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Course

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A Short Example for LaTeX

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1 First Section

2 About Writing Text in General

The idea of this guide is to show how LaTeXcode and the resulting document correlate. The idea is to view the code and document *side by side*. So, bring up the code now if you haven't already, and look through it up to this point.

Here is where the body text goes. It can be written directly. The number of spaces within the text doesn't matter, they are all treated as one. LaTeXis blind to spaces, so you can use tabs in the code however you like. The number of line breaks doesn't matter either, from two upwards (except in some special environments like align). However, it's a good idea to keep the code neat and readable, so don't misuse indentations and comments.

If there's an error in the code, you'll get an error message when running it. The error message gives a description of the error and the line where the problem occurred. Based on this, the issue can be fixed. A new line doesn't start in the text even if there's a line break in the code.
A new line starts with two backslashes or the newline command.
Now the line has changed.

An empty line starts a new paragraph.

LaTeXcontains some special characters. The most important one is the backslash \, as it starts all commands. Other characters that cannot be written directly are:

$ % ^ & _ { } ~

These are included in the text by using a backslash. These characters either have a special meaning in code (e.g., % is a comment symbol) or cause a font issue.

"Quotation marks" "work" 'inconsistently.' To get a proper quotation

mark in the text, you need to use two single ' marks. Hyphens, en dashes, and em dashes work on the same principle: - – — Ellipsis requires its own command, called ldots. Compare ... and …

You can also add images to the text. However, they may jump around if there's not enough space on the page, but you can try to guide LaTeX. You can also draw images yourself using TikZ, as shown in the example image. More on this later.

Figure 1: Caption

It's also good to know about the commands underline and *emph. Inside the emph command, another emph command makes* normal *text.*

There are three types of lists: First start with command *enumerate*, as an example

1. First item
   (a) sub item
      i. subsub item
      ii. another subsub item
2. Second item

By default, first level items are numbered in arabic numbers, second level with alphabetic and third level Roman numberign.

Another usufull list structure star with command *enumerate*.

- item
- French item
- ♡ arbitrary item

You can create also here sub items.

Last but less used list environment is *description*:

first item

second item

The syntax is almost the same for all.

Tables can also be created. The command is tabular. A good way to learn how complex systems work is to take example code and remove or add

commands to see what happens. This way, you can deconstruct the code.

7C0	hexadecimal
3700	octal
11111000000	binary
1984	decimal

More fancy things needs bit more knowlegde. For example the command @, can replace the column separator with a comma (or any other character). This way, you can create tables where the decimals are aligned.

Pi notation	Value
π	3,1416
π^{π}	36,46
$(\pi^{\pi})^{\pi}$	80662,7

Tables may also float, just like images. These are known as floating elements. Placements work the same way as with images.

2.1 Subsection

For demonstration purposes.[1]

2.1.1 Sub-subsection

You cannot go deeper than this.

3 Mathematical Formatting

LaTeXproduces beautiful text and tables, but it truly shines when formatting mathematics.

[1] Footnotes are created with the footnote command.

Some described features of the mathematical environment are not available directly; they must be included by adding packages at the beginning of the code. If the compiling gets stuck, even if the command is correct, this is likely the issue.

To insert mathematical text among regular text, place it between two $ signs: x or $E = mc^2$. However, it is better to put equations on their own lines: the commands are displaymath or equation. Using equation, you can refer to an equation (2) neatly with label and ref commands, but just like with the table of contents, this requires two runs. LaTeXkeeps track of everything, so you don't need to worry about the numbers. The equation command numbers the equation even if it is not referenced.

$$c^2 = a^2 + b^2$$

$$c^3 = a^3 + b^3 + c^3 = a^3 + b^3 \tag{1}$$

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

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

The $ sign-based mathematical environment behaves differently from the displaymath-type environment: the $ signs are meant to be used within text, so the text is compressed. Compare

$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{1}{k_2} = \left(\frac{\pi^2}{6}\right)^2$

and

$$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{1}{k_2} = \left(\frac{\pi^2}{6}\right)^2$$

You can also access the displaymath environment using brackets. If you

want regular text in a mathematical environment, you can use the {} command:

$$c^2 = a^2 + b^2 \text{ is the Pythagorean theorem.}$$

Formatting commands should generally be placed in curly braces. Compare

$$a^x + y \text{ and } a^{x+y}$$

Different symbols, letters, and formats can be found in the *guide*, Chapter 3. Building equations starts on page 51.

Writing multiple lines can be somewhat clunky with displaymath. A convenient environment is align, which uses the & sign to align all lines. The align environment with * does not number the lines.

$$\begin{aligned} f(x) + g(x) &= (4x^3 + 6) + (6x^4 - x^3 + x^2) \\ &= 6 + (0+0)x + (0+1)x^2 + (4-1)x^3 + (0+6)x^4 \\ &= \underbrace{6}_{a_0} + \underbrace{0}_{a_1}x + \underbrace{1}_{a_2}x^2 + \underbrace{3}_{a_3}x^3 + \underbrace{6}_{a_4}x^4 \end{aligned}$$

$$\begin{aligned} f(x) + g(x) &= (4x^3 + 6) + (6x^4 - x^3 + x^2) && (4) \\ &= 6 + (0+0)x + (0+1)x^2 + (4-1)x^3 + (0+6)x^4 && (5) \\ &= \underbrace{6}_{a_0} + \underbrace{0}_{a_1}x + \underbrace{1}_{a_2}x^2 + \underbrace{3}_{a_3}x^3 + \underbrace{6}_{a_4}x^4 && (6) \end{aligned}$$

4 Useful Links

It is important to remember that LaTeXis a programming language like any other. You can find guides and solutions to problems by googling.

- http://tug.ctan.org/info/lshort/english/lshort.pdf

  A guide, but not too deep. IT IS ALLOWED, EVEN PREFERABLE, TO USE GUIDES AND EXAMPLES FOUND ON THE INTERNET.

- https://www.overleaf.com/

  Another online compiler

- http://cremeronline.com/LaTeX/minimaltikz.pdf

  A short TikZ guide

  - http://www.texample.net/tikz/examples/

    Examples of all kinds

- http://detexify.kirelabs.org/classify.html

  A handy symbol search system

- http://tug.ctan.org/info/symbols/comprehensive/symbols-a4.pdf

  A list containing *all* symbols, from various euro symbols to Icelandic magical symbols [2].

5 Other Stuff

With these tools, you can get quite far and write all your reports and so on. The following topics are neat and interesting, but you don't need to know them if you just want to use LaTeX. Those who are curious can continue from here, while the more relaxed can move on to the exercise.

[2] Wink wink, investors.

5.1 TikZ

TikZ is a method to draw vector graphics. The aforementioned TikZ guide is quite competent, though very minimalist (as the title suggests). It gets you off to a good start, but you'll find new tricks by searching. It's recommended to deconstruct various examples.

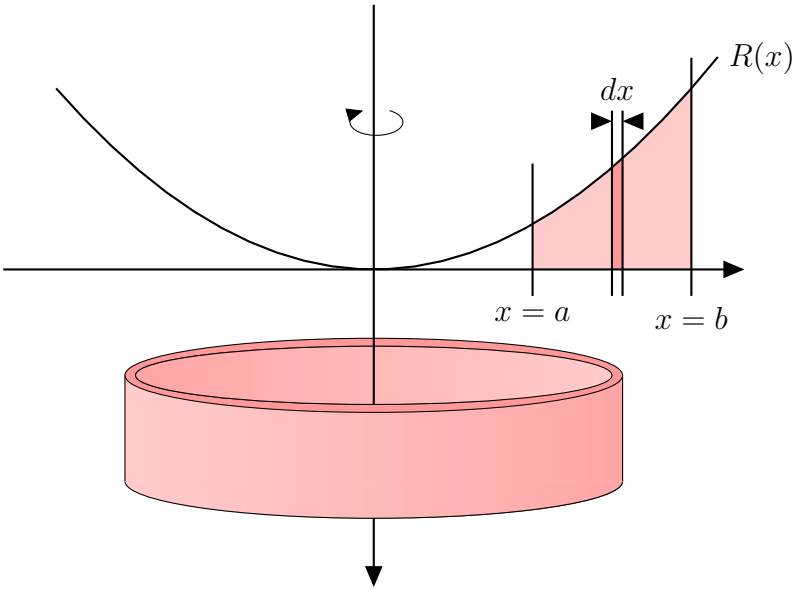

Figure 2: A skilled creator can make all kinds of cool things.

5.2 BibTeX

The idea of BibTeX is to automate citation making. In longer academic writings (e.g., dissertations), there are a lot of citations. With an automatic system, citations remain uniform and well-organized.

The command is [**?**]. [2]

BibTeX is automatically included in LaTeX's standard distribution, so it does not need to be downloaded separately. However, some formatting styles

Figure 3: Necessary and unnecessary things.

may require additional usepackage commands to access them.

The most challenging part is creating the bibliography. One way to do this is to open a new file in TeXShop, place the bibliography code there, and save it directly in bib format. To include references in the code, it needs to be run multiple times again. Depending on how the bib bibliography is created, the code sometimes needs to be run in BibTeX format (in TeXShop, this can be done using the dropdown menu next to the Typeset button) and then a couple more times in LaTeX format. The bibliography file must be in the same directory as the other code.

The library can also be edited (or created) using the BibDesk utility. It should be included in the standard TeXShop distribution. The code-level bibbing can be found in the guide.

Guide: https://www.economics.utoronto.ca/osborne/latex/BIBTEX.HTM
Those interested in the topic should also try Googling it themselves.

Lorem ipsum [1].
Dolor sit amet [2, p. 2]

References

[1] Kenneth J. Arrow, Leonid Hurwicz, and Hirofumi Uzawa, *Constraint qualifications in maximization problems*, Naval Research Logistics Quarterly **8** (1961), 175–191.

[2] R. M. Star, *Foo bar baz*, MIT Press, Cambridge, MA, 1989.