

LaTeX Notes

Introduction

LaTeX is a typesetting system commonly used for creating technical and scientific documents, as well as books and articles. It uses a markup language to describe the structure and layout of a document, and produces high-quality typeset output in a variety of formats. Some of the key features of LaTeX include the ability to create complex mathematical equations, cross-referencing and bibliographies, and support for a wide range of document styles and layouts. To use LaTeX, you will need to install a TeX distribution and a text editor, and then learn the basic syntax of the markup language. There are many resources available online to help you learn LaTeX, including tutorials, documentation, and forums.

LaTeX is a typesetting system widely used in academia for typesetting mathematical and scientific documents. Here are some key points about LaTeX:

1. It's based on TeX, a typesetting system developed by Donald Knuth.
2. LaTeX is free and open-source.
3. LaTeX uses markup language, which is easier to read and write than low-level programming languages.
4. LaTeX handles formatting, page layout, and references automatically, leaving the author to focus on content.
5. LaTeX has a large user community, resulting in a vast library of templates, packages, and tools.
6. LaTeX is widely used in academia, especially in mathematics, physics, computer science, and engineering.
7. LaTeX produces high-quality typeset documents, with support for mathematical symbols, tables, and figures.
8. LaTeX files can be compiled into PDFs, making it easy to share documents electronically.
9. LaTeX has some learning curve, but it's worth it for the level of control and the quality of the final result.

What is LaTeX

LaTeX is a typesetting system used for typesetting mathematical and scientific documents. It is based on TeX and is free and open-source. LaTeX uses markup language rather than low-level programming languages, making it easier to read and write. It automatically handles formatting, page layout, and references, leaving the author to focus on content. LaTeX is widely used in academia, especially in mathematics, physics, computer science, and engineering, and produces high-quality typeset documents with support for mathematical symbols, tables, and

figures. It is popular for its level of control and the quality of the final result, although there is a learning curve.

Structure of Latex

The structure of a LaTeX document typically includes the following components:

1. Document class: This determines the overall format and layout of the document.
2. Preamble: This section contains any necessary packages, custom definitions, and style configurations.
3. Document body: This is the main content of the document, where you write the text, include figures and tables, and typeset equations.
4. References: This section lists any references cited in the document, and is usually created using a package like BibTeX.
5. Appendices: This section includes any additional material, such as detailed derivations or supporting data.

Each section of the document is structured using a hierarchy of sectioning commands, such as `\section`, `\subsection`, `\subsubsection`, etc. The document body is also often divided into chapters, which are denoted using the `\chapter` command. LaTeX uses a markup language, which means that you add formatting and structure to your document using commands, rather than using a visual interface. Basic commands include `\textit` for italic text, `\textbf` for bold text, `\frac` for fractions, and `\begin{equation}...\end{equation}` for typesetting mathematical equations.

Layout in LaTeX

The layout of a LaTeX document can be defined by the document class and any custom configurations in the preamble. Some of the aspects of the layout that can be configured include:

1. Page size and margins
2. Typeface and font size
3. Line spacing and paragraph spacing
4. Headers and footers
5. Page numbering
6. Table of contents and lists of figures/tables
7. Document structure (e.g. chapter and section headings)
8. Equation formatting

The document class determines the overall format and layout of the document, and there are many classes available for different purposes, such as articles, books, and presentations. Custom configurations in the preamble can further refine the layout to meet the specific

requirements of the document. LaTeX provides a high level of control over the document layout, which allows for consistent and professional-looking documents to be produced.

Margin in LaTeX

In LaTeX, margins can be set using the geometry package. To set the margins, use the following code in the preamble of the document:

```
\usepackage[margin=1in]{geometry}
```

Where "1in" sets the margin to 1 inch. The measurement unit can be changed to cm, mm, etc.

To set different margins for each page, use the following code:

```
\usepackage{geometry}
\newgeometry{left=1in,right=1in,top=0.75in,bottom=0.75in}
```

Where "1in" sets the margin to 1 inch. The measurement unit can be changed to cm, mm, etc.

To set different margins for each page, use the following code:

```
\usepackage{geometry}
\newgeometry{left=1in,right=1in,top=0.75in,bottom=0.75in}
```

This sets the left and right margins to 1 inch and the top and bottom margins to 0.75 inches.

Header/Footer in Latex

LaTeX is a typesetting language widely used in the academic and scientific community to produce high-quality documents. In LaTeX, you can add header and footer to your document using the "fancyhdr" package.

Here are the steps to add header and footer in LaTeX:

1. Load the "fancyhdr" package:

The first step to add header and footer in LaTeX is to load the "fancyhdr" package in the preamble of your document. You can do this by adding the following line of code to your document

```
\usepackage{fancyhdr}
```

2. Define the page style:

The next step is to define the page style using the `"\pagestyle"` command. In this case, you will be using the "fancy" style for the header and footer. You can do this by adding the following line of code to your document:

```
\pagestyle{fancy}
```

3. Define the header and footer content:

Once you have defined the page style, you can now specify the content of the header and footer. The header and footer are defined using the `"\fancyhead"` and `"\fancyfoot"` commands, respectively.

For example, to add the page number in the center of the footer and on the right side of the header, you can use the following code:

```
\fancyhead[RE,RO]{\thepage}
```

```
\fancyfoot[CE,CO]{}
```

The `"\thepage"` command is used to insert the page number. The argument `"[RE,RO]"` in `"\fancyhead"` specifies that the page number should be on the right side of the header, and the argument `"[CE,CO]"` in `"\fancyfoot"` specifies that the content should be centered and in the middle of the footer.

4. Add section or chapter names in the header:

You can also add the section or chapter names in the header. To do this, you can use the `"\leftmark"` and `"\rightmark"` commands, respectively.

For example, to add the section name on the left side of the header and the chapter name on the right side of the header, you can use the following code:

```
\fancyhead[LE,RO]{\thepage}
```

```
\fancyhead[RE,LO]{\rightmark}
```

```
\fancyhead[LE,LO]{\leftmark}
```

The `"\leftmark"` and `"\rightmark"` commands are used to insert the section and chapter names, respectively. The argument `"[LE,LO]"` in `"\fancyhead"` specifies that the section name should be on the left side of the header, and the argument `"[RE,RO]"` in `"\fancyhead"` specifies that the chapter name should be on the right side of the header.

5. Add text in the footer:

You can also add custom text in the footer. To do this, you can use the "`\fancyfoot`" command.

For example, to add the text "Footer text" in the footer, you can use the following code:

```
\fancyfoot[LE,RO]{Footer text}
```

6. Remove header and footer on specific pages:

If you want to remove the header and footer on specific pages, you can use the "`\thispagestyle`" command

Sectioning in LaTeX

LaTeX provides several commands for creating sections and subsections in a document, which help to organize the content and improve its readability. Here are some of the commonly used sectioning commands in LaTeX:

1. **`\section`**: This command creates a new section with a numbered heading. For example:
`\section{Introduction}`
2. **`\subsection`**: This command creates a new subsection within a section, also with a numbered heading. For example:
`\subsection{Background}`
3. **`\subsubsection`**: This command creates a new subsubsection within a subsection, with a numbered heading. For example:
`\subsubsection{Related Work}`
4. **`\paragraph`**: This command creates a new paragraph within a subsubsection, with a non-numbered heading. For example:
`\paragraph{Methodology}`
5. **`\subparagraph`**: This command creates a new subparagraph within a paragraph, with a non-numbered heading. For example:
`\subparagraph{Data Collection}`

In LaTeX, the appearance of the sectioning headings can be customized using the "titlesec" package. The default styles for sectioning headings can be changed to suit your needs, such as changing the font size, font type, and text color.

Bullets and Numbering

LaTeX provides several ways to create bulleted and numbered lists in a document. Here are some of the commonly used methods for creating bulleted and numbered lists:

1. **itemize** environment for bulleted lists: This environment creates a bulleted list, with each item in the list marked by a bullet symbol. For example:

```
\begin{itemize}
```

```
\item First item
```

```
\item Second item
```

```
\item Third item
```

```
\end{itemize}
```

2. **enumerate** environment for numbered lists: This environment creates a numbered list, with each item in the list marked by a sequential number. For example:

```
\begin{enumerate}
```

```
\item First item
```

```
\item Second item
```

```
\item Third item
```

```
\end{enumerate}
```

3. **description** environment for labeled lists: This environment creates a list with a label and a description for each item. For example:

```
\begin{description}
```

```
\item[First item] Description of the first item
```

```
\item[Second item] Description of the second item
```

```
\item[Third item] Description of the third item
```

```
\end{description}
```

In LaTeX, the appearance of the lists, such as the bullet symbol, numbering format, and indentation, can be customized using the "enumitem" package. Additionally, you can also change the label for each item in the list.

Images

LaTeX provides several ways to insert and manage images in a document. Here are some of the commonly used methods for inserting images in LaTeX:

1. **\includegraphics** command: This command is used to insert an image file into a LaTeX document. The syntax is as follows:

```
\includegraphics[width=0.5\textwidth]{example.jpg}
```

The **width** option is used to set the width of the image, which can be specified as a fraction of the text width, as shown above.

2. **figure** environment: This environment is used to create a figure, which is a floating object that can be placed anywhere in the document. The syntax is as follows:

```
\begin{figure}  
  
\includegraphics[width=0.5\textwidth]{example.jpg}  
  
\caption{Example figure.}  
  
\end{figure}
```

The **\caption** command is used to add a caption to the figure, which will appear below the image.

3. **wrapfigure** environment: This environment is used to wrap text around an image. The syntax is as follows:

```
\begin{wrapfigure}{l}{0.5\textwidth}  
  
\includegraphics[width=0.5\textwidth]{example.jpg}  
  
\caption{Example figure.}  
  
\end{wrapfigure}
```

The **wrapfigure** environment accepts two arguments: the placement of the figure (left or right), and the width of the figure. The text will wrap around the figure, filling the available space on the opposite side.

In LaTeX, the appearance of the images, such as the placement, size, and caption style, can be customized using the "graphicx" and "caption" packages.