



JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

EN.540.635 Software Carpentry

Lecture 13 A Primer in LaTeX



An introduction to LaTeX

LaTeX, which is pronounced «Lah-tech» or «Lay-tech» (to rhyme with «blech» or «Bertolt Brecht»), is a document preparation system for high-quality typesetting. It is most often used for medium-to-large technical or scientific documents but it can be used for almost any form of publishing.

LaTeX is a markup language used to create documents of “high typographical quality”

- Microsoft Word is a “typesetting system” of the type What You See Is What You Get (WYSIWYG), while LaTeX belongs to What You See Is What You Mean (WYSIWYM)

RESEARCH ARTICLE

An Efficiency Comparison of Document Preparation Systems Used in Academic Research and Development

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```
\documentclass{article}
\usepackage[utf8]{inputenc}

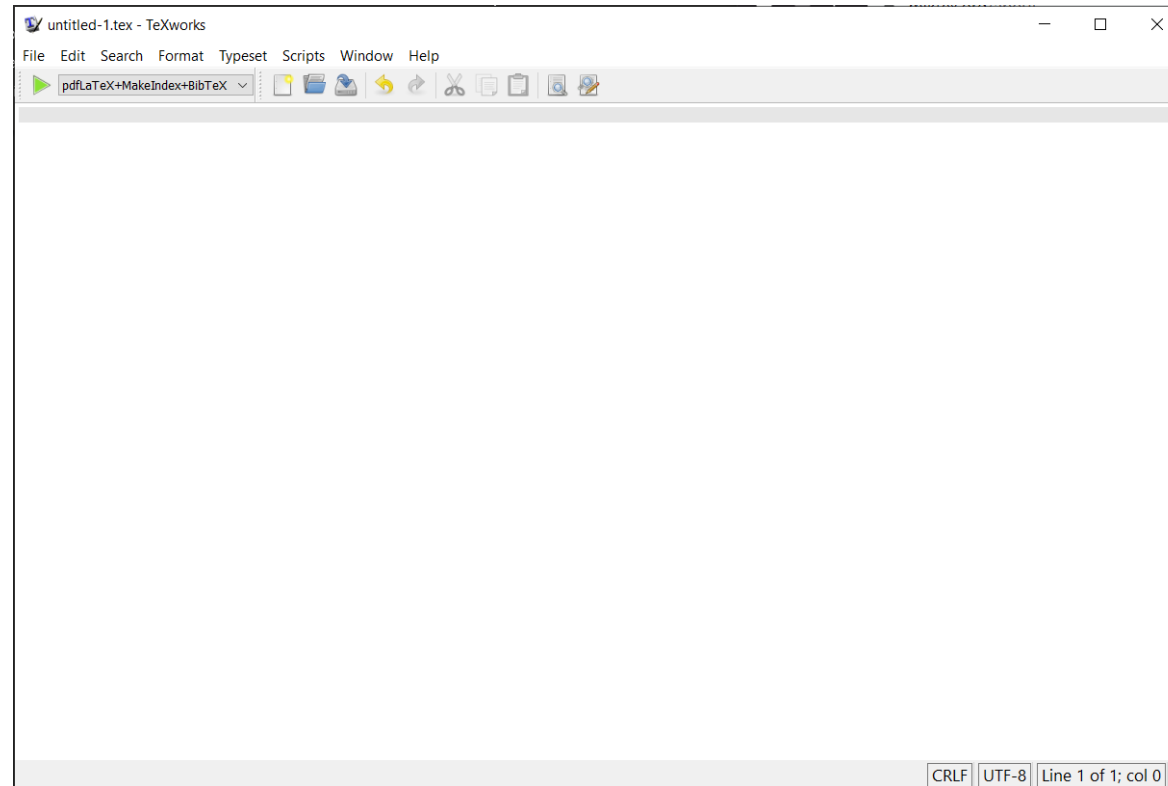
\begin{document}
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque
venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat
sit amet massa molestie sagittis non eget leo. Pellentesque at tempus
velit, sed cursus tellus. Integer pretium quam id dapibus iaculis.
Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna.
Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien
rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta
felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat.
Nulla ultricies leo lorem, sit amet mollis eros fermentum a. Nam quis
odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula
pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat
lacinia id. Maecenas ultrices risus a posuere aliquet.
\end{document}
```

◀ ▶ %A

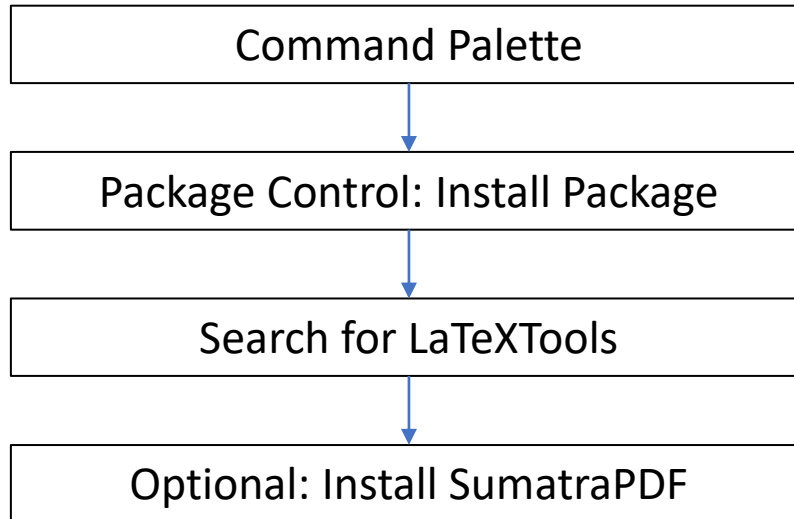
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat sit amet massa molestie sagittis non eget leo. Pellentesque at tempus velit, sed cursus tellus. Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna. Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat. Nulla ultricies leo lorem, sit amet mollis eros fermentum a. Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat lacinia id. Maecenas ultrices risus a posuere aliquet.

Getting Started: Installation

- Install a LaTeX distribution:
 - MiKTeX/proTeXt/TeX Live for Windows
 - MacTeX for MacOS



Getting Started: Sublime



Example Title

Divya Sharma

April 19, 2020

This is random text in $\LaTeX$. This text will appear as it is present in the document 'environment'. Please remember to wash your hands and not touch your face as much!

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat sit amet massa molestie sagittis non eget leo. Pellentesque at tempus velit, sed cursus tellus. Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna. Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat. Nulla ultricies leo lorem, sit amet mollis eros fermentum a. Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat lacinia id. Maecenas ultrices risus a posuere aliquet.

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Example Title}
\author{Divya Sharma}

\begin{document}
\maketitle
This is random text in  $\LaTeX$ . This text will appear as it is present in the document 'environment'. Please remember to wash your hands and not touch your face as much!

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat sit amet massa molestie sagittis non eget leo. Pellentesque at tempus velit, sed cursus tellus. Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna. Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat. Nulla ultricies leo lorem, sit amet mollis eros fermentum a. Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat lacinia id. Maecenas ultrices risus a posuere aliquet.

\end{document}
```

- Online LaTeX editor
- <https://www.overleaf.com/>
- Numerous templates for different document types:
 - CV/Resume
 - Homework Assignments
 - Reports
 - Thesis



- article – For scientific journals, presentations, etc
- IEEEtran – For articles with the IEEE Transactions format
- proc – Proceedings
- report – Longer reports (chapters, small books, thesis)
- book – Books
- slides – Slides
- memoir – Memoirs
- letter – Letters
- beamer – Presentations

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Example Title}
\author{Divya Sharma}

\begin{document}
\maketitle
This is random text in \LaTeX. This text will appear as it is present in the document 'environment'. Please remember to wash yor hands and not touch your face as much!

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat sit amet massa molestie sagittis non eget leo. Pellentesque at tempus velit, sed cursus tellus. Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna. Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat. Nulla ultricies leo lorem, sit amet mollis eros fermentum a. Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat lacinia id. Maecenas ultrices risus a posuere aliquet.
\end{document}
```

- Preamble
 - Document “settings”
 - This text does not appear in the final document
 - Load extra packages
- “Document” environment

- Paragraphs and Alignment
 - `\begin{center}`
 - `\begin{flushleft}` or `\begin{flushright}`
- Newlines
 - `\\` Comments
 - Lines starting with `%`
 - The `'comment'` environment
- Sections

```
\section{Section Title}

\begin{center}
This is random text in \LaTeX.
This text will appear as it is present in the document 'environment'.\\
Please remember to wash yor hands and not touch your face as much!
\end{center}
% this a comment
% ths is also a comment
\begin{comment}
These lines will not appear in the document
\end{comment}

\begin{flushleft}
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque
venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat
sit amet massa molestie sagittis non eget leo. Pellentesque at tempus
velit, sed cursus tellus.
Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate
ac faucibus quis, interdum at magna.
\end{flushleft}

\begin{flushright}
Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien
rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta
felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat.
Nulla ultricies leo lorem, sit amet mollis eros fermentum a.\\
Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet
ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula
erat lacinia id. Maecenas ultrices risus a posuere aliquet.
\end{flushright}
```

1 Section Title

This is random text in L^AT_EX. This text will appear as it is present in the document 'environment'.

Please remember to wash yor hands and not touch your face as much!

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis dolor magna, et luctus mauris vestibulum vel. Etiam eget erat sit amet massa molestie sagittis non eget leo. Pellentesque at tempus velit, sed cursus tellus. Integer pretium quam id dapibus iaculis. Maecenas nisl turpis, vulputate ac faucibus quis, interdum at magna.

Fusce iaculis ullamcorper purus in sodales. Quisque et magna a sapien rutrum ultrices. Duis id nisl ut dolor dignissim porttitor nec porta felis. Curabitur lectus odio, bibendum et sagittis a, fermentum et erat. Nulla ultricies leo lorem, sit amet mollis eros fermentum a.

Nam quis odio in velit malesuada maximus. Nullam cursus nunc sit amet ligula pulvinar consequat. Etiam aliquet ultricies justo, ac vehicula erat lacinia id. Maecenas ultrices risus a posuere aliquet.

- Lists
 - `\begin{enumerate}`
 - `\begin{itemize}`
- Font formatting
 - Font size: `\tiny`, `\small`, `\large`, `\Large`, `\LARGE`, `\huge`, `\Huge`
 - Font style:
 - Boldface: `\textbf`
 - Italicized: `\textit` or `\emph`
 - Small Caps: `\textsc`
 - Underlined: `\underline`

- Inline Math should be enclosed within ‘\$’ signs
- Useful package “amsmath”:
 - `\begin{equation}`
 - `\begin{align}`
 - `\begin{matrices}`
- Greek letters: `\alpha`, `\epsilon`, `\rho`, etc
- Maths symbols: `\int`, `\oint`, `\sum`, `\prod`

```
\begin{align}
E &= \sum E_{\text{bond}} + E_{\text{angle}} + E_{\text{dihedral}} + E_{\text{nonbonded}} \quad \text{\label{eq:opls1}}\\
E_{\text{bond}} &= K_r(r - r_0)^2 \quad \text{\label{eq:opls2}}\\
E_{\text{angle}} &= K_\theta(\theta - \theta_0)^2 \\
\text{\label{eq:opls}} \\
\end{align}

\begin{equation}
\left[ -\frac{1}{2} \sum_i \nabla_i^2 - \sum_A \frac{1}{2M_A} \nabla_A^2 - \sum_{i,A} \frac{Z_A}{|\vec{R}_A - \vec{r}_i|} + \sum_{A>B} \frac{Z_A Z_B}{|\vec{R}_A - \vec{R}_B|} + \sum_{i>j} \frac{1}{|\vec{r}_i - \vec{r}_j|} \right] \Psi = E \Psi
\text{\label{eq:schrodinger}}
\end{equation}
```

$$E = \sum E_{\text{bond}} + E_{\text{angle}} + E_{\text{dihedral}} + E_{\text{nonbonded}} \quad (1)$$

$$E_{\text{bond}} = K_r(r - r_0)^2 \quad (2)$$

$$E_{\text{angle}} = K_\theta(\theta - \theta_0)^2 \quad (3)$$

$$\left[-\frac{1}{2} \sum_i \nabla_i^2 - \sum_A \frac{1}{2M_A} \nabla_A^2 - \sum_{i,A} \frac{Z_A}{|\vec{R}_A - \vec{r}_i|} + \sum_{A>B} \frac{Z_A Z_B}{|\vec{R}_A - \vec{R}_B|} + \sum_{i>j} \frac{1}{|\vec{r}_i - \vec{r}_j|} \right] \Psi = E \Psi \quad (4)$$

- The package 'graphicx' must be used
- A figure with the correct path can be included and captioned as follows:

```
\begin{figure}[h!]  
  \centering  
  \includegraphics[width = 0.5\linewidth]{cool_cat.jpg}  
  \caption{Now that's a cool cat}  
\end{figure}
```

- Figures can also be organized by grabbing from a folder!

```
11  
12 \graphicspath{{figures/}{figs/}{imgs/}}  
13
```

- Tables can be created using the `table` and `tabular` environments

```
\begin{table}[h!]  
  \centering  
  \caption{A bunch of nonsense}  
  \begin{tabular}{|c|c|c|}  
    \hline  
    \textbf{Reaction Type} & \textbf{Status} & \textbf{Comments} \\ \hline  
    \multicolumn{3}{|c|}{\textbf{Shakespeare}} \\ \hline  
    RXN TYPE 01 & Finished & This table took a really long time to make\\ \hline  
    RXN TYPE 02 & Finished & Start your work on time kids \\ \hline  
    RXN TYPE 03 & Finished & And finish it on time too\\ \hline  
    RXN TYPE 04 & Running & I am now out of ideas on what to write\\ \hline  
    RXN TYPE 05 & Running & Man this Coronavirus thing is crazy right?\\ \hline  
    \multicolumn{3}{|c|}{\textbf{Caesar}} \\ \hline  
    RXN TYPE 06 & Finished & You guys can stop reading now\\ \hline  
    RXN TYPE 07 & Finished & Seriously, stop\\ \hline  
    \multicolumn{3}{|c|}{\textbf{MARCC}} \\ \hline  
    RXN TYPE 08 & Running & Why are you still reading\\ \hline  
    RXN TYPE 09 & Pending & NA\\ \hline  
    RXN TYPE 10 & Pending & NA \\ \hline  
  \end{tabular}  
  \label{tab:lbfgs_status}  
\end{table}
```



Figure 1: Now that's a cool cat

Table 1: A bunch of nonsense

Reaction Type	Status	Comments
Shakespeare		
RXN TYPE 01	Finished	This table took a really long time to make
RXN TYPE 02	Finished	Start your work on time kids
RXN TYPE 03	Finished	And finish it on time too
RXN TYPE 04	Running	I am now out of ideas on what to write
RXN TYPE 05	Running	Man this Coronavirus thing is crazy right?
Caesar		
RXN TYPE 06	Finished	You guys can stop reading now
RXN TYPE 07	Finished	Seriously, stop
MARCC		
RXN TYPE 08	Running	Why are you still reading
RXN TYPE 09	Pending	NA
RXN TYPE 10	Pending	NA

1. Include the correct package for e.g.
`\usepackage["settings"]{biblatex}`
2. Make a file with all your bibtex entries
3. Cite whenever you want with `\cite{}`
4. Call:
 - `\bibliographystyle{}`
 - `\bibliography{}`
5. Insert the bibliography

Styles [Here](#)

Basics: Citations using Bibtex

```
\usepackage[backend=bibtex, bibstyle=chem-acs, citestyle=numeric-comp, articletitle=true, chaptertitle=false, sorting=none, url=true]{biblatex}  
\bibliography{ref}
```

```
\printbibliography[heading=subbibliography]  
\end{document}
```

```
@article{latex,  
  doi = {10.1371/journal.pone.0115069},  
  url = {https://doi.org/10.1371/journal.pone.0115069},  
  year = {2014},  
  month = dec,  
  publisher = {Public Library of Science ({PLOS})},  
  volume = {9},  
  number = {12},  
  pages = {e115069},  
  author = {Markus Knauff and Jelica Nejasmic},  
  editor = {Cynthia Gibas},  
  title = {An Efficiency Comparison of Document Preparation Systems Used in Academic Research and Development},  
  journal = {{PLOS} {ONE}}  
}
```

References

- (1) Knauff, M.; Nejasmic, J. An Efficiency Comparison of Document Preparation Systems Used in Academic Research and Development. *PLOS ONE* **2014**, *9*, ed. by Gibas, C., e115069, <https://doi.org/10.1371/journal.pone.0115069>.

- Make your own commands and environments (`\newcommand`)
- Redefine a previously existing command (`\renewcommand`)
- Make plots and figures in LaTeX (`\usepackage{tikz}`)
- Embed/import code from file into TeX file (`\usepackage{listings}`)
- Fancy headers and footers (`\usepackage{fancyhdr}`)
- Hyperlinking (`\usepackage{hyperref}`)

- [https://www.overleaf.com/learn/how-to/Creating a document in Overleaf](https://www.overleaf.com/learn/how-to/Creating_a_document_in_Overleaf)
- <https://en.wikibooks.org/wiki/LaTeX/Introduction>
- <https://www.latex-tutorial.com/>