\Title{Thesis Title} \Author{First Middle Last} \Copyright{Copyright \copyright\ 2024 First Middle Last} \Language{en-GB} \Keywords{} \Subject{A thesis must have an abstract. The abstract comes after the title page and is marked page "ii".

The abstract is a concise and accurate summary of the thesis. It states the problem that was researched, the methods of investigation, and the general conclusions. An abstract must not contain non-text content, such as tables, graphs, complex equations, or illustrations. Even for theses containing journal articles, there is one single abstract for the entire work, included within the preliminary pages (front pages) of the thesis.

For any thesis that is permitted to be written in a language other than English, two abstracts must be included; the first in English and the second in the language of the thesis.

The font used for the abstract must be at least a 10 point font, with the text double-spaced, to ensure readability. A strict maximum word count of 700 words applies, regardless of whether the abstract is for a master's or a doctoral degree (many abstracts are 300–500 words).

For reference, this section is exactly one-hundred and seventy-six words. }

Thesis Title

by

First Middle Last

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

Department of Example Department
University of Alberta

Abstract

A thesis must have an abstract. The abstract comes after the title page and is marked page "ii".

The abstract is a concise and accurate summary of the thesis. It states the problem that was researched, the methods of investigation, and the general conclusions. An abstract must not contain non-text content, such as tables, graphs, complex equations, or illustrations. Even for theses containing journal articles, there is one single abstract for the entire work, included within the preliminary pages (front pages) of the thesis.

For any thesis that is permitted to be written in a language other than English, two abstracts must be included; the first in English and the second in the language of the thesis.

The font used for the abstract must be at least a 10 point font, with the text double-spaced, to ensure readability. A strict maximum word count of 700 words applies, regardless of whether the abstract is for a master's or a doctoral degree (many abstracts are 300–500 words).

For reference, this section is exactly one-hundred and seventy-six words.

Preface

If you need assistance on writing the preface, ask your supervisor. Your supervisor must review and verify the preface before it becomes part of the final version of the thesis.

A preface is a mandatory component of a thesis, regardless of thesis format, <u>when</u> a thesis contains journal articles authored or co-authored by the student (including an accepted paper that is forthcoming at the time of thesis submission). A preface is <u>also</u> a mandatory component when the research conducted for the thesis required ethics approval. A preface remains optional if there is no inclusion of journal articles and/or no need for ethics approval.

When required because a thesis contains journal articles, the preface serves as a place for the student to include a statement indicating his or her contribution to the journal articles, such as the identification and design of the research program, the performance of the various parts of the research (including the collection of data, construction of any necessary apparatus, and the performance of experiments), and the analysis of the research data. If any of the work presented in the thesis has led to any publications (accepted or published), these publications must be listed clearly in the preface with their bibliographical details and an indication as to where in the thesis this work is located (e.g. state in which chapter or chapters). For jointly authored publications, indication must also be given as to the relative contributions of the collaborators and co-authors, and a statement as to the proportion of research and writing conducted by the student. Note that permission may be needed if the co-authors hold the copyright in these publications. If ethics approval was required

for the research, a statement to this effect must be included in the preface with the details of the approval that was granted.

Note that the inclusion of a preface does not excuse a student from failing to acknowledge the contributions of others in the body of the thesis, as per the University's Research and Scholarship Integrity Policy and the Code of Student Behaviour. One would still expect to see footnotes, endnotes or in-text references within the thesis acknowledging the works. Acknowledgements, such as thanks to the supervisor and supervisory committee members, to colleagues, lab mates and friends, and to family, do not appear in the preface.

Examples of several prefaces are given in Appendix B and are also available from the FGSR website.

Acknowledgements

An Acknowledgements page (no more than 2 pages in length) is a recommended, but not mandatory, component of a thesis.

The Acknowledgements page serves as a place within a thesis where students may wish to acknowledge the provision of funding from third parties, such as an external scholarship bodies, research granting agencies, and foreign governments. It is also appropriate to recognize the assistance provided by the supervisor and members of the supervisory committee.

e.g. I would like to thank Daniel R. Aldrich for his continuing contributions to the University of Alberta, and for his work within the graduate student community. More specifically, I would like to acknowledge the work that he put into creating the LaTeX template that this thesis was created in, and the ongoing support that he provides to the students at the University of Alberta. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed

diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer.

Table of Contents

List of Tables

List of Figures

List of Plates

Chapter 1

Introduction

1.1 Background

As a graduate student from the University of Alberta, I understand the daunting task that is associated with writing a Thesis that conforms to the guidelines outlined in the GPS Minimum Thesis Formatting Requirements. It can also be very frustrating to write long, equation and figure heavy, document in a word processor that is prone to crashes, file corruption, seemingly random changes to the formatting, and that do not output a document in the required PDF/A format for submission to GPS.

Due to these problems, lots of students attempt to use an alternative to traditional word processors: LaTeX.

LaTeX allows students/researchers to focus on either the writing of the document or the formatting. Because the writing is separated from the formatting, the writing of the documents can be performed in much more lightweight text editors, or TeX editors (that also allow for the compilation of the documents). These editors are usually able to save the work after every keystroke and due to the plaintext nature, are not generally susceptible to file corruption. LaTeX has the added benefit of providing a consistent and professional look and feel throughout the document.

1.2 Objectives

The main objectives of this thesis are:

1. To provide a comprehensive guide on writing a thesis using LaTeX.

2. To assist students and researchers in mastering the nuances of LaTeX document preparation.

3. To showcase best practices for structuring and formatting a thesis in LaTeX.

1.3   Scope and Limitations

While there are existing templates for writing a thesis for the University of Alberta in LaTeX, there does not appear to be a template for LaTeX that provides students all the information required to write an outstanding thesis. This template/document aims to defeat this shortcoming by providing all the necessary information to create a well structured thesis, as well as providing examples to assist in the formatting of documents written in LaTeX. This thesis focuses on the following aspects:

- Installation and basic usage of LaTeX.

- Document structure and formatting.

- Inclusion of figures and tables.

- Handling mathematical equations.

- Citations and references using BibTeX.

- Introduction to advanced topics and recommended packages.

However, it does not cover advanced LaTeX programming or extensive customization of document classes. Mainly because I did the heavy lifting for you; the class file, `ualberta.cls`, provides all the major document requirements while this document provides the references of how to include all the bits and bobs that one might what in a thesis.

1.4 Organization of the Thesis

The thesis is organized into several chapters, each addressing a specific aspect of writing a thesis in LaTeX. The breakdown is as follows:

- **Chapter 2:** Getting Started with LaTeX

- **Chapter 3:** Document Structure and Formatting

- **Chapter 4:** Figures and Tables

- **Chapter 5:** Mathematical Equations

- **Chapter 6:** Citations and References

- **Chapter 7:** Advanced Topics and Recommended Packages

- **Chapter 8:** Conclusion

Each chapter provides detailed information, examples, and recommendations to help the reader navigate the LaTeX document preparation process effectively.

1.5 Summary

This chapter introduced the background, objectives, scope, and organization of the thesis. The subsequent chapters delve into specific topics, providing practical guidance and examples for mastering the art of writing a thesis in LaTeX.

Chapter 2

Getting Started with LaTeX

2.1 Installation

To begin using LaTeX, you need to install a LaTeX distribution on your computer. Here are the steps for installing LaTeX on different platforms:

2.1.1 Windows

For Windows users, you can install MiKTeX or TeX Live. Download the installer from the respective websites and follow the installation instructions.

2.1.2 Mac

On Mac, you can use MacTeX or MiKTeX. Download the package from the respective websites and follow the installation instructions.

2.1.3 Linux

For Linux users, TeX Live is a common choice or one can use MiKTeX. Use your package manager to install it, or download the installer from the respective websites.

2.2 Basic Document Structure

Once LaTeX is installed, you can create a basic LaTeX document. Here is a minimal example:

```
\documentclass{article}
\begin{document}
    \title{My First \LaTeX{} Document}
    \author{Your Name}
    \date{\today}

    \maketitle

    Hello, \LaTeX{}!
\end{document}
```

This example demonstrates a simple LaTeX document with a title, author, and date.
The \maketitle command generates the title information.

2.3   Other Software Considerations

While by itself, LaTeX can be used with just a text editor and compiler, there are
some additional software resources that will be very useful.

First of these softwares is a Reference Manager.

Note: *While a reference manager is suited for creating a thesis in LaTeX, it is not*
exclusive for use with LaTeX. In fact, even if you are writing your thesis in
word I would recommend the use of one of the suggested reference managers
to help keep track of all your references, and to keep track of the information
you found within your references.

Second of these (maybe should have been first or earlier in the document) is a
different LaTeX editor. While all of the distributions above come with TeXWorks (a
simple editor and compiler) you might find it more beneficial to have some additional
features. For this I recommend one of the following:

- TeXstudio

- Texmaker

- TeXnicCenter

- Overleaf *See Note Below

I am sure there are others, but any of these will do you fine for writing your thesis.

Note: *Due to changes with Overleaf, I recommend it less and less. While it is convenient as it is web based, they have restricted it more and more forcing the users to now pay more for the software... including to get longer compile times. While this is not an issue for short articles, in longer documents, such as a thesis, this can be a large hinderance and cost ($100CAD/year with student discount).*

Chapter 3

Document Structure and Formatting

A thesis for the University of Alberta can consist of many different parts that come together to create the final document. These will include the Title Page, Abstract, and other prefatory pages; and the chapters, sections, and subsections. In the following sections, we will look into how we can add these different sections and how to manipulate them too.

3.1   Title Page, Abstract, and Other Prefatory Pages

To create a title page in LaTeX, you can use the \maketitle command after providing the necessary title, author, and date information. This is usually performed in the following way:

```
\title{Your Thesis Title}
\author{Your Name}
\date{\today}

\begin{document}
 \maketitle
\end{document}
```

For a thesis at the University of Alberta, there are a few more pages that are required (Abstract and Preface) and some that are optional (Quote, Dedication, and Acknowledgements), but all of them have specific formatting requirements. To aid you in the creation of these pages a few new macros have been provided.

- `\abstracttext{Abstract Text goes here.}`

- `\preface{Preface Text goes here.}`

- `\thesisquote{Quote Text goes here.}`

- `\dedication{Dedication Text goes here}`

- `\acknowledgementtext{Acknowledgement Text goes here.}`

3.1.1 Title Page

The thesis Title Page has a few more fields to be filled in than a regular LaTeX document. These include `\degree`, `\specialization`, `\department`, `\faculty`, and `\convocationdate`. An example of how to fill these in can be seen in the original LaTeX code (`ualberta.tex`) or in Listing 3.1.

Most of the fields are fairly self explanatory, however, to be extra clear as to what needs to be included I will now provide an explanation of each field.:

Table 3.1: Title Page Macro Definitions and Examples

Field	Description	Example
\title	The Title of your Thesis.	The Perfect Thesis Title That is Perfectly Captivating
\author	Your Full Name.	Daniel Ryan Aldrich
\degree	Degree or one of the premade macros (note they are **not** case sensitive) *e.g.*, \MSc.	Master of Science or \Msc
\specialization	Specialization, otherwise, leave it blank.	Applied Math
\department	Department, or if you are non-departmentalized, leave this blank.	Mechanical Engineering
\faculty	If you are non-departmentalized, fill this in, otherwise, leave this blank.	
\convocationdate	The year in which you will **convocate**.	2024

Listing 3.1: Example of How to Set Title Page Info

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                 TITLE PAGE AND FRONTMATTER INFORMATION                    %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% TITLE PAGE INFO
  \title{Thesis Title}                 % Title of your Thesis
  \author{First Middle Last}           % Your Full Name
  \degree{\MSc}                        % \MSc, \PhD, \MA, \MEd, \MBA, \MAc, \MFM, \MN, \
      LLM, or \MMus
  \specialization{}                    % Leave blank if none
  \department{Example Department}      % Fill in the Department unless you are non-
      Departmental
  \faculty{}                           % Leave blank unless non-Departmental
  \convocationdate{2023}               % Convocation Year
```

3.1.2 Abstract

3.1.3 Preface

The following sections will provide you with examples of how to include specific elements into your preface. The examples in the following sections have been included from the document titled "Appendix for Thesis Formatting Guidelines" by GPS[1]. Due to the "Appendix for Thesis Formatting Guidelines" being generated using Chat-GPT3.5 there are some inconsistencies within the document and the examples provided; while these are fine for providing a general idea of what to include, this goes against the ideology of this document. To combat this I have taken the liberty of adapting the examples to better blend into the style of this document and to increase the consistency, however, full credit still goes to the University of Alberta's Faculty of Graduate and Postdoctoral Studies for providing the document and I would strongly suggest anyone writing their thesis at the University of Alberta to read the updated documentation that they have put out this year (2024). This new documentation provides much more guidance than previous iterations. Fun fact before you read on, Professor C. Ayranci who was mentioned in a few of the following examples was in-fact the supervisor for my Master's thesis.

Note: *Before preceeding I would like to emphasize that the following examples are are not a one-and-done, you might need to combine elements from multiple of the following sections to build an appropriate preface for your thesis.*

💡 If none of the following apply make sure to include a preface in the style of the one shown in Section 3.1.3.6.

3.1.3.1 Research Ethics Approval

If your thesis required you to get Research Ethics Approval, then you should include a preface based on the one here.

" This thesis is an original work by YOUR FULL NAME. The research project, of which this thesis is a part, received research ethics approval from the

University of Alberta Research Ethics Board 3, Project Name "Etymologies and Entomologies: Unraveling the Threads of Language and Ecology," No. 12345, January 15, 2022. "

3.1.3.2 Collaborative Work

If your thesis required you to work collaboratively with other, organizations, researchers or otherwise, then you should include a preface based on the one here.

" Some of the research conducted for this thesis forms part of an international research collaboration, led by Professor T. Raivio at the University of Hogwarts, with Professor S. Agrawal being the lead collaborator at the University of Alberta. The technical apparatus referred to in chapter 3 was designed by myself, with the assistance of Professor A. Shiri and Professor C. Ayranci. The data analysis in chapter 4 and concluding analysis in chapter 5 are my own work, as well as the literature review in chapter 2. "

3.1.3.3 Previously Published Material

If your thesis is based on or includes work previously published by yourself, or work you co-authored, then you should include a preface based on the one here.

" Chapter 2 of this thesis has been published as A.D. Lee, C. Ayranci, and S. Persad, "Unraveling Entomologies," Journal of Scientific Affairs, vol. 165, issue 3, 459-475. I was responsible for the data collection and analysis as well as the manuscript composition. C. Ayranci assisted with the data collection and contributed to manuscript edits. S. Persad was the supervisory author and was involved with concept formation and manuscript composition. "

3.1.3.4 Use of Artificial Intelligence (AI)

If your thesis used AI to help you outline, or otherwise write sections of including help with analyzing, summarizing, *etc.*, then you should include a preface based on the one here.

> " The generative artificial intelligence application or Large Language Model ChatGPT 3.5 was used for data analysis, summarization, synthesis, and simulation in chapter three of this thesis, as well as to generate a preliminary draft of the literature review in chapter one. "

3.1.3.5 Receiving of Competitive Funding

If your thesis required you to get Research Ethics Approval, then you should include a preface based on the one here.

> " This work was supported by a Doctoral Fellowship from the Social Sciences and Humanities Research Council, a grant from the Entomological Association of Edmonton, and the National Scholarship Council of Narnia. "

3.1.3.6 Previous Prefaces Did Not Apply

If your thesis did not fall into any of the categories shown previously, then you should include a preface based on the one here.

> " This thesis is an original work by `YOUR FULL NAME`. No part of this thesis has been previously published. "

3.1.4 Dedication or Quotations

Dedications or Quotations are limited to maximum of one page.

In the template provided you may fill in the appropriate Quote and Dedication fields in the document `01_Prefatory/Quotes_Dedications.tex`. These can be filled

out if you plan to include them or not. To control whether they show up in the document you will want to uncomment **ONLY ONE** of the following commands in the `ualberta.tex` file.

Listing 3.2: Quote and Dedication Inclusion Options (uncomment only one)

```
%\makequote                    % Creates the Quote Page
%\makededication               % Creates the Dedication Page
%\makededicationandquote       % Creates the Quote/Dedication Page
```

3.1.5 Acknowledgments

This is an optional section but it is strongly recommended: acknowledge the assistance of your supervisor, committee, and others. 2 pages maximum.

3.1.6 Table of Contents

Include chapter headings and 2–4 levels of subheadings. This template will automatically include all required chapters including the correct ones from the prefatory pages. However, due to stylistic considerations you may want more or less levels included the in the Table of Contents. To accomplish this I have created the command near the top of the `ualberta.tex` file that allows you to set both the depth of the Numbered Headings and the level of depth for the Table of Contents. To do this change the number shown in Listing 3.3 to 2, 3, or 4.

Listing 3.3: Set Numbered Heading and ToC Level

```
% Option to change the Level of subheading included in the Table of Contents
%  This should be set at 2, 3, or 4 (As per GPS)
 \settoclevel{3}
```

💡 For the `\settoclevel{n}` command, setting n to 2 will included everything down to `subsection`, 3 will include everything down to `subsubsection`, and 4 will include everything down to `paragraph` in the Table of Contents.

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3.1.7 Lists of Figures, Tables, ...

Include a separate list, beginning on a new page, for each kind of nontextual item appearing in the body of the thesis (one list for tables, another for illustrations, etc.). Lists can be in any order.

3.2 Nomenclature, Glossary, & Acronyms

3.2.1 Lists of Symbols/Abbreviations

3.2.2 Glossary of Terms

3.3 Chapters, Sections, Subsections, and Paragraphs

Organize your document hierarchically using chapters, sections, subsections, *ect*. These structures all utilize the base macros from LaTeX including:

- \chapter{Chapter Heading},

- \section{Section Heading},

- \subsection{Subsection Heading},

- \subsubsection{Sub-Subsection Heading},

- \paragraph{Paragraph Heading},

- \subparagraph{Subparagraph Heading}.

ϙ For writing your thesis, it is strongly recommended that one outlines the thesis using these commands first, while also added in a small description of what that chapter, section, *ect.*, should accomplish. This will help you stay organized and on track. Remembering that you can use comments, %, to hide these descriptions when you start to fill in your content.

3.4 Page Layout and Margins

⚠ WARNING While one can adjust the values using the commands provided by the following packages, unless you really know LaTeX inside and out this should be avoided. Everything provided in these files are aimed at making writing your thesis as easy as possible.

You can customize the layout and margins of your document using the `geometry` package. Additionally, you can use the `titlesec` package to customize the formatting of chapter and section titles.

Chapter 4

Figures, Tables, & Plates

4.1   Introduction

Figures and Tables play a crucial role in conveying information effectively in academic documents. This chapter will delve into the intricacies of incorporating figures and tables in your LaTeX document, exploring various features and advanced techniques to enhance the visual appeal and clarity of your content.

⚠ WARNING   **Throughout this Chapter there will be code listings that include lines that show the required packages. These lines should be included in your LaTeX preamble, not in the body of your document. To make this easy I have actually included a document specifically to add your packages too. This can be found: `./00_LaTeX_Files/includePackages.tex`**

💡   `./00_LaTeX_Files/includePackages.tex` includes all the packages required for creating all the examples in this document, some of these will not be necessary, however, I have included comments on all packages for what they are used for. This allows you to make a decision on if you will need them as well. If you are unsure, you may just comment out the line.

4.2   Inserting Figures

In LaTeX, figures are included using the `graphicx` package. The `\includegraphics` command is used to insert an image. Let's consider an example:

Listing 4.1: A Basic Example of Including a Figure.

```latex
\usepackage{graphicx}

\begin{figure}[htb]
 \centering
 \includegraphics[width=0.7\linewidth]{example-image}
 \caption{Example Figure}
 \label{fig:example}
\end{figure}
```
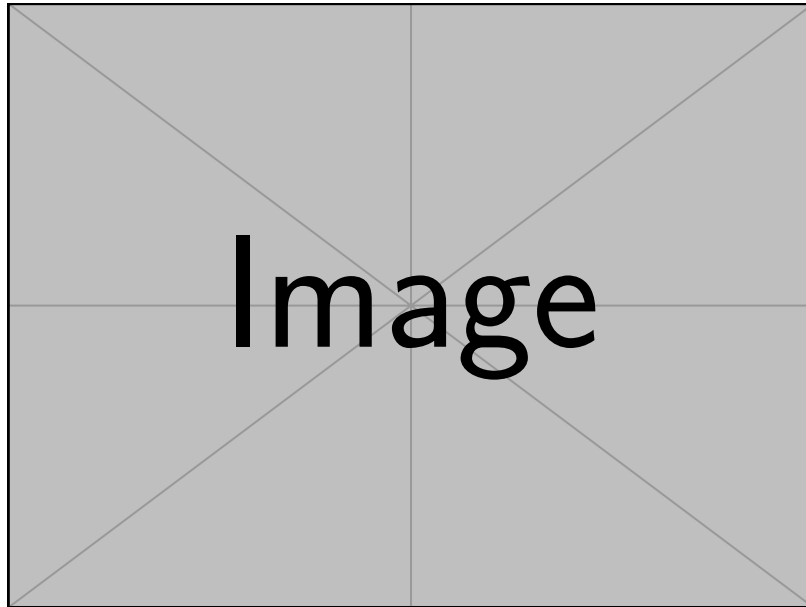

Figure 4.1: This is an example of a single figure similar to that produced by Listing 4.1.

In this example, the figure environment is used to contain the image. The \centering command ensures the image is centred horizontally. The width parameter is used to control the size of the image. The \caption and \label commands provide a caption and label for referencing, respectively.

Figures can be formatted to meet specific requirements. The \subfigure command from the subcaption package can be used for side-by-side figures:

This example uses the subfigure environment to create subfigures within a larger figure (as show in Figure 4.2. The \hfill command adds horizontal space between the subfigures.

```latex
\usepackage{subcaption}

\begin{figure}[htb]
 \begin{subfigure}{0.45\linewidth}
  \centering
  \includegraphics[width=\linewidth]{example-image-a}
  \caption{Subfigure A} % Leave blank for just letter
  \label{subfig:a}
 \end{subfigure}
 \hfill
 \begin{subfigure}{0.45\linewidth}
  \centering
  \includegraphics[width=\linewidth]{example-image-b}
  \caption{Subfigure B} % Leave blank for just letter
  \label{subfig:b}
 \end{subfigure}
 \caption{Example with Subfigures}
 \label{fig:subfigures}
\end{figure}
```
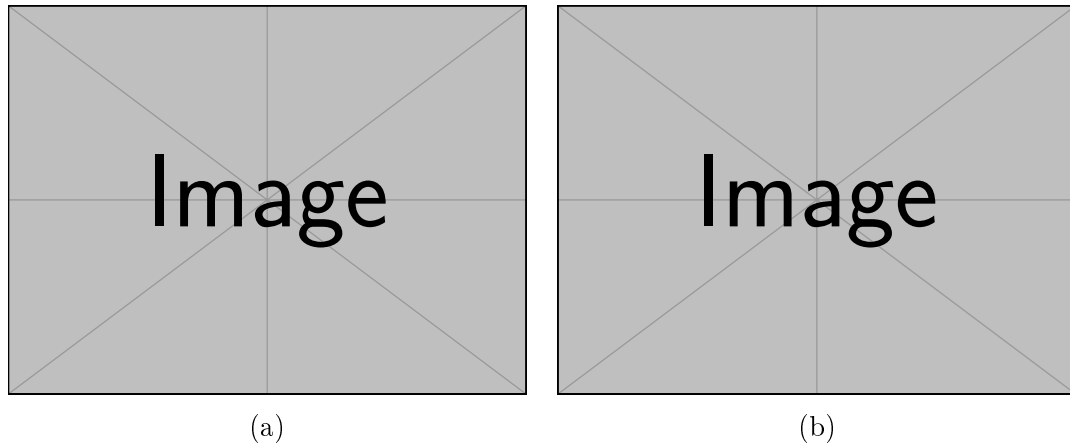

(a) (b)

Figure 4.2: This is an example of a double image figure similar to that produced by Section 4.2.

While this section provided a few examples on how to make some figures and sub figures, I would strongly recommend checking out some of the provided examples in Appendix A. This will provide the code and examples for how to create more intricate subfigures and layouts.

4.3   Tables and Tabularx

Tables in LaTeX are created using the tabular environment. The tabularx package is particularly useful when you want the table to automatically adjust its width. Let's define some custom column types for convenience:

```
\usepackage{tabularx}
\newcolumntype{C}{>{\centering\arraybackslash}X}
\newcolumntype{L}{>{\raggedright\arraybackslash}X}
\newcolumntype{R}{>{\raggedleft\arraybackslash}X}
Now, let's create a table using tabularx:

\begin{table}[htb]
 \centering
 \begin{tabularx}{\linewidth}{|C|L|R|}
  \hline
  \textbf{Centered} & \textbf{Left Justified} & \textbf{Right
      Justified} \\
  \hline
  Content & More content & Additional content \\
  \hline
 \end{tabularx}
 \caption{Example Table with Tabularx}
 \label{tab:example}
\end{table}
```

In this example, the tabularx environment is used, and the custom column types C, L, and R are applied to the columns. This ensures the content is centered, left-justified, and right-justified, respectively.

4.4   Advanced Table Features

To create professional-looking tables, the booktabs package can be employed. It provides commands for better spacing and styling of tables:

The \toprule, \midrule, and \bottomrule commands create horizontal rules with appropriate spacing.

```latex
\usepackage{booktabs}

\begin{table}[htb]
 \centering
 \begin{tabular}{ccc}
  \toprule
  \textbf{Header 1} & \textbf{Header 2} & \textbf{Header 3} \\
  \midrule
  Content 1 & Content 2 & Content 3 \\
  Content 4 & Content 5 & Content 6 \\
  \bottomrule
 \end{tabular}
 \caption{Example Table with Booktabs}
 \label{tab:booktabs_example}
\end{table}
```

4.5 Additional Packages for Enhanced Table Functionality

Several other packages can be employed to enhance table functionality:

The longtable package allows tables to span multiple pages, which is useful for large datasets. The multirow and multicolumn packages provide commands for cells that span multiple rows or columns, respectively. The makecell package enables more complex table layouts. Each of these packages comes with its set of commands and options. Let's briefly explore the usage of longtable, multirow, and multicolumn:

In these examples, the `longtable` environment is used for tables that span multiple pages. The multirow command is employed to create cells that span multiple rows, while multicolumn is used for cells that span multiple columns.

4.6 Conclusion

This chapter provided a comprehensive overview of including figures and tables in your LaTeX document. From basic insertion of figures to advanced table formatting using packages like `tabularx`, `booktabs`, and others, you now have a solid foundation to include tables and figures in your thesis. While this provides a lot of details on

how to add figures that have already been pre-generated, one might want to generate figures on the spot potentially even using data generated from other programs (such as MatLab®, Python, *etc.*). For this Chapter 5 provides in-depth workings of the `pgfplots` package and how to generate consistent and professional looking plots and graphs.

```latex
\usepackage{longtable}
\usepackage{multirow}
\usepackage{multicolumn}

% Example Longtable
\begin{longtable}{|c|c|}
 \caption{Longtable Example} \label{tab:longtable} \\
 \hline
 \textbf{Header 1} & \textbf{Header 2} \\
 \hline
 \endfirsthead
 \hline
 \textbf{Header 1} & \textbf{Header 2} \\
 \hline
 \endhead
 Content 1 & Content 2 \\
 Content 3 & Content 4 \\
 \hline
\end{longtable}

% Example Multirow and Multicolumn
\begin{table}[htb]
 \centering
 \begin{tabular}{|c|c|c|}
  \hline
  \multirow{2}{*}{\textbf{Multirow-Col1}} & \multicolumn{2}{c
    |}{\textbf{Multicolumn-Col2-3}} \\
  \cline{2-3}
  & \textbf{Column 2} & \textbf{Column 3} \\
  \hline
  Content 1 & Content 2 & Content 3 \\
  \hline
 \end{tabular}
 \caption{Example Table with Multirow and Multicolumn}
 \label{tab:multirow_multicolumn}
\end{table}
```

Chapter 5

Plots, Charts, & Graphs

5.1   Introduction

In the following sections, there will be a few examples of how to generate different plots. Though this can be quite useful, I will be excluding in-depth information on creating these. For more information on how to create plots, here is the manual for `pgfplots`.

5.2   Line Plots

A simple line plot can be created using the `axis` environment from `pgfplots`. The following code (see Section 5.2) can be used to create the figure shown in Figure 5.1.

```
\begin{figure}[H]
 \centering
 \begin{tikzpicture}
  \begin{axis}[
   title={Simple Line Plot},
   xlabel={X-axis},
   ylabel={Y-axis},
  ]
   \addplot coordinates {
    (0,0)
    (1,1)
    (2,4)
    (3,9)
    (4,16)
   };
  \end{axis}
 \end{tikzpicture}
 \caption{A simple line plot.}
 \label{fig:line-plot}
\end{figure}
```
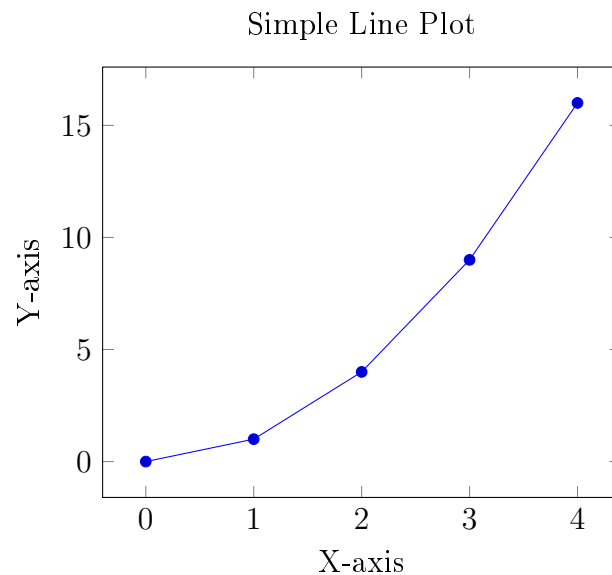

Figure 5.1: A simple line plot.

Expanding on this example, we can add a second plot by adding the following code below the closing bracket and semi-colon (`};`) of the `addplot` command: This will result in the addition of the second red line shown in Figure 5.2.

```
\addplot coordinates {
 (0,16)
 (1,9)
 (2,4)
 (3,1)
 (4,0)
};
```
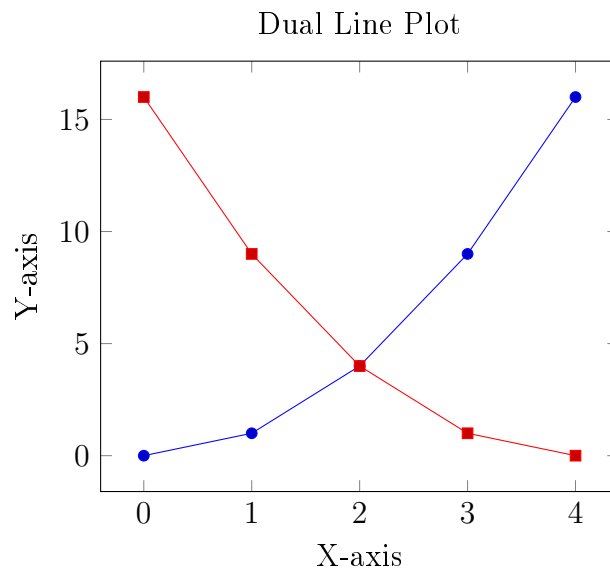

Figure 5.2: A simple line plot with two sets of data.

5.3   Customizing Plots

This section provides some ways to increase the readability and customization of the plots we generate.

5.3.1   Adding a Legend

Legends can be added to plots for better readability. To add a legend to your plot you can use the code in Section 5.3.1 to generate the plot shown in Figure 5.3. Each plot is individually added to the legend by adding a `\addlegendentry{YOUR LEGEND ENTRY HERE}` command following the `addplot` command.

Note: *The position of the legend can be specified by using the optional parameter* `legend pos=`

followed by a set of compass coordinates.

```
\begin{figure}[H]
 \centering
 \begin{tikzpicture}
  \begin{axis}[
   title={Plot with Added Legend},
   xlabel={X-axis},
   ylabel={Y-axis},
   legend pos=north west,
  ]
   \addplot coordinates {
    (0,0)
    (1,1)
    (2,4)
    (3,9)
    (4,16)
   };
   \addlegendentry{\(y = x^2\)}
   \addplot coordinates {
    (0,16)
    (1,9)
    (2,4)
    (3,1)
    (4,0)
   };
   \addlegendentry{\(y = 16 - x^2\)}
  \end{axis}
 \end{tikzpicture}
 \caption{A customized plot with a legend.}
 \label{fig:legend-plot}
\end{figure}
```
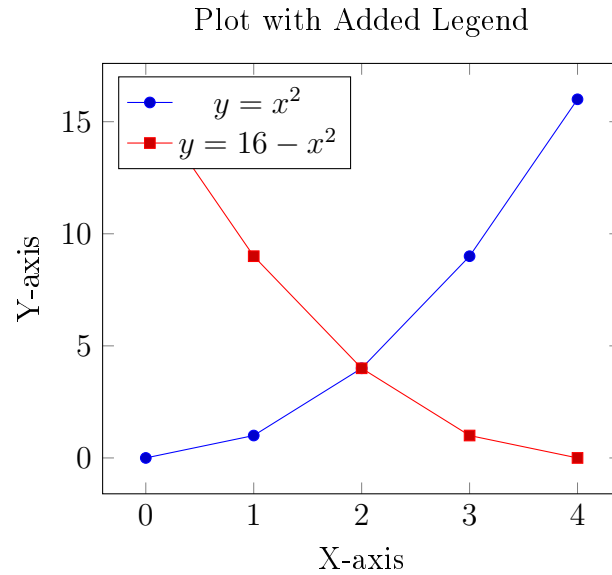
Figure 5.3: A customized plot with a legend.

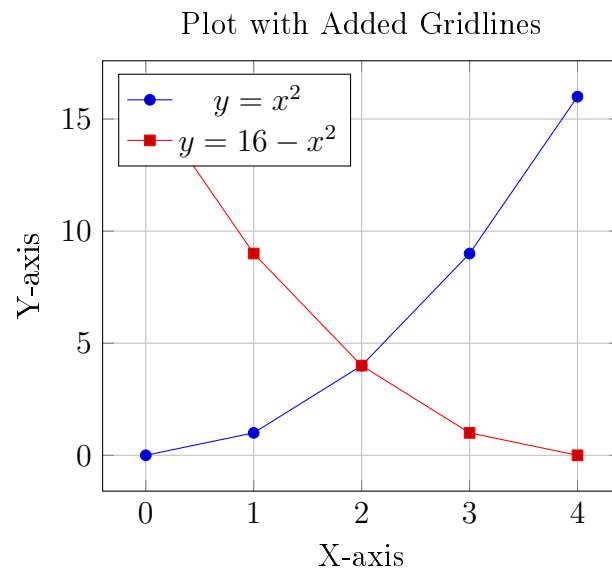## 5.3.2   Adding Grid Lines

To add gridlines to your plot

Figure 5.4: A customized plot with added gridlines.

5.3.3   Changing Colors and Line Styles

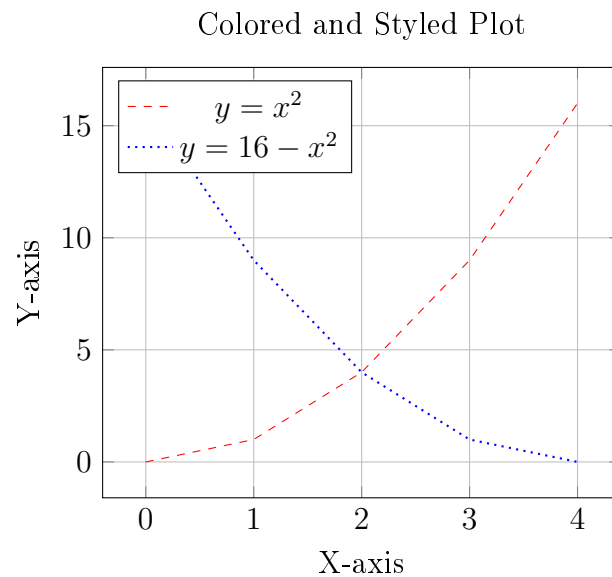Colors and line styles can be easily modified:

Colored and Styled Plot

Figure 5.5: A plot with customized colors and line styles

5.4 Advanced Plot Types
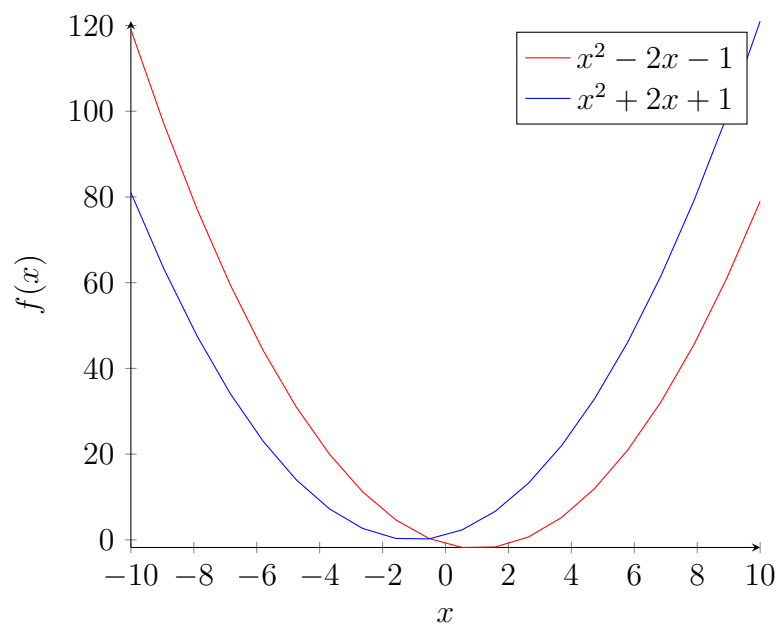
5.4.1 Equations

Figure 5.6: Plot of two parabola.
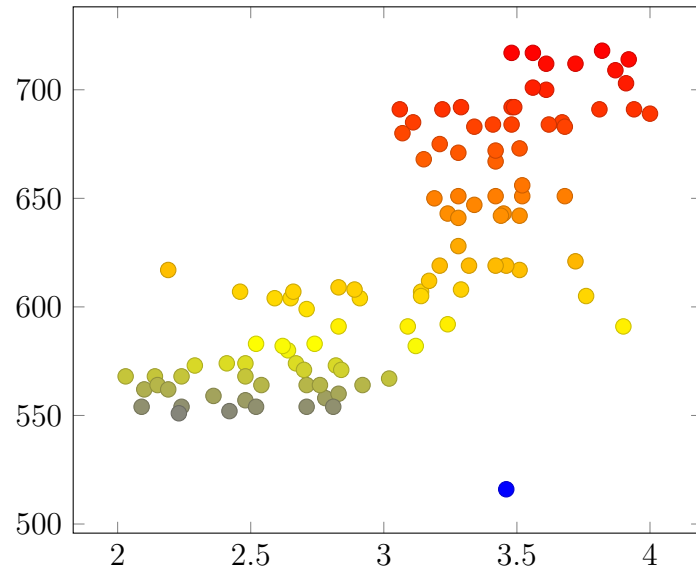
5.4.2 Scatter Plot with External Data

Figure 5.7: Example of a Scatter Plot.

5.4.3 Bar Plot

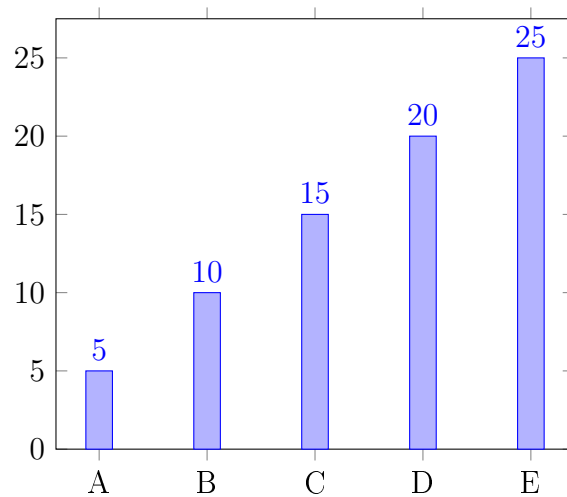Bar plots are useful for categorical data. Here's how to create one:

Figure 5.8: A bar plot
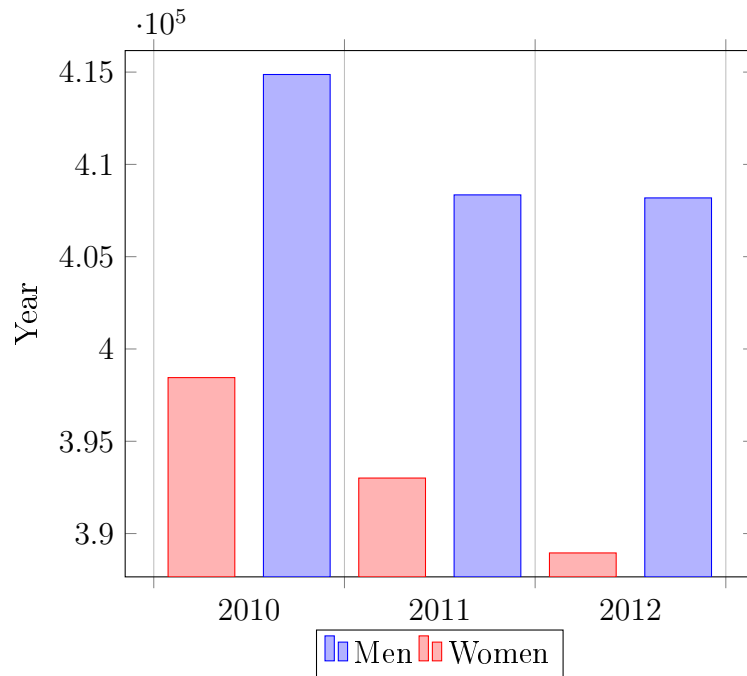
Figure 5.9: Example of a Bar Graph.

5.4.4 Pie Chart

Pie charts are less common in LaTeX, but can still be created using `pgf-pie`:
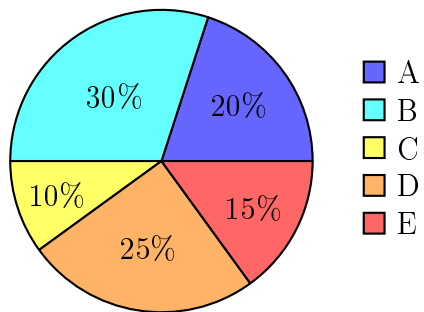
Figure 5.10: A pie chart
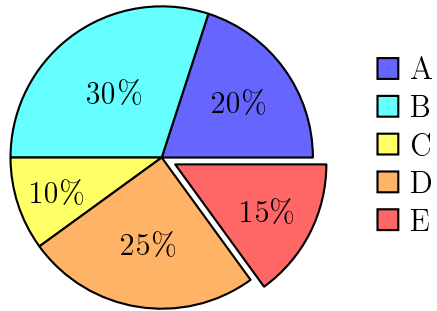
Figure 5.11: A pie chart
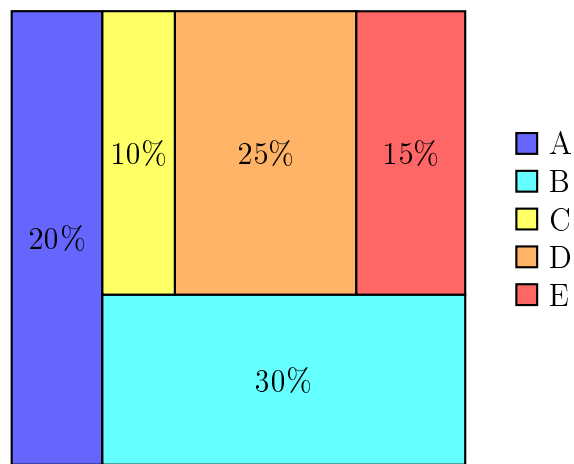
Figure 5.12: A pie chart

5.4.5 3D Plot

3D plots can be created for more complex data visualization:
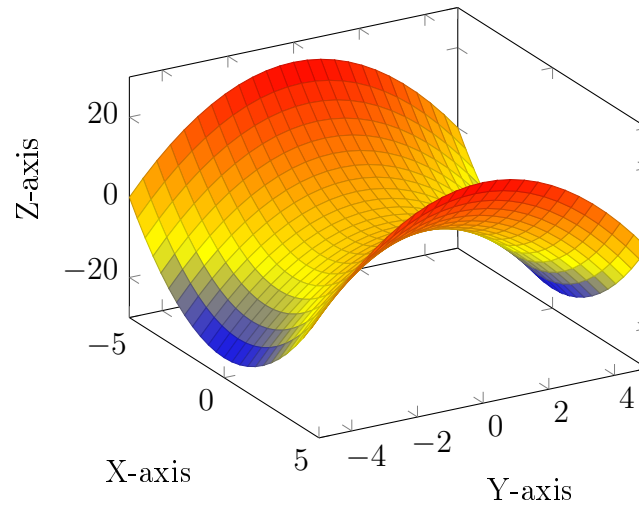
Figure 5.13: A 3D surface plot

Example using the mesh parameter

$\frac{sin(r)}{r}$
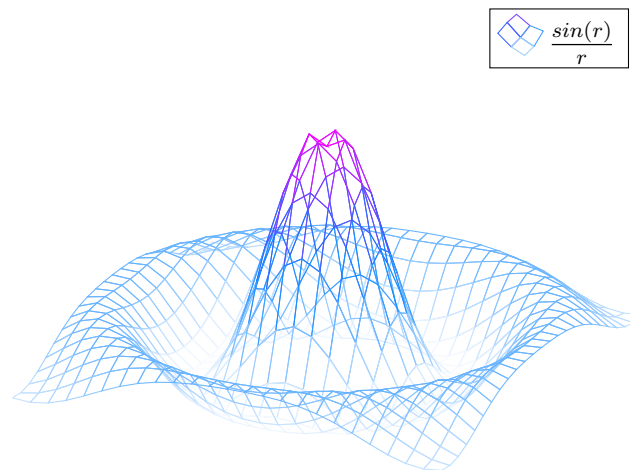
Figure 5.14: Example of a 3D Plot

5.4.6 Polar Plot

Polar plots are useful for circular data:
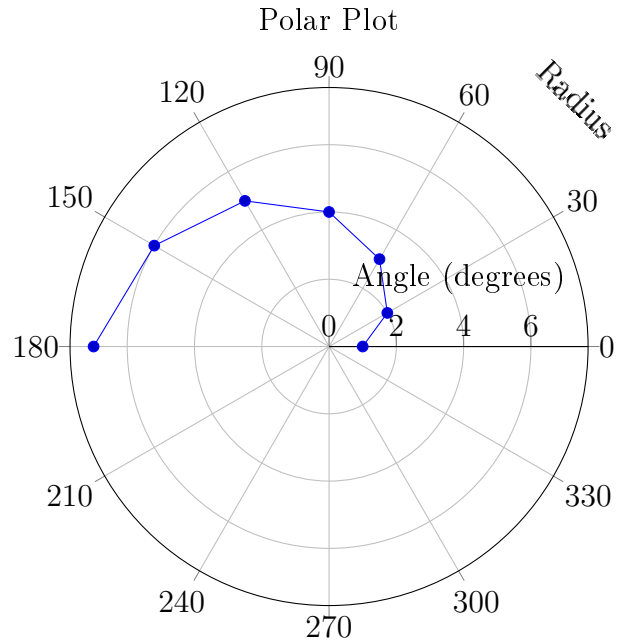
Figure 5.15: A polar plot

5.4.7 Box Plot

Box plots are used to visualize the distribution of data:
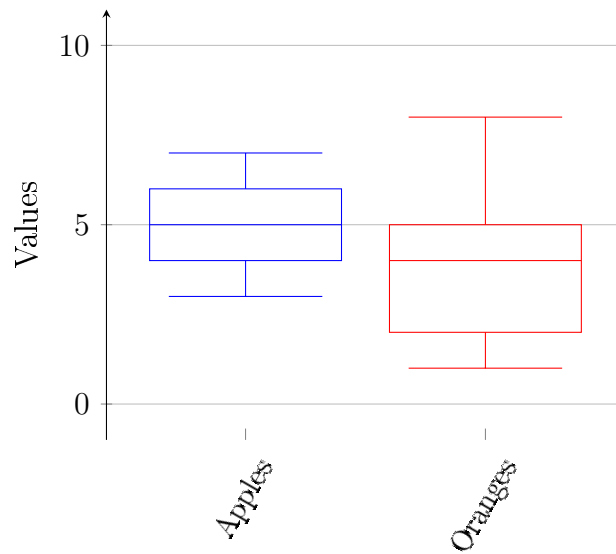
Figure 5.16: A box plot

5.5 Conclusion

The `pgfplots` package is an incredibly versatile tool for creating a wide range of plots and graphs in LaTeX. This chapter has provided examples of various plot types and customization options, showcasing the power and flexibility of `pgfplots`. By leveraging these capabilities, you can create high-quality, publication-ready figures for your thesis.

Chapter 6

Mathematical Equations

There are many ways to include formulas in your thesis. This section will provide some different ways of adding them (inline and standalone), as well as provide some ways of referencing the equations.

To start the simplest way to add an equation is using the built-in LaTeX math mode. To enter and exit math mode one just needs to use the `\(<Equation>\)` symbols around an equation. While there also exists `$<Equation>$` to add math, it is not recommended due to potential compatibility issues. Additionally, this, `\(<Equation>\)`, method is capable of being redefined to add further customization. An example of using math mode to get an inline equation is by using the following command:

<div align="center">

`\(\vec{F_{d}}=\frac{1}{2}\ A\ C_{d}\ \vec{V}^{2}\)`

</div>

The above command has the effect of creating the following output: $\vec{F}_d = \frac{1}{2}\, A\, C_d\, \vec{V}^2$. Sometimes it can be quite beneficial to separate what would be an inline equation to be on its own line. For this, we have two different ways of doing it. The first was will produce an equation that has no reference:

$$E = m\, c^2$$

$$E = m\, c^2$$

The second will produce an equation with a reference. For this, there are two main ways of creating the reference, the first one, see Equation (6.1), creates a numbered

reference, the other one, see Equation (Constant pi), creates a reference with a 'tag'. The difference between the two is just the inclusion of a \tag{<text>} command that will replace the regular number with <text>.

$$\pi = 3.1415... \tag{6.1}$$

$$\pi = 3.1415... \tag{Constant pi}$$

If you have multiple equations that you want arranged very neatly, use the align environment and you can assign individual equations numbers as shown in Equations (6.2) to (6.4). Note that it is the & symbol that determines what will be aligned. Further note that spaces in "math mode" are ignored and need to be specifed using the space commands in

$$Equation 1 = 1 \tag{6.2}$$
$$Equation 2 = 2 + 2 \tag{6.3}$$
$$Equation 3 = 3 + 3 + 3 \tag{6.4}$$

It may be very important in a math heavy thesis to be able to show your equations, or even data in a readable way. For this, we will explore some of the ways to create specific data.

6.1 Vector, Sets, Piecewise Functions, Matrix Math, and More

$$f(x) = \begin{cases} x^{2*\ln x}, & \text{if } x < 3 \\ -\frac{x}{2}, & \text{if } 3 \le x \le 4 \\ x, & \text{if } 4 < x \end{cases} \tag{6.5}$$

Vectors and Matrices are used in many fields of math and science and provide a

Table 6.1: Math Mode Greek Letters

Command	Output	Command	Output	Command	Output
\alpha	α	\beta	β	\gamma	γ
\delta	δ	\epsilon	ϵ	\zeta	ζ
\eta	η	\theta	θ	\iota	ι
\kappa	κ	\lambda	λ	\mu	μ
\nu	ν	\xi	ξ	o	o
\pi	π	\rho	ρ	\sigma	σ
\tau	τ	\upsilon	υ	\phi	ϕ
\chi	χ	\psi	ψ	\omega	ω
A	A	B	B	\Gamma	Γ
\Delta	Δ	E	E	Z	Z
H	H	\Theta	Θ	I	I
K	K	\Lambda	Λ	M	M
N	N	\Xi	Ξ	O	O
\Pi	Π	P	P	\Sigma	Σ
T	T	\Upsilon	Υ	\Phi	Φ
X	X	\Psi	Ψ	\Omega	Ω

convenient way to represent 2-Dimensional arrays of numbers.

$$x \in \{1, 2, 3, 4, 5, 6, 7\} \tag{6.6}$$

$$V_1 = \begin{pmatrix} a, & b, & c, & d \end{pmatrix} \tag{6.7}$$

$$V_2 = \begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix} \tag{6.8}$$

$$M = \begin{bmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m37n & o & p \end{bmatrix} \tag{6.9}$$

Table 6.2: Blackboard Bold Letters

Command	Output	Command	Output	Command	Output
\mathbb{A}	$\mathbb{A}$	\mathbb{B}	$\mathbb{B}$	\mathbb{C}	$\mathbb{C}$
\mathbb{D}	$\mathbb{D}$	\mathbb{E}	$\mathbb{E}$	\mathbb{F}	$\mathbb{F}$
\mathbb{G}	$\mathbb{G}$	\mathbb{H}	$\mathbb{H}$	\mathbb{I}	$\mathbb{I}$
\mathbb{J}	$\mathbb{J}$	\mathbb{K}	$\mathbb{K}$	\mathbb{L}	$\mathbb{L}$
\mathbb{M}	$\mathbb{M}$	\mathbb{N}	$\mathbb{N}$	\mathbb{O}	$\mathbb{O}$
\mathbb{P}	$\mathbb{P}$	\mathbb{Q}	$\mathbb{Q}$	\mathbb{R}	$\mathbb{R}$
\mathbb{S}	$\mathbb{S}$	\mathbb{T}	$\mathbb{T}$	\mathbb{U}	$\mathbb{U}$
\mathbb{V}	$\mathbb{V}$	\mathbb{W}	$\mathbb{W}$	\mathbb{X}	$\mathbb{X}$
\mathbb{Y}	$\mathbb{Y}$	\mathbb{Z}	$\mathbb{Z}$		

Table 6.3: Calligraphic Letters

Command	Output	Command	Output	Command	Output
\mathcal{A}	$\mathcal{A}$	\mathcal{B}	$\mathcal{B}$	\mathcal{C}	$\mathcal{C}$
\mathcal{D}	$\mathcal{D}$	\mathcal{E}	$\mathcal{E}$	\mathcal{F}	$\mathcal{F}$
\mathcal{G}	$\mathcal{G}$	\mathcal{H}	$\mathcal{H}$	\mathcal{I}	$\mathcal{I}$
\mathcal{J}	$\mathcal{J}$	\mathcal{K}	$\mathcal{K}$	\mathcal{L}	$\mathcal{L}$
\mathcal{M}	$\mathcal{M}$	\mathcal{N}	$\mathcal{N}$	\mathcal{O}	$\mathcal{O}$
\mathcal{P}	$\mathcal{P}$	\mathcal{Q}	$\mathcal{Q}$	\mathcal{R}	$\mathcal{R}$
\mathcal{S}	$\mathcal{S}$	\mathcal{T}	$\mathcal{T}$	\mathcal{U}	$\mathcal{U}$
\mathcal{V}	$\mathcal{V}$	\mathcal{W}	$\mathcal{W}$	\mathcal{X}	$\mathcal{X}$
\mathcal{Y}	$\mathcal{Y}$	\mathcal{Z}	$\mathcal{Z}$		

Table 6.4: Fraktur Letters

Command	Output	Command	Output	Command	Output
\mathfrak{A}	$\mathfrak{A}$	\mathfrak{B}	$\mathfrak{B}$	\mathfrak{C}	$\mathfrak{C}$
\mathfrak{D}	$\mathfrak{D}$	\mathfrak{E}	$\mathfrak{E}$	\mathfrak{F}	$\mathfrak{F}$
\mathfrak{G}	$\mathfrak{G}$	\mathfrak{H}	$\mathfrak{H}$	\mathfrak{I}	$\mathfrak{I}$
\mathfrak{J}	$\mathfrak{J}$	\mathfrak{K}	$\mathfrak{K}$	\mathfrak{L}	$\mathfrak{L}$
\mathfrak{M}	$\mathfrak{M}$	\mathfrak{N}	$\mathfrak{N}$	\mathfrak{O}	$\mathfrak{O}$
\mathfrak{P}	$\mathfrak{P}$	\mathfrak{Q}	$\mathfrak{Q}$	\mathfrak{R}	$\mathfrak{R}$
\mathfrak{S}	$\mathfrak{S}$	\mathfrak{T}	$\mathfrak{T}$	\mathfrak{U}	$\mathfrak{U}$
\mathfrak{V}	$\mathfrak{V}$	\mathfrak{W}	$\mathfrak{W}$	\mathfrak{X}	$\mathfrak{X}$
\mathfrak{Y}	$\mathfrak{Y}$	\mathfrak{Z}	$\mathfrak{Z}$		

Chapter 7

Citations/References, and Cross-References

This section will be showing off some of the different ways to include "citations" and "cross-references" within your document. Note that **cross-references** in LaTeX utilize \ref{} as a command, while one might think that this is short for reference this is not the case citation/references utilize the \cite{} commands.

7.1 Cross-References

In LaTeX, references will "reference" a \label{Reference:Label} command. This section has the following command to define the chapter:

```
\chapter{Citations/References, and Cross-References}\label{ch:citref}
```

By using \ref{ch:citref}, this allows you to insert a reference that look like this: 7. Now this by itself is not the most useful, to make it a bit better we should keep track of what we are referencing, in this case a **Chapter**, and add this label in front of the reference (Chapter~\ref{sec:citref}) and this will display like this: Chapter 7. Note to ensure the reference is not split we add a non-breaking space (~) to prevent LaTeX from accidentally adding a linebreak.

While using the ref command, you might ask "*Why does LaTeX not just know what it is that I am referencing and insert that automatically in front of the reference?*"

The answer is to provide more flexibility to the user. However, that being said, individuals have created a number of packages that work to enhance the workflow of adding these cross-references. Some of these are provided by the **hyperref** and **cleveref** packages. To include these packages add the following lines to the **bottom** of your preamble (order matters, cleveref needs to be after hyperref and hyperref should be one of the last packages loaded):

```
\usepackage{hyperref}
\usepackage[nameinlink]{cleveref}
```

With these packages loaded we can now use the commands listed in Table 7.1.[1]

Table 7.1: Built-in, hyperref, and cleveref commands and outputs

Command	Output
built-in	
\ref{}	7.1
\pageref{}	41
hyperref	
\autoref{}	Table 7.1
cleveref	
\cref{}	table 7.1
\Cref{}	Table 7.1
\cref*{}	table 7.1
\Cref*{}	Table 7.1
\cpageref{}	page 41
\Cpageref{}	Page 41
\namecref{}	table
\nameCref{}	Table

Further, the **cleveref** also includes features that allows for the auto sorting and

---

[1]Note that because the floats are added where they are in the text this causes them to insert large amounts of white space because it only fits on the following page.

combining of references:

```
\Cref{fig:doubleImage ,fig:singleImage ,fig:tripleImage1 ,
    fig:quadImage}
```

Noting that there are **NO** spaces between the labels; this will produce: Figures 4.1, 4.2, A.2 and A.4. Allowing one to quickly and efficiently keep references up-to-date and consistent in their style. More examples of the use of the **cleveref** cross-referencing is found through the rest of this Chapter.

7.2 Citations/References

7.3 Citation Managers

7.3.1 JabRef

Information on the use of this has been moved to it's own Chapter

7.4 This is old Material

This section will be showing off some of the different ways to include "citations" and "cross-references" within your document. Note that **cross-references** in LaTeX utilize \ref{} as a command, while one might think that this is short for reference this is not the case citation/references utilize the \cite{} commands.

7.4.1 Cross-References

In LaTeX, references will "reference" a \label{Reference:Label} command. This section has the following command to define the the section:

```
\subsection{Cross-References}\label{subsec:cross-reference}
```

By using \ref{subsec:cross-reference}, this allows you to insert a reference that look like this: 7.4.1. Now this by itself is not the most useful, to make it a bit better we should keep track of what we are referencing, in this case a **Section**, and add this label in front of the reference (Section~\ref{subsec:cross-reference}) and this

will display like this: Section 7.4.1. Note to ensure the reference is not split we add a non-breaking space (~) to prevent LaTeX from adding a line break.

While using the ref command, you might ask "*Why does LaTeX not just know what it is that I am referencing and insert that automatically in front of the reference?*" The answer is to provide more flexibility to the user. However, that being said, individuals have created a number of packages that work to enhance the workflow of adding these cross-references. Some of these are provided by the **hyperref** and **cleveref** packages. To include these packages add the following lines to the bottom of your preamble (order matters, cleveref needs to be after hyperref and hyperref should be one of the last packages loaded):

```
\usepackage{hyperref}
\usepackage[nameinlink]{cleveref}
```

With these packages installed we can now use the commands in Table 7.1.[2]

---

[2]Note that because the floats are added where they are in the text this causes them to insert large amounts of white space because it only fits on the following page.

Table 7.2: Built-in, hyperref, and cleveref commands and outputs

Command	Output
built-in	
\ref{}	7.2
\pageref{}	44
hyperref	
\autoref{}	Table 7.2
cleveref	
\cref{}	table 7.2
\Cref{}	Table 7.2
\cref*{}	table 7.2
\Cref*{}	Table 7.2
\cpageref{}	page 44
\Cpageref{}	Page 44
\namecref{}	table
\nameCref{}	Table

Further, the **cleveref** also includes features that allows for the auto sorting and combining of references:

```
\Cref{fig:doubleImage,fig:singleImage,fig:tripleImage
    1,fig:quadImage}
```

Noting that there are **NO** spaces between the labels; this will produce: Figures 4.1, 4.2, A.2 and A.4. Allowing one to quickly and efficiently keep references up-to-date and consistent in their style. More examples of the use of the **cleveref** cross-referencing is found through the rest of this document.

7.4.2 Citations

Citations are a lot easier than dealing with the cross-referencing. There are no additional packages required for citations, the built-in ones are feature-rich enough. Now, while there are no additional packages required to make citations in your document, there are in fact a few programs that should help you manage all of your citations/references. These programs can include Mendeley, JabRef, or Zotero; a comparison of the softwares can be found in Table 7.3, and more information of the use of JabRef can be found in Chapter 8. Single citations can be included with the

Table 7.3: Comparison of Reference Softwares

Software	Developer	Version	Cost	License
JabRef	The JabRef Team	5.11	Free	MIT
Mendeley	Elsevier	2.99.0	Free up to 2 GB	Proprietary
Zotero	CDS	6.0.27	Free up to 300 MB	AGPL

\cite{citationKey} command, the one at the end of this sentence is created with the \cite{TEST} command[2]. Multiple citations can be included in a single cite command by adding commas in between the citation keys. The citation at the end of this sentence shows how to create more than one citation and how they are grouped together, it is created with the \cite{testone,cite2,cite3,cite4,cite5} command[3–7]. Finally this sentence shows how a gap in the citations is handled, this is created with the \cite{testone,cite2,cite3,cite5} command[3–5, 7].

Chapter 8

JabRef: Managing Bibliographies Efficiently

8.1 Introduction

JabRef stands as a powerful tool for researchers and academics engaged in scholarly writing. JabRef offers a robust solution for bibliography management, including a number of features to ensure that you are not only able to organize your references but keep track of progress, and notes on each reference. This chapter aims to provide an review of JabRef, including its myriad features that I find particularly useful, and to guide you through its implementation in writing your thesis.

8.2 Key Features of JabRef

JabRef, with its versatile features, emerges as an indispensable tool for bibliography/reference management. Delving deeper into its functionalities reveals a wealth of tools designed to streamline the often cumbersome process of handling references.

8.2.1 BibTeX Compatibility

JabRef's commitment to the BibTeX format is a testament to its roots in the LaTeX ecosystem. This compatibility ensures a seamless integration between the reference management process and the LaTeX document preparation workflow. Users can easily export and import BibTeX files, facilitating collaboration and compatibility across

various platforms.

8.2.2 Reference Import

The capability to import references directly from online databases and journal websites significantly accelerates the reference collection process. JabRef supports various import formats, allowing users to effortlessly populate their databases with accurate and structured reference information. This feature is particularly valuable for researchers dealing with large/extensive bibliographies.

8.2.3 Customizable Entry Types

The flexibility offered by customizable entry types allows users to categorize references based on the nature of the source. Whether it's a book, article, conference proceeding, or any other reference type, JabRef accommodates diverse sources, ensuring a well-organized and easily navigable bibliography.

8.2.4 Search and Filter

The ability to efficiently search and filter references is a hallmark of JabRef's usability. Researchers dealing with extensive databases will appreciate the quick and precise retrieval of references based on author names, titles, keywords, or any other criteria. This feature is crucial for maintaining order in a rapidly growing bibliography.

8.2.5 Grouping

JabRef's grouping functionality provides a systematic approach to organizing references. Users can create custom groups to categorize references based on themes, projects, or any other criteria. This feature is especially useful for large research projects where a systematic organization of references is essential for maintaining clarity and coherence.

8.2.6 Integration with LaTeX

The seamless integration of JabRef with LaTeX editors fortifies the synergy between bibliography management and document preparation. This integration minimizes the manual effort required for citation insertion and ensures consistency between the bibliography and the in-text citations. Users can easily copy citation keys from JabRef and paste them directly into their LaTeX documents.

8.3 Getting Started with JabRef

Now that we've outlined the key features of JabRef, let's embark on a comprehensive guide on how to get started with JabRef. This step-by-step walkthrough will cover everything from installation to creating a new bibliography and populating it with references.

8.3.1 Installation

The initial step in utilizing JabRef is to install the software on your system. For all users, regardless of OS, the easiest way to download JabRef is to visit their website: https://www.jabref.org/. Once there select 'Download' from the navigation bar, and press the "Download JabRef" button. This will take you to the FossHub page where you can select the appropriate version for your OS and download and install it.

8.3.2 Creating a New Bibliography

Once JabRef is successfully installed, launch the application. When the program loads you will be faced with a window that looks like the one shown in Figure 8.1. Now that the program is open, to create a new bibliography:

1. Click on 'File → New Library'.

To save the database:

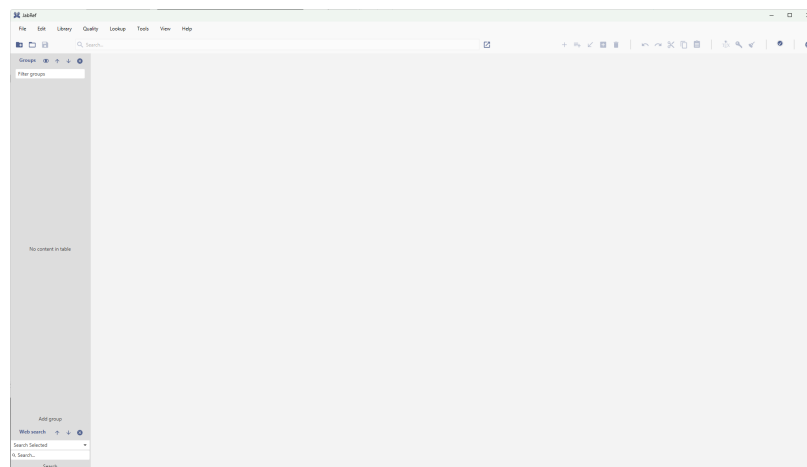1. Click on 'File → Save Library'.

Figure 8.1: JabRef Main Window.

2. Choose an appropriate and location.

3. Click 'Save'.

Congratulations! You've initiated your bibliography using JabRef. Now that we have this created, the next step is to add references to the database.

8.3.3 Adding References

JabRef offers multiple avenues for adding references to your database. Some of the methods are generally more useful than others but we will go over a few that you are likely to use:

8.3.3.1 Web Search

JabRef's integrated web search (see Figure 8.2) feature simplifies the process of importing references from online sources. This is by-far the easiest way to enter a reference.

1. Click on 'Web Search'.

2. Search for the desired reference using the integrated search feature.

3. Select the reference all the references you wish to import,as shown in Figure 8.3.
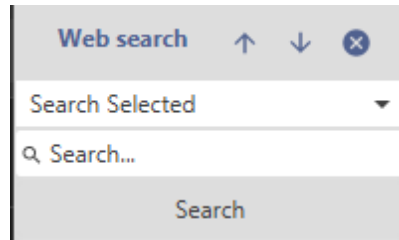
Figure 8.2: JabRef Web Search Tool.

4. Click 'Import entries' to import the selected entries.
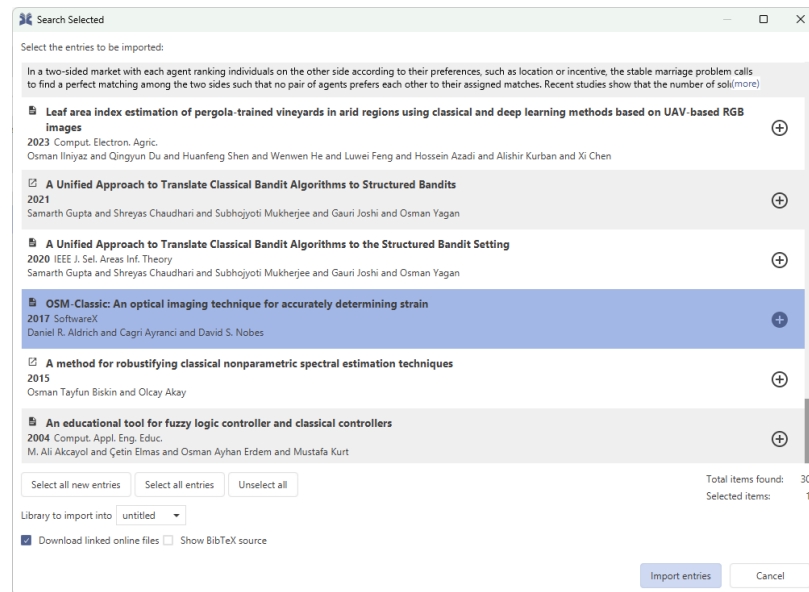
5. The references are added to your library.

Figure 8.3: Example Web Search Results for ''`OSM-Classic`''.

Note: *The Web Search tool by default uses a general search, however, a specific database can be chosen as well using the drop down arrow next to "Search Selected".*

8.3.3.2 Manual Entry

Manually adding a reference can be done in a 'manual' and 'automatic' way. When adding a new entry you will be faced with the option to select an entry type or to enter an ID (DOI, ArXiv, ISBN, *etc.*). If you enter an ID, the information for the

reference will be automatically pulled from the internet. Otherwise to manually enter all the information for a reference:

1. Click Library → 'New entry' or use the shortcut 'Ctrl + N' and this will show the following window.
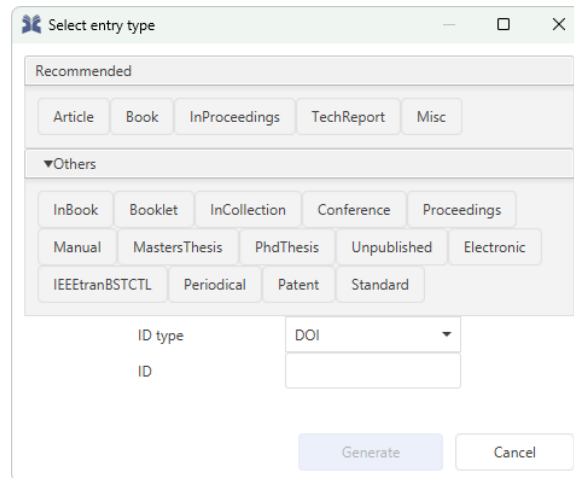
2. Choose the entry type (*e.g.*, article, book, inproceedings).

3. Fill in the required fields like author, title, journal, *etc.*

By following these steps, you can efficiently populate your JabRef database with the necessary references.

8.3.4   Organizing References

Effectively organizing references is essential for a streamlined bibliography. JabRef's grouping feature allows you to categorize references based on your preferences:

1. On the left panel, select 'Add Group'.

2. Give the group an appropriate name.

3. Optionally you can add a Description, Icon, Colour, *etc.*

To assign a reference to a group:

1. Select the Reference(s) from the center list.

2. Drag them to the group on the left of the screen.

Note: *Groups can even be nested into groups to provide more levels of organization.*

Organizing references into groups enhances accessibility and facilitates a more systematic approach to bibliography management.

8.4 Exploring Advanced Features of JabRef

JabRef's capabilities extend beyond the basics covered in the previous sections. In this section, we'll explore some of the advanced features that enhance the efficiency and effectiveness of JabRef as a reference manager.

8.4.1 Quality Assurance: Checking and Correcting Entries

Ensuring the accuracy and completeness of references is crucial. JabRef provides tools for quality assurance, allowing users to check and correct entries.

To check for duplicate entries:

1. Click on 'Quality $\rightarrow$ Find duplicates'.

2. JabRef will identify and display duplicate entries.

To correct entries:

1. Click on 'Quality $\rightarrow$ Cleanup entries'.

2. JabRef will provide some useful option to ensure conformity within the different references. This includes renaming Linked PDFs to match the standard of "`CitationKey - Title`".

These quality assurance features contribute to maintaining a clean and error-free bibliography.

8.4.2 Managing PDFs and File Links

JabRef facilitates the management of associated PDFs and file links, offering a consolidated approach to reference and document management.

To link a PDF or file:

1. Open the entry editor for a reference.

2. Click on 'General' and use the 'PDF' or 'File' field to link the document.

This integration streamlines the retrieval of associated documents directly from JabRef. Further, this allows JabRef to keep track of the comments and highlights in a single place (see Figure 8.4). These annotations can be found by selecting the entry, and selecting the 'File annotations' tab.
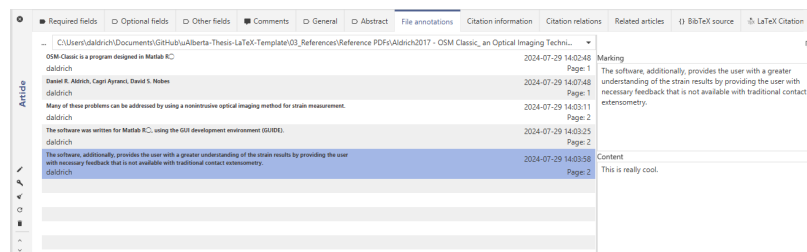

Figure 8.4: Showcase of the file annotations in JabRef.

8.4.3 Additional Information

JabRef keeps track of a lot of information and can even help you with your research. Some additional information JabRef provides includes:

- Citation information

- Citation relationships (what the reference cites and who has cited the reference). This further lets you open the links to the reference's source, or even add these references directly to your library.

- If one right clicks an entry you are provided the following options:

– Rank - rank the reference with one to five stars.

– Toggle Relevance - add a marker to show this is a relevant source.

– Priority - rank items as low, medium, or high priority.

– Read Status - set the status to read or skimmed.

Chapter 9

Submitting Your Thesis

So you have seemingly gotten to the end of the writing, and you may be already taking the steps to set up your last review with your supervisor, set up your thesis defence, or even submit your thesis to GPS... but now what do you do?

Quick answer is a lot, long answer will be discussed throughout this Chapter.

There are a number of steps that you will want to take to make sure that you are submitting the best version of your work. This includes checking for some of the more obvious and less obvious pitfalls that writing a Thesis in LaTeX or really any software poses.

Bibliography

[1] Faculty of Graduate & Postdoctoral Studies. "Appendix for thesis formatting guidelines," University of Alberta. (Jun. 2024), [Online]. Available: https://www.ualberta.ca/graduate-studies/media-library/current-students/appendix-for-thesis-formatting-guidelines.pdf.

[2] A. Thor, "Cited article," *Journal Name*, 2020.

[3] A. one, "Article 1," *Journal 1*, 1989.

[4] A. two, "Article 2," *Journal 2*, 1900.

[5] A. three, "Article 3," *Journal 3*, 1990.

[6] A. four, "Article 4," *Journal 4*, 1990.

[7] A. five, "Article five," *Journal five*, 1990.

Appendix A: Additional Example Figures

Each of the following pages will provide an example of a different figure configuration. In addition to the examples the code that generates the figure will be provided and explanations of what the different parts of the code do will be included. From all of the included information in this Appendix it should be possible to even develop your own figures that potentially suit your needs best.
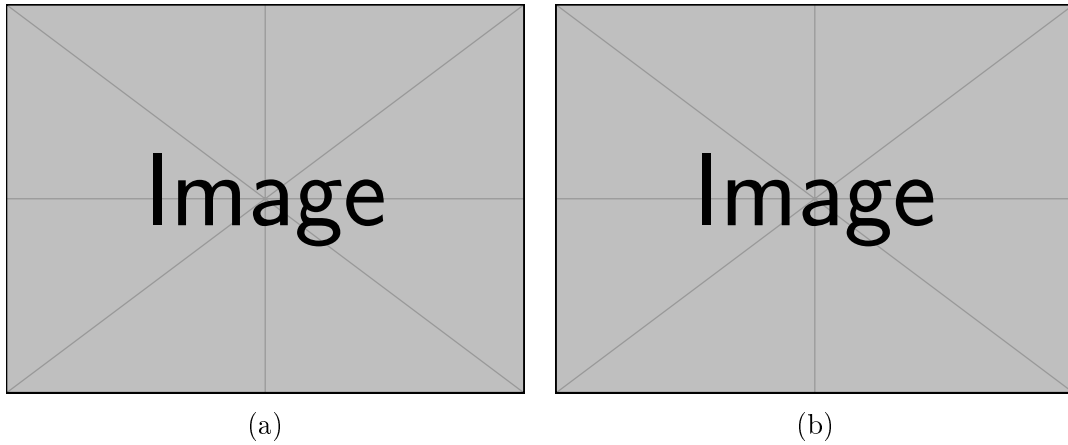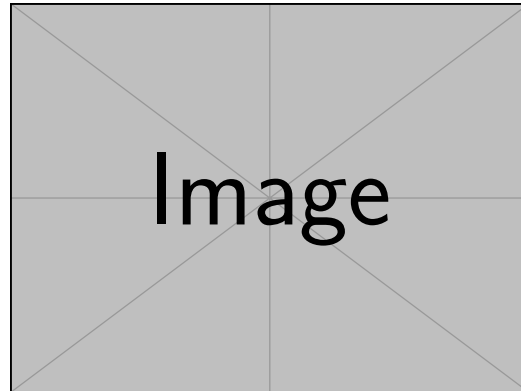
Figure A.1: This is an example of a double image figure.
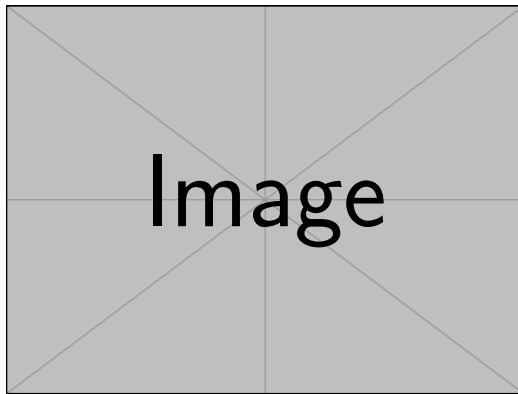
```
\begin{figure}[H]
 \centering
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:doubleImage2:a}
 \end{subfigure}
 ~
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:doubleImage2:b}
 \end{subfigure}
 \caption{This is an example of a double image figure.}
 \label{fig:doubleImage2}
\end{figure}
```
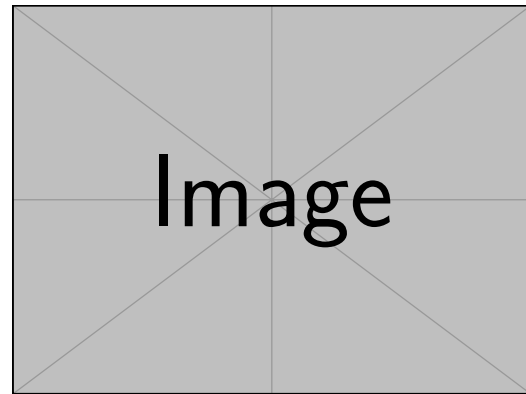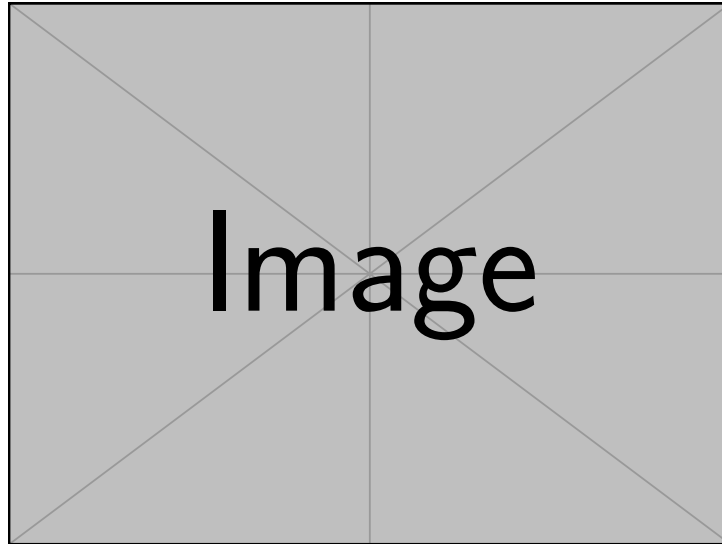
(a)

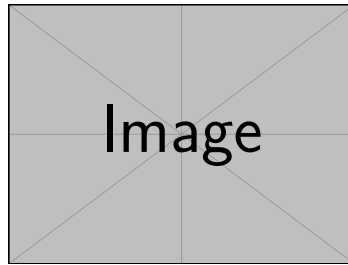(b)   (c)

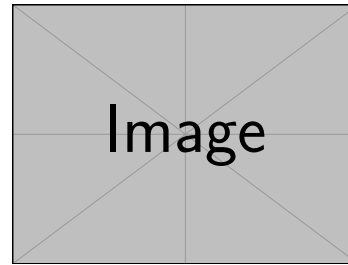Figure A.2: This is an example of a triple image figure.

```
\begin{figure}[H]
 \centering
 \hspace*{\fill}% Adds space to left of top image (prevents two images from going to top)
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage1:a}
 \end{subfigure}
 \hspace*{\fill} % Adds space to right of top image (prevents two images from going to top)
 \par\vspace{1em}% Adds space between upper and lower images
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage1:b}
 \end{subfigure}
 ~ % Adds space between the two lower figures
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage1:c}
 \end{subfigure}
 \caption{This is an example of a triple image figure.}
 \label{fig:tripleImage1}
\end{figure}
```

(a)

(b)

(c)

Figure A.3: This is a second example of a triple image figure.

```latex
\begin{figure}[H]
 \centering
 \hspace*{\fill}% Adds space to left of top image (prevents two images from going to top)
 \begin{subfigure}{0.90\textwidth+1em} % 0.9 = 0.45 + 0.45, and 1em is the width of ~
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage2:a}
 \end{subfigure}
 \hspace*{\fill} % Adds space to right of top image (prevents two images from going to top)
 \par\vspace{1em}% Adds space between upper and lower images
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage2:b}
 \end{subfigure}
 ~ % Adds space between the two lower figures
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:tripleImage2:c}
 \end{subfigure}
 \caption{This is a second example of a triple image figure.}
 \label{fig:tripleImage2}
\end{figure}
```
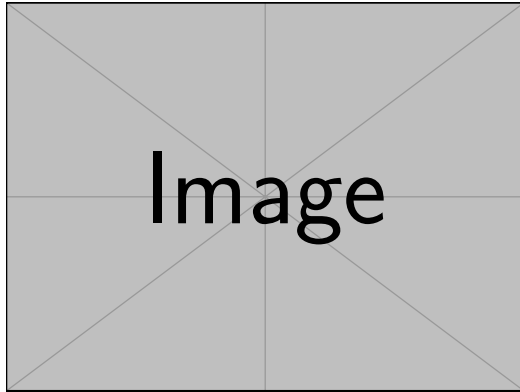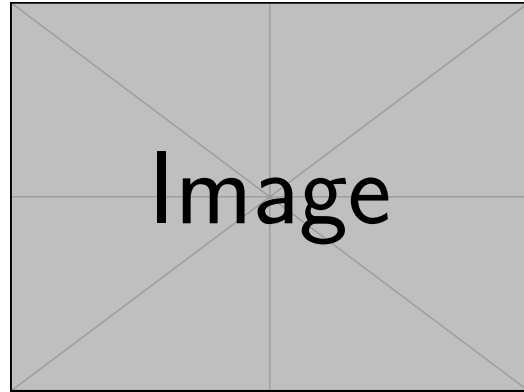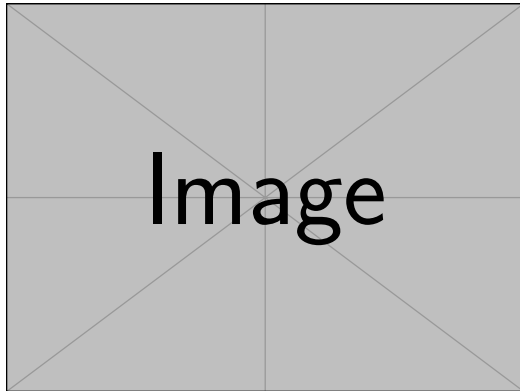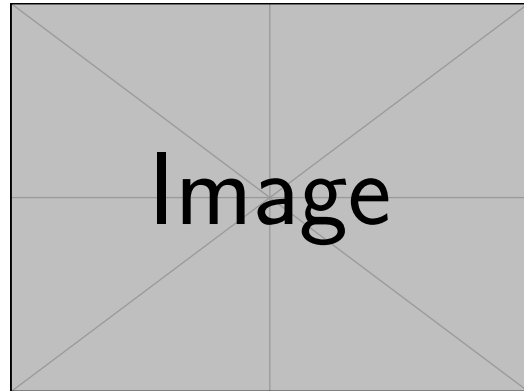
Figure A.4: This is an example of a quad image figure.

```latex
\begin{figure}[H]
 \centering
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:quadImage:a}
 \end{subfigure}
 ~ % Adds space between the two top figures
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:quadImage:b}
 \end{subfigure}
 \par\vspace{1em} % Adds space between upper and lower images
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:quadImage:c}
 \end{subfigure}
 ~ % Adds space between the two lower figures
 \begin{subfigure}{0.45\textwidth}
  \includegraphics[width=\textwidth]{example-image}
  \caption{} % Leave blank for just letter
  \label{fig:quadImage:d}
 \end{subfigure}
 \caption{This is an example of a quad image figure.}
 \label{fig:quadImage}
\end{figure}
```

Appendix B: Additional Example Tables

B.1 Section 1

Nullam eleifend justo in nisl. In hac habitasse platea dictumst. Morbi nonummy. Aliquam ut felis. In velit leo, dictum vitae, posuere id, vulputate nec, ante. Maecenas vitae pede nec dui dignissim suscipit. Morbi magna. Vestibulum id purus eget velit laoreet laoreet. Praesent sed leo vel nibh convallis blandit. Ut rutrum. Donec nibh. Donec interdum. Fusce sed pede sit amet elit rhoncus ultrices. Nullam at enim vitae pede vehicula iaculis.

Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Aenean nonummy turpis id odio. Integer euismod imperdiet turpis. Ut nec leo nec diam imperdiet lacinia. Etiam eget lacus eget mi ultricies posuere. In placerat tristique tortor. Sed porta vestibulum metus. Nulla iaculis sollicitudin pede. Fusce luctus tellus in dolor. Curabitur auctor velit a sem. Morbi sapien. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Donec adipiscing urna vehicula nunc. Sed ornare leo in leo. In rhoncus leo ut dui. Aenean dolor quam, volutpat nec, fringilla id, consectetuer vel, pede.

Nulla malesuada risus ut urna. Aenean pretium velit sit amet metus. Duis iaculis. In hac habitasse platea dictumst. Nullam molestie turpis eget nisl. Duis a massa id pede dapibus ultricies. Sed eu leo. In at mauris sit amet tortor bibendum varius. Phasellus justo risus, posuere in, sagittis ac, varius vel, tortor. Quisque id enim. Phasellus consequat, libero pretium nonummy fringilla, tortor lacus vestibulum nunc,

ut rhoncus ligula neque id justo. Nullam accumsan euismod nunc. Proin vitae ipsum ac metus dictum tempus. Nam ut wisi. Quisque tortor felis, interdum ac, sodales a, semper a, sem. Curabitur in velit sit amet dui tristique sodales. Vivamus mauris pede, lacinia eget, pellentesque quis, scelerisque eu, est. Aliquam risus. Quisque bibendum pede eu dolor.

B.2   Section 2

Fusce suscipit cursus sem. Vivamus risus mi, egestas ac, imperdiet varius, faucibus quis, leo. Aenean tincidunt. Donec suscipit. Cras id justo quis nibh scelerisque dignissim. Aliquam sagittis elementum dolor. Aenean consectetuer justo in pede. Curabitur ullamcorper ligula nec orci. Aliquam purus turpis, aliquam id, ornare vitae, porttitor non, wisi. Maecenas luctus porta lorem. Donec vitae ligula eu ante pretium varius. Proin tortor metus, convallis et, hendrerit non, scelerisque in, urna. Cras quis libero eu ligula bibendum tempor. Vivamus tellus quam, malesuada eu, tempus sed, tempor sed, velit. Donec lacinia auctor libero.

Appendix C: Including Code Listings

C.1 Section 1

Listing C.1: This is a caption for the inserted code

```matlab
function [outputs] = functionName(inputs)
  %{
    This is a Comment Block
    That
    can
    span
    multiple
    lines.
  %}

  % This is a regular comment
  a = 1 + 2 * sin(angle);
  b = 'This is a String';
```

C.2 Section 2

Listing C.2: This is a caption for the inserted code

```cpp
#include <iostream>
using namespace std;
/* This function adds two integer values
 * and returns the result
 */int
sum(int num1, int num2){
    int num3 = num1 + num2; return num3;
}

int main(){
    //Calling the function
    cout << 'The sum is:' << sum(1,99);
    return 0;
}
```

Appendix D: Including PDFs

Note: *The PDFs are inserted at 85% their full size to ensure that they don't over-lap any GPS page formatting required for the headers and footers.*

⚠ WARNING **While it is possible to have horizontal pages have the page numbers centered on the bottom long edge, I *DO NOT* recommended it. This is because, while it looks okay in a digital format, this is not suitable for print-ing... this would print page numbers on the side of the page rather than consistently on the bottom.**

D.1   How to Insert a Portrait PDF

To insert a portrait-oriented PDF into your LaTeX document, you can use the `pdfpages` package, which provides a convenient way to include external PDF files. The following code snippet demonstrates how to include a portrait PDF with the specified options:

```
\includepdf[landscape=false,pages=-,pagecommand={},scale
    =0.85]{./99_Inclusions/PDFs/examplePDF}
```

In this example, `landscape=false` ensures that the PDF is inserted in portrait mode, `pages=-` includes all pages of the PDF, `pagecommand={}` avoids adding any additional LaTeX commands to each page, and `scale=0.85` scales the PDF to 85% of its original size. Adjust these options as needed for your document.

This is an Example PDF that is Portrait

This is the second page

D.2 How to Insert a Landscape PDF

Inserting a landscape-oriented PDF is similarly straightforward using the `pdfpages` package. The code snippet below demonstrates how to include a landscape PDF:

```
\includepdf[landscape=true,pages=-,pagecommand={},scale
   =0.85]{./99_Inclusions/PDFs/landscapePDF}
```

Here, `landscape=true` sets the orientation to landscape, `pages=-` includes all pages from the PDF, `pagecommand={}` prevents any extra LaTeX commands on each page, and `scale=0.85` scales the inserted PDF to 85% of its original size. This configuration ensures that your landscape PDF is correctly oriented and properly sized within your document.

This is an Example PDF that is Landscape

This is the second page