LaTeX Tutorial for Beginners

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Abstract—This document is a detailed tutorial on how to get started with LaTeX and design your document anyway you want. This tutorial is especially focused for beginners who have no background in LaTeX but it can also serve as a useful resource for people who already know how to use LaTeX. Lets Begin!!!!

Index Terms—CSE185, LaTeX Tutorial, IEEEtran, journal, LaTeX, paper, template.

1 Introduction

WHY learn LaTeX ? You must be wondering why should you learn LaTeX since there are so many other easily accessible options like Microsoft Word and Google Docs, we have at our disposal. Let me tell you why – With LaTeX you can have high quality typesetting document with minimal effort. Ever tried writing mathematical equation in Google Docs, I tried and it was a nightmare. Well, LaTeX got you covered, you won't struggle adding mathematical notation or adding citation with appropriate format with LaTeX. Especially, if you plan on working in academia, writing papers, proposal, grants writing are some of the things you will do at least once at some point in your career. And LaTeX is the best option you have to get your documents formatted per you needs. This tutorial will help you get started in LaTeX and you will be able to generate beautifully formatted documents by the end of this tutorial. Now, Lets start our tutorial.

1.1 The Basics to get started

1.1.1 Where to LaTeX?

Overleaf is the best option to get started on LaTeX. It in important in LaTeX to establish a document environment where it begins and ends. Overleaf automatically provides basic document structure command in your main.tex.

Lets break it down here. The commands we are using here is to add title in the document author and date. All our writing work will be within **begin** and **end**.

- `\title{Your Title}`
- `\author{Author's name}`
- `\date{Today's date}`
- `\begin{document}`
- `\maketitle`
- `\end{document`

We use `\begin{document}` the beginning - and `end{document` at end. Here, We also add `\maketitle` in between `\begin{document}` and `end{docuemnt}` to add the title, author name and date in our document.

1.1.2 Reserved Characters

Some of the **Reserved Characters in** LaTeX are:

```
\, ~, \\, % etc.
```

Now, Let's talk about why these characters are reserved and how do we use them. These characters helps us to layout our document in LaTeX. We cannot use them directly in our documents and if we want to use them we need special command or notation to do so.

- `"\"` a single backslash is the prefix for LaTeX commands.
- `"~"` a tilde is to specify that the space cannot be broken by a line break.
- `"\\"` a double backslash breaks the line.
- `"%"` a percentage sign is to add comments in .tex file.

But how am I displaying these character here? You have to use another command that can

help us display these character like `\verb` and if you want to display a bunch of characters you can also use `\begin{verbaim}` and `\end{verbatim}`. Add you character in between.

1.1.3 Section and Subsections

In this section we will discuss about creating sections and sub-sections in the document. First, we use `\section{Topic}` command for sections. To create subsection we use `\subsection{subtopic}`. What's even interesting is to create subsection of subsection you can use `\subsubsection{subtopic}`. Here, in all of them you write your title with in the "`{ }`".

2 Additional Features

We can install different packages to work with in LaTeX that will go on the very top of your main.tex and some of them listed are:

- `\usepackage{graphicx}`
- `\usepackage{amsmath}`
- `\usepackage{balance}`

Here, **graphix** package is for including graphics in various formats, **amsmath** package provides environment for math equations and other mathematical content. **balance** helps to make document look asthetically pleasing especially with two columns.

2.1 Figures

Lets discuss about figures. First, we need to upload the figure in our folder and make sure they are acceptable formats. we can create figure environment to add and make adjustments to our figure. Here we add an image of sammy the slug. To add an image we must start with the environment `\begin{figure}` and `\end{figure}`.

Now everything we do for this particular figure will be with in **begin** and **end** of this environment.

Now, For the figures we have **graphicx** package that will help us here.

We will add `\centering` that will help us center the image.

Then, We include our image using

```
\includegraphics[]{}
```

Here `[]` we add our image modifications.

Here,`{ }`we can add the image file name inside the parenthesis. Now, we add caption using `\caption{sammy}`. Finally, we use `\label{fig_slug}` to label our image.

Fig. 1: Sammy the Slug

2.2 Label, Cite, and Ref Commands

Now, we will discuss the Label, cite and ref commands in LaTeX. We already discussed how to use `\label` in our document.

```
\label{fig_slug}
```

Now, To cite we use `{\cite{}`. This help is to add citation to our references. Oftentimes, research papers we use also needs to be cited and they provide citation in LaTeX format which you can easily download and upload and add to the document.

```
\cite{IEEEhowto:kopka}
```

appears like: [1] in References. Now, to add references we call `\ref{}` command and add our reference inside the `{}`. Here, I have added the reference to the Figure 1 which was named `fig_slug`. Additionally, `\ref{fig_slug} \end{verbatim}` adds the reference to the image we are using which can be called later in the document if needed.

2.3 Tables

Here is an example of a floating table. Here, I will be using the Titration plot pdf file data.

TABLE 1: Titration Data Table

Volume of Base (mL)	pH
1	3.15
2	3.24
3	3.39
4	3.54
5	3.63
6	3.78
7	3.85
8	3.98
9	4.11
10	4.2
10.5	4.26
11	4.31
11.5	4.39
12	4.47
13	4.6
14	4.75
15	4.9
16	5.2
16.5	5.4
17	5.6
17.5	5.95
18	6.6
18.5	7.3
18.7	7.6
18.9	8.15
19.1	9.95
19.3	10.5
20.5	10.9
21	11.8
21.5	12.2
22.5	12.3
23.5	12.35

I created an environment to work on. I added all my commands in

`\begin{table} and \end{table}`

I used the `\caption{}` to add caption on the top of the table. Also, centered it and used

`\begin{tabular}{|c||c|}`

and `\end{tabular}` to work on my two column table of titration data.

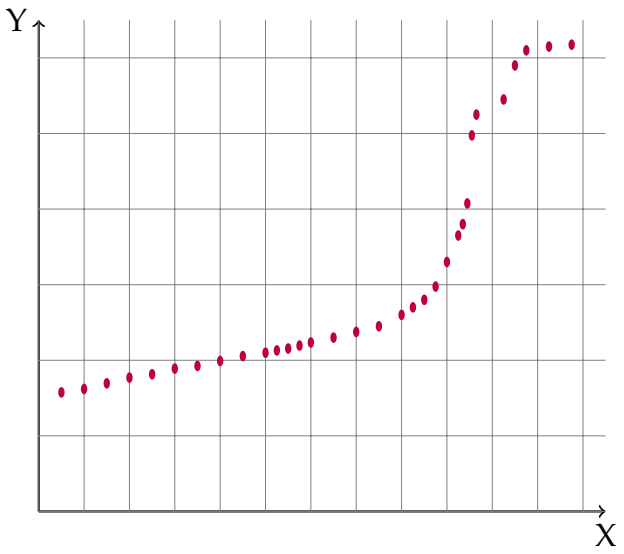

Fig. 2: Titration Plot

Now, Creating a graph is very interesting. I have created one for the titration data. We are going to use

`\usepackage{tikz}`

We first create a figure environment, then tkiz environment in it. Now, When we create the tkiz environment. We do want to scale it using this `[xscale =0.2, yscale = 0.5]` next to `\begin{}`. To fill the graph with data I used `\fill` command for all the data points.

`\begin{figure} and \end{figure}`

All our commands will be inside this for this graph.

2.4 Mathematics

Now, Lets work on the Mathemetics symbols and formulas in LaTeX. Inorder to write mathematical formula and symbols, we need to use `\usepackage{amsmath}` or `\usepackage{mathrm}`. Here, inline `$...$` will display equation in line. To display in centered of the page or column, we should put the formulas inside `$$...$$`. To insert the fraction I can do `\frac{}{}` where I can add the expressions inside the parenthesis. Here's an example using inline mode: $\frac{n!}{k!(n-k)!} = \binom{n}{k}$.

Here's an example of another mathematical expressions using display mode:

$$\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

. Here, to write the delta symbol I used `\Delta`. I have added the detailed explanation of this expression in **Appendix B**

Next, we can also add superscript and subscript in the expression by doing `f^n` and `f_{n}`. This will result in f^n and f_n.Here's an example of univariate density function with subscripts and superscripts. Here, I used the product of univariate density functions:

$$f_n(y;\theta) = \prod_{k=1}^{n} f_k^{univar}(y_k;0)$$

3 Conclusion

Here, in this tutorial we started with creating simple document with title and now its ending with writing mathematical equations. I also wanted to give a detail overview of what is coming after conclusion in this document.

- `\appendices`- We can add Appendix section in the document by adding this command.
- `\section*{Acknowledgements}` - This is how we can to add acknowledgements section in a document.
- - Here, we have an example of how to add References in a document.
- `\begin{thebibliography}` - This command will initiate to add the bibilography in the document. Don't forget to add the end to begin.
- `\bibitem` - We also, have to be careful when adding the bibliographies in the document. Here, in bibliographies we use `\bibitem` command.

I hope this tutorial was helpful.

Appendix A

Here in this appendix I am adding the extra commands that was not discussed in the tutorial.

1) `\textbf{}` - This command is used to make the text bold.
2) `\textit{}` - This command italicizes the text.
3) `\draw(n,n)(n,n)` - I used this command to draw the graph and set the dimensions, where n is replaced with the dimensions we want.
4) `\fill[color] (n,n) shape(npt)` - I used this command to fill the graph with all the titration points.
5) `\begin{enumerate}` - This helped me to set the environment and itemize with numbers

Appendix B

Here, I will go in detail about the mathematical expression I used.

1) `\binom{}{}`- I used this function to write the binomial distribution formula.
2) `\lim_` - I used this command to write limit in the expression.
3) `\Delta` - This is a bit tricky. To get the triangular delta symbol we need to use Delta and the scientific delta symbol we use delta. So, be aware of the lower case and upper case D.
4) `\theta` - I used this to add theta symbol in the document.
5) `\prod` - I used this to write that fancy symbol also called capital pi.

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I would like to thank Professor Moulds and the TAs for providing this opportunity to write this tutorial and help beginners to learn LaTeX. It has been truly a wonderful experience and I have learned new ways to use LaTeX which will definitely be very useful my future career.

References

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