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Powerful Research Documentation Software 'LaTeX'

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INTRODUCTION:

LaTeX is a powerful document markup language text processing system available for preparing impressive and highly structured documents. LaTeX is becoming the "Standard" text processor for publications in science, engineering, mathematics and report writing to scientific community. LaTeX is a family of programs integrates many tools needed to design, develop, documents in one application. It gives amazing results and particularly a deserving tool when working with mathematical symbols. This tool is an open source, where new features can be added to the software for further enhancement virtually by anyone who is interested in.

The history of LaTeX begins with a program called TEX. In 1978, the computer scientist, "Donald Ervin Knuth" got frustrated with the mistakes that his publishers made in typesetting his work. He decided to create a typesetting program that everyone could easily use to typeset documents, specifically those that include formulae, and made it freely available, the result is TEX. Knuth has been called the "father" of analysis of algorithms for his contribution to the development of analysis of computation complexity of algorithms and systematized formal mathematical techniques for it. Also, 'Knuth' popularized the asymptotic notation for evaluating algorithms. Another mathematician and computer scientist by the name "Leslie Lamport" wrote a variant of TEX called LaTeX that focuses on document structure rather than such mathematical symbols alone. The author simply added first two letters of his name La with TeX and named the software as LaTeX.

LaTeX has many features:

- ✓ Distinguished excellent print quality!
- ✓ Equations are relatively easy to enter, once you understand the programming aspects
- ✓ Latex automatically numbers the sections, sub-sections, figures, tables, foot notes, equations, theorems, lemmas, and the references of your paper. When you add a new section or sub-section, or a new reference, every item is re-numbered automatically. It can create its own table of contents and indices automatically as well.
- ✓ Spacing between Word is uniform throughout the document. In contrast, MS Word has this drawback when you justify a paragraph.
- ✓ It can easily manage very lengthy documents like books and theses.

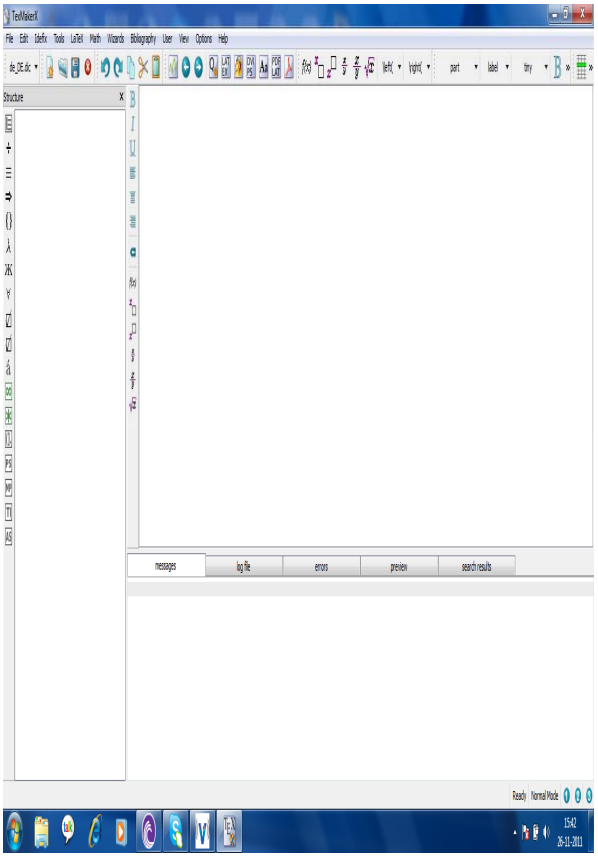

Fig 1 - LaTeX Documentation Tool

1.0 BASIC SOURCE FILE PREPARATION IN LATEX

Latex is a document preparation system that internally uses tags to prepare a readable document with crystal clarity. Document preparation with Latex typically consists of using a text editor like Vi Editor, Notepad, Emacs to edit a Latex source file which has the extension as *.tex* file. Then, run the latex program to convert the source file to a document interchange format such as PostScript or PDF. Once the document is converted to PostScript or PDF format, it can be previewed on the screen, sent to others, and printed.

1.1 Using Mark Up Tags for Typesetting

Latex uses mark up language like HTML tags for typesetting paragraphs, tables, figures, diagrams etc., it does not contain any Graphical User Interfaces(GUI) like icons for numbered bullets, icons for performing alignment of text as we use in MS-Word or Star office. User has to set tags for typesetting the document and the output format will never be shown immediately. After compiling the tags,

convert the file in to a PostScript of PDF file, it produces an output document file. Nevertheless, you will be able to insert, delete, copy, change any tag as per user requirement. PostScript is a good interchange format for UNIX operating system. But for windows based environment PDF would be the ideal choice as of now.

1.2 Merits of LATEX Documentation

Superior Typographical Quality: Latex facilitates unique typographical quality; however, one must spend time for familiarising the tags and appropriate usage of each.

Built-in Fonts: It supports all categories of fonts as available in MS-Word and Open office. In addition to that additional fonts like *tiny*, *footnote size*, *normal size*, *large*, *huge* are available.

Good spacing algorithm: In TEX software, Knuth used $(1/100)^{th}$ of wavelength of light particles in his algorithm to measure and to fix uniform automatic spacing between one word to another. Also, Knuth challenged that his algorithm is more accurate. Absolutely there is no other tool in the market with this typographic accuracy even if you are willing to purchase.

Ability to fine-tune spacing arbitrarily: Latex is provided with additional tags for fine-tuning the space arbitrarily.

Cross Platform/Portability: Latex can run virtually on any operating system in existence. MS-Word is compatible with windows and does not work on Unix/Linux/Mac os machines.

Document Longevity: Latex documents written ten years ago still works and produce the same output as they did when originally written. In contrast, Microsoft uses version evolution as a strategic tool to force people to upgrade continuously. Consequently, MS Word documents are typically useful only for 3-4 years.

Mathematical Typesetting: Knuth created TeX primarily to typeset mathematics beautifully. Latex includes all the capabilities of TeX in Mathematics typesetting and with few easier user interfaces. There are packages like *amsmath* which enhance and refine these interfaces. This tool facilitates all Greek and Hebrew letters, Relational Algebraic symbols, trigonometric symbols, binary operation, arrays, and vector symbols. Any complex equations can also be typed in this tool. LaTeX continue to excel in this task.

Cross-referencing capability: LaTeX automatically assigns label for tables, figures and equations while it is typed. You can refer to a table or equation with the corresponding label during the course of appending the document. If any mismatch in cross-referencing LaTeX compiler will report an error.

Macros and other programmatic features: Latex allows us to define macros, which contains sequences of text and/or mark-up. It's equivalent to copy and paste in MS Word documents. Instead of copy and paste, here same macro name is called in different location of document. Latex allows people to write programs in their documents. Moreover, any graphical diagrams can be drawn using a utility called *tikz.*

1.3 Demerits of Using Latex

Difficulty in Learning: User must be a computer literate to learn and make use of mark up language.

Preview Delay: Every time there is time delay between the time tags are prepared and to see the result in PDF or PostScript.

Possibility of Syntax errors: Unlike in a "What you see is what you get" [WYSIWYG] word processor, you need to create *.tex* file. Latex software will reject if there is violation in syntax. It takes time for learning the tags, debugging and compilation.

Adding New font: You need to write code for adding new font tags in to the software.

2.0 THE BASIC ELEMENTS OF A LATEX FILE

To use LATEX, begin by creating an ASCII text file with a *.tex* suffix. Any favourite editor such as notepad, WordPad, vi editor, Emacs can be used to create a source file. Blank lines in your *.tex* file indicate a new paragraph and a space character indicates a new word. Otherwise, all blank spaces are ignored. It is a common practice to start new sentences with a new line in your *.tex* file.

Comments in a *.tex* file start with a % character and it is ignored, similar to programming language complier. The % character is therefore a special character in LaTeX. If you intend to print a percent-sign, you must type \%. Three other special characters that are used often are $, \, and &. The other special characters are #, _, ~, ^ , {, }. To print any of these characters in document simply precede it with a \ character.

2.1 The first command

.tex file must contain the following as first command:

\documentclass[12pt]{article}

This tells the LaTeX compiler that you will be writing an article, which is a kind of document you are not breaking up your work in to chapters. Options are included within square brackets. LaTex default font size is 10 pt. The text that you want to display must be accompanied with

\begin{document}
and end with the line
\end{document}

```
% comment statement%
\documentclass{article}
\begin{document}
 Future Directions of Robot
\end{document}
```

For these tags, LaTex will use default font, margins, line spacing, page numbering and paragraph indentation for the pre-defined article class.

2.2 Margins, Line-spacing and other optional formatting commands

Unlike MS-Word, changing the default font-size of your section headings is not trivial. Latex has a standard format which is applied automatically to your entire document.

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

A new section starts with

\section{ "section title"} command

A sub-section starts with

\subsection{"sub-section title"} command

Paragraphs are identified by Latex by a blank line.

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

To start a new page, use *\newpage*.

2.4 Italics, Bold-face, underlining, and centering

The default font is TimeNew Roman *{\rm}*. Other type faces are: sans serif *{\sf}*, slanted *{\sl}*, italics *{\it}*, bold-face *{\bf}*, small caps *{\sc}*, and typewriter *{\tt}*. A broader range of fonts can be used by adding package in the preamble.

For example *\usepackage{palatino}*, *\usepackage{utopia}* and others are available.

Underlining a text using *\underline{ }* command.

Text between *\begin{center}* and *\end{center}* are centered horizontally.

In addition to specifying a font size in your *\documentclass* command, you can change your font size within your text. These fonts are *{\tiny}*, *{\scriptsize}*, {\footnotesize}, *{\small}*, *{\normalsize}*, *{\large}* and *{\huge}*.

2.5 Examples of mathematical expression

When you want to type an equation in center

$$\alpha = \beta\gamma\delta \qquad (1)$$

To type the above equation:

\begin{equation}
\alpha = \beta \gamma \delta
\label{eq:abc}
\end{equation}

Equations are numbered automatically by LaTex. You can refer to its equation by its number, if you label the equation in your *.tex* file. Equation (1) has the label *\label{eq:abc}* in the *.tex* file, and is referred to with the command *\ref{eq:abc}*. At any point your document you can refer to this equation by typing *\ref{eq:abc}* in your *.tex* file. Labeling equation is optional. LaTeX is self contained with all integral calculus, differential calculus, trigonometric functions and equations and much more. All mathematical symbols are denoted by their Greek and Hebrew letters and few are shown here:

\tau - □ \epsilon - □ \chi - χ \omega - □

2.6 Lists

Lists of items can be enumerated and itemized. This is similar to numbering and bulleting respectively. An enumerated list begins with:

\begin{enumerate}
and ends with the command
\end{enumerate}

An itemized list begins with:

\begin{itemize}
\item computer science
\item mathematics
\item statistics
\end{itemize}

2.7 Spelling Correction

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

2.8 Automatic Cross-Reference Checking

In a written article, you may often have occasion to refer to equation or table mentioned earlier in the same document. Assume you are explaining a new term in the second page of article and when you again intend to use the same term in fourth page, it is a matter of courtesy to the reader to point to the explanation. The act of citing previous term for better understanding is termed as cross-referencing. Such cross-referencing can be done manually but if you revise your document and insert some new sections then, changing all cross-references manually is not a easy task in case of voluminous document. This cross-referencing is automated in this tool.

If your document contains bibliography, a table of contents, other labelled items like equations, figures, tables, you need to run latex more than once to get the cross-references checked properly. 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 a question mark? Prompt.

If you type 'e' at this 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 fix the error and re-process your *.tex* file. Running the latex program creates a file called *myfile.dvi*. Now, you can see the output document file using PDF or PostScript.

CONCLUSION:

As you can see, using LaTeX successfully is not trivial. However, easy ways to get around the more difficult parts once you spare time. For engineering students and professionals the presentation and results are worth rewarding. Documentation done in LaTeX is simply a value addition to researchers, for preparing the theses and publications. Reference [7] by Leslie Lamport is the standard reference on LaTeX. For tricky problems that need to be resolved quickly, you may pose your questions to various newsgroups and discussion forums.

REFERENCES:

[1] Buerger, David.J., Latex for scientists and Engineers, (New York: McGraw-Hill, 1990).2] Diller, Antoni, Latex line by line: Tips and Techniques for Document Processing, (New York:J.Wiley, 1993).

[2]Goossens, Michel, 'The Latex Companion", (New York: Addison, 1994).

[3] Gurari, Eitan, TEX and LATEX: Drawing and Literate Programming, (New York:McGraw-Hill, 1994).

[4] Kopka, Helmut, "A Guide to LATEX: Document preparation for beginners and advanced users,(New York:Addison-Wesley Pub. Co,. 1993).

[5]Lamport, Leslie, LATEX:A Document preparation system: user's guide and reference manual, (New York:Addison-Wesley Publishing company.,, 1994).

[6] Shultis, J.Kenneth, LATEX notes: Practical Tips for preparing Technical Documents, (New York: PTR PrenticeHall,1994).