DOCUMENTATION ON LATEX

Advanced Software Lab Assignment

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What is LATEX?

- LATEX is a document preparation system for high-quality typesetting. It is most often used for medium-to-large technical or scientific documents but it can be used for almost any form of publishing.
- LaTeX is not a word processor! Instead, LaTeX encourages authors not to worry too much about the appearance of their documents but to concentrate on getting the right content.

Features of LATEX

- Typesetting journal articles, technical reports, books, and slide presentations.
- Control over large documents containing sectioning, cross-references, tables and figures.
- Typesetting of complex mathematical formulas.
- Advanced typesetting of mathematics with AMS-LaTeX.
- Automatic generation of bibliographies and indexes.
- Multi-lingual typesetting.
- Inclusion of artwork, and process or spot colour.
- Using PostScript or Metafont fonts.

Getting Started

- To make documents in LaTex we use different **TAGS** and we define them by using a **Backslash(\)**
- The first line of code in any LaTeX document is the **document class** declaration command.
- There are five standard classes distributed with LATEX: **article, report, book, letter, slides**

-**article** for simple or short documents.
-**report** for small books and longer reports containing chapters.
-**book** for books.
-**letter** for letters, either business or personal.
-**slides** for making transparencies for projection on a screen.

```
\documentclass{class_name}
```

```
\documentclass{article}
for "an article document"
```

Packages, Size, Margins and Spacing

- To use outside packages in LaTex we use

  `\usepackage[options ]{package }`
  `Here, \usepackage[a4paper, margin=1in]{geometry}`

  used to set margin 1 inch and page size A4
- We define font size, number of cloumns in a page and also Page Type during documentclass declaration like-

  `\documentclass[12pt,twocolumn,letterpaper]{article}`
- To add Vertical Spacing we use

  `\vspace{1cm}` -> Add 1 cm Vertical Spacing
- To add Horizontal Spacing we use

  `\hspace{1cm}` -> Add 1 cm Horizontal Spacing

Input File & Title Page Structure

- LATEX input files must conform to a certain structure.

```
\documentclass[options]{class}
      Preamble
      \begin{document}
            Document text
      \end{document}
```

- If you are using the article, report, or book class, you may want a title page for your document. To do this, you need to tell LATEX to generate the title page with the command "\maketitle".

```
\title{This is the Title} % provide title info
\author{My Name}          % provide author info
\date{the date}           % provide date
\maketitle                % print title page
```

Text Formatting and Alignment

- Basic Text Formatting syntax:

```
\textbf{Some Text}          % Make Some Text Bold
\textit{Some Text}          % Make Some Text Italic
\underline{Some Text}       % Underlined Some Text
```

- Text Alignment in Latex:

```
\begin{flushleft}
     Make all text left-justified written
     within this scope
\end{flushleft}

\begin{flushright}
     Make all text Right-justified
\end{flushright}
```

Text Formatting and Alignment(Contd.)

- Text Alignment in Latex:

```
\begin{center}
     Make all text center allign written
\end{center}

\centering          % also used for center alignment
\textsc{text}       % make text in UPPERCASE
\large{text}        % make text larger than normal fort
\Large{text}        % make text larger than large text
\LARGE{text}        % make text larger than Large text
\huge{text}         % make text larger than LARGE text
\tiny text          % make text smaller than normal font
\texttt{Every One} % change text font style
```

Paragraph Formatting

- To add indentation to a Paragraph we use

  `\indent The indent Paragraph Started`
- To remove indentation to a Paragraph we use

  `\noindent The non-indent Paragraph Started`
- To add indentation to a Paragraph after a section we use

  `\usepackage{indentfirst}`
- To start a new line in latex we use

  `\\[*][extra-space]`

  It has an optional argument, extra-space, that specifies how much extra vertical space is to be inserted before the next line.

Paragraph Formatting(Contd.)

- To start a new paragraph with a line gap we use

```
\\*                    it tells LaTeX not to
                       start a new page after the line.
```

- To start from a new Page or Line

```
\newpage               % starts from a new page
\pagebreak             % break the current page at
                       the point of the command
\newline               % request a new line
```

- To draw horizontal line in a page we use

```
\rule[h]{w}{t}  % where h w and t are lengths
                upon user's choice
\hrulefill      % It draw a Horizonal line from
                left end to right end of a page
```

Section, Sub-section & TOC

```
\section{Section}  <-Make a Section
Hello World!
\subsection{Subsection}  <-Make a sub-section
Structuring a document is easy!
\subsubsection{Subsubsection}  <-Make sub section
More text.                          of a sub-section
\section{Another section}  <-Make another Sectioin
```

- To show all Sections and sub sections in Table of Content we use

  `\tableofcontents`
- To make all Sections and sub sections clickable in Table of Content we use a package

  `\usepackage{hyperref}`

Un-ordered & Ordered List

- Unordered List:

```
\begin{itemize}
    \item Each entries are denoted with a bullet
    \item Text in the entries may be of any length
\end{itemize}
```

- Ordered List:

```
\begin{enumerate}
    \item The labels consists of sequential numbers
    \item The numbers starts at 1
\end{enumerate}
```

Un-ordered & Ordered List(Contd.)

- Changing the bullets of Unordered list:

```
\begin{itemize}
      \item[$-$]              % From bullet to dash
      \item[$\ast$]           % From bullet to asterisk
      \item[$\CHARACTER$]     % Use any math character
\end{itemize}
```

- To change the number in Ordered list

```
Add \usepackage{enumitem} in your input file and
now we can use
% for Roman numbers
\begin{enumerate}[label=(\roman*)]
% for Alphabetical
\begin{enumerate}[label=\alph*)]
```

Latex Math & Equations

- Using inline math - embed formulas in your text

```
This formula $f(x) = x^2$ is an example.
```

- The most useful math envorinment is the equation environment:

```
\begin{equation*}
  1 + 2 = 3
\end{equation*}   % The Output is:
```

$$1 + 2 = 3$$

or

```
\begin{equation} % This syntax add an equation no.
  1 + 2 = 3
\end{equation}   % The Output is:
```

$$1 + 2 = 3 \tag{1}$$

Latex Math & Equations(Contd.)

- Greek and Hebrew letters:

α \alpha	δ \delta	
β \beta	Δ \Delta	Π \Pi
γ \gamma	ρ \rho	ε \varepsilon
π \pi	σ \sigma	Σ \Sigma
Θ \Theta	τ \tau	

- When we use math syntax or matrix always include `\usepackage{amsmath}` package in your input file
- for more details about equations **Please Click Here**

Matrix & Determinant

The basic format to make matrix is

```
\begin{matrix}    % This syntax create a matrix
Item1 & Item2\\      without braces
Item3 & Item4\\
Item5 & Item6\\
\end{matrix}

\begin{Bmatrix}   %for a matrix with curly brackets

\begin{vmatrix}    % This syntax create a determinant
Item3 & Item4\\
Item5 & Item6\\
\end{vmatrix}
```

Images & Sub-images

- To insert a image we need to use some packages which are

```
\usepackage{graphicx}
```

- After package we need to insert image folder path

```
% Path related to the tex file containing folder path
     \graphicspath{{images/}}

%Path in Windows format
    \graphicspath{{c:/user/images/}}
```

- After insert package and image path the basic syntax to insert an image is

```
\begin{figure}
     \includegraphics[scale=1]{image_name}
\end{figure}
```

Images & Sub-images(Contd.)

- Some addtional features:

```
\begin{figure}[h]
      \includegraphics[scale=1, angle=45]{image_name}
      \caption{Image Caption}
\end{figure}
```

- The parameter **scale=1** determines size of the image. Here we can also use the following code to set image size:

```
\includegraphics[width=3cm, height=4cm]{image_name}
```

- The parameter **angle=45** rotates the picture 45 degrees counter-clockwise. To rotate the picture clockwise use a negative number.

Images & Sub-images(Contd.)

- \begin{figure}[h], the parameter inside the brackets set the position of the figure. There is a list of parameter used to set position. They are
  - **H** Places the float at precisely the location in the LATEX code. Requires the float package, though may cause problems occasionally. This is somewhat equivalent to h!.
  - **h** Place the float here, i.e., approximately at the same point it occurs in the source text (however, not exactly at the spot)
  - **b** Position at the bottom of the page.
  - **t** Position at the top of the page.
- \caption{Some text} This line of code add caption to an image

Images & Sub-images(Contd.)

- Labels and cross-references:

```
\begin{figure}[h]
    \centering
    \includegraphics[width=0.25\textwidth]{mesh}
    \caption{a nice plot}
    \label{fig:mesh1}
\end{figure}

As you can see in the figure \ref{fig:mesh1},
the function grows near 0. Also, in the page
\pageref{fig:mesh1} is the same example.
```

- There are three commands that generate cross-references in this example. They are

Images & Sub-images(Contd.)

label{**fig:mesh1**} This will set a label for this figure. Since labels can be used in several types of elements within the document, it's a good practice to use a prefix, such as fig: in the example.

ref{**fi:gmesh1**} This command will insert the number assigned to the figure. It's automatically generated and will be updated if insert some other figure before the referenced one.

pageref{**fig:mesh1**} This prints out the page number where the referenced image appears.

** The **caption**{ } is mandatory to reference a figure **

- Another great characteristic in a LATEX document is the ability to automatically generate a list of figures. The syntax is

```
\listoffigures
```

Images & Sub-images(Contd.)

- To use subfigure we are using float(subfloat). Subfloat is very useful for placing subfigures at any desired position to do so add **usepackage**{**float,subfig**} and the the following syntax:

```
\begin{figure}[h]
\centering  % Make images center align
\subfloat[Cation of Image_1]
{\includegraphics[width=0.4\textwidth, height=40mm]
{Image_name_1}\label{fig:one}}
    \hfill % This is to fill the space horizontally.
\subfloat[Cation of Image_2]
{\includegraphics[width=0.4\textwidth, height=40mm]
{Image_name_2}\label{fig:three}}
\caption{Caption for whole image segments}
\end{figure}
```

Tables in Latex

We are creating a simple table:

```
\begin{center}
\begin{table}[h]
\begin{tabular}{ |c|c|c| }
 \hline
 cell1 & cell2 & cell3 \\
 cell4 & cell5 & cell6 \\
 cell7 & cell8 & cell9 \\
 \hline
\end{tabular}
\caption{Some Text}
\label{table:1}
\end{table}
\end{center}
```

{ **| c | c | c |** } This declares that three columns, separated by a vertical line, are going to be used in the table. Each c means that the contents of the column will be centred, you can also use **r** to align the text to the right and **l** for left alignment.

Output:

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

Table: Some Text

Tables in Latex(Contd.)

hline This will insert a horizontal line on top of the table and at the bottom too. There is no restriction on the number of times you can use \hline.

cell1 & cell2 & cell3 \\ Each **&** is a cell separator and the double-backslash \\ sets the end of this row.

caption{**Some Text**} This will add a caption to the table same as image caption.

label{**table:1**} and **ref**{**table:1**} They also work same as image label and image reference

begin{**table**}**[h]**, the parameter inside the brackets set the position of the table also same as image position. There is a list of parameter used to set position which are also same as image position options.

Tables in Latex(Contd.)

When formatting a table a fixed length either for each column also can be set by following code:

```
\begin{center}
\begin{tabular}{ | m{2cm} | m{1cm}| m{1cm} | }
\hline
cell1 dummy text dummy text & cell2 & cell3 \\
\hline
cell1 dummy text dummy text & cell5 & cell6 \\
\hline
cell7 & cell8 & cell9 \\
\hline
\end{tabular}
\end{center}
```

Tables in Latex(Contd.)

To set column width we need to add a package \usepackage{array}

The parameter **m{2cm}** sets a length of 2cm for first column (1cm for the other two) and centres the text in the middle of the cell.

The aligning options are **m** for middle, **p** for top and **b** for bottom.

Output:

cell1 dummy text dummy text	cell2	cell3
cell1 dummy text dummy text	cell5	cell6
cell7	cell8	cell9

Tables in Latex(Contd.)

Multi-column and multi-row cells in LaTeX tables

To use Multi-column and multi-row we need to use a package **usepackage**{**multirow**}

Basic commands:

```
%multi-column
\multicolumn{number cols}{align}{text} % align: l,c,r

%multi-row
\multirow{number rows}{width}{text}

%Using * as width in the multirow command, the text
argument's natural width is used.
```

Tables in Latex(Contd.)

Example of Multi-column and multi-row:

```
\begin{table}[h]
\begin{tabular}{|c|c|c|c|c|}
\hline
\multicolumn{5}{|c|}{Multi-Column}                    \\
                                \hline
\multirow{3}{*}{Multi-Row} & 7  & 8  & 9  & 10 \\
                                \cline{2-5}
                           & 12 & 13 & 14 & 15 \\
                                \cline{2-5}
                           & 17 & 18 & 19 & 20 \\
                                \hline
\end{tabular}
\end{table}
```

Tables in Latex(Contd.)

```
\multicolumn{5}{|c|}{Multi-Column} % To merge 5 columns

% To merge 3 rows as output
\multirow{3}{*}{Multi-Row}
```

cline{**2-5**} is used to draw a horizontal line from column no. 2 to column no. 5 (starting index 1). Actually \cline{ } command used to draw horizontal line within a fixed column range.

- To create a table in landscape we used **begin**{**sidewaystable**} instead of **begin**{**table**}

Output:

Multi-Column				
Multi-Row	7	8	9	10
	12	13	14	15
	17	18	19	20

** Finally to create a list of tables we use **listoftables** command **

Bibliography in Latex

- We are using Bibtex for Bibliography in Latex.
- When using Bibtex, the bibliography style is set and the bibliography file is imported with the following two commands:

  ```
  \bibliographystyle{stylename}
  \bibliography{bibfile}
  ```

  where **bibfile** is the name of the bibliography **.bib** file, without the extension and **stylename** is one of the following:
  - abbrv
  - acm
  - plain and etc.
- This \cite{label} is used insert a citation where label is the label of a bibliographic entry in a .bib file depends on the bibliography style used.

Bibliography in Latex(Contd.)

- Bibliographic references are usually kept in a bibliography file(.bib), this file consists of a list of records and fields. Each bibliography record holds relevant information for a single entry.
  Syntax for .bib file:

```
@article{einstein,
    author =   "Albert Einstein",
    title =    "{Zur Elektrodynamik bewegter
               K{\"o}rper}. ({German})
    [{On} the electrodynamics of moving bodies]",
    journal =  "Annalen der Physik",
    volume =   "322",    number =   "10",
    pages =    "891--921",
    year =     "1905",
    DOI =      "http://dx.doi.org/10.1002" }
```

Bibliography in Latex(Contd.)

@article{...} This is the first line of a record entry, @article denotes the entry type and tells BibTeX that the information stored here is about an article. There are a lot more types like **book, conference, unpublished, misc, manual and etc**.

einstein The label einstein is assigned to this entry, is an identifier that can be used to refer this article within the document.

author = "Albert Einstein", This is the first field in the bibliography entry, indicates that the author of this article is Albert Einstein. Several comma-separated fields can be added using the same syntax key = value, for instance: **title, pages, year, URL, volume, ISBN, journal, edition, chapter, copyright, etc.**

Bibliography in Latex(Contd.)

- Remember if you do not refer a particular entry in your bibliography it will note be shown in reference.
- To make sure bibliography is present in table of contents add this following line of syntax right before bibliography style

```
\addcontentsline{toc}{section}{References}
\bibliographystyle{plain}
\bibliography{filename without .bib}
```

Chapter & Page Style

- Basically \chapter is used in **report** and **book** class.
  The syntax is:

  `\chapter{chapter_name}`
- To customize a chapter we can use a package:

  `\usepackage[style_name]{fncychap}`

  where **style_name** can be **Sonny, Lenny, Glenn, Conny, Rejne, Bjarne, and Bjornstrup** depending upon user's choice.
- The \pagestyle command changes the style from the current page on throughout the remainder of your document. The valid options are:
  - **headings** Puts running headings on each page. The document style specifies what goes in the headings.
  - **plain** Just a plain page number.
  - **empty** Produces empty heads and feet - no page numbers.

Chapter & Page Style(Contd.)

- we can also customize the header footer using \pagestyle. So the syntax is:

```
\usepackage{fancyhdr} % Add this package
\pagestyle{fancy}     % make style name "fancy"
\fancyhf{}
\rhead{text}          % add text in left header
\lhead{text}          % add text in right header
\rfoot{\thepage}      % add page no. in right footer
\lfoot{text}          % add text in right footer
```

Multi-column in Latex

- We can also use multiple column in a LATEX document by using the following code:

```
\usepackage{lipsum}   %add this package for dummytext
\usepackage{multicol} %add this package for multi-row
\usepackage{color}    %add this package for colour
\setlength{\columnsep}{10pt} %add hspace between col
\setlength{\columnseprule}{0.5pt} %set line width
\def\columnseprulecolor{\color{black}}%set line color

\begin{document}
    \begin{multicols}{2}  %make tow columns
        \lipsum[1-3]      %add some dummy text
    \end{multicols}
\end{document}
```

Multi-column in Latex(Contd.)

Output:

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Beamer class(Introduction)

- **beamer** is one of the document class which is used to create slides. Basic structure of beamer class is:

```
\documentclass[12pt]{beamer} %set the document class
\title{Some text}            %add title
\subtitle{some text}         %add sub-title
\author{author name}         %add author name
\institute{institute name} %add institute name
\date{date(optional)}        %add date

\begin{frame}            %create a single slide
\frametitle{text}        %heading of the slide
\framesubtitle{text}  %sub-heading of the slide
\titlepage               %print the title in a slide
\end{frame}              %end the created slide
```

Beamer class(Themes)

- In beamer class we can also use custom theme for slide.The basic syntax is:

```
\usetheme{AnnArbor}                 %setting theme
\usecolortheme{whale,beaver}        %setting theme color
```

- To know more about themes visit: **Beamer Theme Gallery**

Beamer class(Pause)

The **pause** command tells Beamer to make a new PDF page for what follows. This can be done basically anywhere.

Latex Syntax for pause:

```
\begin{frame}

Some content
 \pause
 Some more content

\end{frame}
```

In the above command it will create 2 slides where 1st slide print only some content but the 2nd slide will show some content with Some more content that increase code reusability.

Beamer class(Table of Contents)

- To add table of content we use the following command:

```
\begin{frame}
\frametitle{Table of Contents}
\tableofcontents
\end{frame}
```

- Remember one thing **tableofcontents** only shows sections and sub-sections.

Beamer class(Table of Contents(Contd.))

- It's also possible to put the table of contents at the beginning of each section and highlight the title of the current section. Just add the code below:

```
\AtBeginSection[]{
\begin{frame}
    \frametitle{Table of Contents}
    \tableofcontents[currentsection]
\end{frame}}
```

- If you use \AtBeginSubsection[] instead of \AtBeginSection[], the table of contents will appear at the beginning of each subsection.
- And other features of beamer class is pretty much same as other document class.