LaTeX: Our First File

Constanza F. Schibber

August 31, 2018

This is an example.

See the difference between LaTeXexample and LaTeX example.
We will learn about how to change font types,
how to write an equation and greek letters,
and how to do a 2×2 table.

You will also work on typesetting the example on Homework #0.

You can generate sequentially nested numbered sections like the following:

1 What is LaTeX? What are the Advantages of LaTeX?

1. What is LaTeX?

   - A document preparation system for high-quality typesetting.
   - Pronounced "Lay-tech" or "Lah-tech."
   - The author provides the content
   - AND additional information to describe the logical structure of her/her work.
   - Then it will be written into the text as "LaTeX commands."

2. Advantages

   - Professionally crafted layouts
   - A convenient way of typesetting mathematical formulae
   - A few easy-to-understand commands
   - Easy to generate footnotes, references, table of contents, and bibliographies

2 Font Styles

You can bold a **word**, underline a <u>word</u>, or *emphasize* a world. You can also bold and emphasize a ***word***. There are also colors, such as red, blue, or yellow (see `http://latexcolor.com/` for more).

3 Mathematical Environment

How to write an equation:
a squared plus b squared is equal to c squared: $a^2 + b^2 = c^2$
You can separate the equation from the rest of paragraph and give an equation number:

$$a^2 + b^2 = c^2 \tag{1}$$

Here are two more equations:

$$\ln \exp^x = x \tag{2}$$

$$\ln ab = \ln a + \ln b \tag{3}$$

But what if we want to solve a problem over multiple lines. For instance, we know that any number can be broken down into a string of prime numbers multiplied together and we want to do this for the number 500.

$$\begin{aligned}
500 &= 5 \times 100 \\
&= 5 \times 2 \times 50 \\
&= 5 \times 2 \times 2 \times 25 \\
&= 5 \times 2 \times 2 \times 5 \times 5 \\
&= 2 \times 2 \times 5 \times 5 \times 5 \times
\end{aligned}$$

Note that this last example has the equal signs $=$ aligned by using the ampersand (&), whereas equations number (2) and (3) do not. See what we did just there? We labeled the equations and we referred to them by their label. However, if you don't want to number an equation, you can do any of the following:

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

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

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

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

For some equations, you may want to adjust the size of parentheses. For example, here,

$$\bar{X} = (\frac{1}{n}) \sum X \tag{4}$$

the parentheses should be like this,

$$\bar{X} = \left(\frac{1}{n}\right) \sum X \tag{5}$$

3.1 Logical Symbols and Inequality Notation

Tables 1 and 2 show notation for logical symbols and for inequalites.

Symbol	Explanation
$\neg$	logical negation statement
$\in$	is an element of, as in $3 \in \mathcal{I}^+$
$\ni$	such that
$\therefore$	therefore
$\because$	because
$\implies$	logical "then" statement
$\iff$	if and only if, also abbreviated "iff"
$\exists$	there exists
$\forall$	for all
$\between$	between
$\parallel$	parallel
$\angle$	angle

Table 1: Logical Symbols

Symbol	Meaning
$<$	less than
$\leq$	less than or equal to
$\ll$	much less than
$>$	greater than
$\geq$	greater than or equal to
$\gg$	much greater than
$\approx$	approximately the same
$\cong$	approximately equal to
$\lessapprox$	approximately less than (also $\lesssim$)
$\gtrapprox$	approximately greater than (also $\gtrsim$)
$\equiv$	equivalent by assumption

Table 2: Inequality Notation

3.2 More on Mathematical Equations

$f(x) = x^2$
$f'(x) = 2x$
$f(\bar{x})$
C'
C'
$\mathbf{C'}$
$f(y|x)$
p_{ij}^3
$e^{x^2} \neq e^{x2}$
$h \approx \frac{(x+1)(y+1)}{x^2+1}$
The sum operator in text style: $\sum_{i=1}^{n}$ $\sum_{k=1}^{3} k$

In display style:

$$\sum_{i=1}^{n}$$

The product operator:

$$\prod_{i=1}^{n} p_{ij}$$

Typeset arrays and matrices:

$$\mathbf{X} = \begin{pmatrix} x_1 & x_2 & \cdots \\ x_3 & x_4 & \cdots \\ \vdots & \vdots & \ddots \end{pmatrix}$$

$$\mathbf{X} = \begin{matrix} x_1 & x_2 \\ x_3 & x_4 \end{matrix}$$

$$\mathbf{X} = \begin{bmatrix} x_1 & x_2 \\ x_3 & x_4 \end{bmatrix}$$

$$\mathbf{X} = \begin{bmatrix} x_1 & x_2 \\ x_3 & x_4 \end{bmatrix} \begin{bmatrix} x_5 & x_6 \end{bmatrix}$$

3.3   Tabular Environment

To do a 2 by 2 table, use the `tabular` environment:

`\begin{tabular}[pos]{table spec}`

For example,

Pi expression	Value
π	3.1416
π^{π}	36.46

You can define how you want to align text in a column:

Pi expression	Value
π	3.1416
π^{π}	36.46

You can align numeric columns to a decimal point:

Pi expression	Value.
π	3.1416
π^{π}	36.46

You need to adjust the placement for a column label:

Pi expression	Value
π	3.1416
π^{π}	36.46

3.4 Greek Alphabet

To write Greek letters: for example, use `$\delta$` or `$\Delta$`. Notice that we have to use math mode for greek letters. You can type lowercase letters like this: $\alpha, \beta, \gamma, \delta$, or uppercase letters: A, B, Γ, Δ. Table 3 shows the complete Greek Alphabet.

Table 3: Greek Letters

αA	νN
βB	$\xi \Xi$
$\gamma \Gamma$	$o O$
$\delta \Delta$	$\pi \Pi$
$\epsilon \varepsilon E$	$\rho \varrho P$
ζZ	$\sigma \Sigma$
ηH	τT
$\theta \vartheta \Theta$	$\upsilon \Upsilon$
ιI	$\phi \varphi \Phi$
κK	χX
$\lambda \Lambda$	$\psi \Psi$
μM	$\omega \Omega$

4   Where to Learn More?

Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl. 2016. The Not So Short Introduction to LaTeX2ϵ, which is available here:
`https://tobi.oetiker.ch/lshort/lshort.pdf`