Document Preparation using LaTeX

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What is LaTeX

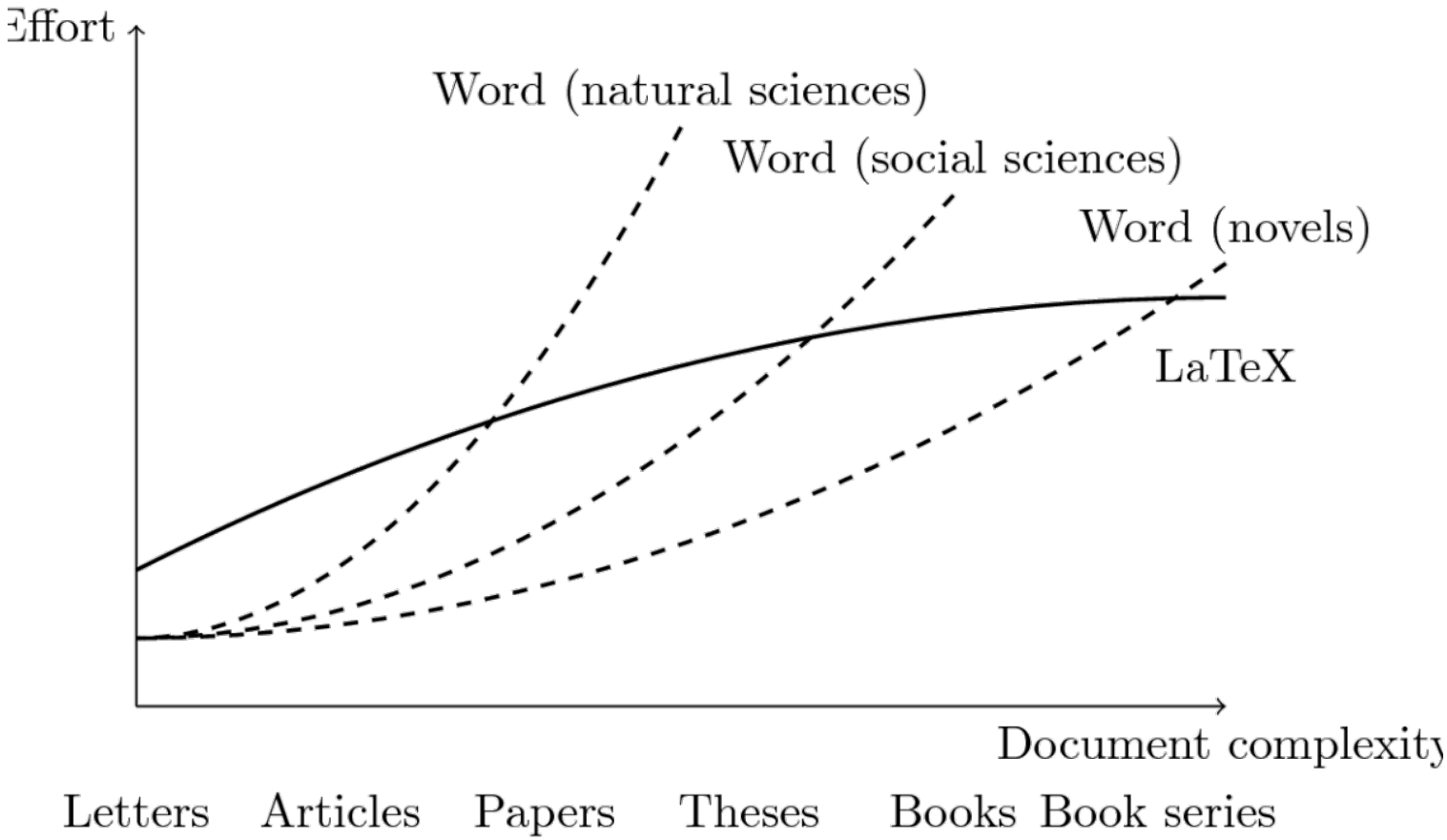
- A document preparation system for high-quality typesetting of research papers, technical reports, books, presentation slides, and academic documents
- Pronounced 'Lah-tech' or 'Lay-tech'
- Alternative to Word, Libreoffice writer, Google doc etc.

(source: Google images)

Why LaTeX

- When you want to work on complex/large documents
- LaTeX is open-source and cross-platform compatable
- When you document evolves as time passes
- Easy and robust reference management
- If you are serious about the typesetting quality
- For scientific/technical document with lot of mathematical content

Document Complexity



(source: Better Books with LaTeX the Agile Way (book))

Platforms

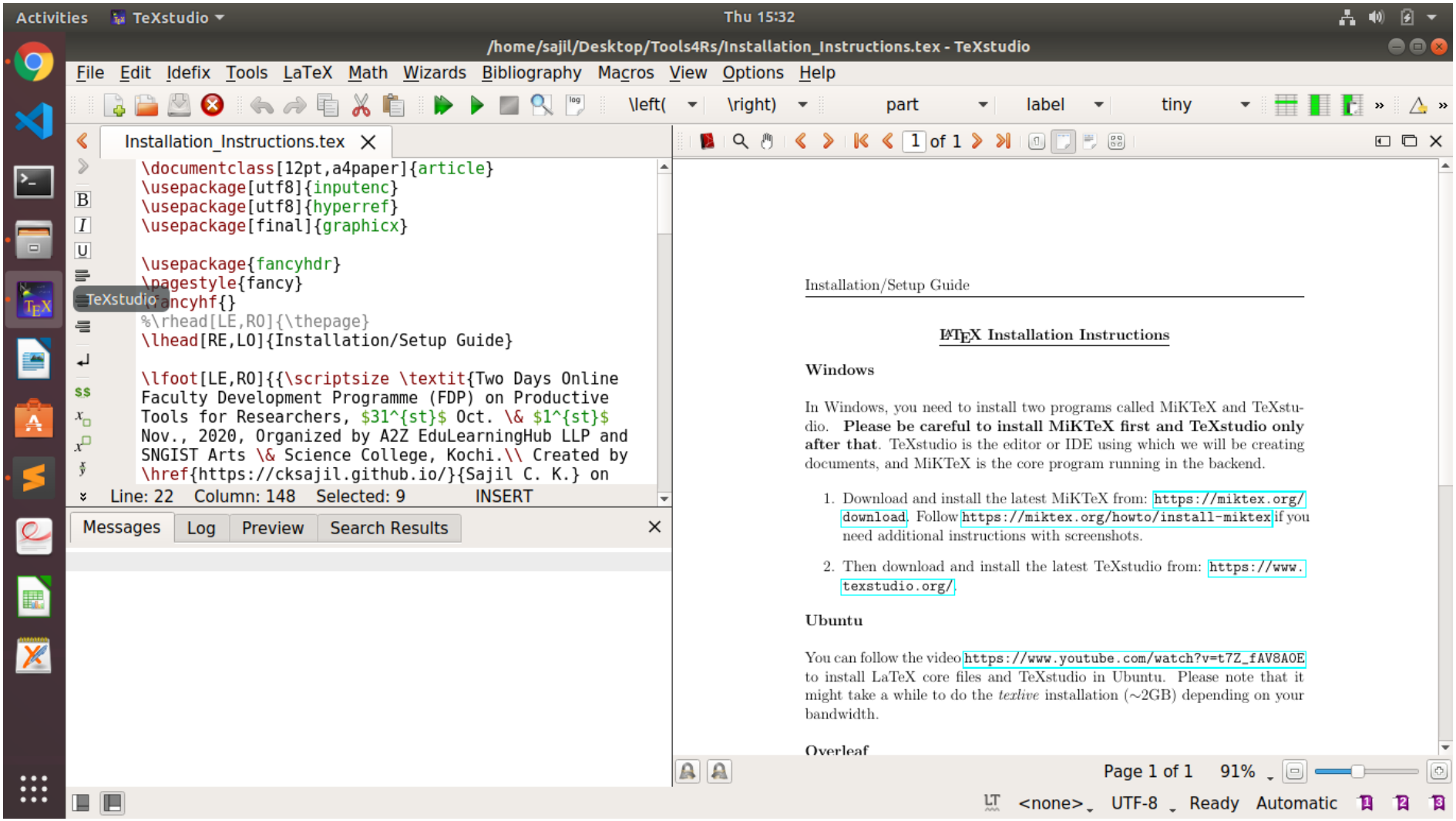
- TeXstudio
- Overleaf

(source: Google images)

Introduction to TeXstudio

- Offline installation
- Faster processing

TeXstudio GUI

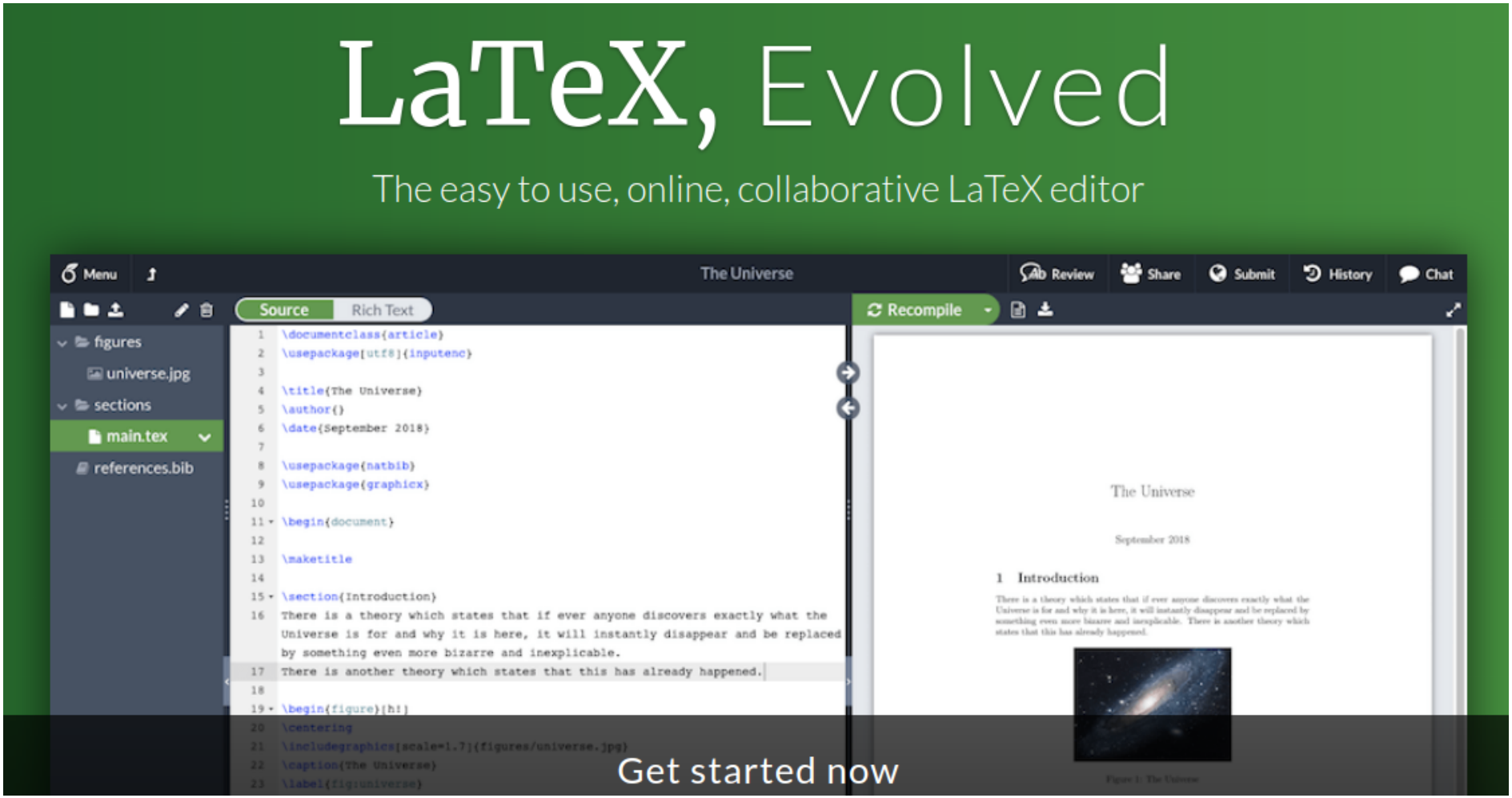


Introduction to Overleaf

- Work from anywhere
- No installation or Library issues
- Sync your files via Dropbox and GitHub
- View collaborator edits in real time

Overleaf Account Creation

- Create an acccount at `www.overleaf.com`



Overleaf User Interface

- Files window
  - New file & folder creation
  - Upload, delete, and rename
- Editor window
- Visualizer window
  - Compile
  - Errors & Warnings
  - Download

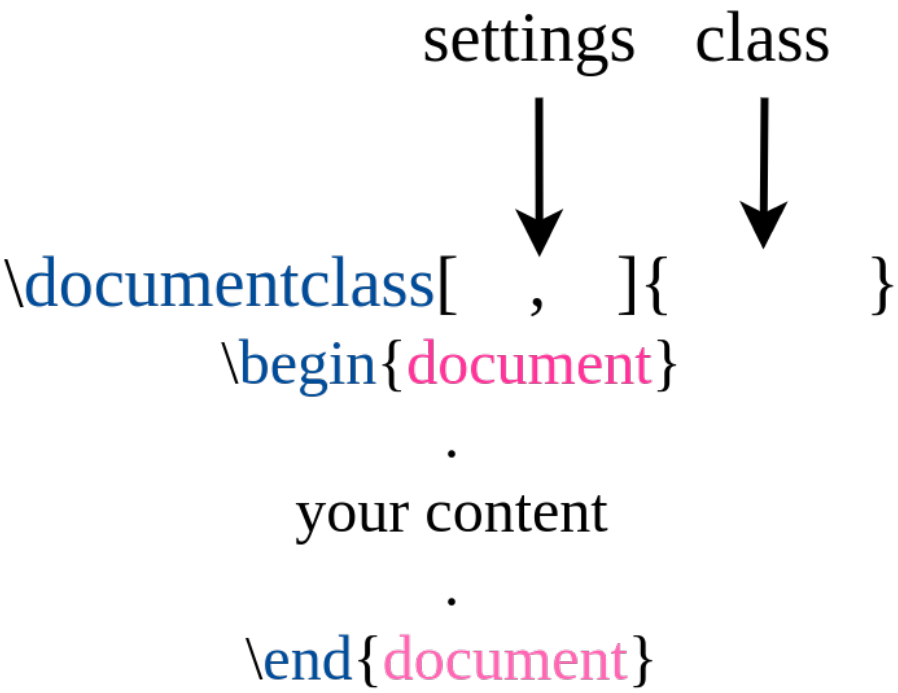
Creating Basic Document

- Starts with Preample and followed by content

```
\documentclass{article}
\begin{document}
First document
\end{document}
```

- Everything in your .tex file before begin document is called the preamble
- The document classes include article, book, letter, report, and slides
- Special characters: \, #, $, %, &, {, and }

Creating Basic Document



Exploring Preample

- In the preamble you define the type of document you are writing
- The language you are writing in
- The packages you would like to use
- A normal document preamble would look like

```
\documentclass[12pt, letterpaper]{article}
\usepackage[utf8]{inputenc}
```

- Font sizes (10pt, 11pt, 12pt) and Paper sizes (a4paper, letterpaper) are passed (comma separated) as parameters. Recommended encoding is utf8

Exercise

- Create a basic document with your Overleaf account

Few Design Principles

- Know the output medium
  - Print or Screen ?
- Know the medium dimensions
  - Size (A4, letter, etc.), width, & Aspect ratio (for images)
- Know the audience

Paper Size

- Basic paper sizes and their dimentions are

letterpaper	$11\times8.5in$	*a4paper*	$20.7\times21in$
legalpaper	$14\times8.5in$	*a5paper*	$21\times14.8in$
executivepaper	$10.5\times7.25in$	*b5paper*	$25\times17.6in$

Customizing Margins

- We can customize margins with **geometry** package
- ```
  \usepackage[a4paper, width=145mm, top=30.5mm,
      bottom=30.5mm, bindingoffset=6mm]{geometry
      }
  ```
  - **width**: controls text width
  - **top** & **bottom** control vertical spacing
  - **bindingoffset** to adjust binding space
  ```

Exercise

- Create a document Specific dimensions

Basic features & formating

- Font size

```
\Huge{Overleaf.com}
\huge{Overleaf.com}
\LARGE{Overleaf.com}
\Large{Overleaf.com}
\large{Overleaf.com}
\normalsize{Overleaf.com}
\small{Overleaf.com}
\footnotesize{Overleaf.com}
\scriptsize{Overleaf.com}
\tiny{Overleaf.com}
```

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Overleaf.com

Basic features & formating

- Autocomplete & Selection
- Commenting : CNTRL+/
- Escape sequence
- Paragraph
- Indent
- Bold
- Italics
- Underline

```
Some of the \textbf{greatest} discoveries in \
    underline{science} were made by \textbf{\
    textit{accident}}
```

Some of the **greatest** discoveries in <u>science</u> were made by ***accident***

Basic features & formatting continued

- Text coloring
- emphasis
- alert

```
When it is \textcolor{green}{green} you can go
    \& when it is \textcolor{red}{red} you have
    to stop. I am \emph{stressing} this point.
    Please be \alert{careful}.
```

When it is green you can go & when it is red you have to stop. I am *stressing* this point. Please be careful.

Page Numbering

- You can choose different page numbering styles shown below

```
\documentclass[12pt]{article}
\usepackage[utf8]{inputenc}

%\pagenumbering{arabic}
%\pagenumbering{roman}
\pagenumbering{Roman}
%\pagenumbering{alph}
%\pagenumbering{Alph}

\begin{document}
Your content
\end{document}
```

Reset Page Numbering

```
\documentclass[12pt]{article}
\usepackage[utf8]{inputenc}
\usepackage[a4paper]{geometry}
\setcounter{page}{10}

\begin{document}
your content here
\end{document}
```

Exercise

- Create a document with following features

Water Marking

- We can watermark the document with **draftwatermark** package
- ```
  \usepackage{draftwatermark}
  \SetWatermarkLightness{0.8}
  \SetWatermarkScale{2}
  ```
  - **Lightness** : 1 (white) & 0 (black)
  - **Scale** : controls size
  ```

Exercise

- Create a document with Watermark

Columns, Line spacing, & Sides

- Single column/double column
- Single side/double side
- Line spacing

```
\documentclass[12pt,oneside,twocolumn]{article}
\renewcommand{\baselinestretch}{1.5}
```

Setting Multi-columns

- You can easily define the number of columns and space separation with them using the package called multicol.

```
\documentclass{article}
\usepackage{multicol}
 \setlength{\columnsep}{5mm}

\begin{document}

\begin{multicols}{2}
Your content
\end{multicols}

\end{document}
```

Setting Multi-columns

- You can exclude parts from columns.

```
\documentclass{article}
\usepackage{multicol}

\begin{document}

\begin{multicols*}{2}
[This content is excluded from columns.]
Here the content is filled in column 1 first.
\end{multicols*}

\end{document}
```

Exercise

- Create a document with following specifications
  - Double side, 1.5 linespace, twocolumn

Simple Image Insert

```
\documentclass{article}
\usepackage{graphicx}
\begin{document}
\includegraphics[width=0.5\textwidth]{universe.
    jpg}
\end{document}
```

- Scaling
- Width & Height
- Rotation

Inserting Figures

- Needs to add graphicx package
- Positioning & alignment
- Caption
- Width
- Label for cross-referencing

```
\usepackage{graphicx}
\begin{figure}[h]
    \centering
    \includegraphics[width=0.7\textwidth]{
        universe.jpg}
    \caption{Photograph of Universe}
    \label{fig:universe}
\end{figure}
```

Inserting Figures

Figure: Photograph of Universe

Figure 1 was captured by Hubble space telescope.

Figure Path

- You can organise all your images in one folder and specify the path.

```
\documentclass{article}
\usepackage{graphicx}
\graphicspath{{./Images/}}

\begin{document}
\begin{figure}[h!]
    \centering
    \includegraphics[width=0.5\textwidth]{universe.
        jpg}
    \caption{The Universe}
    \label{fig:universe}
\end{figure}
\end{document}
```

Placing of figures & tables

```
\usepackage{graphicx}
\begin{figure}[h]
      \centering
      \includegraphics[width=0.7\textwidth]{
          universe.jpg}
      \caption{Photograph of Universe}
      \label{fig:universe}
\end{figure}
```

- h : approximately same as source text position
- t : At top of the page
- b : At bottom of the page
- ! : Override default settings
- H : Precisely at the location of LaTeX code (needed **float** package)

Sub figures

```
\begin{figure}
  \centering \subfigure{\includegraphics[width
     =0.4\textwidth]{universe.jpg}\label{fig:
     exph}}
  \subfigure{\includegraphics[width=0.4\
     textwidth]{universe.jpg}\label{fig:exgr}}
  \caption{Two twin universe}
  \label{fig:universer}
\end{figure}
Figure \ref{fig:exph} shows the one captured by
   Hubble-1. Figure \ref{fig:exgr} was captured
   by Hubble-2
```

Exercise

- Practice with figures

Creating Sections

Sections with & without numbering

```
\section{Main Heading 1}\label{heading1}
content 1
\subsection{Sub Heading 2}
sub content
\subsubsection{Sub sub Heading 3}
sub sub content
\section{Main Heading 2}
content 2
```

Ordered & Unordered Lists

```
\begin{itemize}
   \item Item1
   \item Item2
\end{itemize}
```

```
\begin{enumerate}
   \item Task 1
   \item Task 2
\end{enumerate}
```

Exercise

- Practice with Sections & Lists

Equations

```
In physics, the mass-energy equivalence is stated
by the equation $E=mc^2$, discovered in 1905 by Albert Einstein.
```

In physics, the mass-energy equivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

```
\begin{equation}
    E = mc^2
\end{equation}
```

$$E = mc^2 \tag{1}$$

Equations

- Subscript
- Superscript
- Symbols
- Grouping
- Fractions and Binomials
- Brackets and Parentheses
- Spacing
- Operators
- Integrals, sums and limits

Exercise

- Practice with Equations

$$E = mc^2 \tag{2}$$

$$F = G\frac{m_1 m_2}{r^2} \tag{3}$$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} \tag{4}$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2} \tag{5}$$

$$P(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \tag{6}$$

Hyperlink & URL

```
\documentclass{article}
\usepackage{hyperref}

\begin{document}
\href{http://www.google.com}{Click Here}
\newline
\url{http://www.google.com}
\newline
\href{mailto:sajilck@gmail.com}{sajilck@gmail.
    com}
\end{document}
```

Hyperlink Color

- Color can be specified to citations, figures, tables, sections, and URLs

```
\usepackage{hyperref}
\hypersetup{
    colorlinks=true,
    linkcolor=blue,
    urlcolor=blue,
    citecolor=blue
}
```

Inserting Table

```
\begin{table}\small
\centering
\begin{tabular}{l |c| c}
\hline
hight & weight & Age\\
\hline
174 & 77 & 32\\
150 & 55 & 28\\
\hline
\end{tabular}
\caption{A sample table}
\label{tab:SampleTable}
\end{table}
```

- Lines
- Alignment

Inserting Table

height	weight	Age
174	77	32
150	55	28

Table: A sample table

Inserting Footnotes

- Type 1 [1]
- Type 2 [2]
- Type 3 [iii]

```
Type 1 \footnote{footnote 1}
Type 2 \footnotemark \footnotetext{footnote 2}
\renewcommand{\thefootnote}{\roman{footnote}}
Type 3 \footnote{footnote 3}
```

[1] footnote 1
[2] footnote 2
[iii] footnote 3

Exercise

- Practice with Footnotes

Headers & Footers

- Single Sided Documents

```
\documentclass{article}
\usepackage{fancyhdr}
\pagestyle{fancy}
\fancyhf{}
\rhead{\LaTeX}
\lhead{Tutorial}
\rfoot{Page \thepage}
```

- Double Sided Documents

```
\documentclass[twoside]{book}
\usepackage{fancyhdr}
\pagestyle{fancy}
\fancyhf{}
\fancyhead[LE,RO]{\LaTeX}
\fancyhead[RE,LO]{Tutorial}
\fancyfoot[CE,CO]{\leftmark}
\fancyfoot[LE,RO]{\thepage}
```

- rhead
- lhead
- chead
- rfoot
- lfoot
- cfoot

- E for even page
- O for odd page
- L for left side
- C for centered R for right side

Exercise

- Practice with Header & footer

Inserting ToC, list of figures & tables

- Inserting ToC, list of figures & tables
- \tableofcontents
  \listoffigures
  \listoftables

Abbreviations

- Inserting Abbreviations
- ```
  \chapter*{Abbreviations}
  \input{FrontPages/Abbreviations}
  \item[ETA] Expected Time of Arrival
  ```
  ```

Inserting Code

- From file

```
\lstinputlisting[basicstyle=\large]{code.txt}
\usepackage{minted}
\inputminted{python}{python.py}
```

Exercise

- Practise with Code

Citation & Bibliography

- Cross-referencing
- Bibtex
- Citation

```
\usepackage[
backend=biber,
style=alphabetic,
citestyle=authoryear
]{biblatex}
```

Citation & Bibliography

- cite{} or parencite{}
- Style Names
  - American Chemical Society (ACS) : chem-acs
  - Institute of Electrical and Electronics Engineers (IEEE) : ieee
  - American Psychological Association (APA) : apa
- More info : `https://www.overleaf.com/learn/latex/Biblatex_citation_styles`

Citation

- You can cite one or more research items.

```
\cite{key1}
\cite{key1,key2}
\parencite{key3}
```

Exercise

- Practice with Citation

File management

- Downloading PDF
- Downloading project
- Uploading project

Exercise

- Create a basic research paper

Exercise : Journal Template

- Compile a research paper using IEEE Journal Template

Title Page

```
\begin{titlepage}
    \begin{center}
        \vspace*{1cm}
        \Huge
        \textbf{Thesis Title}
        \vspace{3.5cm}
        \large{Thesis submitted to the University for the award of
            the Degree of Doctor of Philosophy in
********}
        \vspace{3.5cm}\\
        \textbf{\large Name}
        %\includegraphics[width=0.35\textwidth]{Logo.png}
        \vspace{3.5cm}
        \Large
      Department of *****\\
      University of ****\\
      Month Year
    \end{center}
\end{titlepage}
```

Presentation Slide

- Create Presentation Slides with LaTeX
- ```
  \documentclass{beamer}
  \mode<presentation> {
  \title[Title of Talk}
  \author{\textbf {Name}}
  \date{Month Year}
  \institute[University/Organization]
  {Address\\
  \medskip
  \textit{email}
  }
  \begin{document}
  \begin{frame}
  \titlepage
  \end{frame}
  \begin{frame}
  \frametitle{Slide1}
  \end{frame}
  \end{document}
  ```
  ```

Exercise

- Practice with Slides

Creating Technical Diagrams

- High quality LaTeXdocument requires carefully crafted images/graphs
- Needs to follow data visualization fundamentals

Primer on Data Visualization

- Vector & Raster images
- Basic graphics with draw.io
- Aspect ratio
- Resolution
- Other important software: imagemagick, Gimp, InkScape

Exercise

- Practice with Technical Diagram

Thesis Creation

- Select document class
  - Font, sides, columns
- Set line-spacing
- Set paper size & margins
- Set Bibtex styles
- Header and footers
- Title & front pages
  - Certificates
  - Declaration
  - Acknowledgement
  - Dedication
- ToC, figure & tables list
- Chapters
- References & Appendix

Splitting LaTeXCode & Setting Image Path

- You can split the code among multiple LaTeXfiles
  - `\input{Section1/Section.tex}`
    `\graphicspath{{Images/}}`
- Use a folder structure

```
SampleThesis
|-- Appendix
|   `-- Appendix.tex
|-- Chapters
|   |-- Chapter1.tex
|   |-- Chapter2.tex
|   `-- Chapter3.tex
|-- FrontPages
|   |-- Abbreviation.tex
|   |-- Abstract.tex
|   |-- Acknowledgement.tex
|   |-- Certificates.tex
|   |-- Declaration.tex
|   |-- Dedicaion.tex
|   `-- Titlepage.tex
|-- Images
|   |-- Graph1.png
|   |-- Graph2.png
|   `-- Graph3.png
|-- main.tex
`-- references.bib
```

Exercise

- Thesis/Report Creation

CV/Resume Creation

- You can create your CV/resume using readily available templates
- Visit `https://www.overleaf.com/gallery/tagged/cv` to get CV/resume templates

LaTeXProject: Automated Document Generation

- You can automate recurring document preparation tasks and save time
- Example: `https://intuitivetutorial.com/2020/11/08/automated-pdf-creation/`

Forums & Getting Help

- https://www.overleaf.com/learn/latex/Tutorials
- https://www.sharelatex.com/blog/latex-guides/beginners-tutorial.html
- https://tex.stackexchange.com/

Thank you