LaTeX Training

Faculty of Engineering, course unit: CIV4202 Final Year Report

David Bensel

Ndejje University - Water Research and Development Centre

February 26th - April 16th 2021

Table of Contents

Table of Contents

What is LaTeX

- A typesetting program (document preparation)
- Where TeX is the typesetter and LaTeX the book designer
- NOT a word processor
- WYWIWYG vs WYSIWYG
- The author sets a logical structure, the program decides on the best layout.

LaTeX strengths (and weaknesses)

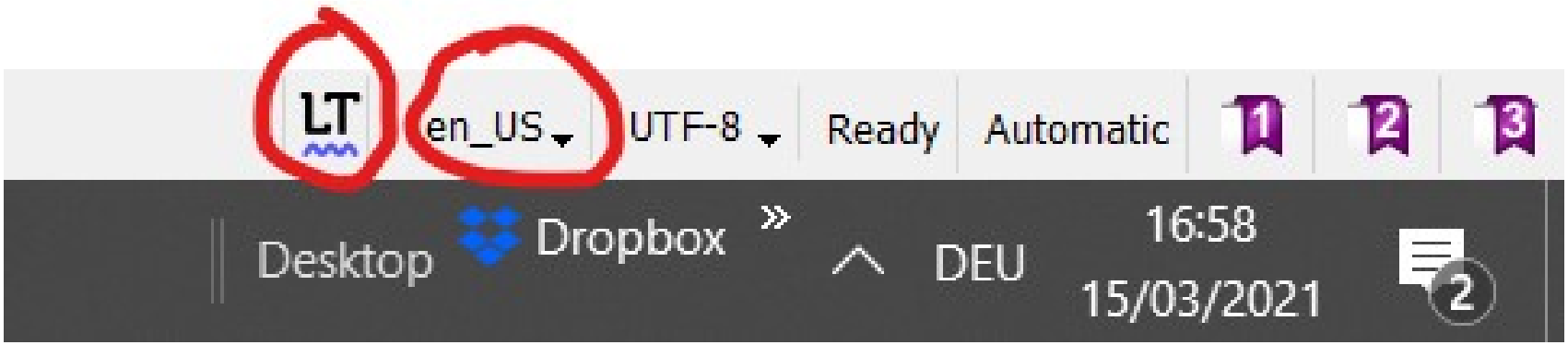
- Helps to focus on the content (unless you want to change simple things)
- A predefined layout saves time (unless you want to change it)
- LaTeX generates beautiful documents (unless you break it)
- It's simple to do hard work, but it's hard to do simple things
- It's free of costs

somethingofthatilk.com 2010-2012

Spelling and grammar check

Some packages bring multi-lingual support to LaTeX, e.g. `https://ctan.org/pkg/babel`. Babel helps to get the correct typography but won't be necessary with purely English texts.

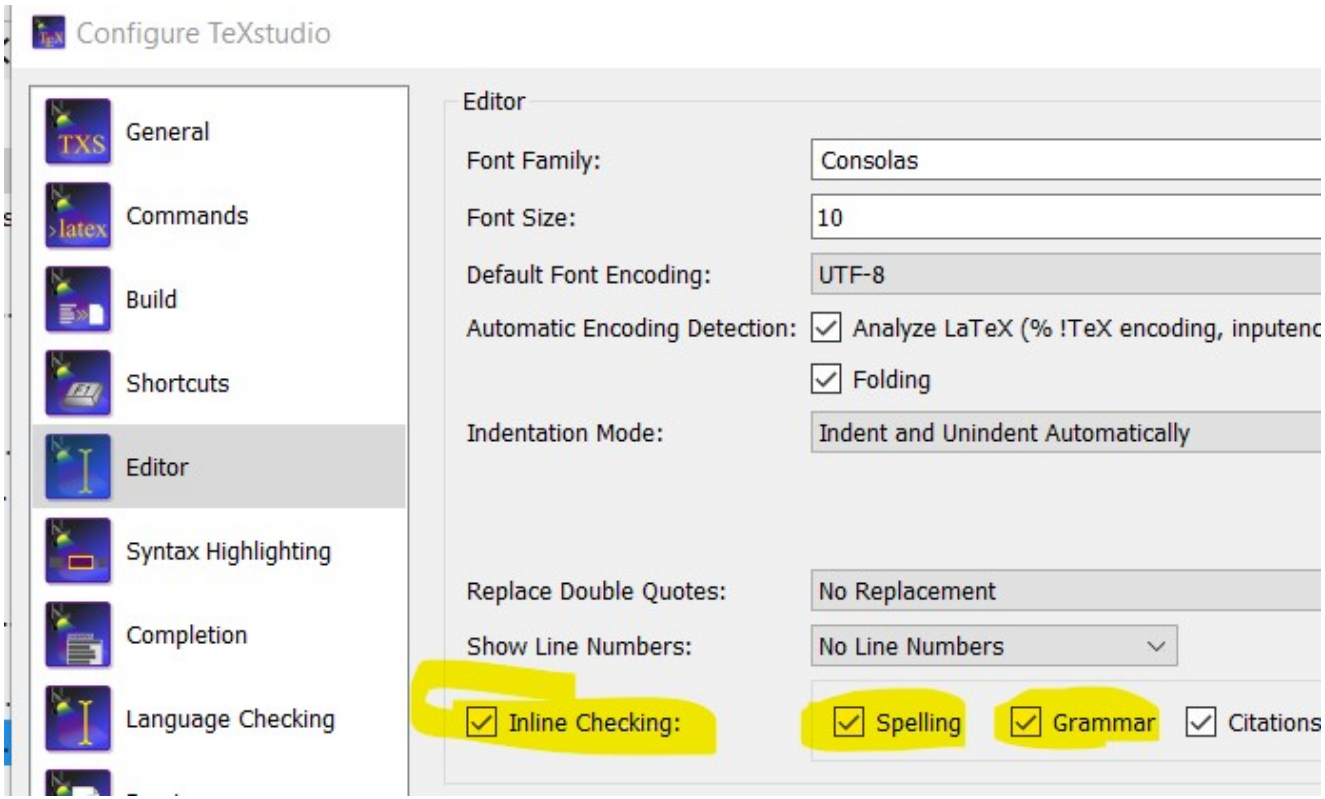
For catching spelling mistakes and writing good grammar some settings in TeXstudio can help.
Successfully configured grammar and spell checking is indicated in the status line.



Spelling

TeXstudio: Menu Options → Configure TeXstudio... : Editor

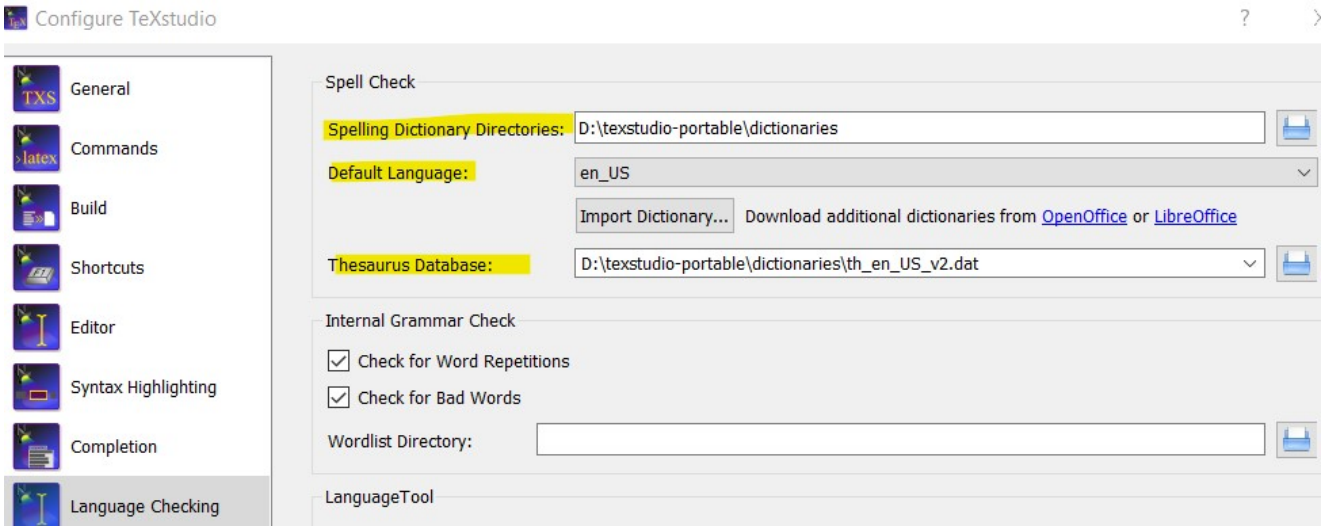
- Enable 'Inline Checking'
- Enable 'Spelling' and 'Grammar'



Spell Check

TeXstudio: Menu Options → Configure TeXstudio... : Language Checking, Spell Check
Make sure the following settings point to the already existing files. Make your choice for the default language.

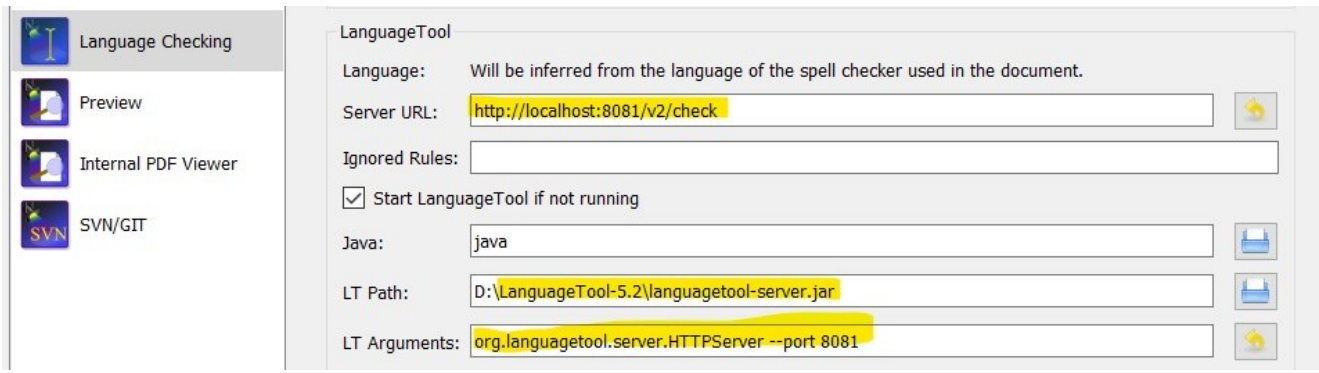
- Spelling Dictionary Directories
- Thesaurus Database



LanguageTool Setup (Grammar)

Download
`https://languagetool.org/download/LanguageTool-stable.zip`
(v5.2, 182 MB, March 2021) and extract the zip.
TeXstudio: Menu Options → Configure TeXstudio... : Language Checking, LanguageTool

- Server URL: http://localhost:8081/v2/check
- LT Path: [path_to_LT]languagetool-server.jar
- LT Arguments: org.languagetool.server.HTTPServer ––port 8081



Import and export to MS Word

`https://pandoc.org/`

Some tips for starting

- Concentrate on your content from the beginning
- NEVER use MS Word for first typing your text, tables, etc.
- Use an IDE that makes you happy
- For your thesis, use a Reference Management Software from an early stage
- Never stop exploring

Further reading

General information:

- LaTeX for beginners: `http://www.docs.is.ed.ac.uk/skills/documents/3722/3722-2014.pdf`
- The Not So Short Introduction to LaTeX: `https://tobi.oetiker.ch/lshort/lshort.pdf`
- The Comprehensive TEX Archive Network (CTAN): `https://ctan.org/`

Specific topics:

- `https://tex.stackexchange.com/`
- `https://www.overleaf.com/learn/latex/`

Table of Contents

Flash with installers and portable versions

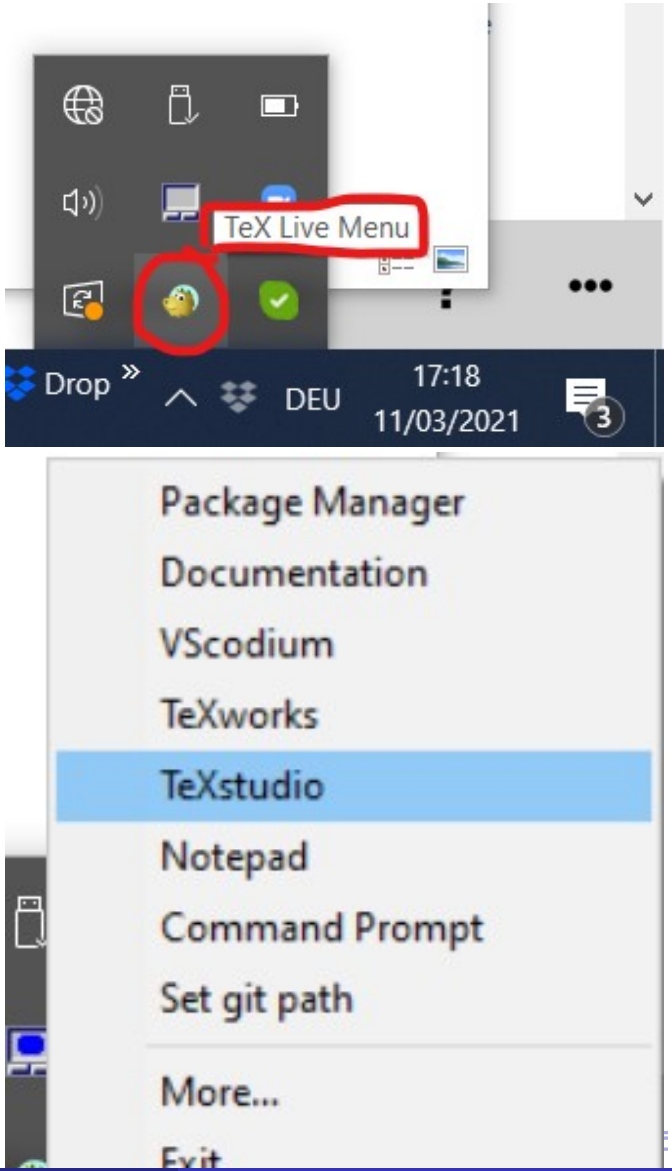
The flash content is about 6.9GB big (uncompressed).
Find setup-files in folder 'Software Installers'
Find ready-to-use software in folders with 'portable' in the name
Copy-Procedure:

- Copy the zip file to your computer
- After copying, pass the flash on
- Extract the files to a folder
- Follow the lecture as your PC is busy ☺

Run TeXstudio from flash (portable)

After all files are copied...

- Run 'StartTeXlive.cmd' (double click)
- Click on Tray-Icon 'TeX Live Menu'
  - Package Manager ... Install new packages
  - TeXstudio ... Write and compile LaTeX code



LaTeX distributions

A distribution brings all required files together necessary to produce a PDF from tex-files.
Two major distributions are available on the flash.
(Portable version size)

- MiKTeX: `https://miktex.org/` (963 MB)
- TeX Live: `https://tug.org/texlive/` (1.776 MB)

Depending on the packages pre-installed, the size of the distribution differs. A full install of TeX Live requires 7 GB of disc space.
A missing package can be installed (downloaded) at any point later.

Editors

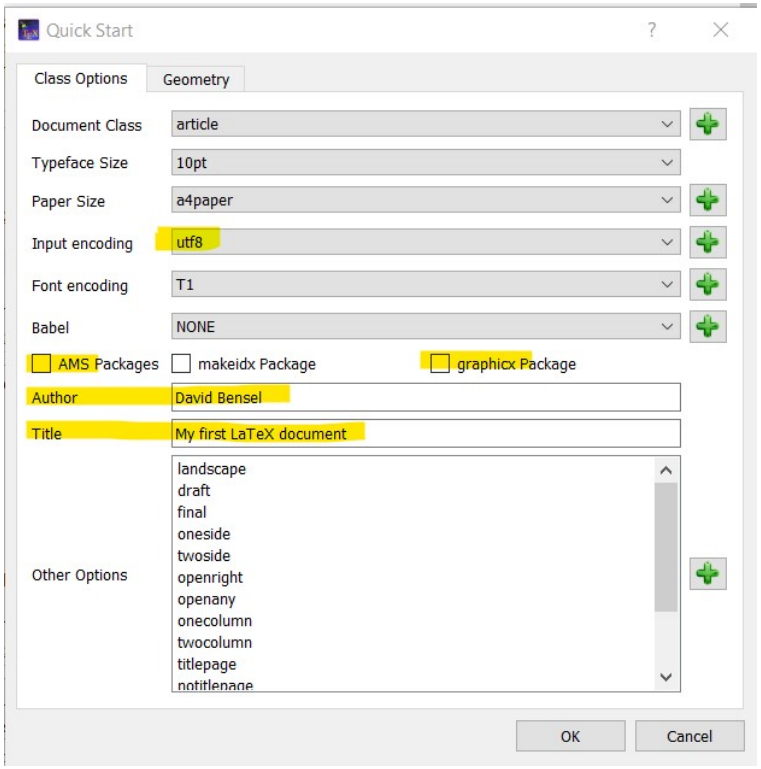
A simple text editor is enough to write tex-files. However, it is advised to use one that integrates the LaTeX environment.
There are different editors available on the flash.
(Portable version size)

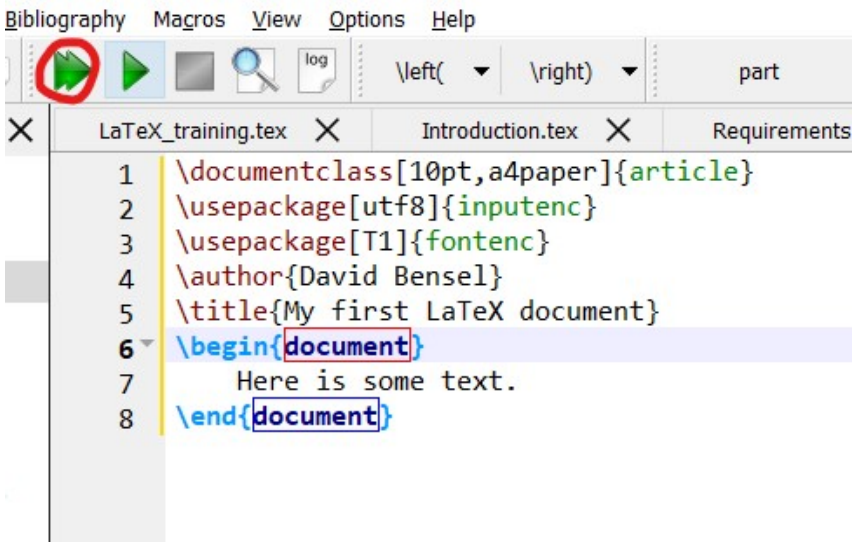
- VSCodium (375 MB)
- TeXworks (part of the distribution)
- TeXstudio (390 MB)

Table of Contents

TeXstudio: Wizards - Quick Start: article

- Menu Wizards-Quick Start...
- Input Encoding: 'UTF-8'
- Disable 'AMS Packages' and 'graphicx Package'
- Enter 'Author' and 'Titel' and click 'OK'
- Type some text in the 'document'-section, Click 'Build & View F5'





White spaces

- Blanks or tabs are treated as 'space'
- Many blanks are still treated as one 'space'
- Use blank line to create a new paragraph
- Use ~ to keep letters or words together even with a line break in between. Usefull with numbers/units or names, e.g. 20 km/h (20~km/h), D. Bensel (D.~Bensel)

Special characters: # $ % ^ & _ { } ~ \

- Use \ in front of a special character to print it
- Use \\ for a linebreak
- Use a blank line to create a new paragraph

Unintended special characters are a major reason for an error message. In many cases a curly bracket { misses his partner }.

Commands

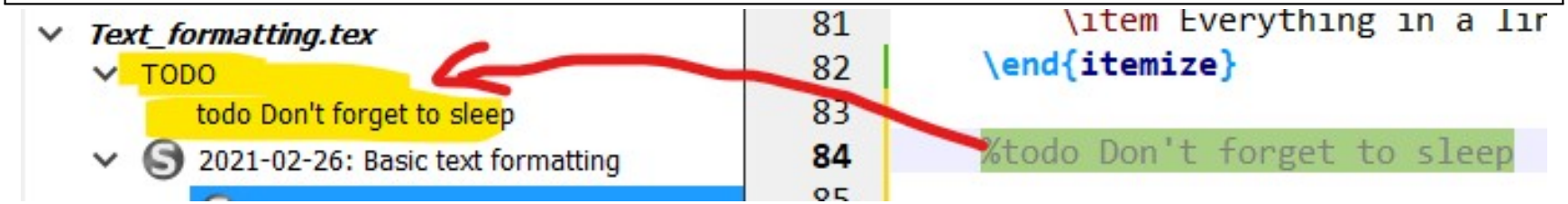
- Start with a backslash \
- Spaces after commands are ignored, make use of {}
- Some have parameters
  \command[optional parameter]{parameter}

Examples:
\newline (which is equal to \\)
\textbf{bold text} (TeXstudio: CTRL + B)
\documentclass[11pt,twoside,a4paper]{article}

Comments

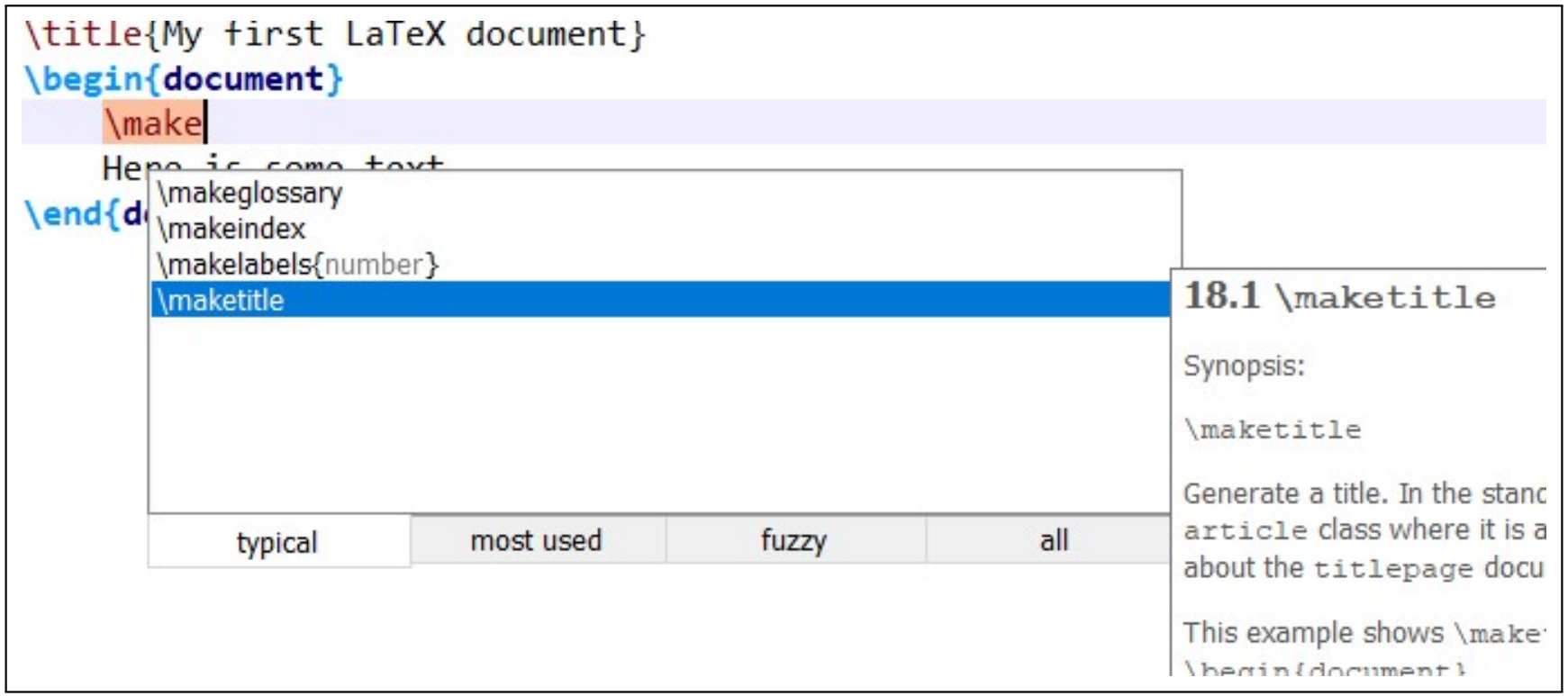
- Start with a percent sign %
- Everything in a line after % is ignored
- In TeXstudio %todo or %TODO will add an item to the side panel

```
90  \include{100-Introduction/Introduction} %% Write your introduction
91
92  \include{200-Literature/Literature}     %% Present your literature review
93
94  \include{300-Methodology/Methodology}   %% State your methodology
95
96  \include{400-Results/Results}           %% Discuss your results
97
98  %\include{500-Conclusions/Conclusions}  %% Present conclusions and recommendations
99
100 \bibliography{Bibliography/references}
```



Document class article and \maketitle

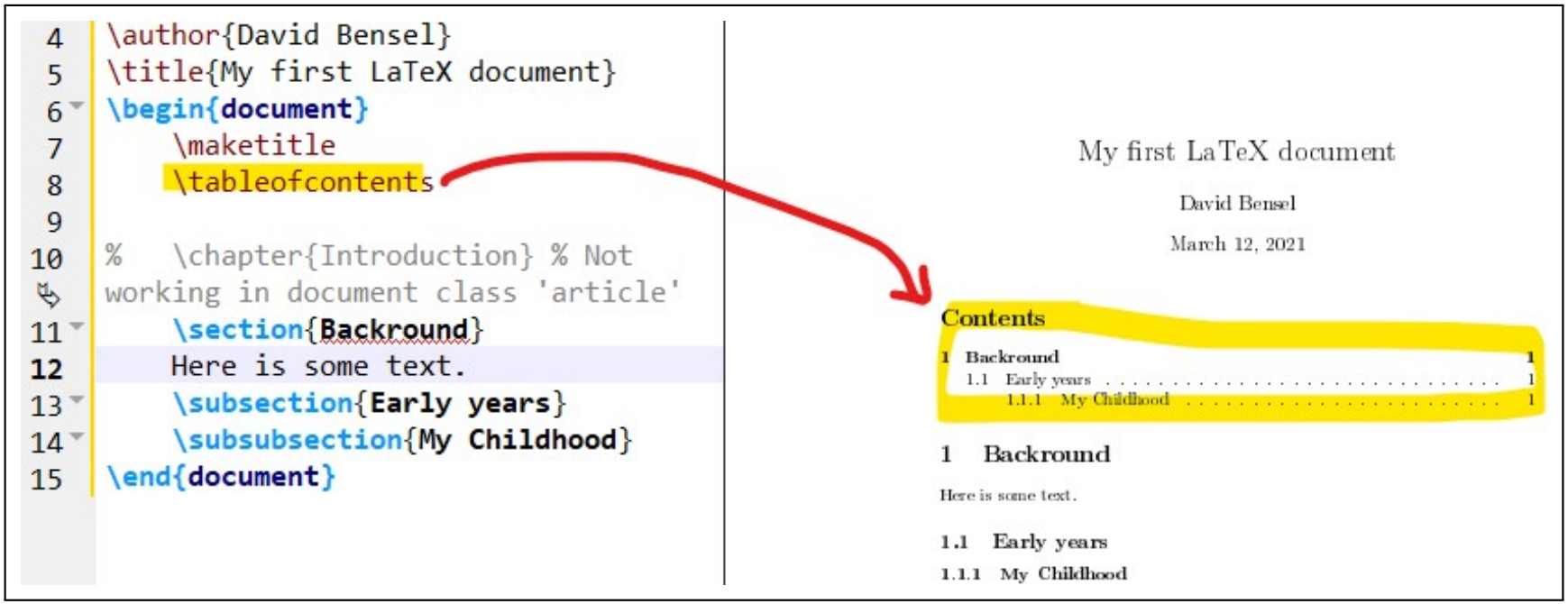
To your text add the command \maketitle.
As you type the automatic completion feature will suggest possible commands. Select with arrow down/up. With TAB the selected list entry gets completed. A tool tip provides information about this command.



Document sectioning

Depending on the document class (article, report, book) there are seven different levels for sectioning a document.[1] Use \tableofcontents to produce a table of contents.[2]

TeXstudio: LaTeX - Sectioning



[1] https://www.overleaf.com/learn/latex/sections_and_chapters

[2] https://www.overleaf.com/learn/latex/Table_of_contents

List environments

There ordered and unordered lists available and a combination of them.[3]

TeXstudio: LaTeX - List Environments

```
Unordered list:
\begin{itemize}
    \item use itemize
    \item to get this
\end{itemize}
Ordered list:
\begin{enumerate}
    \item use enumerate
    \item to see this
\end{enumerate}
```

Unordered list:

- use itemize
- to get this

Ordered list:

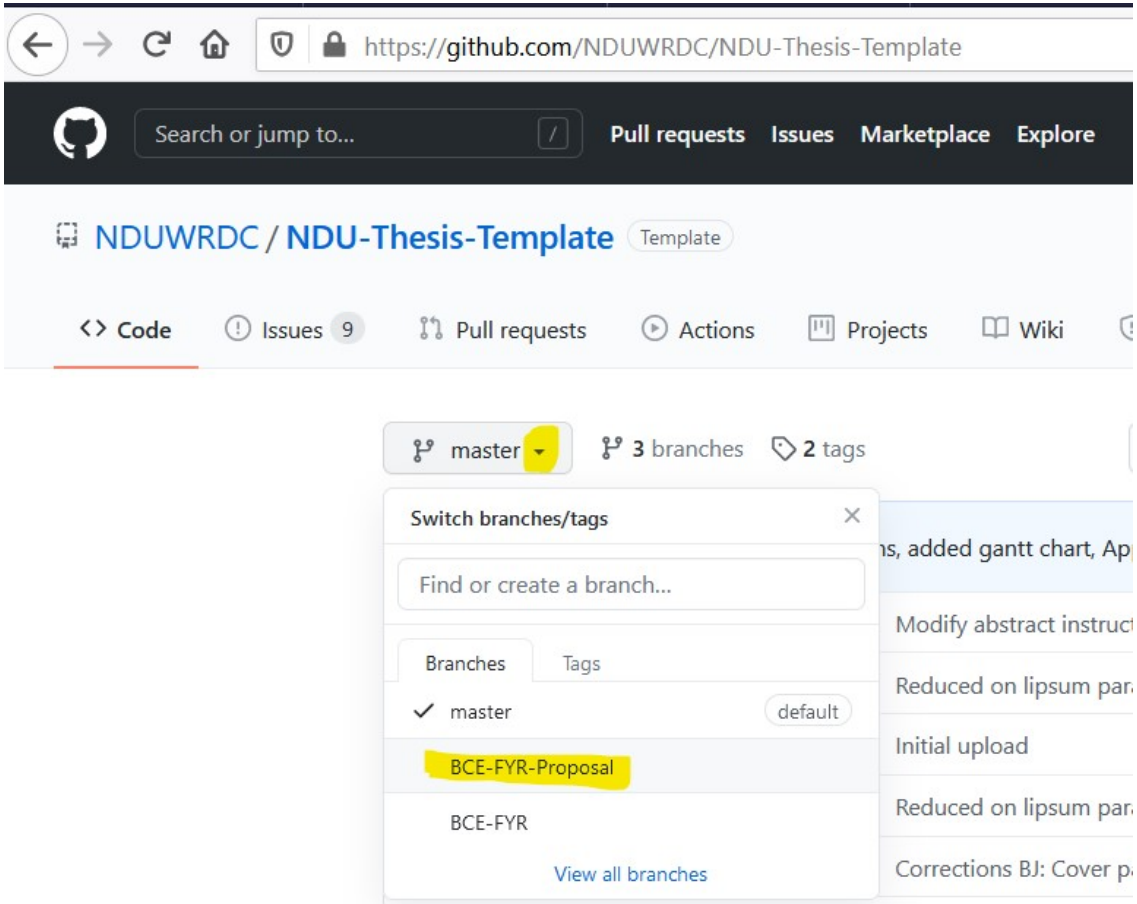
1. use enumerate
2. to see this

[3] https://www.overleaf.com/learn/latex/Lists

Table of Contents

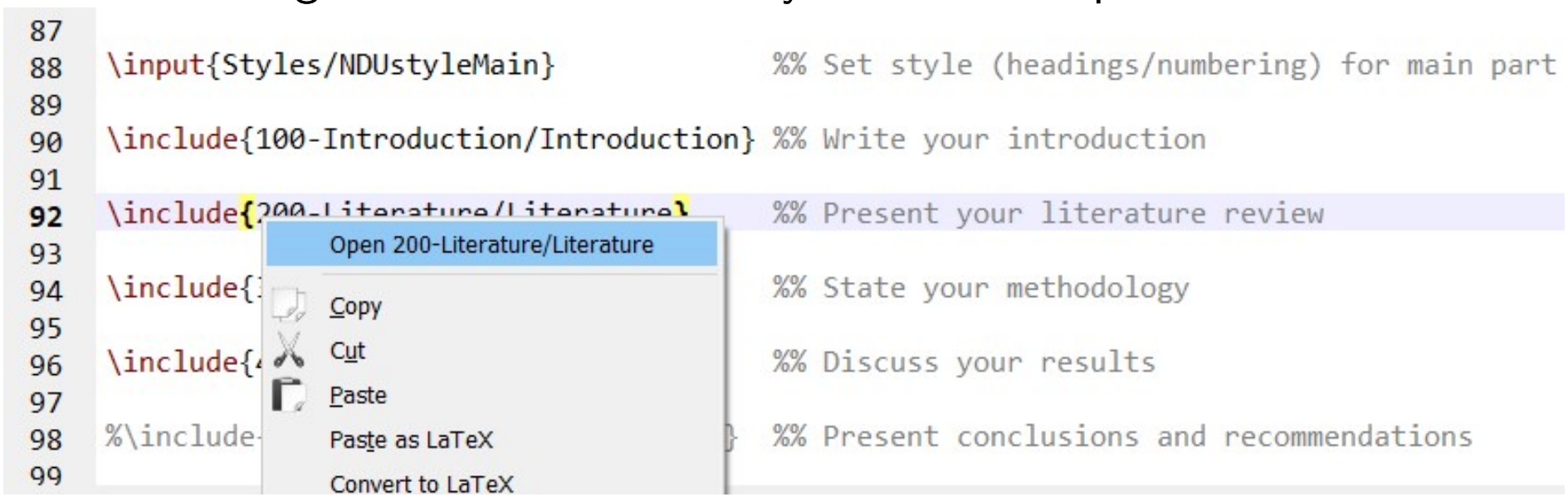
Download latest version of template

At `https://github.com/NDUWRDC/NDU-Thesis-Template` select the desired branch, e.g. 'BCE-FYR-Proposal'.



Open thesis.tex

Open the file 'Thesis.tex' in TeXstudio and click 'Build & View'.
This file does not need to be changed, but the other files with the specific chapter content.
'Thesis.tex' uses \include and \input to load the content of other files.
TeXstudio: Right-click inside the curly brackets to open a file.



Edit different chapters

/github.com/NDUWRDC/NDU-Thesis-Template/tree/BCE-FYR-Proposal 90%

Editing

Download the latest release or use the git clone option (see below). Edit the following files:

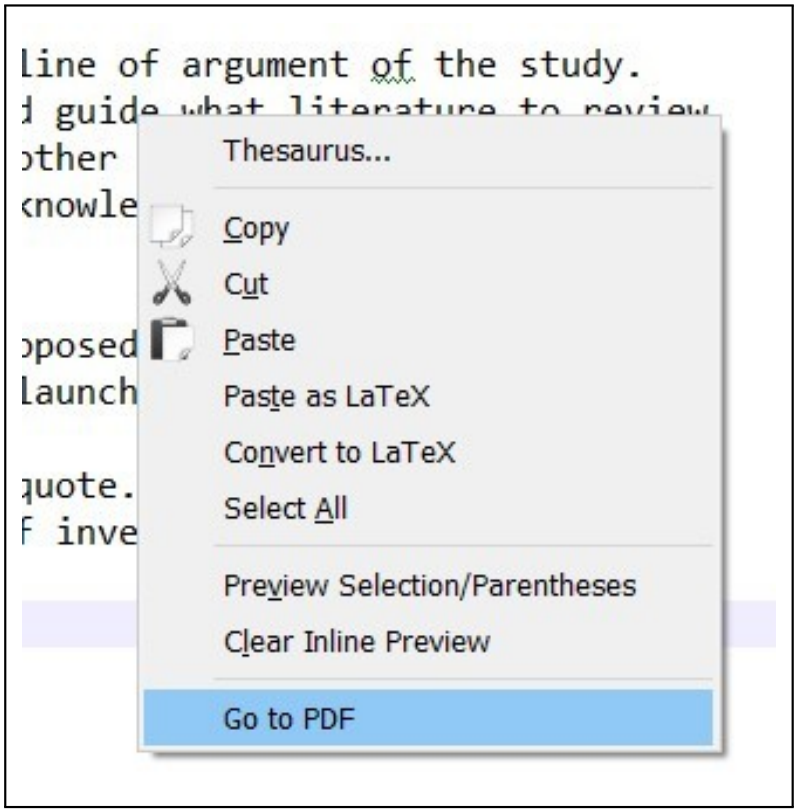
- `Macros/Definitions.tex` to change
  - faculty name, thesis type, degree type,
  - author's names and IDs,
  - supervisor(s) names,
  - title and subtitle of report,
  - date of submission.
- `002-FrontMatters/Abstract.tex` to write the abstract.
- `003-Acronyms/Acronyms.tex` to add to the list of available acronyms.

Edit different chapters

- `100-Introduction/Introduction.tex` to write chapter *Introduction*. The chapter already has subsections
  - *Background*
  - *Problem Statement*
  - *Objectives*
  - *Research Question (or Hypothesis)*
  - *Justification*
  - *Scope*
- `200-Literature/Literature.tex` to write chapter *Literature Review*.
- `300-Methodology/Methodology.tex` to write chapter *Methodology*.
- `400-Results/Results.tex` to write chapter *Expected Results*.
- `600-Appendices/Appendices.tex` to add *Activity Plan* and *Budget*.
- `Bibliography/references.bib` to have all references available for easy citation in the text.

Source $\Longleftrightarrow$ PDF

TeXStudio:
Right-click on the source: Go to PDF
Right-click on the PDF: Go to Source



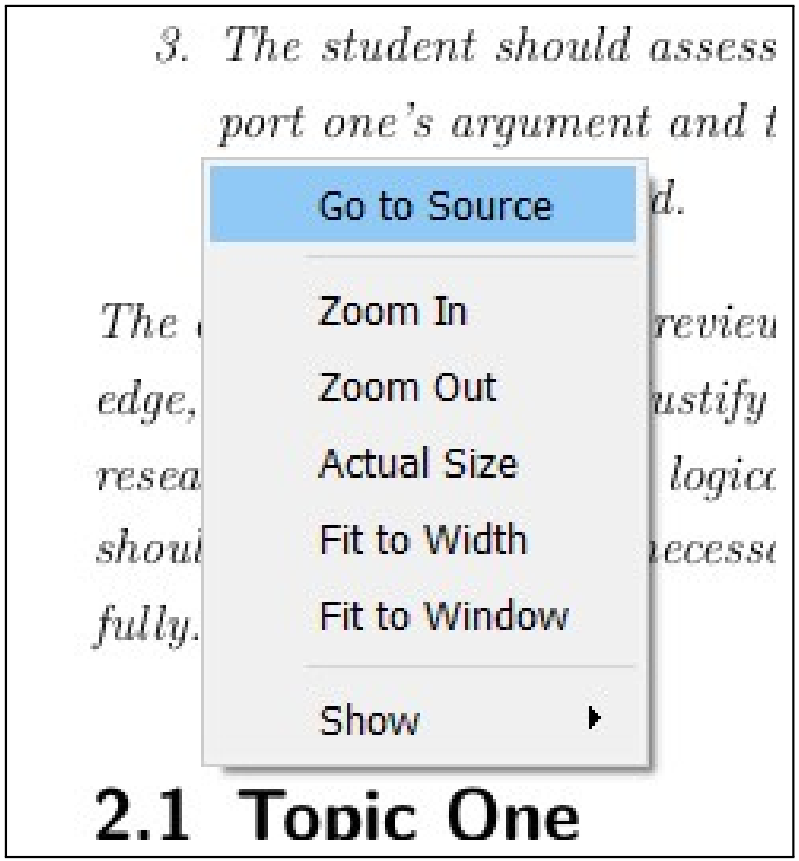


Table of Contents

IEEE Citation style

How to cite sources in your work is not part of this lecture but very crucial. See details here:

- `https://libraryguides.vu.edu.au/ieeereferencing/gettingstarted`

Creating a Bibliography Manually

A list of references can be build manually using

- 'thebibliography' environment & 'bibitem' command
- Referencing is done using 'cite' command

```
\begin{document}
    Watermarks in audio signals has been of increasing importance over the last
    years \cite{Boney96}.

    \begin{thebibliography}{100} % 100 is a random guess of the total number of
        %references
        \bibitem{Boney96} Boney, L., Tewfik, A.H., and Hamdy, K.N., ``Digital
        Watermarks for Audio Signals,'' \emph{Proceedings of the Third IEEE
            International Conference on Multimedia}, pp. 473-480, June 1996.
    \end{thebibliography}

\end{document}
```

Watermarks in audio signals has been of increasing importance over the last years [1].

References

[1] Boney, L., Tewfik, A.H., and Hamdy, K.N., "Digital Watermarks for Audio Signals," *Proceedings of the Third IEEE International Conference on Multimedia*, pp. 473-480, June 1996.

Disadvantages:

- Hard to stay consistent with font and other matters
- Hard to change citation style, e.g. IEEE to Harvard
- Large databases are hard to maintain
- Sorting is, you guessed it, hard

Creating a Bibliography Automatically

A list of references can be build automatically using commands

- 'bibliographystyle' to define the style (select a bst-file)
  - alpha: Labels are formed from name of author and year. Bibliographic items are sorted alphabetically.
  - plain: Labels are integers. Bibliographic items are sorted alphabetically.
  - ...
- 'bibliography' to define the bib-file, print list of references
- 'cite' for actual referencing

```
% bibliography ordered alphabetically
%  in-text references with square brackets and
numbers
\bibliographystyle{plain}

\begin{document}
    In the context of academic writing there
    are three forms of borrowing ideas
    \cite[180-187]{Monippally2010}.

\bibliography{Bibliography/references}
```

HOW

WHAT

In the context of academic writing there are three forms of borrowing ideas [1, 180-187].

References

[1] Mathukutty M. Monippally and Badrinarayan Shankar Pawar. *Academic Writing: A Guide for Management Students and Researchers*. Response, Los Angeles, 2010. OCLC: ocn551198634.

Packages like 'natbib', 'apacite' provide more options and require different commands etc.

Creating a Bibliography Automatically (cont'd)

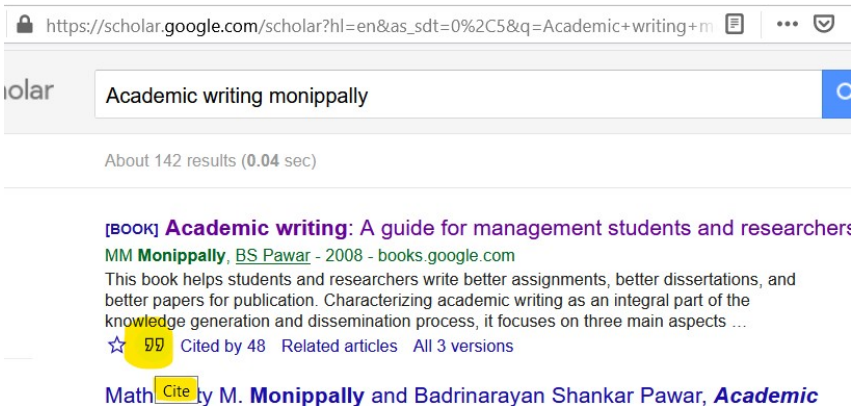
The bibliography database file (bib-file) has the extension *.bib.
Besides the type 'book' as seen in the example below, there others like article, booklet, conference, inbook, incollection, etc.
The program BibTeX compiles the bibliography. TeXstudio: menu Tools - Bibliography (F8)

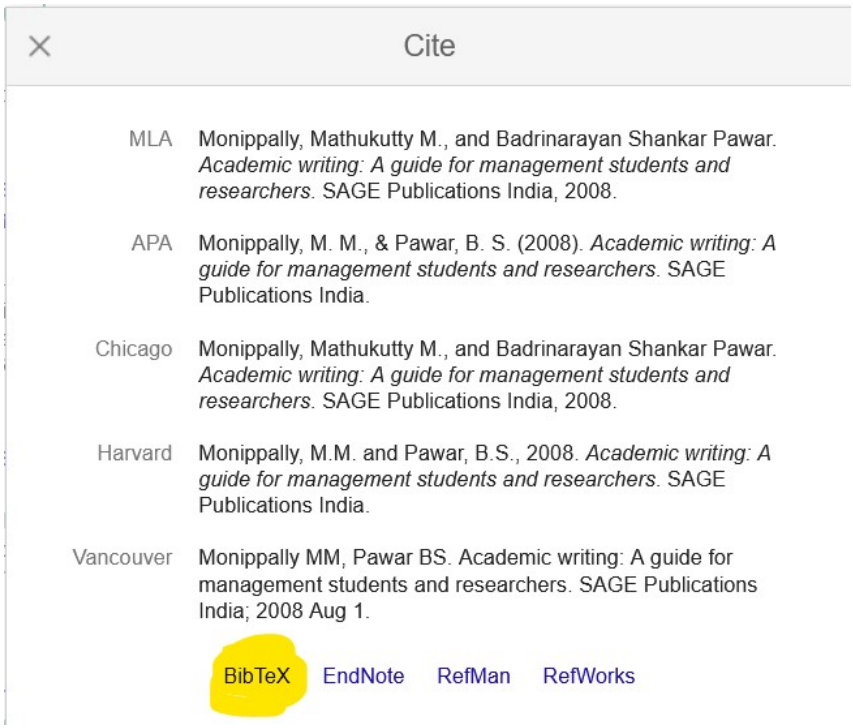
tex | Bibliography.tex | Thesis.tex | document.tex | references.bib

```
1
2  @book{Monippally2010,
3    title = {Academic Writing: A Guide for Management Students and Researchers},
4    shorttitle = {Academic Writing},
5    author = {Monippally, Mathukutty M. and Pawar, Badrinarayan Shankar},
6    year = {2010},
7    publisher = {{Response}},
8    address = {{Los Angeles}},
9    isbn = {978-81-321-0441-4},
10   keywords = {Academic writing,Business writing,English language,Handbooks;
     manuals; etc,Rhetoric,Technical writing},
11   lccn = {PE1408 .M594 2010},
12   note = {OCLC: ocn551198634}
13 }
14
```

Add a bibitem to the bib-file: scholar.google.com

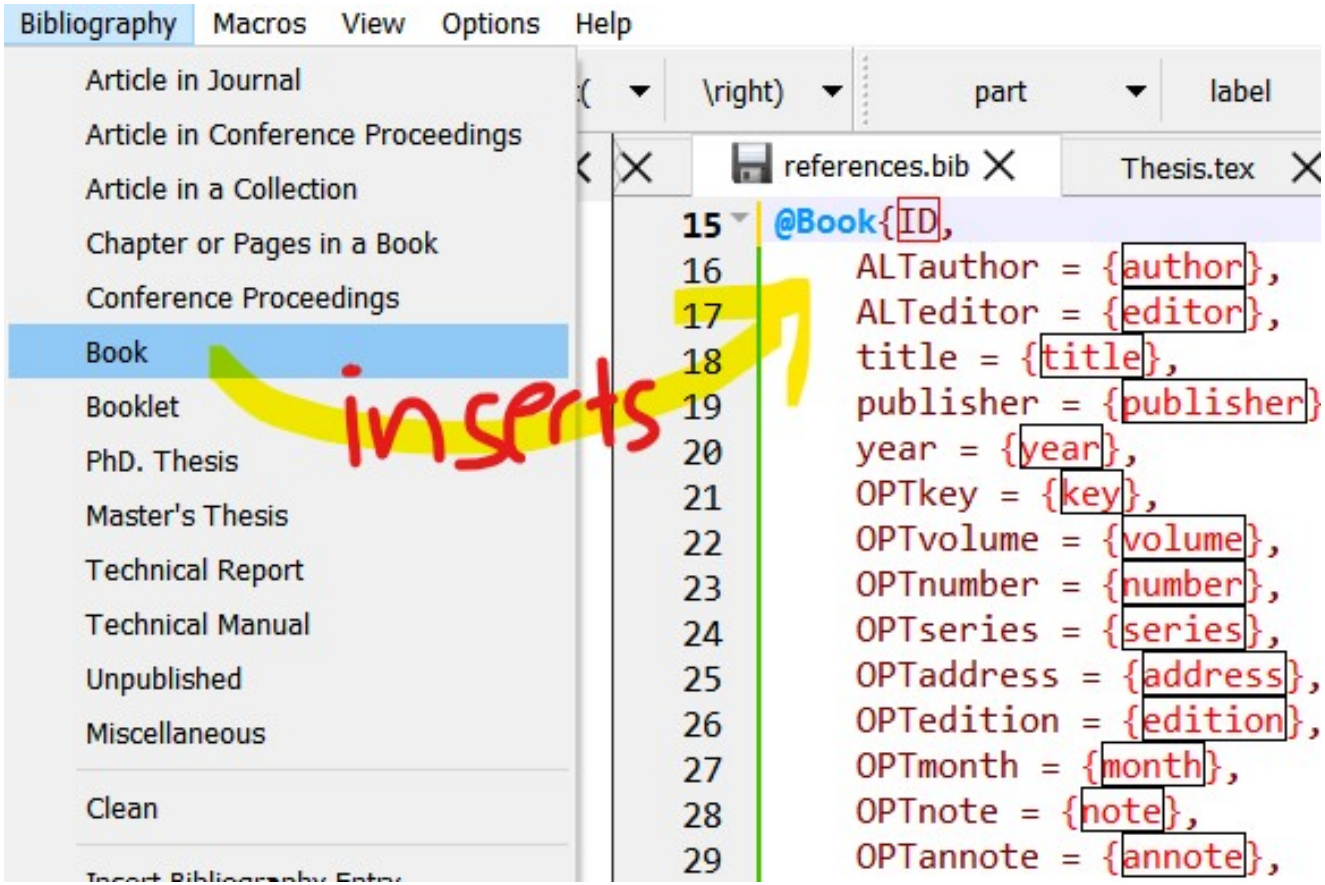
Click on the " symbol (Cite) and then click on BibTeX, copy & paste to your bib-file.





Add an bibitem to the bib-file: TeXstudio

Use menu Bibliography to insert different bib-file items.



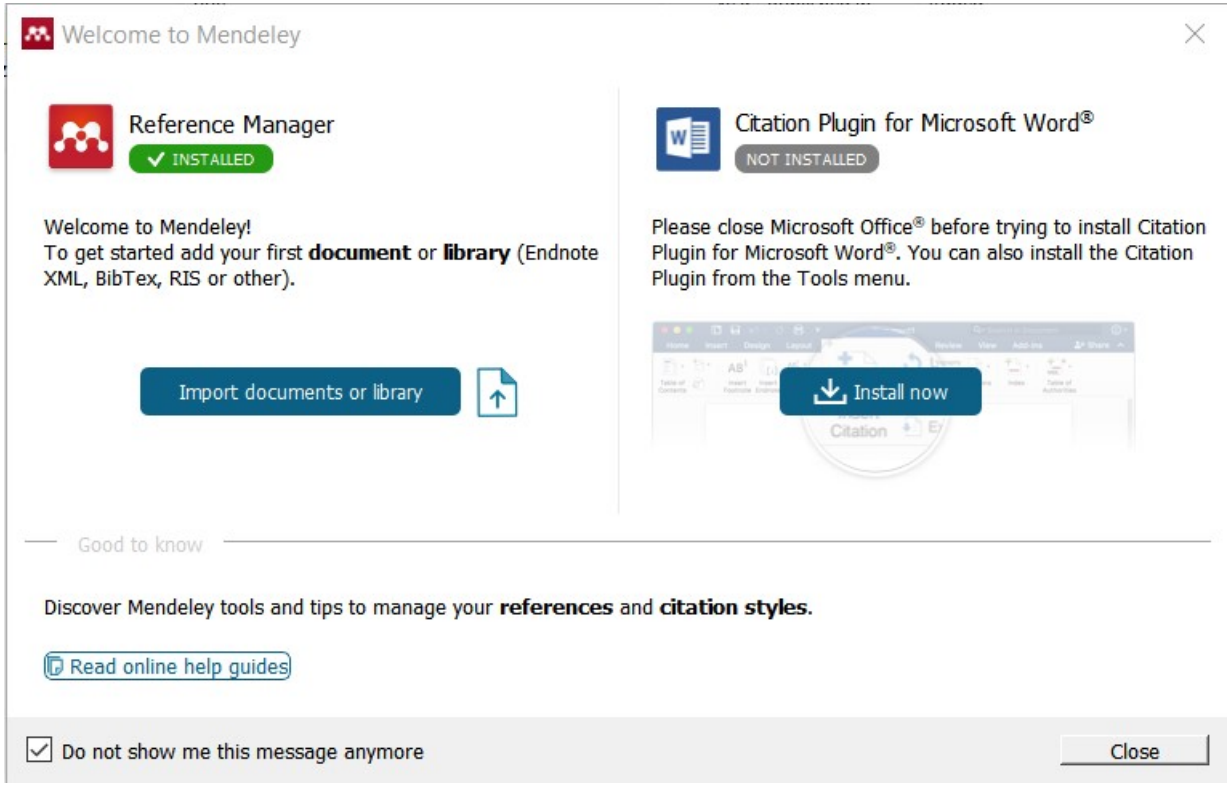
Reference Management Software

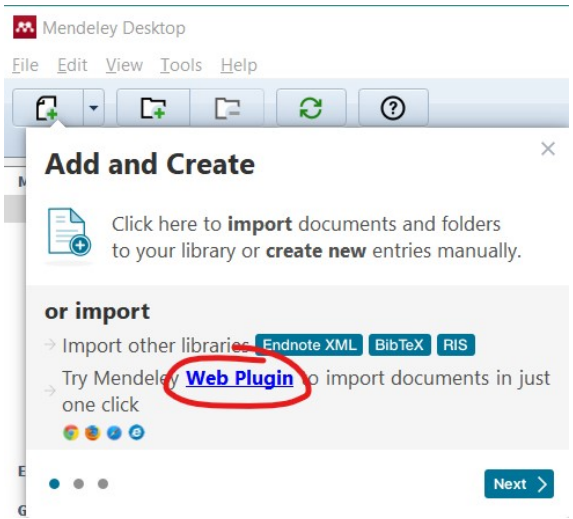
There are some major softwares available to manage references:

- Mendeley, needs an Elsevier-login, not FOSS but free `https://www.mendeley.com/guides/mendeley-reference-manager`
- Zotero, FOSS `https://www.zotero.org/support/`
- EndNote, not FOSS (Free Open Source Software)
- JabRef `https://www.jabref.org/`

Mendeley Desktop

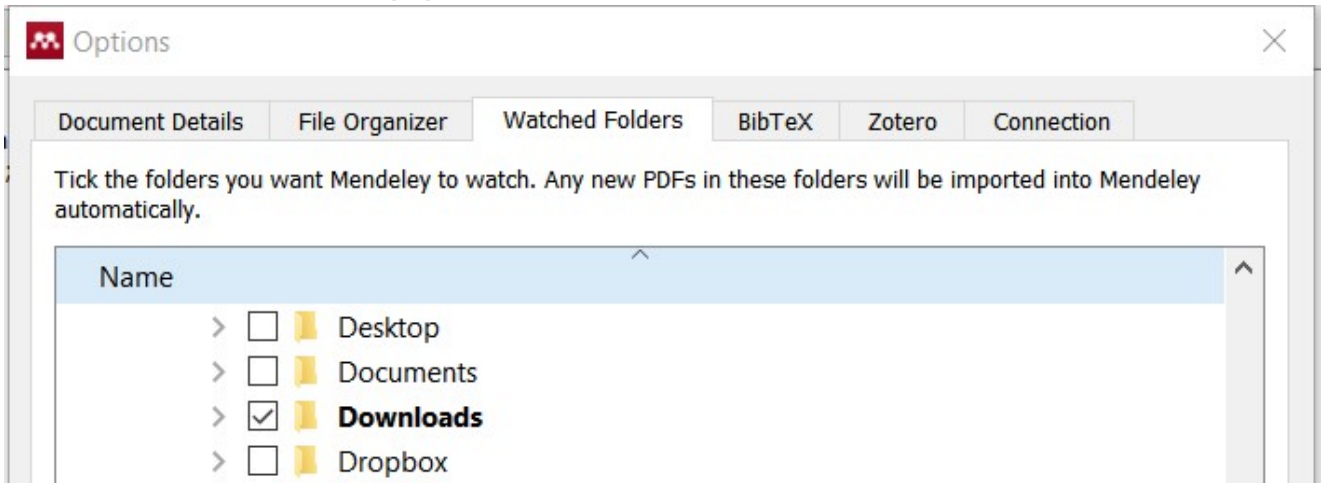
https://www.mendeley.com/guides/mendeley-reference-manager





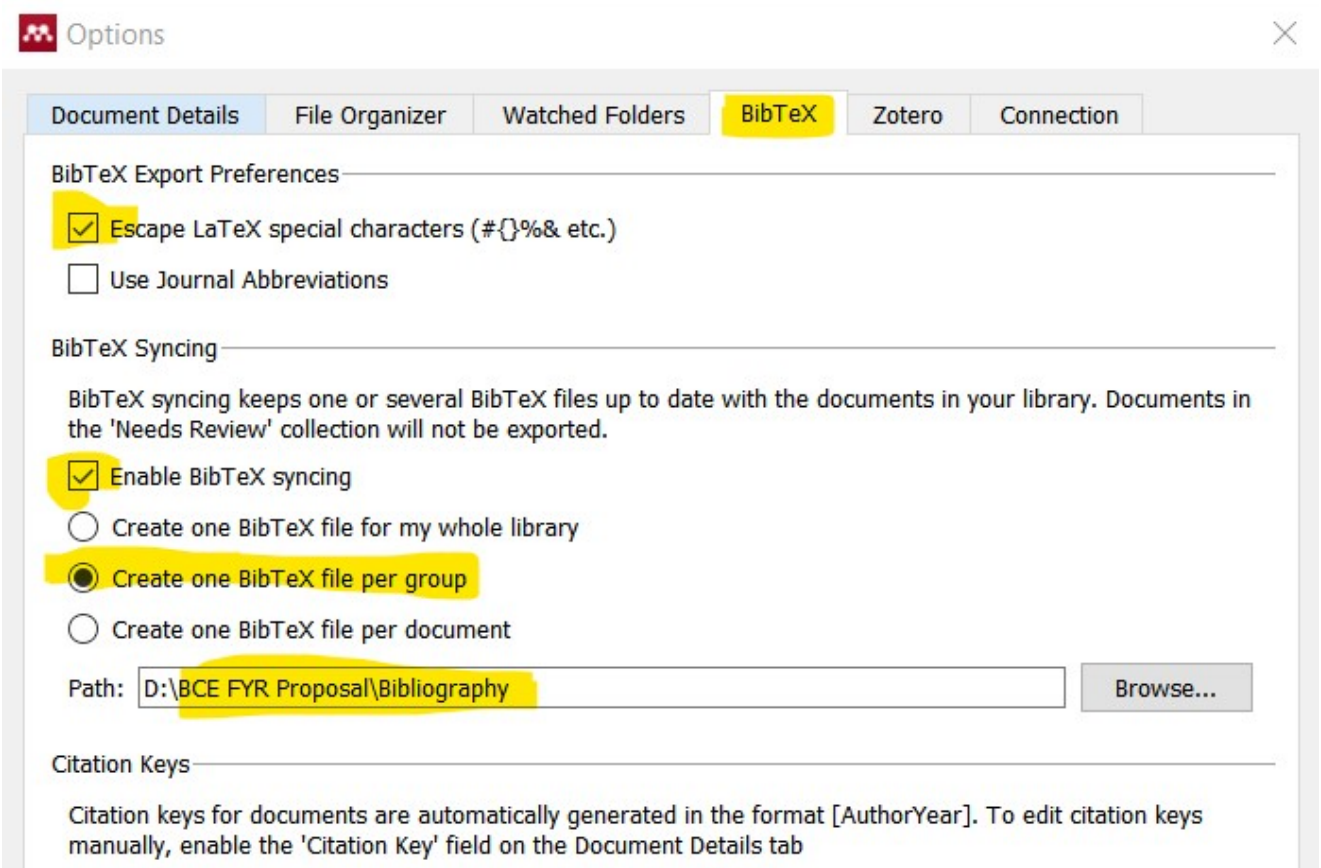
Mendeley: Sync with folder

Menu Options - Watched folders:
Tick the folder(s) that Mendeley has to sync with.



Mendeley: BibTeX

Menu Options - BibTeX:
Tick Escape LaTeX special characters
Enable BibTeX Syncing, create one file per group, specify the path



Mendeley: Other ways to add resources

- Drag & drop PDFs to the application or use
- Web Importer

Further reading & watching

- Bibliography management with bibtex `https://www.overleaf.com/learn/latex/bibliography_management_with_bibtex`
- Using bib-tex: a short guide `https://www.economics.utoronto.ca/osborne/latex/BIBTEX.HTM`
- Video How to use Mendeley to automatically manage and sync references `https://www.youtube.com/watch?v=sQoGo8PyOxA`

Table of Contents

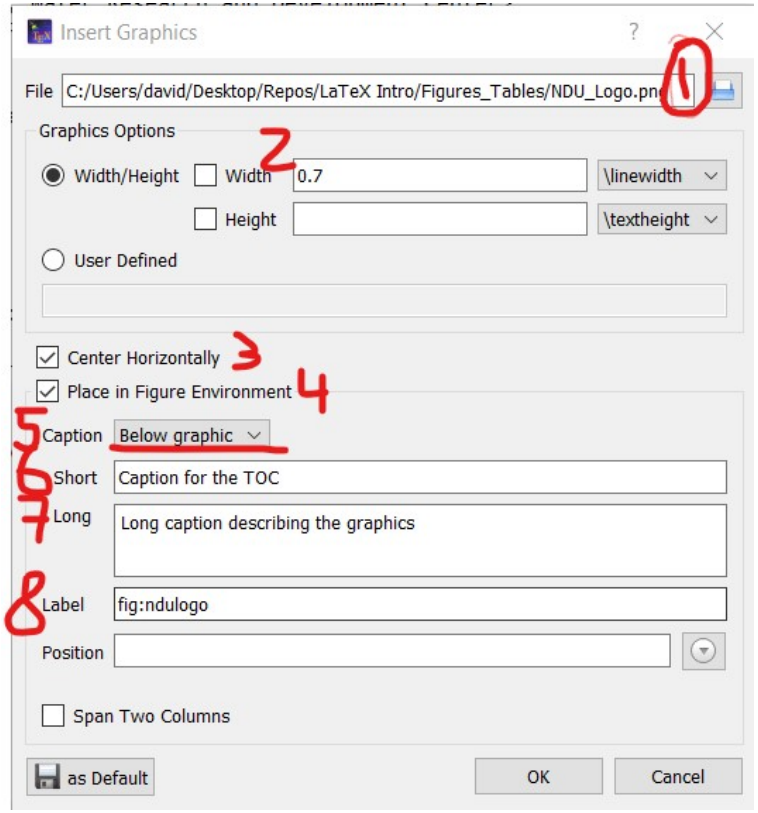
Floats and Text

One major difference to a word processor in LaTeX is the placement of floats. A graph or table very likely won't appear at the -exact- place of mentioning. It is advisable to leave the fiddling with float positions to the very end of preparing the document. In case text is added or removed, the positions may change again. See also here:

- `https://en.wikibooks.org/wiki/LaTeX/Floats,_Figures_and_Captions`
- `https://www.overleaf.com/learn/latex/Positioning_of_Figures`

TeXstudio: Add a Figure (Menu Wizards-Insert Graphics)

1. Type the file path or browse and select
2. Specify the width and/or height as a fraction of linewidth or absolute in cm
3. Enable 'Centre horizontal'
4. Enable 'Place in Figure Environment'
5. Set Caption to 'Below graphic'
6. The short caption will be displayed in the table of content section
7. The long caption should be descriptive to the image/graph
8. The label should start with 'fig:' and is used for in-text referencing



TeXstudio: Add a Figure (drag & drop)

Drag and drop a graphics file to the desired place in your text. This will open the 'Insert Graphic' tool and pre-fill the 'File' field.

```
\paragraph{Demonstration of including a graphics}
Fig. \ref{fig:ndulogo} shows an image stored as
jpg-file. The file is limited to the page width and is
rotated by 90\textdegree. Because of the rotation
'height' becomes 'width'.

\begin{figure}[h]
    \centering
    \includegraphics[height=1\textwidth,
    angle=90]{600-Appendices/Examples/Thermometer.jpg}
    \caption{Thermometers showing different temperature
    readings.}
    \label{fig:ndulogo}
\end{figure}
```

Demonstration of including a graphics Fig. 7.1 shows an image stored as jpg-file. The file is limited to the page width and is rotated by 90°. Because of the rotation 'height' becomes 'width'.

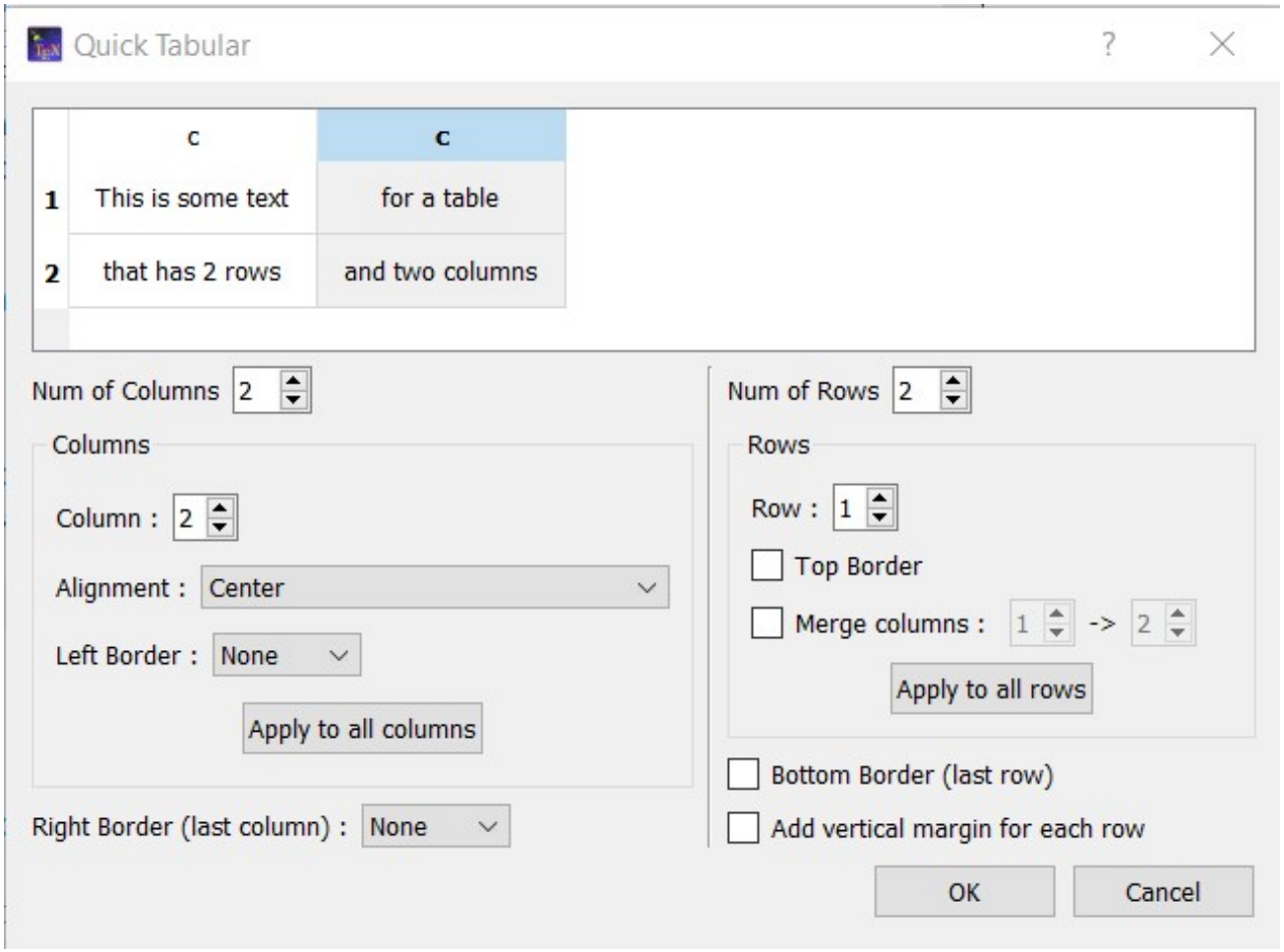
Figure 7.1: Thermometers showing different temperature readings.

Elements of Figures

Every figure must

- have the **title below**
- be numbered, with the chapter designation, e.g. Fig. 2.3 refers to the third figure in chapter 2
- comply with copyrights. For your own figure, table or equation, no references are required.
- be displayed after it is mentioned and referred to by the number in the text, e.g. 'This is illustrated in Fig. 2.3.'

TeXstudio: Add a Table (Menu Wizards-Quick Tabular)



Basic LaTeX table

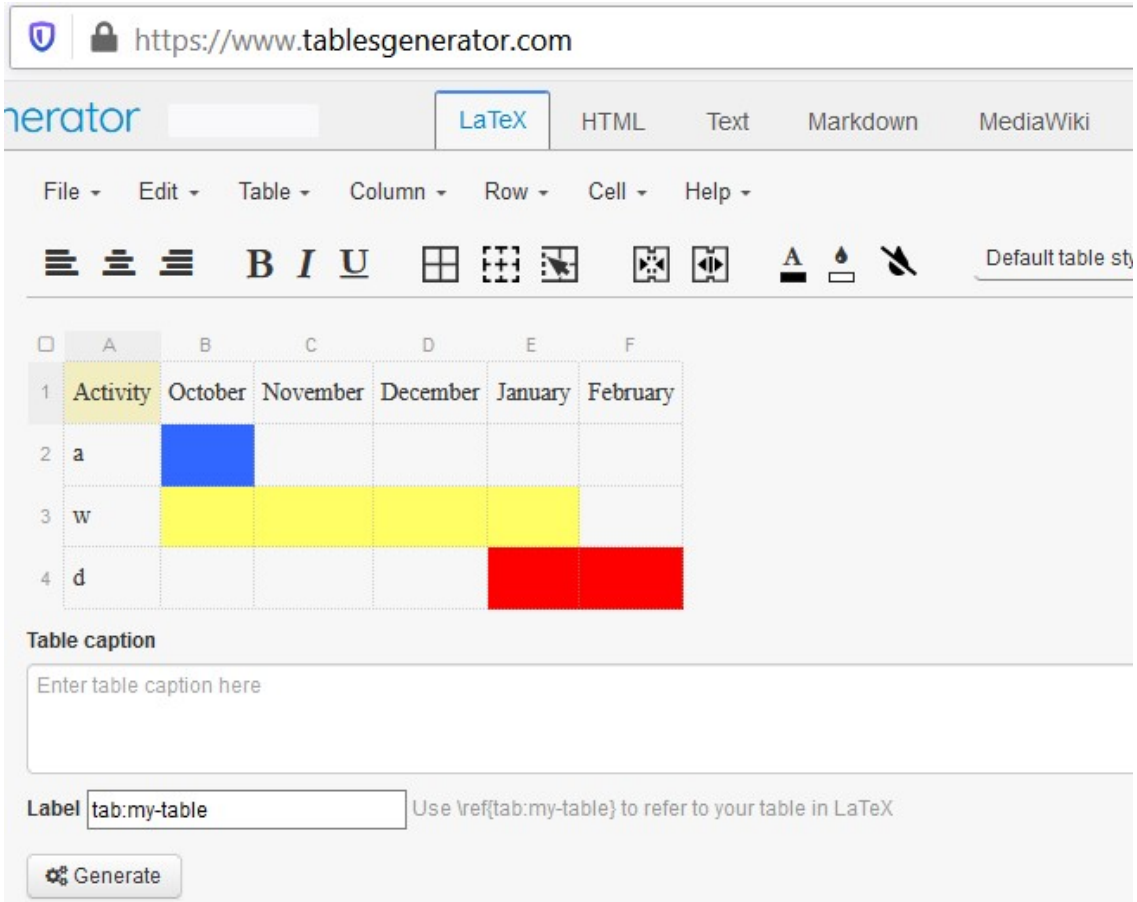
```
\begin{tabular}{cc}
This is some text & for a table \\
\hline
that has 2 rows & and two columns \\
\end{tabular}
```

... will produce ...

This is some text	for a table
that has 2 rows	and two columns

Web Tools and Examples

For larger tables it can be advisable to use a table generator, e.g. `https://www.tablesgenerator.com/`.
The NDU template holds nice tables in examples.tex.



A LaTeX Table Example

```
\begin{table}
    \begin{center}
        \caption{\label{tbl:ModuleWeight}Module CIV4202 Final Year Report - Assessment}
        \begin{tabular}{llc}
            \hline \\
            Category                    & Chapter or Feature                & Weight \\
            \\
            \hline \\
            Engineering Content (60\%)  & Introduction and Objectives       & 10\%   \\
                                        & Problem definition                & 5\%    \\
                                        & Literature review                 & 5\%    \\
                                        & Methods                           & 15\%   \\
                                        & Results and Discussion            & 15\%   \\
                                        & Conclusions and recommendations   & 10\%   \\
            Language (25\%)             & Grammar and spelling              & 15\%   \\
                                        & Sentence structure                & 10\%   \\
            References (15\%)           & Use of references                 & 10\%   \\
                                        & Quality and format of references  & 5\%    \\
            \hline \\
        \end{tabular}
    \end{center}
\end{table}
```

... and it's output

Table 7.3: Module CIV4202 Final Year Report - Assessment

Category	Chapter or Feature	Weight
Engineering Content (60%)	Introduction and Objectives	10%
	Problem definition	5%
	Literature review	5%
	Methods	15%
	Results and Discussion	15%
	Conclusions and recommendations	10%
Language (25%)	Grammar and spelling	15%
	Sentence structure	10%
References (15%)	Use of references	10%
	Quality and format of references	5%

Elements of Tables

Every table must

- have the **title above**
- be numbered, with the chapter designation, e.g. Table 2.3 refers to the third table in chapter 2
- comply with copyrights. For your own figure, table or equation, no references are required.
- be displayed after it is mentioned and referred to by the number in the text, e.g. 'Differences are listed in Table 2.3.'

IEEE Referencing of Figures, Tables, and Equations

See also here:

- `https://libraryguides.vu.edu.au/ieeereferencing/figurestablesequations`

Table of Contents

$Text$ and display style, \eqref

Equations can be either put as *text style*, in-line within a paragraph, or separately in *display style*. An example for in-line equations is to have simple formulae like $a^2 + b^2 = c^2$ placed between $ $ as part of the text. The amsmath-package provides the **equation environment** for display style, demonstrated in (1). If the sentence starts with the reference, **Equation** precedes the it. **eqref** is used to get the parentheses around the number.

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

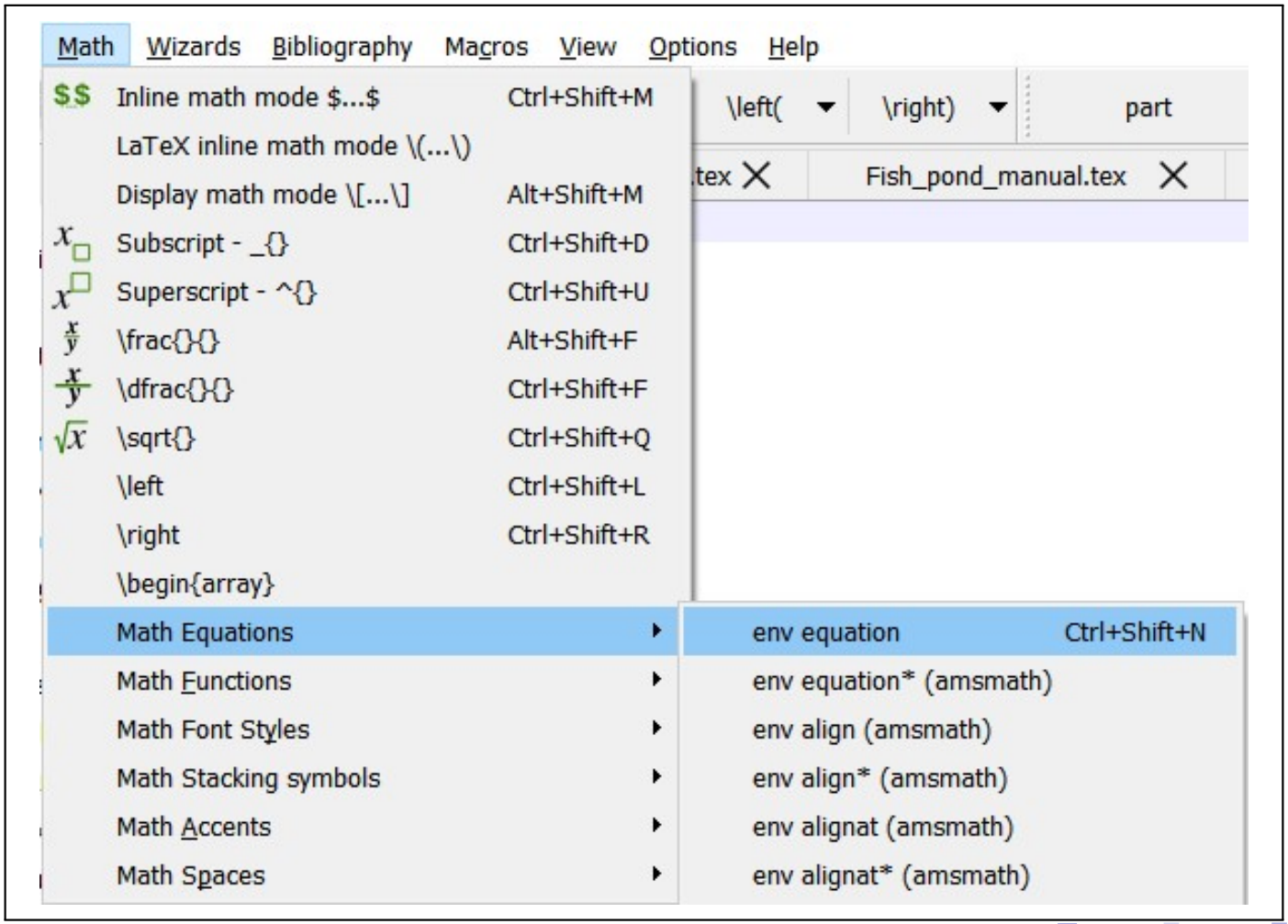
Equation (1) can be transformed to $c = \sqrt{a^2 + b^2}$.

```
\begin{equation}\label{equ:pythagoras}
    a^2+b^2=c^2
\end{equation}

Equation \eqref{equ:pythagoras} can be transformed to $c=\sqrt{a^2+b^2}$.
```

TeXstudio: Menu Math

TeXstudio provides short-cuts to insert some widely used symbols and operators. Ctrl+Shift+N inserts the equation environment.



Template: Macro *Conditions*

The environment *conditions* can be used to explain the equation components.

```
304 \begin{figure} % figure is used here
    to keep the block together
305 \begin{equation}\label{equ:Population}
306 P_f=P_0(1+\frac{i}{100})^t
307 \end{equation}
308 where:
309 \begin{conditions}
310     P_f &   Future population \\
311     P_0 &   Current population \\
312     i   &   Growth rate in \% \\
313     t   &   Time in years
314 \end{conditions}
315 \end{figure}
316
317 The Hazen-Williams formula expressed
    in metric units as seen in
```

$$P_f = P_0(1 + \frac{i}{100})^t$$

where:

$$\begin{aligned} P_f &= \text{Future population} \\ P_0 &= \text{Current population} \\ i &= \text{Growth rate in } \% \\ t &= \text{Time in years} \end{aligned}$$

Table of Contents

Collaboration

How to work in teams

- where every member
- can add to or modify content
- of any part
- at any time and
- all changes are tracked and
- previous versions can be reverted if required?

Online LaTeX Editor: Overleaf

How to start:

1. Sign up at `https://www.overleaf.com/register`
2. New Project - Upload Project
3. Share Project to invite co-labourers

How to use comments:

`https://www.overleaf.com/learn/how-to/Track_Changes_in_Overleaf`

How to view and revert to previous versions:

`https://www.overleaf.com/learn/latex/Using_the_History_feature`

Working offline by syncing with Dropbox or GitHub is a premium feature:

`https://www.overleaf.com/learn/how-to/Working_Offline_in_Overleaf`

Off-line LaTeX Editor and GitHub Desktop

How it works

- Use `https://github.com` as a remote repository
- Use `https://desktop.github.com/` to push/pull from github
- Edit with any text editor your local latex files

Water Research & Development Centre

https://nduwrdc.org