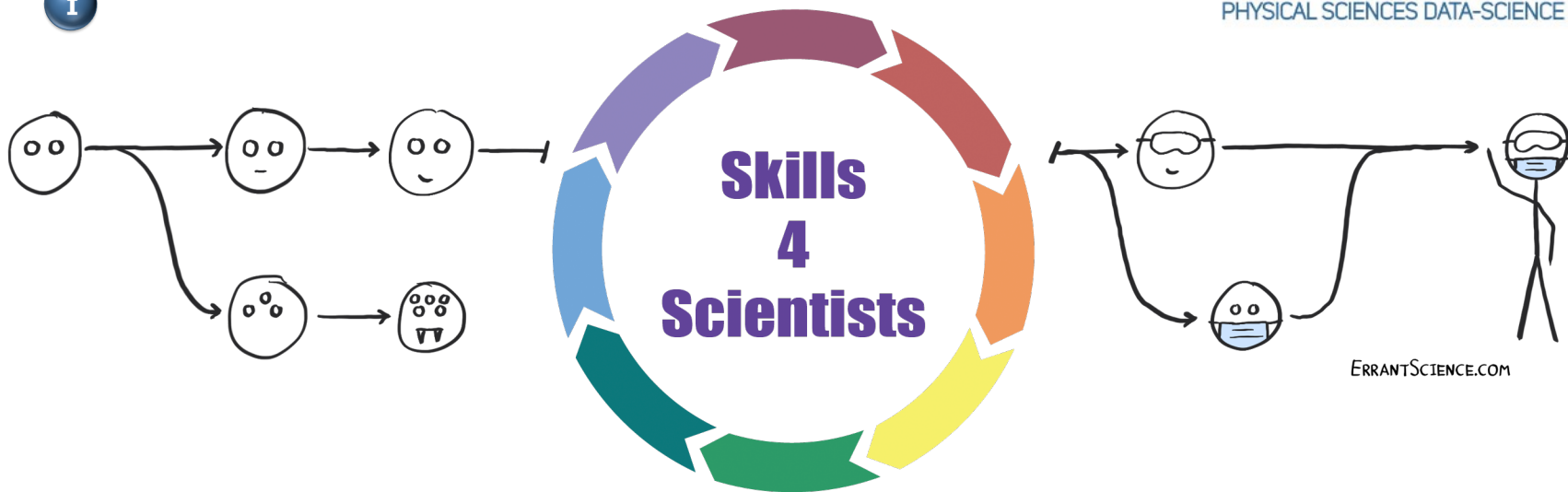


AI 4 Scientific
Discovery Network⁺

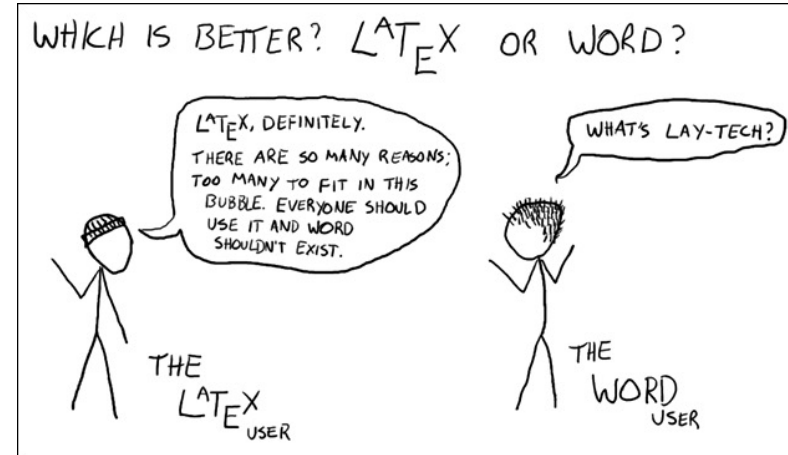


Introduction to LaTeX

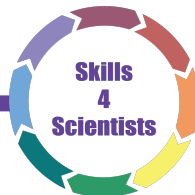
Dr Samantha Kanza

Outline

- LaTeX Resources
- What is LaTeX?
- How do we use LaTeX?

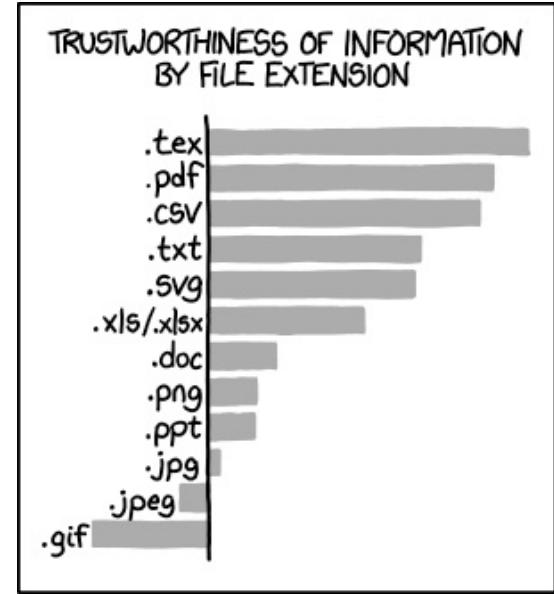


<https://handsonkeyboard.blog/2019/07/31/00-introduction-to-latex/>



Resources

- Hello World
- Examples
 - Individual Examples Files
 - Combined Example File
- Pre-requisites



https://www.explainxkcd.com/wiki/index.php/1301:_File_Extensions

GitHub: <https://github.com/samikanza/Skills4ScientistsLaTeX.git>

AI3SD: <https://www.ai3sd.org/wp-content/uploads/sites/374/2021/07/Skills4ScientistsLaTeX.zip>



What is LaTeX

- Document markup language
- Often used to produce scientific documents



<https://www.bonfacemunyoki.com/post/introduction-to-latex/>



Installing LaTeX

Download & Install

<https://www.ai3sd.org/wp-content/uploads/sites/374/2021/07/Skills4Scientists-LaTeXandGitHubInstructions.pdf>

Skills4Scientists: LaTeX & Version Control Setup Instructions

Please follow these instructions to get LaTeX and Git setup on your machines before this session.

1 LaTeX Setup

The first thing you need to do (if you don't have it already) is to get LaTeX installed on your machine.

1.1 Installing LaTeX

LaTeX can be downloaded from this website: <https://www.latex-project.org/get/>.
Or to shortcut here are some links for specific operating systems:

- Mac: <http://www.tug.org/mactex/>
- Linux: <https://www.tug.org/texlive/>
- Windows: <https://miktex.org/download>



Writing & Compiling LaTeX

LaTeX IDEs

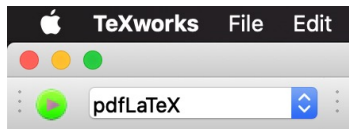
<https://www.ai3sd.org/wp-content/uploads/sites/374/2021/07/Skills4Scientists-LaTeXandGitHubInstructions.pdf>

LaTeX Make file example:

<https://gist.github.com/Nemo157/539229>

TeXWorks

<http://www.tug.org/texworks/>



1.2 LaTeX IDEs

There are a number of ways to write and compile your LaTeX.

TextEditor & Command Line

For the brave at heart you can write your LaTeX files using a text editor and compile them via the command line, either via a set of commands or you can build a custom `make` file; we will touch on these aspects in the workshop.

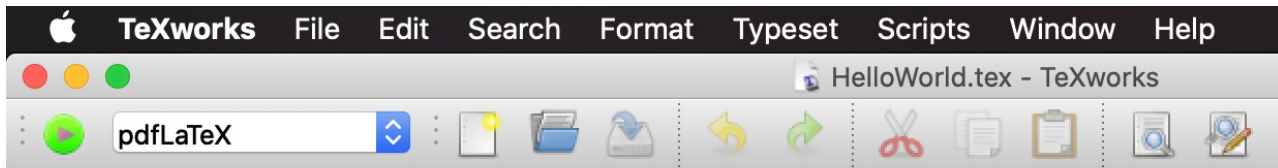
IDEs

Or, you might prefer to use an IDE which provides the advantages of syntax highlighting, and buttons to compile your files. This webpage contains a long list of LaTeX IDEs: <https://tex.stackexchange.com/questions/339/latex-editors-ides>

I personally recommend TeXworks which can be downloaded from here: <http://www.tug.org/texworks/>. However IDEs are often quite a personal choice, so you might want to look into a few different ones to see what suits you.



Hello World



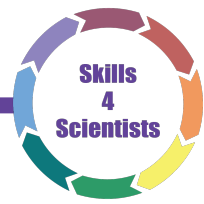
```
\documentclass[10pt,a4paper]{article}  
\begin{document}  
Hello World!  
\end{document}
```

LaTeX



PDF

Hello World!



Hello World

Required command – specifies document details, font, page size and document type: `\documentclass[options]{class}`

`\documentclass[10pt,a4paper]{article}`

`\begin{document}` ← Marks the beginning of the document

Hello World! ← All document text in here

`\end{document}` ← Marks the end of the document



Document Creation

```
\documentclass [options] {class}
```

```
\usepackage [options] {package}
```

```
\begin {document}
```

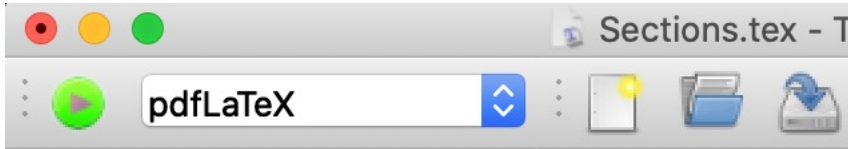
Document Content: Text & Commands

```
\end {document}
```

https://en.wikibooks.org/wiki/LaTeX/Document_Structure



Headings



```
\documentclass[10pt,a4paper]{article}  
\begin{document}
```

```
\section{Heading 1}  
This is a top level heading
```

```
\subsection{Heading 2}  
This is a second level heading
```

```
\subsubsection{Heading 3}  
This is a third level heading
```

```
\end{document}
```

1 Heading 1

This is a top level heading

1.1 Heading 2

This is a second level heading

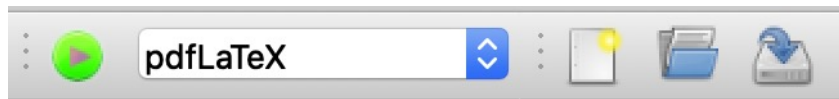
1.1.1 Heading 3

This is a third level heading

Sections.tex



Table of Contents



```
\documentclass[10pt,a4paper]{article}
```

```
\begin{document}
```

```
\tableofcontents
```

```
\section{Heading 1}
```

```
\subsection{Heading 2}
```

```
\subsubsection{Heading 3}
```

```
\end{document}
```

Contents

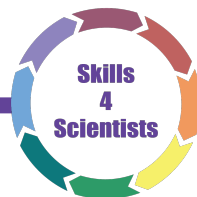
1	Heading 1	1
1.1	Heading 2	1
1.1.1	Heading 3	1

1 Heading 1

1.1 Heading 2

1.1.1 Heading 3

TableOfContents.tex



Paragraphs & Line Endings

```
\documentclass[10pt,a4paper]{article}  
\begin{document}
```

```
\setlength\parindent{0pt}
```

Paragraph Example 1. \par

Paragraph Example 2. I was started after using the par command.

Paragraph Example 3. I was started after leaving a blank line. \\

Paragraph Example 4. I was started after using the new line command and leaving a blank line. \\

Paragraph Example 5. I was started after using the new line command. \\

Paragraph Example 6. I was started after using two new line commands.

```
\end{document}
```

Paragraph Example 1.

Paragraph Example 2. I was started after using the par command.

Paragraph Example 3. I was started after leaving a blank line.

Paragraph Example 4. I was started after using the new line command and leaving a blank line.

Paragraph Example 5. I was started after using the new line command.

Paragraph Example 6. I was started after using two new line commands.

Paragraphs.tex



Text Formatting



```
\documentclass[10pt,a4paper]{article}
\begin{document}

\textbf{Here is some bold text}\\

\textit{Here is some italicised text}\\

\underline{Here is some underlined text}\\

\textbf{\textit{\underline{Here is some bold and italicised text that has also been underlined}}}}

\end{document}
```

TextFormatting.tex

Here is some bold text

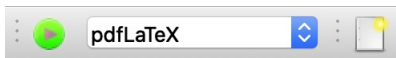
Here is some italicised text

Here is some underlined text

Here is some bold and italicised text that has also been underlined



Lists (numerical & bullets)



```
\documentclass[10pt,a4paper]{article}
\begin{document}
```

This is a bullet pointed list:

```
\begin{itemize}
\item{Bullet item 1}
\item{Bullet item 2}
\item{Bullet item 3}
\end{itemize}
```

This is a numerical list

```
\begin{enumerate}
\item{Numbered Item 1}
\item{Numbered Item 2}
\item{Numbered Item 3}
\end{enumerate}
```

This is a multi-level bullet list

```
\begin{itemize}
\item{Bullet item 1}
\begin{itemize}
\item{Bullet item 2}
\end{itemize}
\item{Bullet item 3}
\end{itemize}
\end{document}
```

This is a bullet pointed list:

- Bullet item 1
- Bullet item 2
- Bullet item 3

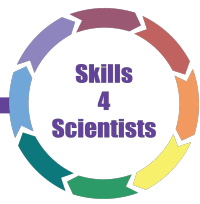
This is a numerical list

1. Numbered Item 1
2. Numbered Item 2
3. Numbered Item 3

This is a multi-level bullet list

- Bullet item 1
 - Bullet item 2
- Bullet item 3

Lists.tex



Figures & Captions

Figures.tex

```
pdfLaTeX
\documentclass[10pt,a4paper]{article}

\usepackage{graphicx} %graphics package

\begin{document}

\begin{figure}[ht] ← Float options
  \centering
  \includegraphics[width = .95\linewidth]{images/Salem.JPG}
  \caption{Salem the Cat}
\end{figure}

\begin{figure}[ht]
  \centering
  \includegraphics[scale=0.1]{images/Salem.JPG}
  \caption{Smaller Salem the Cat}
\end{figure}

\end{document}
```

Float options

Image width Image source

Caption



Figure 1: Salem the Cat



Figure 2: Smaller Salem the Cat

Figures & Captions

Moving a picture in Microsoft Word



- It actually does what you want
- You mess up the whole document

<https://www.funny-memes.org/2013/05/moving-picture-in-microsoft-word-it.html>

Me: *moves an image
0.00002 mm in Word*

Entire text I edited for 4 hours:



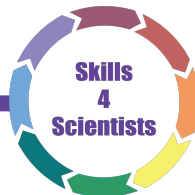
<https://www.memedroid.com/memes/detail/3326537/darn?refGallery=tags&page=1&tag=word>



Figures & Captions

Specifier	Permission
<code>h</code>	Place the float <i>here</i> , i.e., <i>approximately</i> at the same point it occurs in the source text (however, not <i>exactly</i> at the spot)
<code>t</code>	Position at the <i>top</i> of the page.
<code>b</code>	Position at the <i>bottom</i> of the page.
<code>p</code>	Put on a special <i>page</i> for floats only.
<code>!</code>	Override internal parameters LaTeX uses for determining "good" float positions.
<code>H</code>	Places the float at precisely the location in the LaTeX code. Requires the <code>float</code> package, ^[1] i.e., <code>\usepackage{float}</code> .

[https://en.wikibooks.org/wiki/LaTeX/Floats, Figures and Captions](https://en.wikibooks.org/wiki/LaTeX/Floats,_Figures_and_Captions)



Figures & Captions

Figures.tex

```
pdfLaTeX
\documentclass[10pt,a4paper]{article}

\usepackage{graphicx} %graphics package

\begin{document}

\begin{figure}[ht] ← Float options
  \centering
  \includegraphics[width = .95\linewidth]{images/Salem.JPG}
  \caption{Salem the Cat}
\end{figure}

\begin{figure}[ht]
  \centering
  \includegraphics[scale=0.1]{images/Salem.JPG}
  \caption{Smaller Salem the Cat}
\end{figure}

\end{document}
```

Float options

Image width Image source

Caption



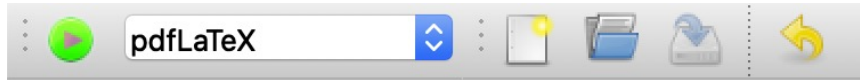
Figure 1: Salem the Cat



Figure 2: Smaller Salem the Cat

[https://en.wikibooks.org/wiki/LaTeX/Floats, Figures and Captions](https://en.wikibooks.org/wiki/LaTeX/Floats,_Figures_and_Captions)

Basic Tables



```
\documentclass[10pt,a4paper]{article}
```

```
\begin{document}
```

#cells, alignment, size

```
\begin{tabular}{| | | | |}\hline
```

```
Cat Name & Fur Colour & Favourite Food \\ \hline  
Lucifer & Black & Mice \\ \hline  
Toulouse & Orange & Milk \\ \hline  
Figaro & Black and White & Fish \\ \hline
```

```
\end{tabular}
```

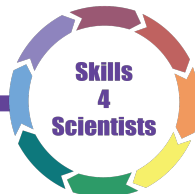
```
\end{document}
```

& denotes new cell

BasicTables.tex

Cat Name	Fur Colour	Favourite Food
Lucifer	Black	Mice
Toulouse	Orange	Milk
Figaro	Black and White	Fish

<https://en.wikibooks.org/wiki/LaTeX/Tables>



Advanced Tables

AdvancedTables.tex



```
\documentclass[10pt,a4paper]{article}
```

```
\usepackage{multirow} %allows cell merging across rows
```

```
\begin{document}
```

Float

```
\begin{table}[ht]
```

```
\begin{center}
```

```
\begin{tabular}{p{90pt} | p{90pt} | p{90pt} | p{90pt}}
```

Specific size cells

```
Disney Film      & Cat Name      & Fur Colour      & Favourite Food \\ \hline  
Cinderella      & Lucifer        & Black           & Mice           \\ \hline  
\multirow{2}{*}{Aristocats} & Marie          & White          & Milk           \\ \cline{2-4}  
                & Toulouse       & Orange         & Milk           \\ \hline  
Pinochio        & Figaro         & Black and White & Fish           \\ \hline
```

```
\end{tabular}
```

```
\caption{Disney Cats}
```

```
\end{center}
```

```
\end{table}
```

```
\end{document}
```

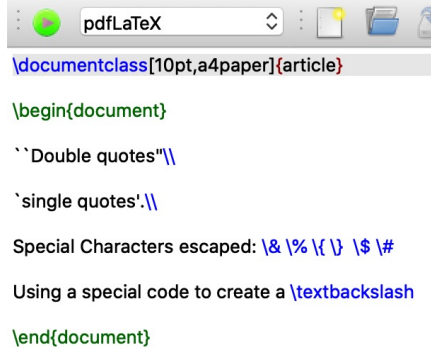
Caption

Disney Film	Cat Name	Fur Colour	Favourite Food
Cinderella	Lucifer	Black	Mice
Aristocats	Marie	White	Milk
	Toulouse	Orange	Milk
Pinochio	Figaro	Black and White	Fish

Table 1: Disney Cats

<https://www.latex-tables.com/>

Special Characters & Quotes



```
pdfLaTeX
\documentclass[10pt,a4paper]{article}

\begin{document}

``Double quotes``\\

`single quotes`.\\

Special Characters escaped: \& \% {\} \$ \#

Using a special code to create a \textbackslash

\end{document}
```

“Double quotes”

‘single quotes’.

Special Characters escaped: & % { } \$ #

Using a special code to create a \

QuotesCharacters.tex

- Common special characters: \ & % { } \$ # (Escape or use special commands)
- Special commands for symbols
- ``quote`` for quotes

https://en.wikibooks.org/wiki/LaTeX/Special_Characters



Mathematical Symbols

- Large list of mathematical symbols
- Keyboard access: $+ - = ! / () [] < > : *$
- Codes for the rest
- Math mode shortcuts:
 $\backslash (\backslash), \$ \$$ or $\backslash begin\{math\} \backslash end\{math\}.$

<https://en.wikibooks.org/wiki/LaTeX/Mathematics>



Mathematical Symbols



```
\documentclass[10pt,a4paper]{article}
```

```
\usepackage{mathtools} %maths package
```

```
\setlength{\parindent}{0cm}%This stops the paragraphs in each section indenting
```

```
\begin{document}
```

Maths symbols using the keyboard:\\

+ - = ! / () [] < > | ' : * \\

Sets & Relations\\

```
\begin{math}
```

```
\forall x \in X, \quad \exists y \leq \epsilon
```

```
\end{math}\\
```

Operators\\

```
\begin{math}
```

```
\cos(2\theta) = \cos^2 \theta - \sin^2 \theta
```

```
\end{math}\\
```

Powers and indices\\

```
\begin{math}
```

```
k_{n+1} = n^2 + k_n^2 - k_{n-1}
```

```
\end{math}
```

```
\end{document}
```

Maths symbols using the keyboard:

+ - = ! / () [] i l — ' : *

Sets & Relations

$\forall x \in X, \quad \exists y \leq \epsilon$

Operators

$\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$

Powers and indices

$k_{n+1} = n^2 + k_n^2 - k_{n-1}$

Maths.tex



Labels & Cross References



1 Heading 1

This is a top level heading

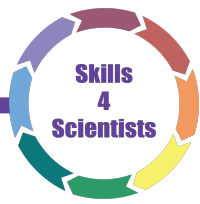
1.1 Heading 2

This is a second level heading that is under Section 1

Labels.tex

- `\label{label}`
- `\ref{label}`

https://en.wikibooks.org/wiki/LaTeX/Labels_and_Cross-referencing



Labels & Cross References

```
\documentclass[10pt,a4paper]{article}

\usepackage{graphicx} %graphics package

\begin{document}

\begin{figure}[ht]
\centering
\includegraphics[width = .95\linewidth]{images/Salem.JPG}
\caption{Salem the Cat}
\label{fig:figure1}
\end{figure}

\begin{table}[ht]
\begin{center}
\begin{tabular}{c|c|c|c}
Disney Film & Cat Name & Fur Colour & Favourite Food \\
\hline
Cinderella & Lucifer & Black & Mice \\
\hline
\end{tabular}
\caption{Disney Cats}
\label{tab:table1}
\end{center}
\end{table}

Here I refer to Figure \ref{fig:figure1} and Table \ref{tab:table1}.

\end{document}
```



Figure 1: Salem the Cat

Disney Film	Cat Name	Fur Colour	Favourite Food
Cinderella	Lucifer	Black	Mice

Table 1: Disney Cats

Here I refer to Figure 1 and Table 1.

FigureTableLabels.tex

Examples

- A full document containing all of the examples can be found in Examples.tex and Examples.pdf in your resources!



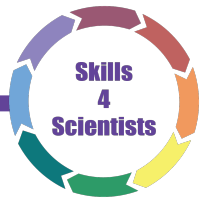
Troubleshooting Guides

- Compile frequently
- Check last changes
- Check for special symbols
- Check for incorrect line spacing
- Figures: check image path
- Tables: check correct number of &
- Google & Stack Overflow are your friends!



LaTeX Top Tips

- Compile often!
- Re-use code!
- Keep a list of your favourite packages
- Use syntax highlighting
- Have cheatsheets
- Layout your document neatly
- Make use of the documentation & forums!



Useful Resources

- <https://en.wikibooks.org/wiki/LaTeX>
- <https://www.overleaf.com/learn>
- <https://wch.github.io/latexsheet/>
- <https://stackoverflow.com/questions/tagged/latex>



Skills4Scientists!

