Latex Certificate Course Instructions

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1 figure Environment

The `figure` environment is used for adding figures to your document. The `figure` environments can have captions. You may also generate a list of figures using `\listoffigures` command.

1.1 includegraphics Command

The `figure` environments are supposed to contain images that you draw using LaTeX or that you already have in your computer.

You can add images on your computer to the document using `\includegraphics` command. This command takes the image address as argument and image dimensions and effects as optional arguments. And it does not require a `figure` environment.

```
\usepackage{graphicx}
...
\begin{document}
...
\begin{figure}
\centering
\includegraphics{flower.jpg}
\caption{Flower}
\end{figure}
```

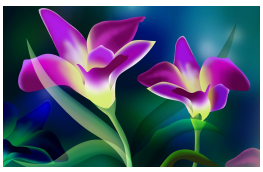

Figure 1: Flower

Figure 2: figure Environment

1.2 Drawing using Tikz

The `tikz` package is user-friendly syntax layer for the `pgf` package. The current version of `pgf` package is 3.1.8b. And is maintained by the PGF-Tikz team. The `pgf` package documentation is available at CTAN and Github.

LaTeX allows you to create vector images using `Tikz` package. The `tikzpicture` enviroment is used and it supports `\draw` commmand which draws a path.

```
1  \usepackage{tikz}
2  ...
3  \begin{document}
4  ...
5  \begin{figure}
6  \centering
7  \begin{tikzpicture}
8  \draw (0,0) -- (2,2) %
9  -- (4,0) -- cycle;
10 \end{tikzpicture}
11 \caption{Triangle}
12 \label{fig:tikz}
13 \end{figure}
```

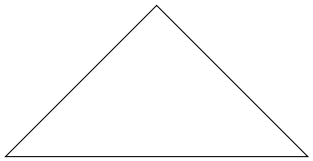

Figure 3: Triangle

Figure 4: Drawing using Tikz

In Figure 4 at line 12, an anchor named `fig:tikz` is created. The purpose of anchors will be discussed in section 3.

1.2.1 Tikz Coordinate Systems

In Figure 4 at line 8, the ordered pairs $(0, 0)$, $(2, 2)$ and $(4, 0)$ represents coordinates in the cartesian coordinate system. You may also write `(2:45)` which represent $2\angle 45$ in the polar coordinate system. Tikz also supports relative coordinates. `++(2,2)` represents 2 units to the right and 2 units to the top. Similarly, `++(2:45)` represents 2 units at 45 degrees.

In Tikz, `\coordinate` command is used to name coordinates. Then you can use those names to draw paths. For example, `\coordinate (A) at (0,0);` names the coordinate $(0, 0)$ as `A`.

1.2.2 Tikz Path Commands

Tikz `\path` command is used to define paths. This path is not visible if not mentioned explicitly. Also paths can be assigned names. The `\path` command has the following variants,

`\draw` draws the path

`\clip` crops the image inside path

`\fill` fill the interior of the path

`\shade` shades the interior of the path with a gradient

`\shadedraw` shades and draws the path

1.2.3 Tikz Nodes

Tikz allows you add draw an image part by part. The `\node` command is used to draw a part of the image. This part could be just a label or a complex sub-image.

2 table Environment

The `table` environment is used for adding tables to your document. The `table` environments can have captions. You may also generate a list of tables using `\listoftables` command.

2.1 tabular Environment

The `tabular` environment is used for creating tabular data. This environment uses & to separate columns and \\ to separate rows. The `\hline` and `\cline` commands are used to draw horizontal lines. The second argument of the `\begin` command is used for drawing vertical lines and aligning data in each column.

```
\begin{table}
\begin{tabular}{|c||l|}\hline
No. & Environments \\ \hline
1 & tabular \\ \hline
2 & equation \\ \hline
3 & matrix \\ \hline
\end{tabular}
\caption{Environments}
\label{tb:table}
\end{table}
```

No.	Environments
1	tabular
2	equation
3	matrix

Table 1: Environments

Table 2: table Environment

3 Cross Reference

LaTeX has a mechanism to refer different elements of the same document. You can refer to equations, sections, tables and figures. The `\label` command is used to create an anchor of reference. And `\ref` command is used to refer to such an anchor. Also `\pageref` command is used to refer to the page number of that anchor.

You can have forward references as LaTeX creates/updates anchors in the associated `aux` file. And updates the references using the existing labels in the `aux` file. You might have to compile twice to update labels which are newly introduced.

3.1 Adding Anchors

The `\label` command is used to create anchors.

In Figure 4 at line 12, an anchor `fig:tikz` is created. And in Table 1 at line 9, another anchor `tb:table` is created. These anchor may be referenced using the command `\ref`.

For example, `\ref{fig:tikz}` gives 4. And, `\pageref{tb:table}` gives 3. The anchor `fig:tikz` is the figure numbered 4 and `tb:table` is the table on page 3. These numbers are automatically updated by LaTeX.

Warning : The `figure` and `table` numbers are updated only if they have a caption. Thus, `\label` command won't work in `figure` and `table` environments if it is not used after the `\caption` command.

3.2 Associated Files

There are many associated files created and managed by LaTeX for generating your document. The files with `tex` extension are LaTeX source files where you write your LaTeX file for document creation. The `pdf` extension is used by the PDF files generated by LaTeX.

We can tell the purpose of each associated file from its file extension. The following are a few important file extensions,

aux Auxiliary Data for toc, reference, index, bibliography, ...

log Compilation Log — Errors and Warnings

toc Table of Contents

lof List of Figures

lot List of Tables

An ellaborate list of file extensions for different purposes, is available at Tex StackExchange.