Preamble and Packages in LaTeX

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What is the Preamble?

- The preamble is the section of your LaTeX document *before* the `\begin{document}` command.
- It's where you define the document's structure, load packages, and customize settings.
- Think of it as the "control panel" for your document. It sets up *everything* that will be used in the document body.

Basic Preamble Structure

Essential Elements

- `\documentclass[options]{class}`: Specifies the type of document (article, book, beamer, etc.) and global options (e.g., font size, paper size).
  - **Example** `\documentclass[11pt, a4paper]{article}`
- `\usepackage[options]{package}`: Loads additional packages to extend LaTeX's functionality.
  - **Example** `\usepackage{amsmath}`
- Custom commands and settings: Define new commands, modify existing ones, and adjust document appearance.
  - **Example** `\newcommand{\mycommand}{Definition}`

Basic Preamble Structure

Example

```
\documentclass{article}
\usepackage[utf8]{inputenc}
\usepackage{amsmath}

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

The `\documentclass` Command

- The very first command in your preamble.
- Specifies the overall document type.
- Common document classes:
  - `article`: For shorter documents like articles and reports.
  - `book`: For longer documents with chapters.
  - `report`: Similar to `book`, but often with different formatting.
  - `beamer`: For creating presentations (like this one!).
  - `letter`: For writing letters.
- Options can be passed in square brackets:
  - `10pt`, `11pt`, `12pt`: Font size.
  - `a4paper`, `letterpaper`: Paper size.
  - `twocolumn`: Two-column layout.
  - `landscape`: Landscape orientation.
- **Example:** `\documentclass[12pt, letterpaper, twoside]{article}`

Loading Packages with `\usepackage`

- LaTeX's functionality is extended through packages.
- Use the `\usepackage` command to load them.
- Some packages take options, specified in square brackets:

Loading Packages with `\usepackage`

Commonly Used Packages

- `\usepackage[utf8]{inputenc}`: Handles input encoding (almost always UTF-8).
- `\usepackage[T1]{fontenc}`: Improves font rendering and hyphenation.
- `\usepackage{amsmath, amssymb}`: Essential for mathematical typesetting.
- `\usepackage{graphicx}`: For including images.
- `\usepackage{hyperref}`: Creates hyperlinks and PDF metadata.
- `\usepackage{geometry}`: Customizing page margins and layout.
  - **Example**

```
\usepackage[left=2cm, right=2cm, top=3cm, bottom=3cm]{geometry}
```

More Useful Packages

- `\usepackage{listings}`: Format and include source code.
  - Use `\lstset` to configure listing styles. (See the preamble of this document!)
  - **Important** you should add `\lstset` to configure listing styles to the preamble.
- `\usepackage{xcolor}`: Define and use custom colors.
  - `\definecolor{mycolor}{RGB}{255, 100, 50}`
  - `\textcolor{mycolor}{Text in my color}`
- `\usepackage{tikz}`: Create vector graphics directly in LaTeX (advanced).
- `\usepackage{booktabs}`: For beautiful tables.
- `\usepackage{enumitem}`: Customize lists (itemize, enumerate).

Defining Custom Commands

- Use `\newcommand` to create your own shortcuts.
- Simplifies repetitive tasks and improves readability.
- Syntax: `\newcommand{\commandname}[num_args]{definition}`
- `\commandname`: The name of your new command (must start with a backslash).
- `[num_args]`: (Optional) The number of arguments the command takes (0 if omitted).
- `{definition}`: What the command does. Use `#1`, `#2`, etc., to refer to arguments.

Using custom commands

Examples

- `\newcommand{\R}{\mathbb{R}}`: Defines `\R` to represent the set of real numbers.
- `\newcommand{\myemph}[1]{\textit{\textbf{#1}}}`: Defines `\myemph` to emphasize text (bold and italic). Takes one argument (`#1`).
- `\newcommand{\greet}[2]{Hello, #1! My name is #2.}` : Defines `\greet` to print a greeting. Takes two arguments.

Here's how to use the custom commands we just defined:

- The set of real numbers is denoted by $\mathbb{R}$. (Uses `\R`)
- ***This text is emphasized.*** (Uses `\myemph{This text is emphasized.}`)
- Hello, Alice! My name is Bob. (Uses `\greet{John}{Alice}`)

Title, Author, and Date

- Use these commands to set the title, author, and date:
  - `\title{Your Title}`
  - `\author{Your Name}`
  - `\date{The Date}` (or `\date{}` for no date)
- These are *usually* placed in the preamble, but are not *required* to be. They *are* required if you want to use the `\maketitle` command.
- For `beamer`, you might also use:
  - `\subtitle{A Subtitle}`
  - `\institute{Your Institution}`
  - `\titlegraphic{\includegraphics{logo.png}}`
- Display the title information using `\maketitle` (for article/book/report) or `\titlepage` (for beamer) *inside* the `document` environment.

Other Common Preamble Settings

- `\linespread{1.5}`: Sets line spacing (1.5 is common for double-spacing). Place *after* `\documentclass`.
- `\setlength{\parindent}{0pt}`: Removes paragraph indentation.
- `\setlength{\parskip}{6pt}`: Adds vertical space between paragraphs.
- Redefining existing commands:
  - `\renewcommand{\section}[1]{\subsection{#1}}`: Makes `\section` behave like `\subsection`. (Be careful with this!)

Comments in the Preamble

- Just like in the main body of your document, you can (and *should*) use comments in your preamble.
- Use the `%` symbol to start a comment. Anything after the `%` on that line will be ignored by LaTeX.
- Use comments to:
  - Explain the purpose of packages.
  - Document your custom commands.
  - Temporarily disable parts of your preamble.
  - Leave notes for yourself or collaborators.

Comments in the Preamble

Example

```
% Load packages for math
\usepackage{amsmath}
\usepackage{amssymb}

% Define a custom command for the real numbers
\newcommand{\R}{\mathbb{R}}

% \usepackage{geometry} % Temporarily disabled
```

Preamble Best Practices

- **Keep it organized**: Group related packages and commands together.
- **Comment generously**: Explain *why* you're doing things.
- **Use a consistent style**: Makes your preamble easier to read and maintain.
- **Don't overcomplicate it**: Only include what you *need*.
- **Consider a separate file**: For very large preambles, put them in a separate `.tex` file and use `\input{preamble.tex}`.

Example: A Complete Preamble

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

% --- Input and Font Encoding ---
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}

% --- Math Packages ---
\usepackage{amsmath}
\usepackage{amssymb}

% --- Graphics ---
\usepackage{graphicx}

% --- Hyperlinks ---
\usepackage{hyperref}
```

Example: A Complete Preamble

```
1
2  % --- Custom Commands ---
3  \newcommand{\mycommand}[1]{\textbf{\textcolor{blue}{#1}}}
4
5  % --- Title Information ---
6  \title{My Awesome Document}
7  \author{Me}
8  \date{\today}
9
10 \begin{document}
11   \maketitle % Must be *inside* the document environment!
12
13   % ... your document content here ...
14 \end{document}
```

Recap

- The preamble sets up your entire document.
- Start with `\documentclass`.
- Load packages with `\usepackage`.
- Define custom commands with `\newcommand`.
- Set title information with `\title`, `\author`, and `\date`.
- Keep your preamble organized and well-commented.

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Thank You for Listening!