Lecture 4: Introduction to LaTeX

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1 Introduction

LaTeXis a typesetting system that is widely used in academia and industry. Most published papers are written using LaTeX. It is particularly useful for writing mathematical documents, as it has a lot of built-in support for mathematical notation.

2 Basic Commands

2.1 Text Formatting

LaTeXhas a number of commands for formatting text. For example, you can make text **bold**, *italic*, or underlined. You can also use different fonts, `typewriter`.

2.2 Mathematical Notation

LaTeXhas a lot of built-in support for mathematical notation. For example, you can write equations like $x^2 + y^2 = z^2$ or $\int_0^1 x^2 dx$. You can also write equations on their own line, like this:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

or

$$\int x^2 dx = \frac{x^3}{3} + C \tag{1}$$

if you don't want the equation number, you can use the `equation*` environment:

$$\int \sin(x) dx = -\cos(x) + C$$

2.3 Aligning Equations

You can align equations using the `aligned` environment. For example, you can write equations like this Equation 2:

$$\begin{aligned} x + y &= 5 \\ \int \prod x + 32y + 5\cos z &= 3 \end{aligned} \tag{2}$$

2.4 Greek Letters

You can use Greek letters in LaTeX. For example, α, β, γ, δ, ϵ, ζ, η, θ, ι, κ, λ, μ, ν, ξ, π, ρ, σ, τ, υ, ϕ, χ, ψ, ω. For the capital letters, you can just capitalize the first letter Γ, Δ, Θ, Λ, Ξ, Π, Σ, Υ, Φ, Ψ, Ω.

2.5 Some oter symbols

You can use a lot of symbols in LaTeX. For example, you can use $\in$, $\notin$, $\subset$, $\subseteq$, $\cup$, $\cap$, $\emptyset$, $\forall$, $\exists$, $\rightarrow$, $\Rightarrow$, $\leftrightarrow$, $\Leftrightarrow$, $\leq$, $\geq$, $\neq$, $\approx$, $\propto$, $\times$, $\div$, $\pm$, $\mp$, $\cdot$, $\cdots$, $\vdots$, $\ddots$, ∇, ∂, $\int$, $\oint$, $\sum$, $\prod$, $\lim$, $\log$, $\ln$, $\exp$, $\sin$, $\cos$, $\tan$, $\cot$, $\sec$, $\csc$, $\arcsin$, $\arccos$, $\arctan$, $\sinh$, $\cosh$, $\tanh$, $\coth$.

2.6 Superscripts and Subscripts

You can use superscripts and subscripts in LaTeX. For example, x^2 and x_2. You can also use multiple levels of superscripts and subscripts, like this: x^{2^3} and x_{2_3}. You can also use both superscripts and subscripts, like this: x_3^2.

2.7 Biger or smaller symbols

There is multiple commands to change the size of text using a few commands. In order, from smallest to largest, tiny scriptsize footnotesize small normalsize large Large LARGE huge Huge

2.8 Change the color

You can change the color of text in LaTeXusing the `xcolor` package. For example, you can write text in red, green, or blue. You can also use RGB values, like this: red, green, blue.

3 Labels and References

You can label equations, figures, and sections in LaTeXand then refer to them later. For example, you can refer to equation (2) by writing (3). You can also refer to sections, like this: 3.

$$a^2 + b^2 = c^2 \tag{3}$$

I recomend using `autoref` to make it easier to refer to different types of objects. For example, you can refer to equations, figures, and sections like this: Equation 3.

4 Figures

You can include figures in LaTeXusing the `figure` environment. For example, you can include a figure like this:

Figure 1: This is an example image

You can refer to the figure like this: Figure 1.

5 Tables

To create tables in LaTeX, you can use the `tabular` environment. For example, you can create a table like this:

A	B	C
1	2	3
4	5	6
7	8	9

Table 1: This is an example table

6 Lists

There is 2 types of lists in LaTeX, the `itemize` and the `enumerate`. The `itemize` environment is for unnumbered lists, like this:

- Item 1
- Item 2
- Item 3
- Item 4

and

1. Item 1
2. Item 2
3. Item 3
4. Item 4

7 Some additional useful Packages

1. `tabularray`: This package provides a lot of useful features for creating tables in LaTeX.
2. `cancel`: This package provides a command for canceling out terms in equations.
3. `algorithm` and `algpseudocode`: These packages provide support for writing algorithms in LaTeX.
4. `listings`: This package provides support for including code in LaTeX.
5. `subfig`: This package provides support for subfigures in LaTeX.
6. `bm`: This package provides support for bold math symbols in LaTeX.
7. `soul`: This package provides support for highlighting text in LaTeX.
8. `enumitem`: This package provides support for customizing lists in LaTeX.

There are a lot of other packages available for LaTeX, so you should explore and see what works best for you.