting them between dollar signs, `\$` .

In general, all mathematical symbols are denoted by their Greek names, i.e., `\alpha` for α, `\Gamma` for Γ and `\epsilon` for ϵ.
[1]

Other mathematical symbols are available, such as `\approx` for $\approx$, `\pm` for $\pm$, `\times` for $\times$, `\div` for $\div$, `\propto` for $\propto$, `\leq` for $\leq$, `\geq` for $\geq$, `\ll` for $\ll$, `\gg` for $\gg$, `\neq` for $\neq$, `\nabla` for ∇, `\Re` for $\Re$, `\Im` for $\Im$, `\flat` for $\flat$, `\sharp` for $\sharp$, `\partial` for ∂, `\infty` for ∞, `\sin` for sin, `\log` for log, `\arctan` for arctan, `\heartsuit` for $\heartsuit$, and many, many more.

Mathematical objects, like arrays, vectors, and matrices can be created as well.
See any text on LaTeX for more details regarding mathematical formulas, lists, tables and so on.

3 Spelling correction

You can check the spelling in your ASCII `.tex` file by issuing the `ispell myfile.tex` command. The `ispell` program automatically ignores the special LaTeX formatting commands when checking files that end in `.tex` .

4 Formatting and printing your .tex file

To create a properly formatted PostScript file, first run the LaTeX program at the unix prompt with the command:

```
latex myfile.tex
```

If you have a bibliography, a table of contents, or other labeled items like equations, or figures, you will usually need to run `latex` more than once to get the cross-references [2] right.

If you have an error in your `.tex` file, the LaTeX pre-processor will catch it, display an error message with the line number of the error, and give you a `?` prompt. If you type `e` at this

[1] Making Greek letters is a piece of π!
[2] Cross referencing is an interesting area which can take more time

prompt, you will enter an editor at this location in the text. If you type an `x` , you will exit the `latex` program.

You can then fix the error and re-process your `.tex` file. Running the `latex` program creates a file called `myfile.dvi` .

After you have run `latex` with no errors, you can create a pdf (portable document format) file with the command:

```
dvipdf myfile.dvi myfile.pdf
```

This will create a .pdf file called `myfile.pdf` .

Before your print the .pdf file, you should check your document on the screen of an X-windows work-station with the command:

`ghostview myfile.pdf (or) kghostview myfile.pdf` (if you are using KDE desktop).

If everything is o.k. you can finally send the pdf file to a laser printer.

5 Conclusion

The potential of LaTeXis limitless. It is not possible to discuss all of that in a very small time. It is advisable one refers to books on LaTeXor tutorials from the internet on LaTeX.

In the meantime wishing you all happy LaTeXing !!

References

[1] Lamport Leslie (2000)*Latex, the document preparation system*, Pearson Education Asia.