Technical Writing using LaTeX (22ISA383)

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Git link of all programs

https://github.com/manojmv24/AEC-Technical-Writing-using-LaTeX

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Contents

Technical Writing using LaTeX

Course Code	22ISA383		**Credits**	1
Hours/Week (L-T-P-S)	0-0-2-0		**CIE Marks**	50
Total Teaching Hours	26		**SEE Marks**	50
Exam Hours	3		**Course Type**	Practical
Course Component	Lab			

COURSE LEARNING OUTCOMES

Students will be able to:

1. Apply LaTeX syntax and formatting rules to create well-structured documents.
2. Develop complex technical documents in LaTeX, incorporating elements like tables, figures, mathematical equations, and bibliographies.
3. Design and layout of technical documents, emphasizing readability, aesthetics, and professional writing standards.
4. Apply the advance features and packages in LaTeX for creating the scientific documents according to requirements

Pre-Requisite Knowledge:

- Microsoft word
- Notepad

COURSE CONTENTS
PART A - (07 Hrs)

1. Create a LaTeX document with standard sections, including title, abstract, sections, and subsections.
2. Utilize advanced text formatting features in LaTeX, such as custom fonts, colours, and spacing.
3. Design a complex table with multi-row and multi-column spanning, including borders and colour formatting.
4. Write a series of complex mathematical equations using LaTeX, including integrals, matrices, and fractions.
5. Create a document with citations and a bibliography using BibTeX, including multiple citation styles.
6. Integrate images with text wrapping and experiment with different placement options.
7. Generate graphs and plots within LaTeX using the pgfplots package.
8. Create complex flowcharts or diagrams using the TikZ package.

PART B - (07 Hrs)

9. Develop a professional presentation using the Beamer class, including transitions and multimedia.
10. Implement hyperlinks, internal cross-references, and a table of contents in a document.
11. Draft a technical report with structured sections, figures, tables, and a bibliography.
12. Create a document in multiple languages, exploring LaTeX's multilingual support.
13. Create a LaTeX document that generates an interactive PDF form with fillable fields and submit buttons.
14. Format a paper following specific guidelines of a scientific conference, including figures, tables, and references.
15. Create a document focused on advanced mathematical typesetting, featuring complex algebraic structures, algorithm, theorem environments, and custom mathematical operators.

TEXTBOOKS					
SINO	**Unit**	**Textbook Title**	**Author(s)**	**Publisher(s)**	**Edition/Year of Publication**
1	All	The LaTeX Companion, 3rd edition (TTCT series) ISBN-13: 978-0-13-816648-9	Frank Mittelbach with Ulrike Fischer	Addison-Wesley Professional	3rd edition/ 2023
2	All	LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX	Stefan Kottwitz	Packt Publishing Limited	2nd edition/2021
REFERENCE BOOKS					
`1	All	LATEX - A Beginner Guide to Professional Documentation	Swapna Kumar	Laxmi Publications Pvt Ltd	2019

ONLINE RESOURCES

Topic/Title	Link

1. Introduction to LaTeX (part 1)
   - https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)
2. LaTeX for Professional Publications
   - https://www.udemy.com/course/learn-latex/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE):

- 1 MSE for 10 Marks
- Lab Exercises are evaluated using rubrics for 30 Marks.
- 1 Learning Activity (Programming Assignment) evaluated for 10 Marks.

Semester End Examination (SEE): 50 Marks

PEDAGOGY

- Handson Session
- Lab Sessions
- Case Study

CO-PO-PSO MAPPING														
CO	**PO**												**PSO1**	**PSO2**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
1	1	2			3				2	2	2	1		1
2	1	2			3				2	2	2	1		1
3	1	2			3				2	2	2	1		1
4	1	2			3				2	2	2	1		1

Rubrics for Lab Exercises

Criteria	Unsatisfactory (0.5 Marks)	Satisfactory (1 Mark)	Good (1.5 Marks)	Excellent (2 Marks)
LaTeX Document Conduction	Ineffective use of LaTeX features; document lacks basic structure	Basic use of LaTeX with limited features; simple document structure	Effective use of LaTeX with good document structuring	Expert use of LaTeX with creative and complex document structuring
Technical Reporting and Documentation	Technical report is poorly organized, lacking clarity and detail in LaTeX usage	Report is complete but lacks depth in explaining LaTeX functionalities	Well-organized technical report demonstrating clear understanding of LaTeX	Exceptional technical report with comprehensive LaTeX usage details
LaTeX Code Modification and Complexity	Minimal or incorrect LaTeX code modifications; lacks complexity	Some LaTeX code modifications, but lacks sophistication and depth	Good LaTeX code modification showing understanding of advanced features	Advanced LaTeX code modification demonstrating innovative solutions
Viva Voce on LaTeX Concepts	Unable to explain basic LaTeX concepts or document structure	Can explain basic concepts but struggles with complex LaTeX functionalities	Confident in explaining LaTeX concepts and their application in the document	Excellent in explaining complex LaTeX concepts and their practical applications

Rubrics for Learning Activity – Programming Assignment

Criteria	Beginning (1-2 Points)	Developing (3-4 Points)	Proficient (5-6 Points)	Exemplary (7 Points)
Understanding of LaTeX Syntax	Basic grasp of LaTeX syntax, with frequent errors	Good understanding of LaTeX syntax with occasional errors	Strong understanding of LaTeX syntax with few errors	Expert level of LaTeX syntax, error-free
Advanced Formatting	Limited formatting, minimal use of advanced features	Moderate use of formatting features, with room for improvement	Effective use of advanced formatting features	Mastery in advanced formatting and LaTeX features
Integration of Figures and Tables	Basic integration of figures and tables, with formatting issues	Proper integration of figures and tables, minor issues in formatting	Seamless integration of figures and tables with excellent formatting	Expert integration of figures and tables with perfect formatting
Mathematical Notation	Simple mathematical notations, prone to errors	Correct use of common mathematical notations	Accurate and complex mathematical notation	Mastery in complex mathematical notation and typesetting
Use of Bibliography and Citations	Basic or incorrect use of bibliography and citations	Adequate use of bibliography and citations	Proficient in using bibliography and accurate citations	Expert use of bibliography, citations, and referencing styles

Steps to Setup TeXStudio on Windows

1. **Install TeX Distribution:**

   - Download MiKTeX from the official website `https://miktex.org/download`.
   - Follow the installation instructions.

2. **Install TeXStudio:**

   - Download TeXStudio from the official website `https://www.texstudio.org/`.
   - Install it on your Windows system.

3. **Configure TeXStudio:**

   - Open TeXStudio after installation.
   - Go to `Options` → `Configure TeXStudio`.
   - In the `Commands` tab, ensure the paths to your TeX distribution are correctly set. TeXStudio should automatically detect your distribution if installed properly.

4. **Create a New LaTeX Document:**

   - Click on `File` → `New` → `New File` to create a new document.
   - Save the document with a `.tex` extension, for example, `mydocument.tex`.

5. **Write LaTeX Code:**

   - Start writing your LaTeX code in the TeXStudio editor. Utilize features like syntax highlighting and auto-completion.

6. **Compile the Document:**

   - To produce the output in LaTeX, compile the document.
   - Click the green arrow icon in the toolbar or press `F5`.
   - TeXStudio will run the LaTeX compiler and generate a PDF output.

7. **View the Output:**

   - After a successful compilation, TeXStudio will display the PDF output in its integrated viewer.

   - Alternatively, you can use an external PDF viewer if preferred.

8. **Edit and Re-Compile:**

   - Continue editing your LaTeX code as needed.

   - To update the PDF output, re-compile the document by clicking the green arrow or pressing `F5` again.

9. **Export and Share:**

   - Once satisfied with your LaTeX document, export it as a PDF.

   - Go to `File` → `Save As` and select PDF as the file type.

Part A

Program 1

Create a LaTeX document with standard sections, including title, abstract, sections, and subsections

1. **Document Class:** `\documentclass[11pt,a4paper]{article}`
   Sets up the document as an article with 11pt font size and A4 paper. The `article` class is suitable for scientific papers, reports, and documentation.

2. **Packages:**

   - `inputenc` with `utf8` option: For UTF-8 encoding, allowing a wide range of characters.
   - `fontenc` with `T1`: Enhances font encoding.
   - `amsmath`, `amsfonts`, `amssymb`: Provide extended mathematical formatting and symbols.
   - `graphicx`: For including graphics in the document.
   - `hyperref`: To create hyperlinks in the document.

3. **Title and Author Information:** Defined using `\title`, `\author`, and `\date` commands.

4. **Abstract Section:** Used for summarizing the main content of the document.

5. **Sectioning Commands:** `\section` and `\subsection` to structure the document.

6. **Bibliography:** Manual bibliography setup using `thebibliography` environment and `\bibitem` for each reference.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{amsmath,amsfonts,amssymb}
\usepackage{graphicx}
\usepackage{hyperref}

\title{Your Paper Title Here}
\author{
    Author Name\\
    Department Name\\
    University/Institution Name\\
    Email Address
}
\date{\today} % Date, can be changed to a specific date

\begin{document}

\maketitle

\begin{abstract}
This is the abstract of your document. Here you briefly summarize the main points, findings, and
    conclusions of your paper. It should be concise and informative, providing an overview of
    the content that follows.
\end{abstract}

\section{Introduction}
Introduce the topic of your paper here. Explain the background, the problem you are addressing,
    and the main objectives of your paper.

\subsection{Subsection Title}
Detail specific aspects of the topic here. Subsections help organize the content into manageable
    parts.

\section{Literature Review}
Discuss relevant previous work by other authors in this section. A literature review typically
    surveys, summarizes, and analyzes published work on a topic.

\subsection{Subsection Title}
Break down different themes or aspects of the literature you are discussing.
```

```latex
\section{Methodology}
Describe the methods used in your research or analysis. This could include experimental methods,
    analytical models, or other approaches.

\subsection{Subsection Title}
Discuss specific parts of your methodology, such as data collection, experimental setup, etc.

\section{Results}
Present the findings of your research or analysis. Include data, observations, and any other
    relevant information.

\subsection{Subsection Title}
You might want to break down your results into different themes or categories.

\section{Discussion}
Interpret and discuss the significance of your results. Compare them with previous work, and
    discuss their implications.

\subsection{Subsection Title}
Discuss specific aspects of your results and their broader implications.

\section{Conclusion}
Summarize the main findings of your paper, their importance, and potential future work.

\section*{Acknowledgments}
Acknowledge anyone who helped you with your research, including funders, advisors, or others.

\begin{thebibliography}{9}
\bibitem{ref1}
Author Name, \textit{Paper Title}, Journal/Conference, Year.

% More bibliography items here
\end{thebibliography}

\end{document}
```

Your Paper Title Here

Author Name
Department Name
University/Institution Name
Email Address

January 3, 2024

Abstract

This is the abstract of your document. Here you briefly summarize the main points, findings, and conclusions of your paper. It should be concise and informative, providing an overview of the content that follows.

1 Introduction

Introduce the topic of your paper here. Explain the background, the problem you are addressing, and the main objectives of your paper.

1.1 Subsection Title

Detail specific aspects of the topic here. Subsections help organize the content into manageable parts.

2 Literature Review

Discuss relevant previous work by other authors in this section. A literature review typically surveys, summarizes, and analyzes published work on a topic.

2.1 Subsection Title

Break down different themes or aspects of the literature you are discussing.

3 Methodology

Describe the methods used in your research or analysis. This could include experimental methods, analytical models, or other approaches.

3.1 Subsection Title

Discuss specific parts of your methodology, such as data collection, experimental setup, etc.

4 Results

Present the findings of your research or analysis. Include data, observations, and any other relevant information.

4.1 Subsection Title

You might want to break down your results into different themes or categories.

5 Discussion

Interpret and discuss the significance of your results. Compare them with previous work, and discuss their implications.

5.1 Subsection Title

Discuss specific aspects of your results and their broader implications.

6 Conclusion

Summarize the main findings of your paper, their importance, and potential future work.

Acknowledgments

Acknowledge anyone who helped you with your research, including funders, advisors, or others.

References

[1] Author Name, *Paper Title*, Journal/Conference, Year.

Program 2

Utilize advanced text formatting features in LaTeX, such as custom fonts, colours, and spacing

Github link

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `lmodern`: Uses a modern font.
   - `graphicx`: Enables inclusion of images.
   - `xcolor`: Allows text color customization.
   - `hyperref`: Adds hyperlinks to the document.

3. `\usepackage{setspace}`: Provides custom line spacing options.

4. `\setstretch{1.15}`: Sets the line spacing to 1.15 (custom spacing).

5. `\usepackage[left=2cm, right=2cm, top=2cm, bottom=2cm]{geometry}`: Adjusts document margins.

6. `\title`, `\author`, `\date`: Define the title, author, and date of the document.

7. `\maketitle`: Generates the title page based on the provided title, author, and date information.

8. `\begin{abstract}...\end{abstract}`: Creates an abstract section where you summarize the main points of the paper.

9. `\section`, `\subsection`: Define sections and subsections in the document.

10. `\textbf`, `\textit`, `\textcolor`: Apply formatting to text, such as making text bold, italic, or changing its color.

11. `\href{mailto:email@example.com}{email@example.com}`: Creates a clickable hyperlink for an email address.

12. `\begin{thebibliography}...\end{thebibliography}`: Sets up the bibliography section for citing references.

13. `\bibitem{ref1}...`: Defines a reference entry with a label for citation.

```latex
\documentclass[11pt,a4paper]{article}

% This template incorporates:
% Font Styles: Usage of bold (\textbf) and italic (\textit) text styles.
% Colors: Application of different text colors using \textcolor.
% Hyperlinks: Email address formatted as a clickable hyperlink.
% Spacing: Custom line spacing with the setspace package.
% Margins: Adjusted document margins using the geometry package.

% Basic packages
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{lmodern} % Better font
\usepackage{graphicx}
\usepackage{xcolor} % For color
\usepackage{hyperref}

% For custom spacing
\usepackage{setspace}
\setstretch{1.15} % Line spacing

% Customizing margins
\usepackage[left=2cm, right=2cm, top=2cm, bottom=2cm]{geometry}

% Title and Author Information
\title{\textbf{\Large Your Paper Title Here}}
\author{
```

```latex
  \textbf{Author Name} \\
  \textit{Department Name} \\
  \textit{University/Institution Name} \\
  \textcolor{blue}{\href{mailto:email@example.com}{email@example.com}} % Email with hyperlink
}
\date{\textbf{\today}} % Date

\begin{document}

  \maketitle

  \begin{abstract}
    \noindent % No indentation for abstract
    \textcolor{gray}{
      This is the abstract of your document. Here you briefly summarize the main points,
          findings, and conclusions of your paper. It should be concise and informative,
          providing an overview of the content that follows.
    }
  \end{abstract}

  \section*{Introduction}
  Introduce the topic of your paper here in \textbf{bold text}. Explain the background, the
      problem you are addressing, and the main objectives of your paper in \textit{italic text}.

  \subsection*{Subsection Title}
  Detail specific aspects of the topic here. You can change the \textcolor{red}{color} of the
      text for emphasis.

  \section*{Literature Review}
  Discuss relevant previous work by other authors in this section. A literature review typically
      surveys, summarizes, and analyzes published work on a topic.

  \subsection*{Subsection Title}
  Break down different themes or aspects of the literature you are discussing.

  \section*{Methodology}
  Describe the methods used in your research or analysis. This could include experimental
      methods, analytical models, or other approaches.

  \subsection*{Subsection Title}
  Discuss specific parts of your methodology, such as data collection, experimental setup, etc.
```

```latex
\section*{Results}
Present the findings of your research or analysis. Include data, observations, and any other
    relevant information.

\subsection*{Subsection Title}
You might want to break down your results into different themes or categories.

\section*{Discussion}
Interpret and discuss the significance of your results. Compare them with previous work, and
    discuss their implications.

\subsection*{Subsection Title}
Discuss specific aspects of your results and their broader implications.

\section*{Conclusion}
Summarize the main findings of your paper, their importance, and potential future work.

\section*{Acknowledgments}
Acknowledge anyone who helped you with your research, including funders, advisors, or others.

\begin{thebibliography}{9}
  \bibitem{ref1}
  \textbf{Author Name}, \textit{Paper Title}, Journal/Conference, Year.
\end{thebibliography}

\end{document}
```

Your Paper Title Here

Author Name
Department Name
University/Institution Name
email@example.com

January 3, 2024

Abstract

This is the abstract of your document. Here you briefly summarize the main points, findings, and conclusions of your paper. It should be concise and informative, providing an overview of the content that follows.

Introduction

Introduce the topic of your paper here in **bold text**. Explain the background, the problem you are addressing, and the main objectives of your paper in *italic text.*

Subsection Title

Detail specific aspects of the topic here. You can change the color of the text for emphasis.

Literature Review

Discuss relevant previous work by other authors in this section. A literature review typically surveys, summarizes, and analyzes published work on a topic.

Subsection Title

Break down different themes or aspects of the literature you are discussing.

Methodology

Describe the methods used in your research or analysis. This could include experimental methods, analytical models, or other approaches.

Subsection Title

Discuss specific parts of your methodology, such as data collection, experimental setup, etc.

Results

Present the findings of your research or analysis. Include data, observations, and any other relevant information.

Subsection Title

You might want to break down your results into different themes or categories.

Discussion

Interpret and discuss the significance of your results. Compare them with previous work, and discuss their implications.

Subsection Title

Discuss specific aspects of your results and their broader implications.

Conclusion

Summarize the main findings of your paper, their importance, and potential future work.

Acknowledgments

Acknowledge anyone who helped you with your research, including funders, advisors, or others.

References

[1] **Author Name**, *Paper Title*, Journal/Conference, Year.

Program 3

Design a complex table with multi-row and multi-column spanning, including borders and colour formatting.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `table,xcolor`: Allows for color in tables and table formatting.
   - `multirow`: Enables the use of multirow cells in tables.
   - `array`: For advanced table formatting.

3. `\definecolor{lightgray}{gray}{0.9}`: Defines a custom color 'lightgray' with a gray shade of 0.9 for use in the table.

4. `\title, \author, \date`: Define the title, author, and date of the document.

5. `\maketitle`: Generates the title page based on the provided title, author, and date information.

6. `\section`: Begins a new section in the document.

7. `table[h]`: Starts a table environment with optional positioning '[h]' (here) to place the table where it is in the code.

8. `\centering`: Centers the table horizontally.

9. `\caption`: Sets the table caption.

10. `\label`: Labels the table for referencing.

11. `tabular`: Begins the tabular environment to create the actual table.

12. `\hline`: Inserts a horizontal line at the top of the table.

13. `\rowcolor{lightgray}`: Sets the background color for the first row.

14. `\multicolumn`: Creates a header row with multicolumn spanning.

15. `\textbf`: Makes text in the table bold.

16. `\multirow`: Allows multi-row cells with specified spanning.

17. `\multicolumn`: Creates a multicolumn cell in the table.

18. `\cellcolor{lightgray}`: Sets the background color for a cell.

19. The table structure is defined with rows, columns, and cell entries, including multi-row and multi-column spanning, cell coloring, and border formatting.

```latex
% Document class and basic settings
\documentclass[11pt,a4paper]{article}

% Packages for encoding, fonts, and colors in tables
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage[table,xcolor]{xcolor} % Allows for color in tables
\usepackage{multirow} % Enables the use of multirow cells in tables
\usepackage{array}  % For advanced table formatting

% Define custom colors to use in the table
\definecolor{lightgray}{gray}{0.9}

% Title settings
\title{Document with a Complex Table}
\author{Your Name}
\date{\today} % Automatically insert the current date

\begin{document}
```

```latex
  % Create the title
  \maketitle

  % Begin a section
  \section{Complex Table Example}

  % Descriptive text
  Below is an example of a complex table with multi-row and multi-column spanning, including
      borders and color formatting.

  % Begin the table environment
  \begin{table}[h]
    \centering % Centers the table
    \caption{Multi-row and Multi-column Table Example} % Table caption
    \label{tab:example} % Label for referencing the table

    % Begin the tabular environment to create the actual table
    \begin{tabular}{|c|c|c|c|}
      \hline % Horizontal line at the top of the table
      \rowcolor{lightgray} % Set the background color for the first row
      % Create a header row with multicolumn spanning
      \multicolumn{2}{|c|}{\textbf{Group Header 1}} & \multicolumn{2}{c|}{\textbf{Group Header
          2}} \\ \hline
      \textbf{Column 1} & \textbf{Column 2} & \textbf{Column 3} & \textbf{Column 4} \\ \hline
      % Multirow cell spanning two rows
      \multirow{2}{*}{Row 1-2} & Cell 1 & Cell 2 & Cell 3 \\ \cline{2-4}
      & Cell 4 & Cell 5 & Cell 6 \\ \hline
      % Row with a multicolumn cell
      Cell 7                 & Cell 8 & \multicolumn{2}{c|}{\cellcolor{lightgray}Multi-column} \\
          \hline
    \end{tabular}
  \end{table}

\end{document}
```

Document with a Complex Table

Your Name

January 3, 2024

1 Complex Table Example

Below is an example of a complex table with multi-row and multi-column spanning, including borders and color formatting.

Table 1: Multi-row and Multi-column Table Example

Group Header 1		Group Header 2	
Column 1	Column 2	Column 3	Column 4
Row 1-2	Cell 1	Cell 2	Cell 3
	Cell 4	Cell 5	Cell 6
Cell 7	Cell 8	Multi-column	

Program 4

Write a series of complex mathematical equations using LaTeX, including integrals, matrices, and fractions.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.

   - `fontenc`: Selects font encoding.

   - `amsmath`: Essential for math environments and more complex formulas.

3. `\title, \author, \date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `equation`: Begins a mathematical equation environment.

7. `\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}`: Represents a complex integral equation.

8. `pmatrix`: Creates a matrix environment.

9. `\mathbf{A}`: Makes a matrix bold.

10. `\sum_{i=1}^n i = \frac{n(n+1)}{2}, \prod_{i=1}^n i = n!`: Demonstrates summation and product equations.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{amsmath} % Essential for math environments and more complex formulas

\title{Document with Complex Mathematical Equations}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Complex Mathematical Equations}
This document demonstrates a series of complex mathematical equations, including integrals,
    matrices, and fractions.

\subsection{Integral Example}
An example of a complex integral:
\begin{equation}
    \int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}
\end{equation}

\subsection{Matrix Example}
An example of a matrix:
\begin{equation}
    \mathbf{A} =
    \begin{pmatrix}
        a & b \\
        c & d
    \end{pmatrix}
\end{equation}

\subsection{Fraction and Square Root Example}
An example of fractions and square roots:
\begin{equation}
    x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{equation}
```

```
\subsection{Summation and Product Example}
An example of a summation and a product:
\begin{equation}
    \sum_{i=1}^{n} i = \frac{n(n+1)}{2}, \quad \prod_{i=1}^{n} i = n!
\end{equation}

\end{document}
```

Document with Complex Mathematical Equations

Your Name

January 3, 2024

1 Complex Mathematical Equations

This document demonstrates a series of complex mathematical equations, including integrals, matrices, and fractions.

1.1 Integral Example

An example of a complex integral:

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi} \tag{1}$$

1.2 Matrix Example

An example of a matrix:

$$\mathbf{A} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \tag{2}$$

1.3 Fraction and Square Root Example

An example of fractions and square roots:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{3}$$

1.4 Summation and Product Example

An example of a summation and a product:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}, \quad \prod_{i=1}^{n} i = n! \tag{4}$$

Program 5

Create a document with citations and a bibliography using BibTeX, including multiple citation styles.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `natbib`: Used for citation formatting and management.
   - `hyperref`: Enables hyperlinks, including those in references.

3. `\title`, `\author`, `\date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `cite`: Allows citations within the text.

7. `\bibliographystyle{plainnat}`: Sets the bibliography style to 'plainnat,' which is commonly used for author-year citations.

8. `\bibliography{references}`: Specifies the name of the bibliography file (usually a .bib file) containing the citation entries.

```latex
\documentclass[11pt,a4paper]{article}

    \usepackage[utf8]{inputenc}
    \usepackage[T1]{fontenc}
    \usepackage{natbib} % For citation
    \usepackage{hyperref} % For hyperlinks in references

    \title{Sample Document with Citations}
    \author{Your Name}
    \date{\today}

    \begin{document}

    \maketitle

    \section{Introduction}
    This is an example of a document with citations. For instance, we can cite a book
        \cite{Author1990} or an article \cite{Smith2019}.

    \section{Another Section}
    More text here, with another reference \cite{Johnson2021}.

    \bibliographystyle{plainnat} % This line sets the bibliography style
    \bibliography{references} % This line links to your .bib file

\end{document}
```

1. @book{Author1990,: This is a BibTeX entry for a book citation. It includes the following fields:

   - author: The author(s) of the book, in this case, "Author, A."
   - title: The title of the book, which is "Title of the Book."
   - publisher: The name of the publisher, which is "Publisher."
   - year: The publication year, which is "1990."
   - address: The address of the publisher, which is "City."

2. @article{Smith2019,: This is a BibTeX entry for an article citation. It includes the following fields:

   - author: The author(s) of the article, in this case, "Smith, B."
   - title: The title of the article, which is "Title of the Article."
   - journal: The name of the journal where the article was published, which is "Journal Name."

- **year**: The publication year of the article, which is "2019."
- **volume**: The volume number of the journal, which is "10."
- **pages**: The page range of the article, which is "100-110."

3. **@misc{Johnson2021,**: This is a BibTeX entry for a miscellaneous or online source citation. It includes the following fields:

   - **author**: The author(s) of the online source, in this case, "Johnson, C."
   - **title**: The title of the online source, which is "Title of the Online Source."
   - **year**: The year the online source was accessed or published, which is "2021."
   - **howpublished**: The method of publication, in this case, a URL provided using \url{}.

```
@book{Author1990,
  author   = {Author, A.},
  title    = {Title of the Book},
  publisher = {Publisher},
  year     = {1990},
  address  = {City},
}

@article{Smith2019,
  author = {Smith, B.},
  title  = {Title of the Article},
  journal = {Journal Name},
  year    = {2019},
  volume = {10},
  pages  = {100-110},
}

@misc{Johnson2021,
  author = {Johnson, C.},
  title = {Title of the Online Source},
  year  = {2021},
  howpublished = {\url{https://example.com}},
}
```

Sample Document with Citations

Your Name

January 3, 2024

1 Introduction

This is an example of a document with citations. For instance, we can cite a book Author [1990] or an article Smith [2019].

2 Another Section

More text here, with another reference Johnson [2021].

References

A. Author. *Title of the Book*. Publisher, City, 1990.

C. Johnson. Title of the online source. `https://example.com`, 2021.

B. Smith. Title of the article. *Journal Name*, 10:100–110, 2019.

Program 6

Integrate images with text wrapping and experiment with different placement options.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `graphicx`: Essential for including images.
   - `wrapfig`: For wrapping text around images.
   - `lipsum`: Generates dummy text for demonstration.

3. `\title, \author, \date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `wrapfigure`: Environment for wrapping text around an image. It takes parameters for positioning (left or right) and width.

7. `\includegraphics`: Inserts an image into the document, specifying the width and file path.

8. `\caption`: Adds a caption to the image.

9. `\lipsum[1]`: Generates and inserts dummy text (Lorem Ipsum) for demonstration purposes.

10. `\clearpage`: Clears floating objects (e.g., images) to ensure proper formatting for a new section.

```latex
    \documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx} % Essential for including images
\usepackage{wrapfig} % For wrapping text around images
\usepackage{lipsum}  % Generates dummy text

\title{Document with Images and Text Wrapping}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Introduction}
\lipsum[1] % Dummy text

% Wrapping text around an image; placement on the right side
\begin{wrapfigure}{r}{0.5\textwidth}
  \centering
  \includegraphics[width=0.48\textwidth]{example-image}
  \caption{Image on the right}
\end{wrapfigure}
\lipsum[2-3] % More dummy text

% Clear the floating objects to ensure a proper new section
\clearpage

\section{Another Section}
\lipsum[4] % Dummy text

% Wrapping text around an image; placement on the left side
\begin{wrapfigure}{l}{0.5\textwidth}
  \centering
  \includegraphics[width=0.48\textwidth]{example-image}
  \caption{Image on the left}
\end{wrapfigure}
\lipsum[5-6] % More dummy text
```

```
\end{document}
```

Document with Images and Text Wrapping

Your Name

January 3, 2024

1 Introduction

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

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.

Figure 1: Image on the right

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,

1. `\documentclass[11pt,a4paper]`article: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `graphicx`: Essential for including images.
   - `float`: Provides the `H` placement specifier for precise image positioning.

3. `\title, \author, \date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `figure`: Environment for inserting figures (images) with optional placement specifiers.

7. `\includegraphics`: Inserts an image into the document, specifying the width and file path.

8. `\caption`: Adds a caption to the image.

9. `\label`: Labels the figure for referencing.

```
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\usepackage{float} % Provides the H placement specifier

\title{Document with Basic Image Handling}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Basic Image Insertion}
Here is an example of an image with custom size and positioning.

% Inserting an image with specific width and centered
```

```latex
\begin{figure}[H]
  \centering
  \includegraphics[width=0.5\textwidth]{example-image}
  \caption{Centered Image with Custom Width}
  \label{fig:centeredimage}
\end{figure}

\end{document}
```

Document with Basic Image Handling

Your Name

January 3, 2024

1 Basic Image Insertion

Here is an example of an image with custom size and positioning.
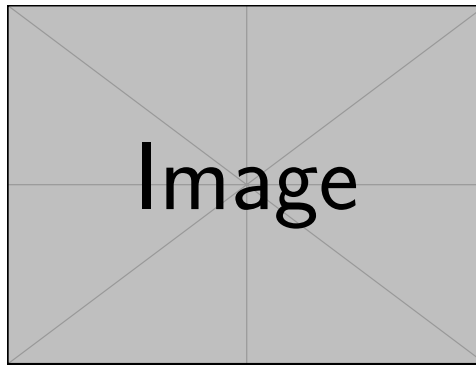
Figure 1: Centered Image with Custom Width

1. \documentclass[11pt,a4paper]article: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. \usepackage: Loads various packages to extend LaTeX functionality.

   - inputenc: Sets the input encoding to UTF-8.
   - fontenc: Selects font encoding.
   - graphicx: Essential for including images.
   - subcaption: For creating subfigures with their own captions.

3. \title, \author, \date: Define the title, author, and date of the document.

4. \maketitle: Generates the title page based on the provided title, author, and date information.

5. \section: Begins a new section in the document.

6. figure: Environment for inserting figures (images) with optional placement specifiers.

7. subfigure: Environment for creating subfigures within a figure.

8. \includegraphics: Inserts an image into the document, specifying the width and file path.

9. \caption: Adds a caption to each subfigure.

10. \label: Labels each subfigure for referencing.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\usepackage{subcaption} % For creating subfigures

\title{Document with Subfigures}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Subfigures Example}
This section demonstrates the use of subfigures, each with its own caption.
```

```latex
% Inserting subfigures
\begin{figure}[h]
  \centering
  \begin{subfigure}[b]{0.4\textwidth}
    \includegraphics[width=\textwidth]{example-image-a}
    \caption{First Subfigure}
    \label{fig:sub1}
  \end{subfigure}
  \hfill % Adds horizontal space between figures
  \begin{subfigure}[b]{0.4\textwidth}
    \includegraphics[width=\textwidth]{example-image-b}
    \caption{Second Subfigure}
    \label{fig:sub2}
  \end{subfigure}
  \caption{Two Subfigures}
  \label{fig:subfigures}
\end{figure}

\end{document}
```

Document with Subfigures

Your Name

January 3, 2024

1 Subfigures Example

This section demonstrates the use of subfigures, each with its own caption.
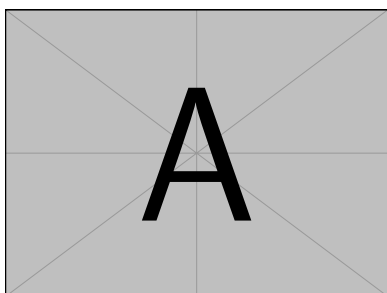
(a) First Subfigure
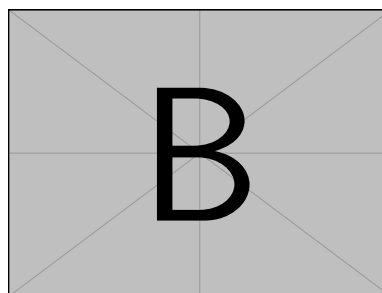
(b) Second Subfigure
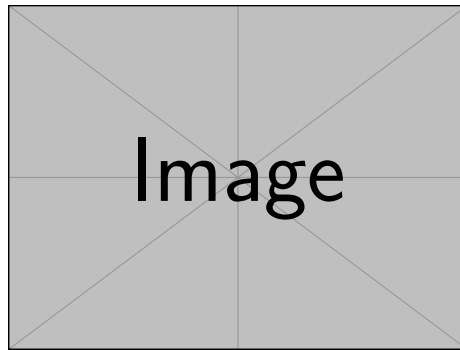
Figure 1: Two Subfigures

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `graphicx`: Essential for including images.
   - `float`: Provides the `H` placement specifier for precise image positioning.

3. `\title, \author, \date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `figure`: Environment for inserting figures (images) with optional placement specifiers.

7. `\includegraphics`: Inserts an image into the document, specifying the scaling factor (`scale`) and rotation angle (`angle`).

8. `\caption`: Adds a caption to the image.

9. `\label`: Labels the image for referencing.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\usepackage{float}

\title{Document with Custom Image Scaling and Rotation}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Image Scaling and Rotation}
An example of an image that is scaled and rotated.
```

```latex
% Inserting a scaled and rotated image
\begin{figure}[H]
  \centering
  \includegraphics[scale=0.5,angle=45]{example-image}
  \caption{Scaled and Rotated Image}
  \label{fig:rotatedimage}
\end{figure}

\end{document}
```

Document with Custom Image Scaling and Rotation

Your Name

January 3, 2024

1 Image Scaling and Rotation

An example of an image that is scaled and rotated.
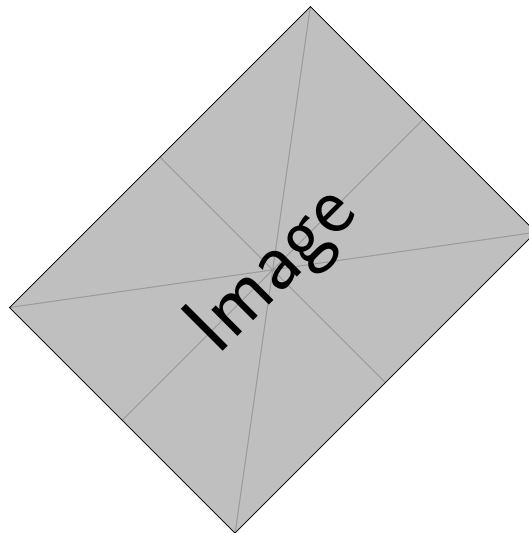
Figure 1: Scaled and Rotated Image

Program 7

Generate graphs and plots within LaTeX using the pgfplots package.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `pgfplots`: Required for creating plots.

3. `\pgfplotsset{compat=1.17}`: Sets the compatibility level of pgfplots to version 1.17.

4. `\title, \author, \date`: Define the title, author, and date of the document.

5. `\maketitle`: Generates the title page based on the provided title, author, and date information.

6. `\section`: Begins a new section in the document.

7. `figure`: Environment for inserting figures (plots) with optional placement specifiers.

8. `tikzpicture`: Environment for creating TikZ-based plots.

9. `axis`: Defines the axis environment for plotting data.

10. `\addplot`: Adds data series to the plot with specific plot coordinates and styles.

11. `\legend`: Adds a legend to the plot to label different series.

12. \xlabel, \ylabel: Labels for the X and Y axes.

13. \xmin, \xmax, \ymin, \ymax: Define the minimum and maximum values for the axes.

14. scatter: Specifies a scatter plot.

15. only marks: Plot only data points, no lines.

16. point meta=explicit symbolic: Allows for custom labels for each data point.

17. scatter/classes: Defines different styles (e.g., markers and colors) for different classes of data points.

18. table: Specifies data points with labels for scatter plot.

19. \legend: Adds a legend to the scatter plot.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{pgfplots} % Required for creating plots
\pgfplotsset{compat=1.17} % Set the compatibility level of pgfplots

\title{Document with pgfplots Examples}
\author{Your Name}
\date{\today}

\begin{document}

  \maketitle

  \section{Bar Plot Example}
  Next, we present a bar plot.

  % Bar plot
  \begin{figure}[h]
    \centering
    \begin{tikzpicture}
      \begin{axis}[
        title={Sample Bar Plot},
        ybar,
        enlargelimits=0.15,
        legend style={at={(0.5,-0.15)},
          anchor=north,legend columns=-1},
```

```
      ylabel={Value},
      symbolic x coords={A, B, C, D, E},
      xtick=data,
      nodes near coords,
      nodes near coords align={vertical},
      ]
      \addplot coordinates {(A,10) (B,15) (C,5) (D,24) (E,30)};
      \addplot coordinates {(A,20) (B,10) (C,15) (D,23) (E,35)};
      \legend{Series 1, Series 2}
    \end{axis}
  \end{tikzpicture}
  \caption{A simple bar plot}
  \end{figure}

\section{Scatter Plot Example}
A scatter plot representing some data points is shown below.

% Scatter plot
\begin{figure}[h]
  \centering
  \begin{tikzpicture}
    \begin{axis}[
      title={Sample Scatter Plot},
      xlabel={X Axis},
      ylabel={Y Axis},
      xmin=0, xmax=50,
      ymin=0, ymax=50,
      legend pos=north west,
      ymajorgrids=true,
      grid style=dashed,
      ]

      % Adding a scatter plot
      \addplot[
      scatter, % Enables scatter plot
      only marks, % Only points, no lines
      point meta=explicit symbolic, % Allows for custom labels
      scatter/classes={
        a={mark=square*,blue}, % Style for class 'a'
        b={mark=triangle*,red}, % Style for class 'b'
        c={mark=o,draw=black,fill=black} % Style for class 'c'
      },
```

```
    ]
    table[meta=label]{
      x   y   label
      5   40  a
      10  30  a
      15  20  a
      20  10  b
      25  30  b
      30  40  b
      35  20  c
      40  10  c
      45  30  c
    };
    \legend{Class A, Class B, Class C}

  \end{axis}
 \end{tikzpicture}
 \caption{A simple scatter plot with different point styles}
\end{figure}
\end{document}
```

Document with pgfplots Examples

Your Name

January 3, 2024

1 Bar Plot Example

Next, we present a bar plot.
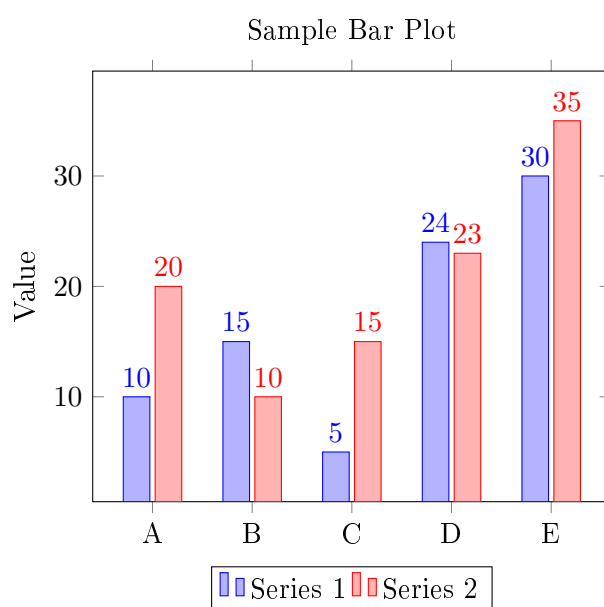
Figure 1: A simple bar plot

2 Scatter Plot Example

A scatter plot representing some data points is shown below.

Sample Scatter Plot
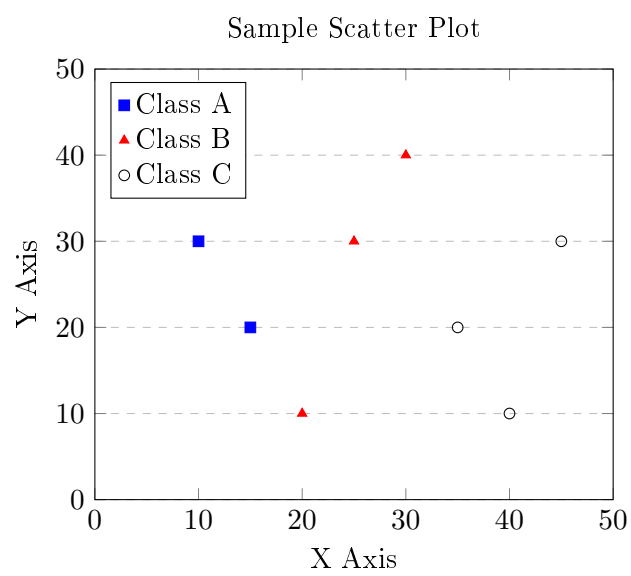
Figure 2: A simple scatter plot with different point styles

Program 8

Create complex flowcharts or diagrams using the TikZ package.

1. `\documentclass[11pt,a4paper]article`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage`: Loads various packages to extend LaTeX functionality.

   - `inputenc`: Sets the input encoding to UTF-8.
   - `fontenc`: Selects font encoding.
   - `tikz`: Required for creating TikZ diagrams.

3. `\title`, `\author`, `\date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\section`: Begins a new section in the document.

6. `tikzstyle`: Defines custom styles for flowchart elements, such as start/stop, process, decision, and arrows.

7. `figure`: Environment for inserting figures (TikZ diagrams) with optional placement specifiers.

8. `tikzpicture`: Environment for creating TikZ-based diagrams.

9. `\node`: Defines nodes in the flowchart with specific styles and names.

10. `[below of=...]`, `[left of=...]`, `[right of=...]`: Positions nodes relative to other nodes in the diagram.

11. `\draw`: Draws arrows between nodes to represent the flow of the process.

12. `[arrow]`: Defines custom arrow styles for the arrows between nodes.

13. `\caption`: Adds a caption to the flowchart.

```latex
% Document class setup
\documentclass[11pt,a4paper]{article}

% Packages for encoding and font
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}

% TikZ package for drawing diagrams
\usepackage{tikz}
% TikZ libraries for geometric shapes and arrow styles
\usetikzlibrary{shapes.geometric, arrows}

% Document metadata
\title{Document with a TikZ Flowchart}
\author{Your Name}
\date{\today}

% Beginning of the document
\begin{document}

  % Create the title
  \maketitle

  % Section for the flowchart
  \section{Flowchart Example}

  % Descriptive text
  Below is an example of a basic flowchart created using TikZ:

  % Define styles for flowchart elements
  \tikzstyle{startstop} = [rectangle, rounded corners, minimum width=3cm, minimum height=1cm,
      text centered, draw=black, fill=red!30]
  \tikzstyle{process} = [rectangle, minimum width=3cm, minimum height=1cm, text centered,
      draw=black, fill=orange!30]
  \tikzstyle{decision} = [diamond, minimum width=3cm, minimum height=1cm, text centered,
      draw=black, fill=green!30]
  \tikzstyle{arrow} = [thick,->,>=stealth]
```

```latex
% Begin figure environment for the flowchart
\begin{figure}[h]
  \centering % Center the figure in the text

  % Begin the TikZ picture environment
  \begin{tikzpicture}[node distance=2cm]

    % Nodes of the flowchart
    \node (start) [startstop] {Start};
    \node (pro1) [process, below of=start] {Process 1};
    \node (dec1) [decision, below of=pro1] {Decision 1};
    \node (pro2a) [process, below of=dec1, left of=dec1] {Process 2A};
    \node (pro2b) [process, below of=dec1, right of=dec1] {Process 2B};
    \node (stop) [startstop, below of=dec1, yshift=-2cm] {Stop};

    % Arrows between nodes
    \draw [arrow] (start) -- (pro1);
    \draw [arrow] (pro1) -- (dec1);
    \draw [arrow] (dec1) -| node[anchor=east] {yes} (pro2a);
    \draw [arrow] (dec1) -| node[anchor=west] {no} (pro2b);
    \draw [arrow] (pro2a) |- (stop);
    \draw [arrow] (pro2b) |- (stop);

    % End of the TikZ picture environment
  \end{tikzpicture}

  % Caption for the flowchart
  \caption{A simple TikZ flowchart}

  % End of the figure environment
\end{figure}

% End of the document
\end{document}
```

Document with a TikZ Flowchart

Your Name

January 3, 2024

1 Flowchart Example

Below is an example of a basic flowchart created using TikZ:
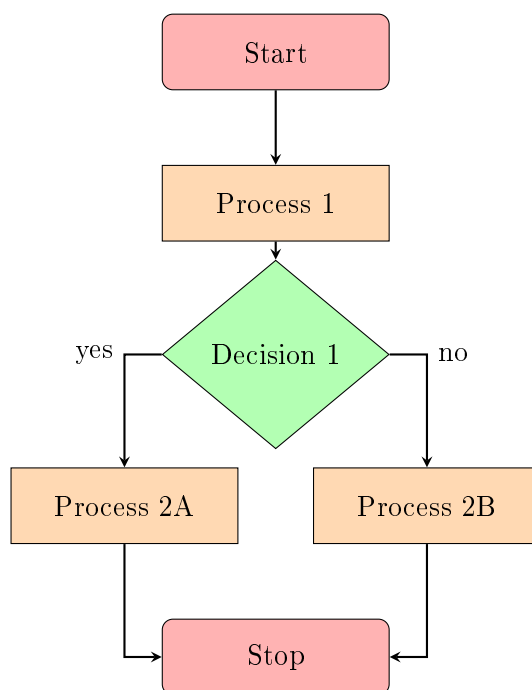
Figure 1: A simple TikZ flowchart

Part B

Program 9

Develop a professional presentation using the Beamer class, including transitions and multimedia.

1. `\documentclass{beamer}`: Specifies the document class as 'beamer' for creating presentations.

2. `\usetheme{Madrid}` and `\usecolortheme{default}`: Set the theme and color theme for the presentation. In this case, the 'Madrid' theme is used.

3. `\usepackage{multimedia}`: Loads the multimedia package for embedding multimedia elements in the presentation.

4. `\title`, `\subtitle`, `\author`, `\institute`, `\date`: Define the title, subtitle, author, institute, and date of the presentation.

5. `\begin{document}` and `\end{document}`: Mark the beginning and end of the document.

6. `\begin{frame}` and `\end{frame}`: Define frames for the presentation. Each frame corresponds to a slide.

7. `\titlepage`: Creates the title page with the title, subtitle, author, institute, and date information.

8. `\frametitle{...}`: Sets the title of a frame.

9. `\pause`: Adds a pause in the content of a slide to reveal information incrementally.

10. `\section{...}`: Defines sections within the presentation.

11. `\movie[...]{}{video.mp4}`: Embeds a video in the presentation. Replace 'video.mp4' with the path to your video file.

12. `\Huge, \centerline`: Change the font size and alignment for the 'Thank You' slide.

```
\documentclass{beamer}

% Theme choice:
\usetheme{Madrid}
\usecolortheme{default}

% Multimedia package
\usepackage{multimedia}

% Document metadata
\title{Sample Presentation}
\subtitle{Using Beamer}
\author{Your Name}
\institute{Your Institute}
\date{\today}

\begin{document}

  % Title Page
  \begin{frame}
    \titlepage
  \end{frame}

  % Table of Contents
  \begin{frame}
    \frametitle{Table of Contents}
    \tableofcontents
  \end{frame}

  % Section 1
  \section{Introduction}

  % Slide 1
  \begin{frame}
    \frametitle{Introduction}
    This is the introduction slide.
    \pause % Adds a pause here
```

```latex
    More content on the same slide after the pause.
  \end{frame}

% Section 2
\section{Multimedia}

% Slide 2 - Including a Video
\begin{frame}{Including a Video}
  Here's how to include a video in your presentation.
  \movie[height = 0.5\textwidth, width = 0.8\textwidth, showcontrols]{}{video.mp4}
  % Replace 'video.mp4' with the path to your video file
\end{frame}

% Slide 3 - Including an Audio
\begin{frame}{Including an Audio}
  Here's how to include audio in your presentation.
  \movie[height = 0.3\textwidth, width = 0.5\textwidth, showcontrols]{}{audio.mp3}
  % Replace 'audio.mp3' with the path to your audio file
\end{frame}

% Conclusion Section
\section{Conclusion}

% Slide 4
\begin{frame}
  \frametitle{Conclusion}
  This is the conclusion slide.
\end{frame}

% Thank You Slide
\begin{frame}
  \Huge{\centerline{Thank You!}}
  \centerline{Questions?}
\end{frame}

\end{document}
```

Sample Presentation
Using Beamer

Your Name

Your Institute

January 3, 2024

Table of Contents

1 Introduction

2 Multimedia

3 Conclusion

Introduction

This is the introduction slide.

Introduction

This is the introduction slide. More content on the same slide after the pause.

Including a Video

Here's how to include a video in your presentation.

Including an Audio

Here's how to include audio in your presentation.

Conclusion

This is the conclusion slide.

Program 10

Implement hyperlinks, internal cross-references, and a table of contents in a document.

1. `\documentclass[11pt,a4paper]{article}`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage[utf8]{inputenc}` and `\usepackage[T1]{fontenc}`: Set the input encoding to UTF-8 and select font encoding.

3. `\usepackage{hyperref}`: Loads the hyperref package, which enables hyperlinks and cross-references.

4. `\hypersetup{...}`: Customizes hyperlink colors and styles. In this case, it sets the colors for external links (`urlcolor`), internal links (`linkcolor`), and citations (`citecolor`).

5. `\title, \author, \date`: Define the title, author, and date of the document.

6. `\maketitle`: Generates the title page based on the provided title, author, and date information.

7. `\tableofcontents`: Generates the table of contents for the document.

8. `\newpage`: Starts a new page in the document.

9. `\section{...}`: Defines sections within the document.

10. `\href{https://www.example.com}{Example Website}`: Creates an external hyperlink with the text "Example Website" pointing to "https://www.example.com."

11. `\hyperref[sec:intro]{Introduction section}`: Creates an internal hyperlink referring to the "Introduction section" labeled as `sec:intro`.

12. \ref{sec:intro}: Cross-references the "Introduction section" by its label.

13. \pageref{sec:intro}: References the page number where the "Introduction section" is located.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{hyperref} % Enables hyperlinks
\hypersetup{
    colorlinks=true, % Colors links instead of ugly boxes
    urlcolor=blue, % Color for external hyperlinks
    linkcolor=blue, % Color for internal links
    citecolor=blue % Color for citations
}

\title{Document with Hyperlinks and Cross-References}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\tableofcontents % Generates the table of contents
\newpage % Starts a new page

\section{Introduction}\label{sec:intro}
This is the introduction section. You can refer back to this section by using the label
    \texttt{sec:intro}.

\section{External Links}
Visit \href{https://www.example.com}{Example Website} for more information. % An external
    hyperlink

\section{Internal References}
Refer back to the \hyperref[sec:intro]{Introduction section} for details. % An internal hyperlink

\section{Conclusion}
This is the conclusion. See Section \ref{sec:intro} on page \pageref{sec:intro} for the
    introduction.

\end{document}
```

Document with Hyperlinks and Cross-References

Your Name

January 3, 2024

Contents

1 Introduction

This is the introduction section. You can refer back to this section by using the label `sec:intro`.

2 External Links

Visit Example Website for more information.

3 Internal References

Refer back to the Introduction section for details.

4 Conclusion

This is the conclusion. See Section 1 on page 2 for the introduction.

Program 11

Draft a technical report with structured sections, figures, tables, and a bibliography.

1. `\documentclass[11pt,a4paper]{report}`: Specifies the document class as 'report' with 11pt font size and A4 paper size. This class is suitable for longer documents, such as reports or theses.

2. `\usepackage[utf8]{inputenc}` and `\usepackage[T1]{fontenc}`: Set the input encoding to UTF-8 and select font encoding.

3. `\usepackage{graphicx}`: Allows for the inclusion of figures (images) in the document.

4. `\usepackage{tabularx}`: Provides advanced table formatting capabilities using the tabularx environment.

5. `\usepackage{hyperref}`: Enables hyperlinks within the document.

6. `\usepackage{natbib}`: Provides support for bibliographies using the natbib package.

7. `\bibliographystyle{plain}`: Sets the bibliography style to 'plain' for the natbib package.

8. `\title`, `\author`, `\date`: Define the title, author, and date of the report.

9. `\maketitle`: Generates the title page based on the provided title, author, and date information.

10. `\tableofcontents`: Generates the table of contents for the report.

11. `\newpage`: Starts a new page in the document.

12. `\chapter{...}`: Defines chapters within the report.

13. `\section{...}`: Defines sections within chapters.

14. `\subsection{...}`: Defines subsections within sections.

15. `\begin{table}[h]` and `\begin{figure}[h]`: Begin the table and figure environments, respectively, with optional placement specifiers '[h]' to indicate preferred placement.

16. `\centering`: Centers the content within the table and figure environments.

17. `\caption{...}`: Adds captions to tables and figures.

18. `\label{...}`: Labels tables and figures for cross-referencing.

19. `\bibliography{...}`: Specifies the bibliography file for the report.

20. `\thebibliography{9}`: Begins the bibliography section with a maximum of nine entries.

21. `\bibitem{...}`: Defines bibliography entries, where each entry has a unique label (e.g., {latexcompanion}).

22. `\textit{The \LaTeX\ Companion}.`: Provides the title and details of a bibliography entry.

23. `\end{document}`: Marks the end of the document.

```latex
\documentclass[11pt,a4paper]{report}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx} % For including figures
\usepackage{tabularx} % For creating tables
\usepackage{hyperref} % For hyperlinks
\usepackage{natbib} % For bibliography
\bibliographystyle{plain} % Set the bibliography style

\title{Your Report Title}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\tableofcontents
\newpage

\chapter{Introduction}
```

```latex
\label{chap:introduction}
This chapter introduces the topic of the report.

\section{Background}
\label{sec:background}
Background information about the report.

\chapter{Main Content}
\label{chap:maincontent}
This chapter covers the main content of the report.

\section{Data Analysis}
\label{sec:dataanalysis}
Discussion about data analysis.

\subsection{Data Tables}
\label{subsec:datatables}
Tables can be included here.

% Example table
\begin{table}[h]
\centering
\caption{Sample Data Table}
\label{tab:sampledatatable}
\begin{tabular}{|c|c|c|}
\hline
Column 1 & Column 2 & Column 3 \\
\hline
Data 1 & Data 2 & Data 3 \\
Data 4 & Data 5 & Data 6 \\
\hline
\end{tabular}
\end{table}

\subsection{Data Figures}
\label{subsec:datafigures}
Figures can be included here.

% Example figure
\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{example-image}
```

```
\caption{Sample Figure}
\label{fig:samplefigure}
\end{figure}

\chapter{Conclusion}
\label{chap:conclusion}
The concluding remarks of the report.

% Example bibliography
\begin{thebibliography}{9}
\bibitem{latexcompanion}
Michel Goossens, Frank Mittelbach, and Alexander Samarin.
\textit{The \LaTeX\ Companion}.
Addison-Wesley, Reading, Massachusetts, 1993.
\end{thebibliography}

\end{document}
```

Your Report Title

Your Name

January 3, 2024

Contents

Chapter 1

Introduction

This chapter introduces the topic of the report.

1.1   Background

Background information about the report.

Chapter 2

Main Content

This chapter covers the main content of the report.

2.1 Data Analysis

Discussion about data analysis.

2.1.1 Data Tables

Tables can be included here.

Table 2.1: Sample Data Table

Column 1	Column 2	Column 3
Data 1	Data 2	Data 3
Data 4	Data 5	Data 6

2.1.2 Data Figures

Figures can be included here.
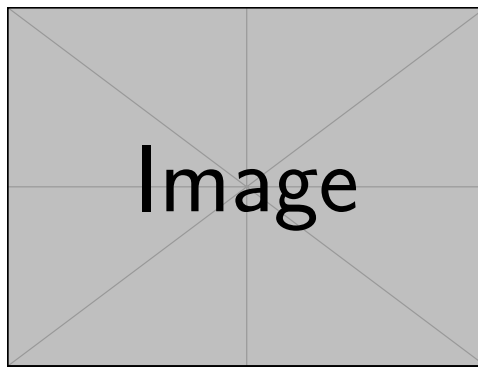
Figure 2.1: Sample Figure

Chapter 3

Conclusion

The concluding remarks of the report.

Bibliography

[1] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The LATEX Companion*. Addison-Wesley, Reading, Massachusetts, 1993.

Program 12

Create a document in multiple languages, exploring LaTeX's multilingual support.

1. `\documentclass[11pt,a4paper]{article}`: Specifies the document class as 'article' with 11pt font size and A4 paper size.

2. `\usepackage[utf8]{inputenc}`: Sets the input encoding to UTF-8 to support extended character sets.

3. `\usepackage[T1]{fontenc}`: Selects font encoding.

4. `\usepackage[english, french, german]{babel}`: Enables multilingual support with three languages: English, French, and German.

5. `\title, \author, \date`: Define the title, author, and date of the document.

6. `\maketitle`: Generates the title page based on the provided title, author, and date information.

7. `\selectlanguage{...}`: Specifies the language for the document section that follows it.

8. `\section{...}`: Defines sections within the document, with titles in the selected language.

9. Text content: Provides content in the selected language for each section.

10. `\selectlanguage{...}`: Can be used to switch to another language for subsequent sections.

11. Revert to the main language: Use `\selectlanguage{...}` to switch back to the main language when needed.

12. `\end{document}`: Marks the end of the document.

```latex
\documentclass[11pt,a4paper]{article}

\usepackage[utf8]{inputenc} % For UTF-8 encoding
\usepackage[T1]{fontenc} % Font encoding
\usepackage[english, french, german]{babel} % Multilingual support

\title{Multilingual Document Example}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

% Select the language for a section
\selectlanguage{english}
\section{English Section}
This section is in English. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

% Switch to another language
\selectlanguage{french}
\section{Section en franais}
Cette section est en franais. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

% Switch to another language
\selectlanguage{german}
\section{Deutscher Abschnitt}
Dieser Abschnitt ist auf Deutsch. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

% Revert back to the main language (English in this case)
\selectlanguage{english}
\section{Conclusion}
This is the conclusion in English.

\end{document}
```

Multilingual Document Example

Your Name

4. Januar 2024

1 English Section

This section is in English. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

2 Section en français

Cette section est en français. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

3 Deutscher Abschnitt

Dieser Abschnitt ist auf Deutsch. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

4 Conclusion

This is the conclusion in English.

Program 13

Create a LaTeX document that generates an interactive PDF form with fillable fields and submit buttons.

1. `\documentclass{article}`: Specifies the document class as 'article.'

2. `\usepackage{hyperref}`: Adds the 'hyperref' package, which allows for creating interactive elements in the PDF document.

3. `\title`, `\author`, `\date`: Define the title, author, and date of the document.

4. `\maketitle`: Generates the title page based on the provided title, author, and date information.

5. `\begin{Form}` and `\end{Form}`: These commands create a form within the document.

6. `\section{...}`: Divides the form into sections with titles.

7. `\TextField`: Creates a text field for user input. The 'name' parameter assigns a name to the field, and 'width' specifies its width.

8. `\ChoiceMenu`: Creates a choice menu (radio buttons) for selecting options. The 'name' parameter assigns a name to the menu.

9. `\Reset{Reset}`: Adds a reset button to clear form input.

10. `multiline=true, width=12cm, height=3cm`: These parameters configure the 'comments' text field to allow multiline input and specify its dimensions.

11. `\end{document}`: Marks the end of the document.

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

\title{Interactive PDF Form}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\begin{Form}

\section{Personal Information}
\begin{tabular}{ll}
\textbf{Name:} & \TextField[name=name, width=5cm]{} \\
\textbf{Email:} & \TextField[name=email, width=5cm]{} \\
\end{tabular}

\section{Survey}
\textbf{Do you enjoy using LaTeX?}\\
\ChoiceMenu[radio, name=question1]{}{Yes=Yes, No=No}

\section{Comments}
\textbf{Your Comments:}\\
\TextField[name=comments, multiline=true, width=12cm, height=3cm]{}

\section{Submit Form}
\Reset{Reset}
\end{Form}

\end{document}
```

Interactive PDF Form

Your Name

January 3, 2024

1 Personal Information

Name:

Email:

2 Survey

Do you enjoy using LaTeX?

Yes   No

3 Comments

Your Comments:

4 Submit Form

Reset

Program 14

Format a paper following specific guidelines of a scientific conference, including figures, tables, and references.

1. `\documentclass[10pt,twocolumn]{article}`: Specifies the document class as 'article' with a 10-point font size and a two-column layout.

2. `\usepackage{inputenc}` and `\usepackage{fontenc}`: Set the character encoding for input and font encoding to support special characters.

3. `\usepackage{graphicx}`: Allows for including images in the document.

4. `\usepackage{tabularx}`: Provides support for creating tables with variable column widths.

5. `\usepackage{natbib}`: Enables bibliography and citation functionality, and `\bibliographystyle{plainnat}` sets the bibliography style.

6. `\title`, `\author`, `\date`: Define the title, authors, and date of the research paper.

7. `\maketitle`: Generates the title, author list, and date based on the provided information.

8. `\begin{abstract}` and `\end{abstract}`: Create an abstract section where you can summarize your research.

9. `\section{...}`: Divide the paper into sections, such as Introduction, Methodology, Results, Discussion, and Conclusion.

10. `\subsection{...}`: Use subsections to further structure your paper.

11. `\begin{figure}...\end{figure}`: Wrap figures with captions inside the 'figure' environment to include and reference them in your paper.

12. `\includegraphics[width=\linewidth]{example-image}`: Include an image with a specified width in the text. Replace 'example-image' with your image file name.

13. `\caption`: Add a caption to the figure.

14. `\ref{fig:example}`: Reference figures in the text using labels.

15. `\begin{table}...\end{table}`: Use the 'table' environment to create and reference tables.

16. `\caption`: Add a caption to the table.

17. `\ref{tab:example}`: Reference tables in the text using labels.

18. `\bibliography{references}`: Include a bibliography section and specify the BibTeX file name ('references.bib' in this case) where your references are stored.

```latex
\documentclass[10pt,twocolumn]{article} % Two-column layout

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{graphicx} % Required for including images
\usepackage{tabularx} % Required for tables
\usepackage{natbib} % Bibliography and citations
\bibliographystyle{plainnat} % Set the bibliography style

% Paper title and authors
\title{Your Research Paper Title}
\author{Author One \and Author Two \and Author Three}
\date{Conference Name, Year}

% Start of the document
\begin{document}

\maketitle

\begin{abstract}
Your abstract text goes here. It should be a concise summary of your work.
\end{abstract}

\section{Introduction}
Introduce your research, background, and motivation for the study.
```

```latex
\section{Methodology}
Describe the methods and materials used in your research.

\section{Results}
Present and discuss the results of your study.

\subsection{Figures}
Include and reference figures in your paper.

% Example figure
\begin{figure}[ht]
\centering
\includegraphics[width=\linewidth]{example-image}
\caption{Example figure caption.}
\label{fig:example}
\end{figure}

Refer to Figure \ref{fig:example} in the text as needed.

\subsection{Tables}
Include and reference tables in your paper.

% Example table
\begin{table}[ht]
\centering
\caption{Example table caption.}
\label{tab:example}
\begin{tabular}{|c|c|c|}
\hline
Column 1 & Column 2 & Column 3 \\
\hline
Data 1 & Data 2 & Data 3 \\
Data 4 & Data 5 & Data 6 \\
\hline
\end{tabular}
\end{table}

Refer to Table \ref{tab:example} in the text as needed.

\section{Discussion}
Discuss the implications of your findings.
```

```latex
\section{Conclusion}
Conclude your paper and suggest future work or implications.

% Bibliography
\bibliography{references} % references.bib is the name of our BibTeX file

\end{document}
```

Your Research Paper Title

Author One   Author Two   Author Three

Conference Name, Year

Abstract

Your abstract text goes here. It should be a concise summary of your work.

1 Introduction

Introduce your research, background, and motivation for the study.

2 Methodology

Describe the methods and materials used in your research.

3 Results

Present and discuss the results of your study.

3.1 Figures

Include and reference figures in your paper. Refer to Figure 1 in the text as needed.

3.2 Tables

Include and reference tables in your paper.

Table 1: Example table caption.

Column 1	Column 2	Column 3
Data 1	Data 2	Data 3
Data 4	Data 5	Data 6

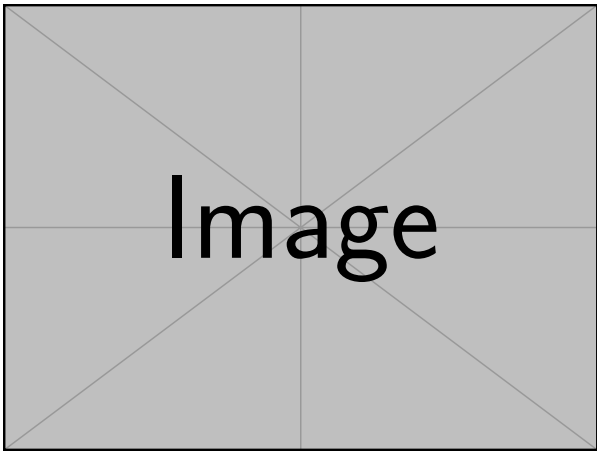Refer to Table 1 in the text as needed.

Figure 1: Example figure caption.

4 Discussion

Discuss the implications of your findings.

5 Conclusion

Conclude your paper and suggest future work or implications.

References

Program 15

Create a document focused on advanced mathematical typesetting, featuring complex algebraic structures, algorithm, theorem environments, and custom mathematical operators.

1. `\documentclass[11pt]{article}`: Specifies the document class as 'article' with an 11-point font size.

2. `\usepackage{inputenc}`, `\usepackage{fontenc}`: Set the character encoding for input and font encoding.

3. `\usepackage{amsmath, amssymb, amsfonts, amsthm}`: Loads packages for mathematical fonts, symbols, environments, and theorem styles.

4. `\usepackage{algorithm, algpseudocode}`: Adds support for typesetting algorithms and pseudocode.

5. Theorem Styles: - `\theoremstyle{definition}`: Defines a theorem style for definitions. - `\newtheorem{definit` Creates a new 'Definition' environment that resets with each section. - `\theoremstyle{remark}`: Defines a theorem style for remarks (unnumbered). - `\newtheorem*{remark}{Remark}`: Creates an unnumbered 'Remark' environment. - `\theoremstyle{plain}`: Defines a theorem style for theorems. - `\newtheorem{theorem}{Theorem}[section]`: Creates a new 'Theorem' environment that resets with each section.

6. `\DeclareMathOperator{\Rank}{Rank}`, `\DeclareMathOperator{\Span}{Span}`: Define custom mathematical operators for rank and span.

7. `\title`, `\author`, `\date`: Set the title, author, and date for the document.

8. `\maketitle`: Generates the document title based on the provided information.

9. Sections: Divide the document into sections with `\section{...}` and `\subsection{...}` for further sub-division.

10. Equations: Use `equation` environments to display mathematical equations, matrices, and vectors.

11. Custom Operators: Use custom operators like `\Rank(\mathbf{A})` and `\Span(\mathbf{v})`.

12. Theorems, Definitions, and Remarks: Create theorems, definitions, and remarks using `\begin{theorem}{Theore` `\begin{definition}{Definition}`, and `\begin{remark}{Remark}` environments.

13. Proof: Add proofs to theorems using `\begin{proof}` and `\end{proof}`.

14. Algorithms: Create algorithms using the `algorithm` and `algorithmic` environments.

```latex
\documentclass[11pt]{article}

\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{amsmath, amssymb, amsfonts, amsthm} % For math fonts, symbols and environments
\usepackage{algorithm, algpseudocode} % For algorithms

% Theorem Styles
\theoremstyle{definition}
\newtheorem{definition}{Definition}[section]
\theoremstyle{remark}
\newtheorem*{remark}{Remark}
\theoremstyle{plain}
\newtheorem{theorem}{Theorem}[section]

% Custom operators
\DeclareMathOperator{\Rank}{Rank}
\DeclareMathOperator{\Span}{Span}

\title{Advanced Mathematical Typesetting in LaTeX}
\author{Your Name}
\date{\today}

\begin{document}

\maketitle

\section{Introduction}
```

Introduction to advanced mathematical typesetting.

```latex
\section{Complex Algebraic Structures}
```
Examples of complex algebraic structures:

```latex
\subsection{Matrices and Vectors}
\begin{equation}
    \mathbf{A} =
    \begin{pmatrix}
        a_{11} & a_{12} \\
        a_{21} & a_{22}
    \end{pmatrix}, \quad
    \mathbf{v} =
    \begin{pmatrix}
        v_1 \\
        v_2
    \end{pmatrix}
\end{equation}
```

```latex
\subsection{Custom Operators}
\begin{equation}
    \Rank(\mathbf{A}), \quad \Span(\mathbf{v})
\end{equation}
```

```latex
\section{Theorems and Definitions}
\begin{definition}[Euclidean Space]
    A Euclidean space is a finite-dimensional inner product space.
\end{definition}
```

```latex
\begin{theorem}
    Every finite-dimensional inner product space is a Euclidean space.
\end{theorem}
```

```latex
\begin{proof}
    The proof is left as an exercise for the reader.
\end{proof}
```

```latex
\begin{remark}
    This is an important theorem in linear algebra.
\end{remark}
```

```latex
\section{Algorithms}
```

```
\begin{algorithm}
\caption{Example Algorithm}
\begin{algorithmic}[1]
\Procedure{Example}{$a,b$}
    \State $r \gets a \bmod b$
    \While{$r \neq 0$}
        \State $a \gets b$
        \State $b \gets r$
        \State $r \gets a \bmod b$
    \EndWhile
    \State \textbf{return} $b$
\EndProcedure
\end{algorithmic}
\end{algorithm}

\end{document}
```

Advanced Mathematical Typesetting in LaTeX

Your Name

January 3, 2024

1 Introduction

Introduction to advanced mathematical typesetting.

2 Complex Algebraic Structures

Examples of complex algebraic structures:

2.1 Matrices and Vectors

$$\mathbf{A} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}, \quad \mathbf{v} = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix} \tag{1}$$

2.2 Custom Operators

$$\mathrm{Rank}(\mathbf{A}), \quad \mathrm{Span}(\mathbf{v}) \tag{2}$$

3 Theorems and Definitions

Definition 3.1 (Euclidean Space). A Euclidean space is a finite-dimensional inner product space.

Theorem 3.1. *Every finite-dimensional inner product space is a Euclidean space.*

Proof. The proof is left as an exercise for the reader. □

Remark. This is an important theorem in linear algebra.

4 Algorithms