

Introduction to \LaTeX and GIT

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Abstract

\LaTeX is a document preparation system for high-quality typesetting used for medium-to-large technical or scientific documents, however, it can be used for almost any form of publishing. It is technically not a word-processor, rather its main purpose is to make sure the appearance of the document is **automatically** taken care of without the supervision of the author.

\LaTeX automatically makes your document beautiful and organized

1 \LaTeX vs. Word processors

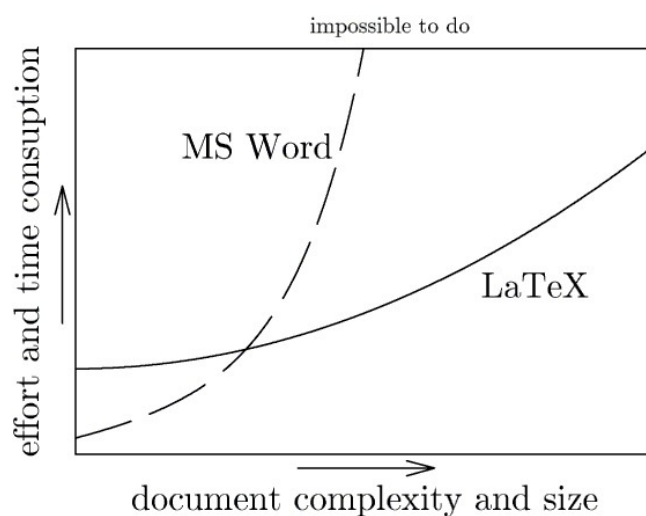


Figure 1: Word Processors vs. \LaTeX

1 Using a word-processor (MS Word, LibreOffice, Pages etc.) only makes sense while
2 writing short documents and get the output quickly. For larger documents with many
3 cross-references, equations, figures and tables, \LaTeX makes things easier and faster.
4 Fig. 1 is a nice demonstration to show the complexity and effort necessary for writ-
5 ing documents using MS Word and \LaTeX [1]. All journals provide \LaTeX template for
6 writing manuscripts in their specific formats. Since all the initial document set up is
7 provided, writing manuscripts using \LaTeX exceptionally easy and less time-consuming.
8 Marquette university also have a \LaTeX template for Ph.D. and MS thesis, available at:
9 <https://ctan.org/tex-archive/macros/latex/contrib/mugsthesis>

\LaTeX is well suited for writing complex documents with cross-references, equations, figures and tables efficiently.

2 Writing Equations using L^AT_EX

Managing equation in word processor is really challenging and time-consuming. Writing equations in L^AT_EX is exceptionally easy and intuitive. In L^AT_EX, equations are easy to create and edit. Both PowerPoint and Word now have equation editors that allow for L^AT_EX (see Fig. 2).

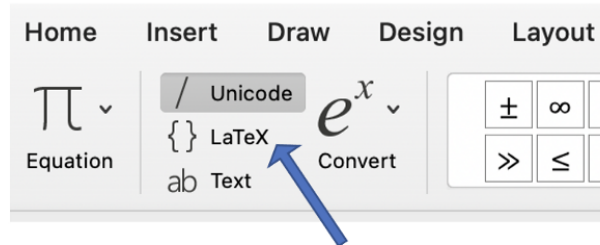


Figure 2: L^AT_EX style equation editor in PowerPoint

There are several methods for writing equation in L^AT_EX, i.e. inline, aligned, equation, gathered etc. The basic L^AT_EX markup for writing equations is shown in Fig. 3.

LaTeX markup...	...results in:
$A_{\infty} + \pi A_0$	$A_{\infty} + \pi A_0$
$\mathbf{A}_{\infty} + \pi \mathbf{A}_0$	$\mathbf{A}_{\infty} + \pi \mathbf{A}_0$
$\mathbf{A}_{\infty} + \pi \mathbf{A}_0$	$\mathbf{A}_{\infty} + \pi \mathbf{A}_0$
$2\alpha x^2 yz + 5$	$2\alpha x^2 yz + 5$
$\mathbf{2\alpha x^2 yz + 5}$	$\mathbf{2\alpha x^2 yz + 5}$

Figure 3: L^AT_EX style equation markup example

Equations can be written in line math such as $a^2 + b^2 = c^2$. One can also give equations their own space (Equation 1). The equations can be as complex as you want them to be ((Equation 2))

$$\gamma^2 + \theta^2 = \omega^2 \quad (1)$$

$$\mathcal{L}_{\mathcal{T}}(\vec{\lambda}) = \sum_{\mathbf{x}, \mathbf{s} \in \mathcal{T}} \log P(\mathbf{x}|\mathbf{S}) - \sum_{i=1}^m \frac{\lambda_i^2}{2\sigma^2} \quad (2)$$

You can be really creative with how you want to present your equation sets (3 and 4)

$$\begin{array}{lll} x = y & w = z & a = b + c \\ 2x = -y & 3w = \frac{1}{2}z & a = b \\ -4 + 5x = 2 + y & w + 2 = -1 + w & ab = cb \end{array} \quad (3)$$

$$\begin{aligned}
f(x_1, x_2, x_3) &= f_0 m_0 \vee f_1 m_1 \vee f_3 m_3 \vee \\
&\vee f_4 m_4 \vee f_5 m_5 \vee f_6 m_6 \vee f_7 m_7 \\
&= 0 m_0 \vee 1 m_1 \vee 0 m_3 \vee \\
&\vee 1 m_4 \vee 0 m_5 \vee 0 m_6 \vee 1 m_7
\end{aligned} \tag{4}$$

\LaTeX provides the fastest way to write complex mathematical equation with symbols, subscripts and superscripts

3 Building Tables with \LaTeX

Building tables using \LaTeX is done using the “Tabular” environment. If the table becomes large and complex, it gets tricky to manage. I usually use a website: https://www.tablesgenerator.com/latex_tables which is an excellent tool for generating \LaTeX code for large and complex tables. For demonstration, Table 1 is generated using the abovementioned website as shown in Fig. 4.

The screenshot shows the Table Generator website interface. At the top, there's a menu bar with options: File, Edit, Table, Column, Row, Cell, and Help. Below the menu is a toolbar with icons for table manipulation and a dropdown for table styles. The main area displays a table with 4 columns (A, B, C, D) and 3 rows. The cells contain numbers (11, 12, 13, 21, 22, 23, 31, 32, 33) and text ('Merged', 'Column'). Below the table, there's a 'Table caption' field with the text 'Sample Table'. A 'Label' field contains 'tb1'. A 'Generate' button is present. Below the button, the 'Result' section shows the generated LaTeX code. The code includes package declarations, a table environment definition, and the table content with cell colors and rowspan/colspan specifications. At the bottom, there are checkboxes for 'Escape special TeX symbols', 'Compress whitespace', and 'Smart output formatting', along with a 'Caption above, Scale table to text width' option.

Table 1

	A	B	C	D
1	11	12	13	Merged
2	21	22	23	Column
3	31	32	33	

Table caption

Sample Table

Label Use \ref{tab.my-table} to refer to your table in LaTeX

Result (click "Generate" to refresh)

```

1 % Please add the following required packages to your document preamble:
2 % \usepackage{multirow}
3 % \usepackage{graphicx}
4 % \usepackage[table,xcdraw]{xcolor}
5 % If you use beamer only pass "xcolor=table" option, i.e. \documentclass[xcolor=table]{beamer}
6 \begin{table}[]
7 \caption{Sample Table}
8 \label{tb1}
9 \resizebox{\textwidth}{!}{%
10 \begin{tabular}{|l|l|l|l|}
11 \hline
12 \cellcolor[HTML]{FFCE93}11 & 12 & 13 & Merged \\ \hline
13 21 & \cellcolor[HTML]{FFCE93}22 & 23 & \\ \hline
14 31 & 32 & \cellcolor[HTML]{FFCE93}33 & \multirow{-2}{*}{Column} \\ \hline
15 \end{tabular}%
16 }
17 \end{table}

```

☒ Escape special TeX symbols (% , _ , # , \$)

☐ Compress whitespace ☒ Smart output formatting

Caption above, Scale table to text width

Figure 4: Demo of \LaTeX table generation

Table 1: A Sample Table

11	12	13	Merged
21	22	23	Column
31	32	33	

4 Citation Management in L^AT_EX

L^AT_EX citation management is effortless. All the citations can be kept in a separate file (in this case “[refs.bib](#)”) in bibtex format. Every time, a citation is required, we just write `\cite{key used in .bib file}`. For example, Mukut et. al. [2] or Claydon et al. [3]. All the citations used in the document will be summarized at the end of the document.

5 List of Contents, Figures and Tables

Creating list of Contents, Figures and Table is really easy in L^AT_EX

Contents

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6 How can we use L^AT_EX

L^AT_EX is an open-source tool which is freely available in all platforms. You can use any one of the following:

1. For Windows: MiKTeX, proTeXt or Tex Live
2. For Linux: Tex Live
3. For MacOS: MacTex
4. From Online: Papeeria, Overleaf, ShareLaTeX, Datazar, and LaTeX base

I personally use the offline version of L^AT_EX alongside with a text editor called [VSCode](#)

7 A Short Introduction to GIT

GIT is a version control system (VCS) for tracking changes in a project. This is a widely used tool for managing large-scale programs like Linux kernel, but it can also be used for smaller scale projects like your own programming projects, homework, assignments, papers, or thesis. GIT is freely available in all platform. There are several online platforms which let you maintain a cloud repository for better collaboration and safety (GitHub, GitLab etc.). GitHub is the most popular of them all.

7.1 GIT Workflow I Use for L^AT_EX

1. Set up the working directory as a GIT repository (enable version control)
2. Make a cloud version of the repository using your favorite GIT server, i.e. GitLab, GitHub etc.
3. Maintain separate branches for the master version, and any collaboration.
4. Work on my computer on my specific branch and when done use the following command:

```
git add <any new files that has been created>
git commit -a -m <specific message for the new updates>
==> This will update the current state of the branch
git checkout <The main/master branch>
==> go to the main/master branch
git merge <the branch I am working in>
==> update the main/master branch with my edits
git push
==> This will sync the cloud repository in GitHub or GitLab
```

5. My collaborator will do the following:

```
git pull
==> get the updates from the cloud repository
git merge <his/her working branch>
==> sync the main/master branch to their working branch

Edit/review the project, add comments, etc.

git add <any new files that has been created>
git commit -a -m <specific message for the new updates>
==> This will update the edits in their local repository
git checkout <The main/master branch>
==> go to the main/master branch
git merge <the branch the collaborator is working in>
==> update the main/master branch with the collaborator's
edits
git push
==> This will sync the cloud repository in GitHub or GitLab
```

6. go back and forth between 4 and 5 until the final version is ready.

References

- [1] Contrasting Microsoft Word and LaTeX, April 2020. [Online; accessed 15. Sep. 2022].
- [2] Khaled Mosharraf Mukut, Somesh Roy, and Eirini Goudeli. Molecular arrangement and fringe identification and analysis from molecular dynamics (MAFIA-MD): A tool for analyzing the molecular structures formed during reactive molecular dynamics simulation of hydrocarbons. *Comput. Phys. Commun.*, 276:108325, July 2022.
- [3] I. Claydon, M. Gieles, and A. Zocchi. The properties of energetically unbound stars in stellar clusters. *MNRAS*, 466:3937–3950, May 2017.