Introduction to LaTeX

A Brief Summary of LaTeX

Ashik Iqubal

Department of Physics
Ramakrishna Mission Vivekananda University
Belur Math, Howrah

ashik.iqubal@gmail.com

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TEX: Introduction

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- Knuth started writing TEX typesetting engine in 1977 and released in 1978
- TEX was developed with two goals: to produce high quality documents, and to produce a system that would produce consistent results irrespective of platform or time

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- TEX is a popular means to typeset complex mathematical formulae, specially among academics
- It is a free / open source software

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- LaTeX is a document markup language and document preparation system based on TeX created by Leslie Lamport
- LaTeX comprises of a collection of TeX macros and a program to process LaTeXdocuments
- Since TeX formatting commands are very low-level, it is usually simpler for end-users to use LaTeX

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- Complex Mathematical formulae can easily be typeset
- Indexes, footnotes, citations, references, etc are automatically generated
- Consistent layout, tables, fonts, etc throughout the document
- Document structure can be easily copied to another document

Example

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

LaTeX: Spaces

- Consecutive "Whitespace" characters are treated as a single space
- "Whitespace" at the beginning of a line is generally ignored
- Single line break is treated as "whitespace"
- Empty line between two lines denotes change of paragraph
- Several empty lines are treated as one empty line

LaTeX: Special Characters

- Following are reserved characters that have special meaning in LaTeX :
  # & $ \ ^ _ ~ { } %
- Special characters can be used in the document adding a backslash \ as prefix :
  \# \& \$ \textbackslash{} \textasciicircum{} _ \~{} \{ \} \%
- Backslash can be entered in math mode as \backslash

LaTeX: Commands

- Case sensitive
- Starts with backslash \ followed by one "non-letter" or multiple letters and terminated by space, number or "non-letter"
- Argument is given between curly braces {} and optional parameters between square brackets [ ]

LaTeX Code

```
\command [ option1, option2, ... ] {argument1} {argument2}
```

LaTeX: Groups

- Defined and limited by a pair of curly braces {}

Example

{ \bf **Bold font text** }

LaTeX: Environment

LaTeX Code

```
\begin{environment}
Contents under influence of the environment
\end{environment}
```

LaTeX: Comments

When LaTeXencounters % it ignores the rest of the current line, line break and all the whitespace at the beginning of the next line

LaTeX: Document Classes

Every LaTeXfile starts with the following

LaTeXCode

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

Example

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

LaTeX: Document Class - {class}

Examples of document classes:

article	articles in scientific journals, short reports, etc.
report	longer reports containing several chapters, small books, thesis, etc.
book	real books
letter	writing letters
slides	slides with big sans serif fonts
beamer	writing presentation

LaTeX: Document Class - [options]

Examples of document class options:

?pt	sets the size of the main font of the document, eg. 10pt, 11pt, 12pt
?paper	defines the paper size, eg, a4paper, letterpaper, legalpaper, a5paper, etc.
?column	instructs LaTeXto typeset in one or two columns, eg. onecolumn, twocolumn
?side	specifies whether double or single sided output should be generated
landscape	landscape mode
draft	makes LaTeX indicate hyphenation and justification problems in the right-hand margin of the problem line

LaTeX: Packages

Packages in LaTeX are activated using

LaTeX Code

```
\usepackage[options]{package}
```

Example

```
\usepackage{amsmath}
\usepackage{amsfonts}
\usepackage{amssymb}
```

LaTeX: Preamble

In LaTeX, preamble is the part from the beginning of the document until \begin{document}. It consists of commands affecting the entire document.

Example

```
% Preamble
\documentclass[a4paper]{article}
\usepackage{amsmaths}
% Preamble

\begin{document}
```

LaTeX: File input

LaTeX files (*filename.tex*) are inserted into a document using

LaTeX Code

```
\input{filename}
or
\include{filename}
```

Using \include{filename}, the output is added to the document, unlike \input{filename} where the commands are added into the document.
Therefore new page will be created with every \include command.

LaTeX: Top Matter

To include information about the document itself, like title, author, date, etc

Example

```
\documentclass[a4paper]{article}
\begin{document}
\title{Title of the LaTeX document}
\author{Humpty \and Dumpty \\ RKMVU \\
\texttt{userid@server.com} }
\date{\today }
\maketitle
.....
\end{document}
```

The command \maketitle creates the title page

LaTeX: Top Matter - Abstract

To include an abstract:

Example

```
\documentclass[a4paper]{article}
\begin{document}
\begin{abstract}
The abstract goes in here.....
\end{abstract}
The main body of the document goes in here.....
\end{document}
```

LaTeX: Sectioning

Except in *letter* class, any document can have sections, subsections, subsubsections, etc.

LaTeX Code

```
\section[TOC Header Name]{Section Name}
.....
\subsection[TOC Header Name]{Sub-Section Name}
.............
\subsubsection[TOC Header Name]{Sub-Sub-Section Name}
.............
```

In *book* class, the document can have chapters

LaTeX Code

```
\chapter{Chapter Name}
.....
```

LaTeX: Appendices

In *article* class, appendix is given by

LaTeX Code

```
\appendix
\section{First Appendix}
.....
```

In *report* or *book* class, appendix is given by

LaTeX Code

```
\appendix
\chapter{First Appendix}
.....
```

LaTeX: Table of Contents

In LaTeX, the Table of Contents is generated automatically

LaTeX Code

```
\tableofcontents
```

Including the command \tableofcontents generates the TOC at that point

LaTeX: Text Alignment

LaTeX Code

```
\begin{alignment}
.....
\end{alignment}
```

The option *alignment* can take the following values

center	center aligned
flushright	left aligned
flushleft	right aligned

LaTeX: Text Size

LaTeX Code

```
{ \size ..... }
```

The option *size* can take the following values

Huge **Huge**

huge **huge**

LARGE **LARGE**

Large **Large**

large **large**

small **small**

footnotesize **footnotesize**

tiny **tiny**

LaTeX: Text Character

LaTeX Code

{ \textbf **Gives Bold Font** }
{ \textit *Gives Italics* }
{ \underline Underlines the Text }

LaTeX: Items

LaTeX Code

```
\begin{itemize}
\item[item symbol] ........
\item[item symbol] ........
........
\end{itemize}
```

Example

- ....
- ....

  ....

LaTeX: Enumeration

LaTeX Code

```
\begin{enumerate}
\item ........
\item ........
........
\end{enumerate}
```

Example

1. ....
2. ....
    1. ......
    2. ......

    ....

LaTeX: Including Graphics

To add grahics to the document, the graphicx package needs to be included in the preamble

LaTeX Code

```
\usepackage{graphicx}
```

To include an *imagefile* in the document :

LaTeX Code

```
\includegraphics[arrt1=val1,attr=val2,....]{imagefile}
```

LaTeX: Including Graphics contd.

LaTeX Code

```
\includegraphics[arrt1=val1,attr=val2,....]{imagefile}
```

The attributes can be specified as follows:

width=xx	width of image
height=xx	height of image
keepaspectratio	preserves the aspect ratio can be set to *true* or *false*
scale=xx	scales the image by factor xx
angle=xx	rotates the image by angle xx degrees (counter clockwise)
trim=l b r t	crops the image by l from left, b from bottom, r from right and t from top
page=x	if image is a pdf file with multiple pages, selects the image on page x

LaTeX: Including Graphics as Figure

To include an *imagefile* as a figure,

LaTeX Code

```
\begin{figure}[placement specifier]
\centering
\includegraphics[attr1=val1]{imagefile}
\caption{Awesome Image}
\label{fig:awesomeimage}
\end{figure}
```

Use \listoffigures to add a list of figures to the beginning of document

LaTeX: Including Graphics as Figure

LaTeX Code

```
\begin{figure}[placement specifier]
\end{figure}
```

The placement specifier can take the following values

- h place float here (approximately)
- H place float precisely at the location of LaTeX code
  requires the use of float package \usepackage{float}
- ! override internal parameters LaTeX uses
- t top of page
- b bottom of page
- p special page

LaTeX: Text Wrapping Around Image

To wrap text around images, the following package can be added in the preamble

LaTeX Code

```
\usepackage{wrapfig}
```

To place *imagefile* in the document

LaTeX Code

```
\begin{wrapfigure}{pos}{Xcm}
\centering
\includegraphics[attr1=val1]{imagefile}
\caption{Awesome Image}
\label{fig:awesomeimage}
\end{wrapfigure}
```

LaTeX: Text Wrapping Around Image contd.

LaTeX Code

```
\begin{wrapfigure}{pos}{Xcm}
\includegraphics[attr1=val1]{imagefile}
\end{wrapfigure}
```

Here *pos* can take eight possible values

- r \ R right side of text
- l \ L left side of text
- i \ L inside edge (ie, near binding in twoside document)
- o \ O outer edge (ie, far from binding in twoside document)

The upper-case allows the figure to float, while lower case means "exactly here"

X is the width of the figure. Can be specified as a factor of \textwidth, eg., 0.5\textwidth

LaTeX: Tables

Tables are generated in LaTeX using the following format in general

LaTeX Code

```
\begin{table}[position specifier h, t, b, p]
\centering
\begin{tablular}{|| l | c| c | c | r || }
.... table .....
\end{tablular}
\caption{Table Caption}
\label{label:table}
\end{table}
```

Use \listoftables to generate a list of tables in the beginning of document

LaTeX: Table Environment

LaTeX Code

```
\begin{table}[position specifier]
\end{table}
```

The position specifier can take the following values

- h here
- !h force here
- t top
- b bottom
- p page

LaTeX: Tabular Environment

LaTeX Code

```
\begin{tablular}[pos]{table spec}
.... table .....
\end{tablular}
```

The table spec can take the following values

l	left-justified column
c	centered column
r	right-justified column
p{width}	paragraph column with text vertically aligned at the top
m{width}	paragraph column with text vertically aligned in the middle (requires array package)
b{width}	paragraph column with text vertically aligned at the bottom (requires array package)
|	vertical line
||	double vertical line

LaTeX: Tabular Environment contd.

LaTeX Code

```
\begin{tablular}[pos]{table spec}
.... table .....
\end{tablular}
```

The optional parameter pos specifies the vertical position of the table relative to the baseline of surrounding text

- b bottom
- c center
- t top

LaTeX: Tabular Environment contd.

LaTeX Code

```
\begin{tablular}[pos]{table spec}
.... table data .......
\end{tablular}
```

The table data is entered using the following commands

&	column separator
\\	starts new row (additional space may be specified after \\ using square brackets [Xpt])
\hline	horizontal line
\newline	starts new line within a cell
\cline{i-j}	partial horizontal line beginning in column i and ending in column j

LaTeX: Tabular Environment contd.

Example

7C0	hexadecimal
3700	octal
11111000000	binary
1984	decimal

Table : This table shows some data

LaTeX: Tabular Environment contd.

Example

```
\begin{table}[h]
\centering
\begin{tabular}{|r|l|}
\hline
7C0 & hexadecimal \\
3700 & octal \\ \cline{2-2}
11111000000 & binary \\
\hline \hline
1984 & decimal \\
\hline
\end{tabular}
\caption{This table shows some data}
\end{table}
```

LaTeX: Labels and Cross-Referencing

- To label something (section, figure, formulas, etc.) in a document, it is marked with a \label{tag}
- To refer to that label, ~\ref{tag} is used
- To refer to that labelled page, ~\pageref{tag} is used
- For referring to equations, one can use ~\eqref{tag}. (For this the amsmath package needs to be included in the preamble)
- To create hyperlink, use \usepackage{hyperref} and \usepackage[all]{hypcap} in the preamble (in the order mentioned). And use ~\autoref{tag} to refer to that label
- Run pdflatex twice to generate all the cross-referencing correctly

LaTeX: Hyperlink

- To create hyperlinks, use \usepackage{hyperref} in the preamble
- \url{http://.....} creates a hyperlink to the link
- \href{http://.....}{url description} creates a hyperlink to the link and also displays the url description
- For email links, \href{mailto:user@server.com}{user@server.com}

LaTeX: Bibliography

Add the list of Bibliography at the end of the document, immediately before \end{document}. The items in the Bibliography can be cited using ~\cite{tag}

Example

```
\begin{thebibliography}{99}

\bibitem{lamport94}
Leslie Lamport,
\emph{\LaTeX: A Document Preparation System}.
Addison Wesley, Massachusetts,
2nd Edition, 1994.

\bibitem{tag}
.....
\end{thebibliography}
```

LaTeX: Including Figure from Xfig

- Create a figure in Xfig. When needed, use LaTeX text like mathematical formulas, etc. in the textbox. Edit the textbox and change the option on "Special Flag" field to Special.
- Export the Xfig figure as "Combined PDF/LaTeX" (or "Combined PS/LaTeX"). Two files with the extension *.pdf_t and *.pdf (or *.pstex_t and *.pstex) will be created in the same directory. Include the figure using the following :

LaTeX Code

```
\begin{figure}
\centering
\input{xfig-figure.pdf_t}
\caption{Caption of figure}
\label{fig:test}
\end{figure}
```