Day 01: Intro to LaTeX

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LaTeX101

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Outline

Introduction

- Course Background
- What is LaTeX?

Document Structure

Logical structure

Document Classes

Packages and Definitions

Figures

Tables

Introduction

Course Background, What is LaTeX?

- **Inspiration** – https://www.learnlatex.org/.
  - Day 1 – `learnlatex.org` lessons 1-8.
  - Day 2 – `learnlatex.org` lessons 9-16.
  - Day 3 – Inkscape for graphics with embedded LaTeX. Specific templates (resume, presentations).
- **Slides Available** – https://github.com/mdelrosa/latex-101.
  - Template based on Clara Pavillet's Oxford Template
- **Slack back channel**
  - UC Davis Slack channel

Markup Language – Instructions for rendering a document.

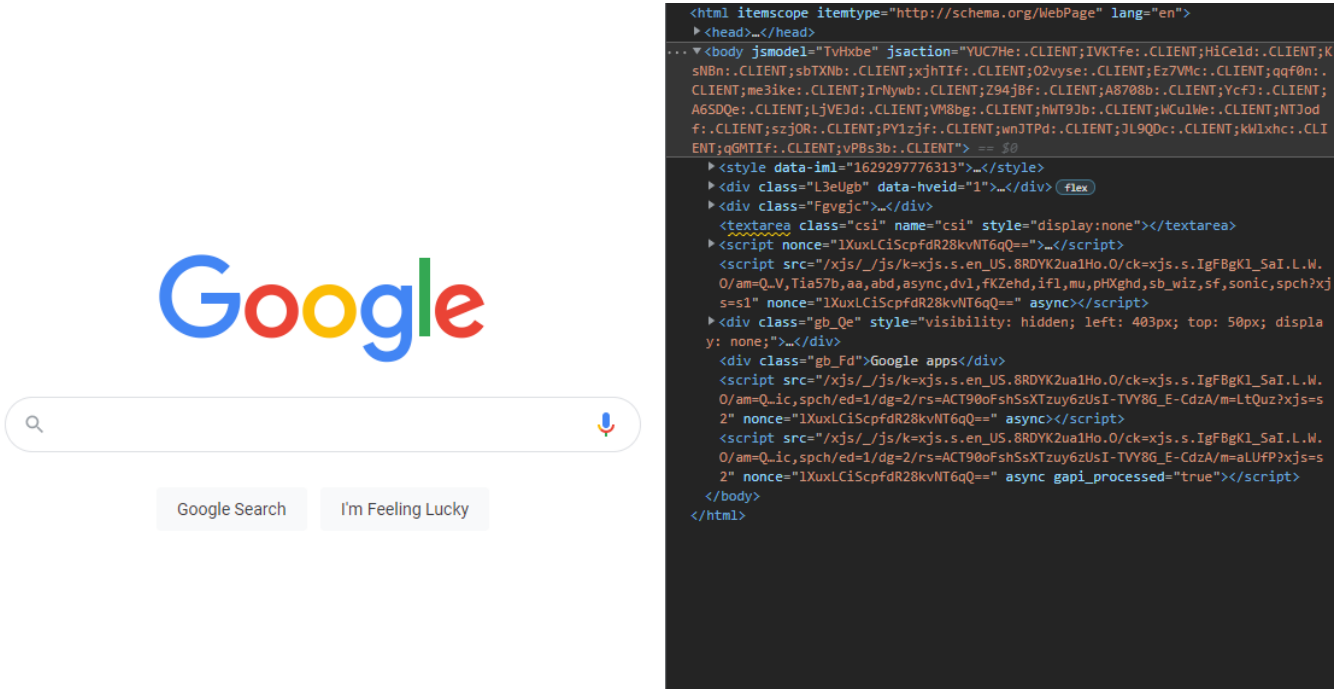


Figure 1: Example – HTML for websites

What is LaTeX?

LaTeX– Markup language for academic documents (e.g., publications, presentations, lecture notes, assignments).

```
\begin{frame}{What is \LaTeX?}
  \LaTeX -- Markup language for academic documents (e.g., publications, presentations, lecture notes, assignments).
  \begin{figure}
    \includegraphics[width=0.8\linewidth]{latex_example.png}
    \caption{Example -- \LaTeX \; snippet for this slide.}
    \label{fig:latex}
  \end{figure}
\end{frame}
```

Figure 2: Example – LaTeX snippet for this slide.

$$V_s = \int_{-R}^{R} \pi(R^2 - x^2)dx = \frac{4}{3}\pi R^3 \tag{1}$$

```latex
\begin{equation}
  V_s = \int_{-R}^R \pi (R^2 - x^2) dx = \frac{4}{3}\pi R^3 \label{eq:sphere}
\end{equation}
```

Figure 3: Example – LaTeXsnippet for this equation.

Enables rich cross-referencing of equations, figures, tables

- Equation 1 (previous page)
- Table 1

Feature	**Support**
Figures	Yes!
Equations	Yes!
Tables	Yes!
Bibliographies	Yes!

Table 1: A simple table.

Two primary components/steps:

1. Write your LaTeXfile(s) (**Text editor**)
2. "Compile" or "Typeset" your document (**LaTeX system**)

Figure 4: Text editors (Notepad, Notepad++, Sublime Text) and LaTeX distributions (MikTeX, TeXLive, and TeX Studio)

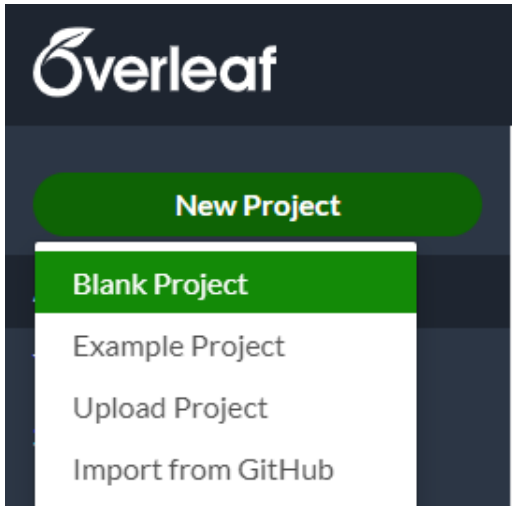
- Editors/systems installed on local device (faster, private)

- Editors/systems installed on local device (faster, private)
- Editor/systems online (convenient, collaborative)

- Editors/systems installed on local device (faster, private)
- Editor/systems online (convenient, collaborative)
- Will use **Overleaf** for this course (free account required)

Our First LaTeX Project

1. Make an Overleaf account (free!)
2. Go to `https://www.overleaf.com/project`
3. Create a blank project and pick a project name



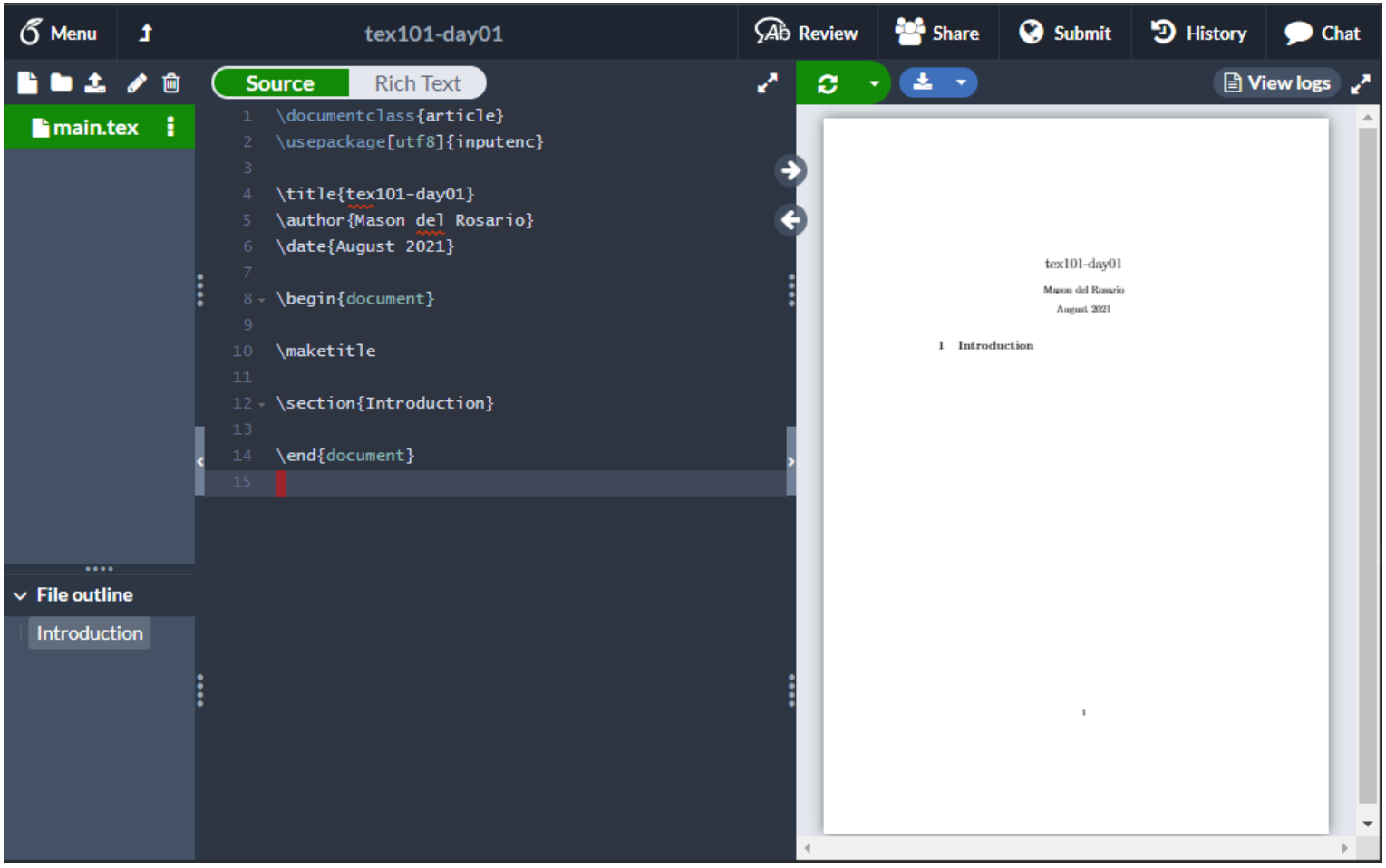


Figure 5: Result of creating new project on Overleaf

Document Structure

Commands, Environments, Errors

LaTeX has special characters to define commands and arguments.

- Backslashes (`\`) = start of a commands
- Curly brackets (`{ }`) = mandatory arguments (i.e., inputs to commands)
- Square brackets (`[ ]`) = optional arguments

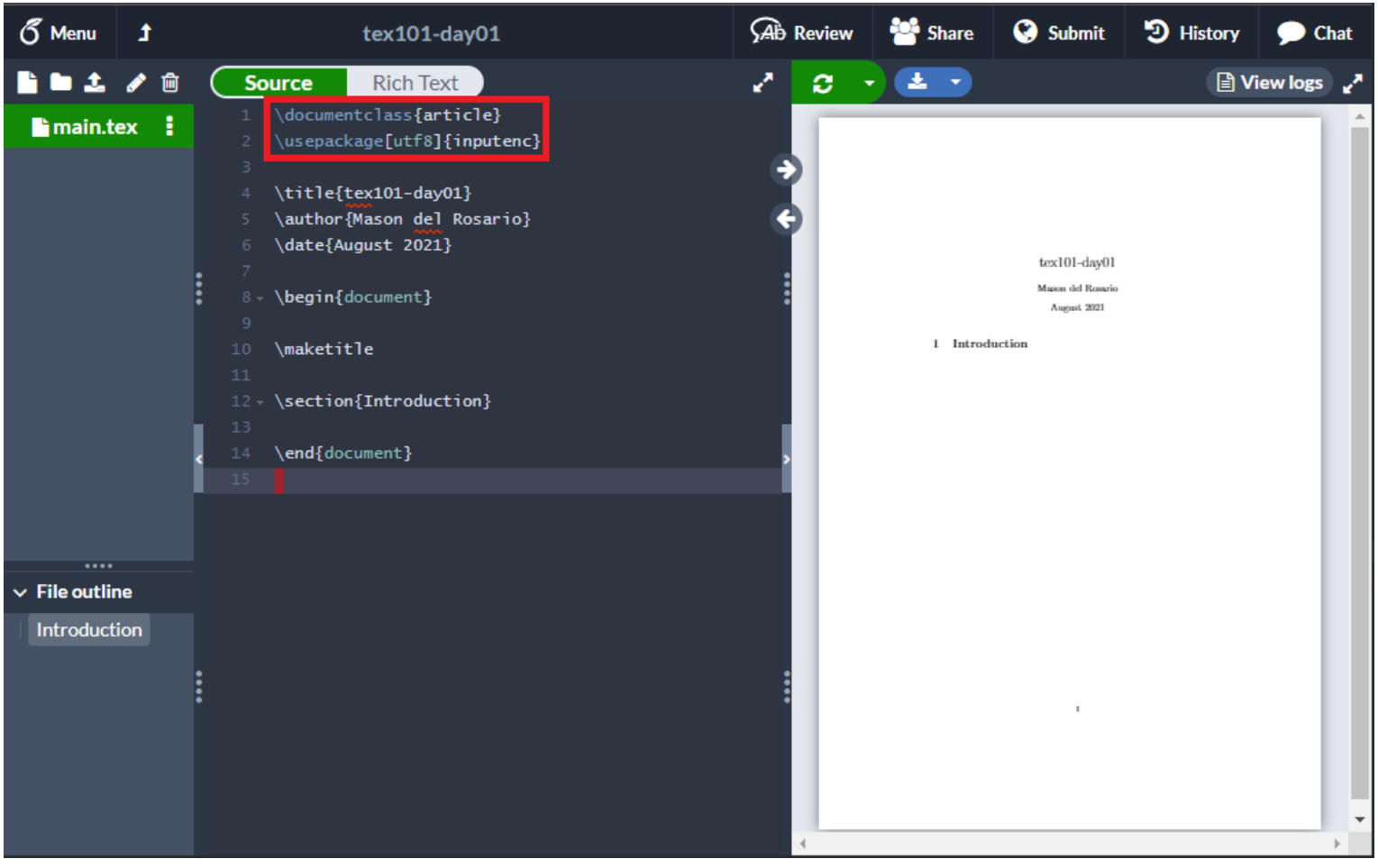


Figure 6: Commands/arguments defining the document class and text encoding of our project.

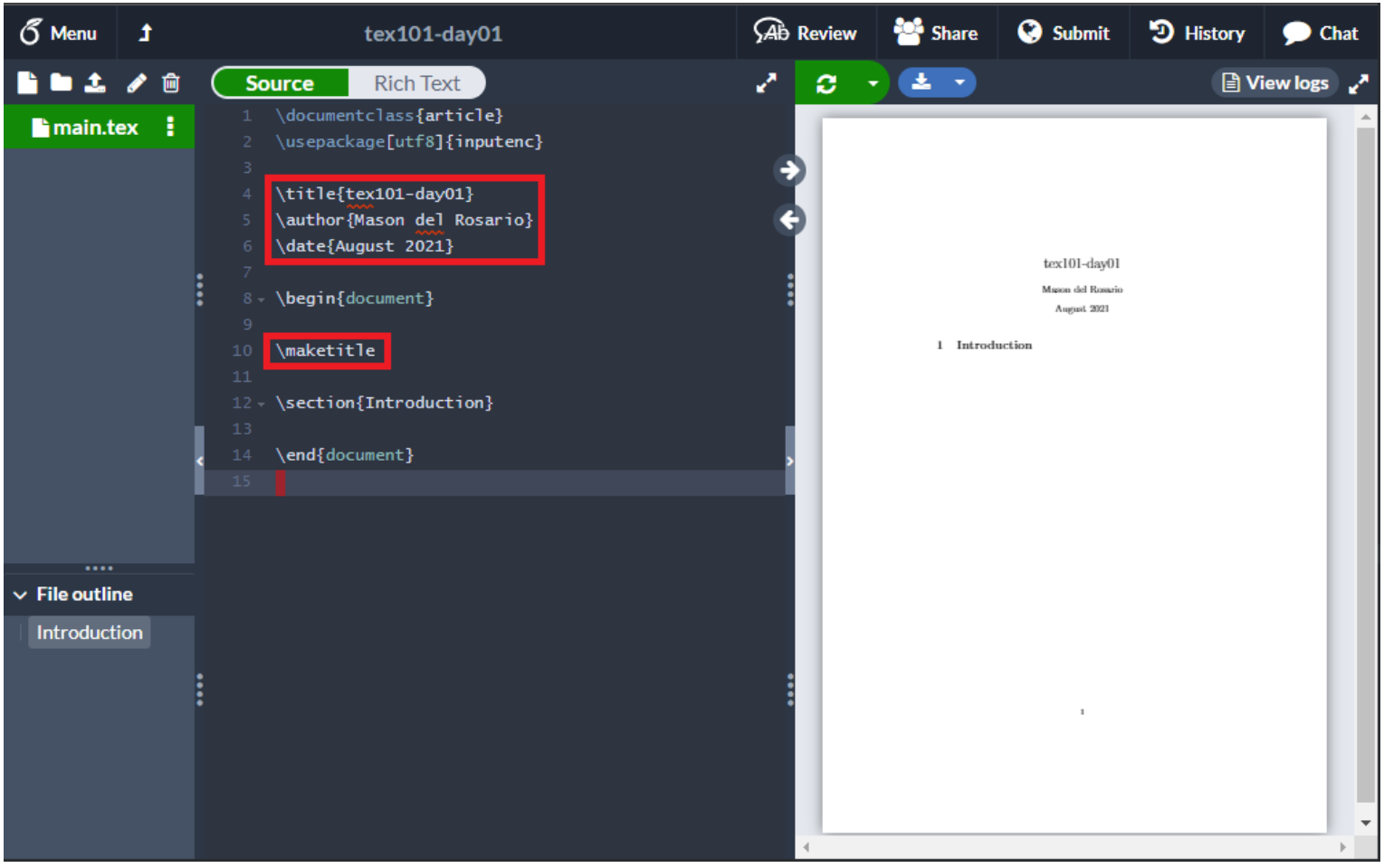


Figure 7: Commands/arguments defining the title in our project.

Environments = `\begin{...}` and `\end{...}` commands.

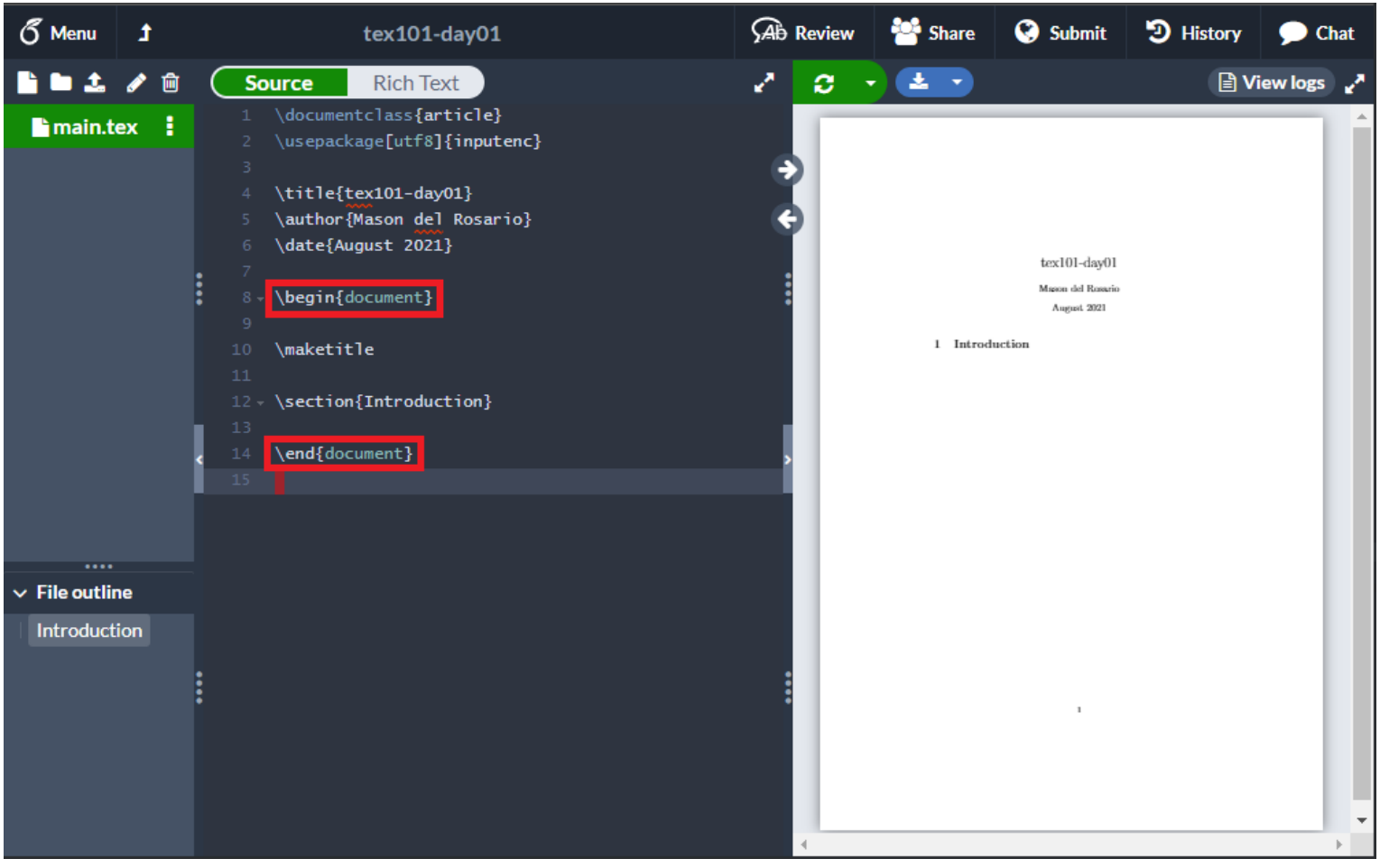


Figure 8: Every LaTeX file includes a `document` environment.

Lots of different environments! Will go over more in this course.

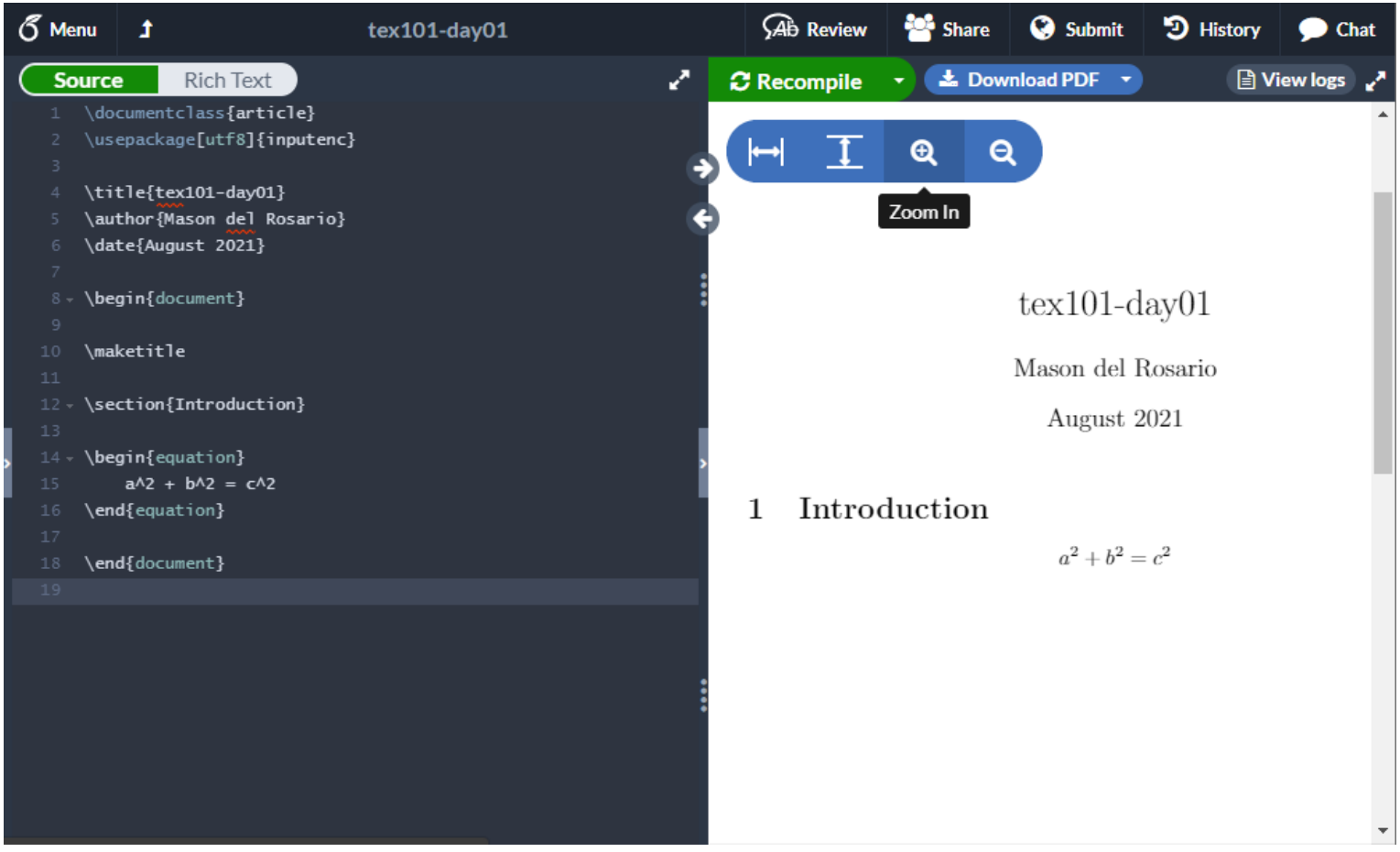


Figure 9: Try writing an `equation` environment!

- What happens when we mess up?
- Remove the `\end{equation}` command, compile the document.

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- Remove the `\end{equation}` command, compile the document.

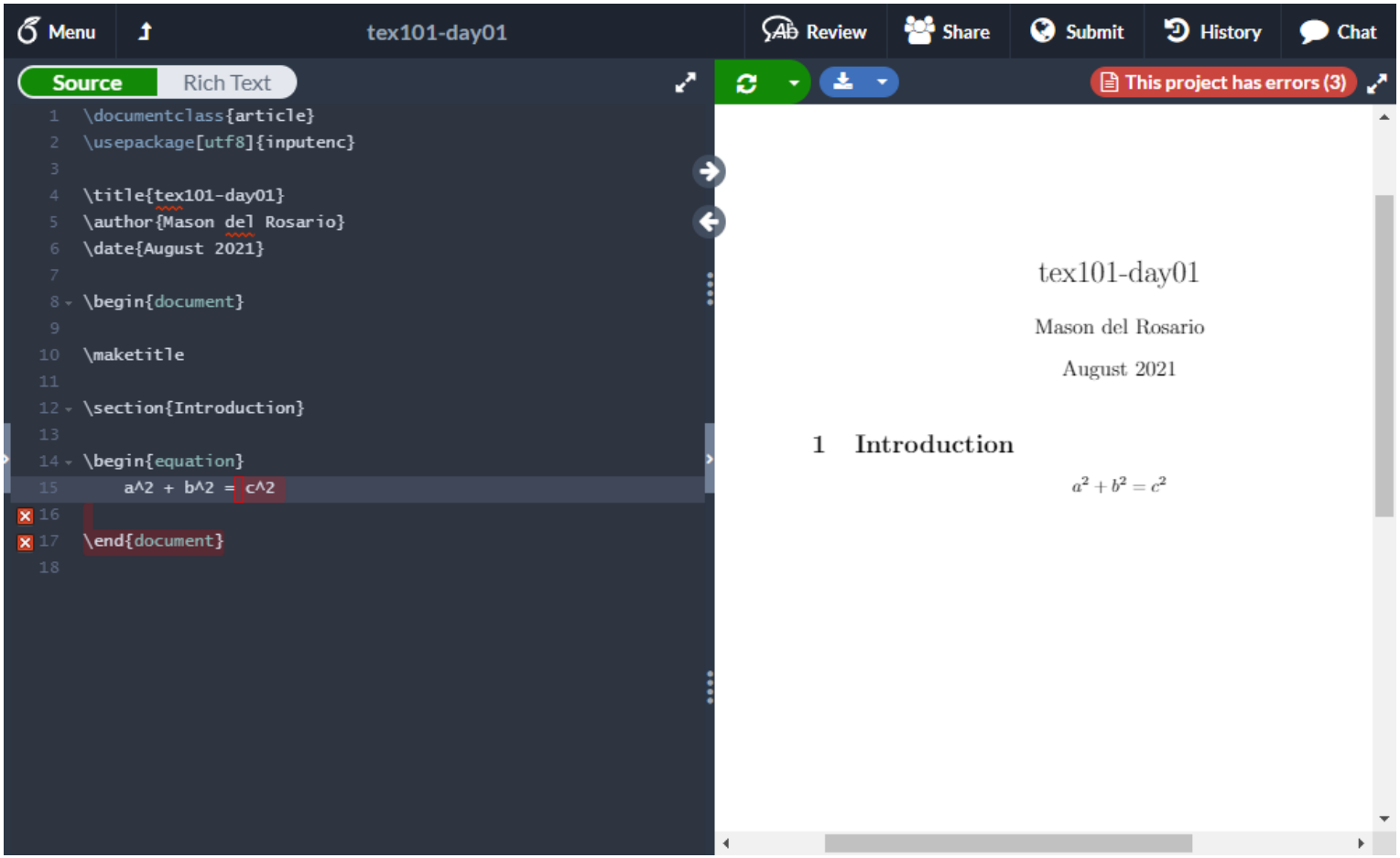


Figure 10: Click on the red badge to reveal more details.

Some errors might be sneakier. Google is your friend!

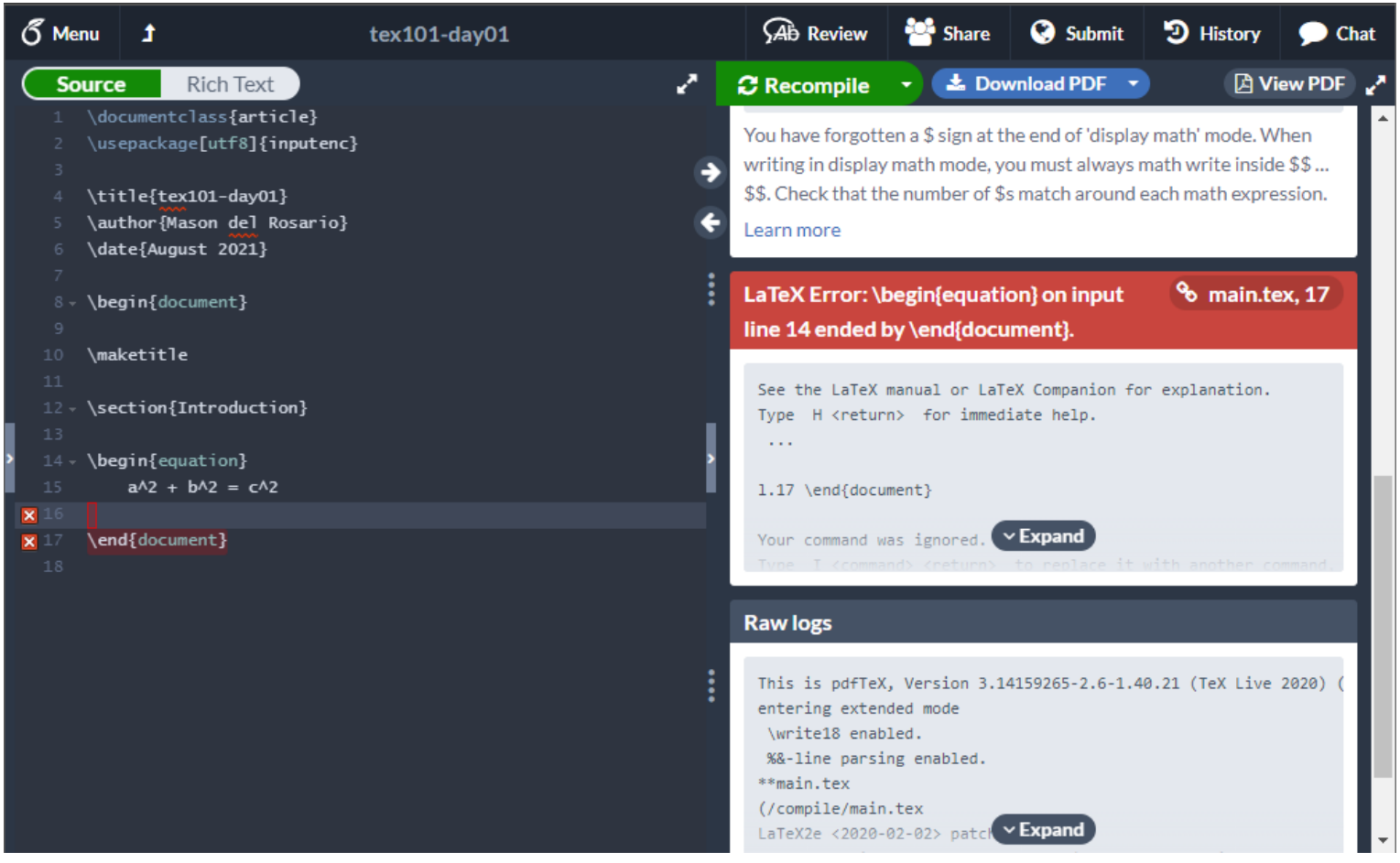


Figure 11: Compiler has returned an error.

Exercise: Text and Whitespace

- Try adding text to your first document, typesetting and seeing the changes in your PDF.
- Make some different paragraphs and add variable spaces.
- Explore how your editor works; click on your source and find how to go to the same line in your PDF.
- Share your observations/questions in chat!

Logical structure

Text formatting, sectioning, lists

Some common commands for formatting text:

- `\textbf`: **Make text boldface.**
- `\textit`: *Make text italic.*
- `\underline`: Underline text.
- `\texttt`: `Make text resemble typewriter.`
- And so many more! For example, see `https://latex-tutorial.com/changing-font-style/`.

Sectioning commands

LaTeX provides commands to generate section/subsection headings.

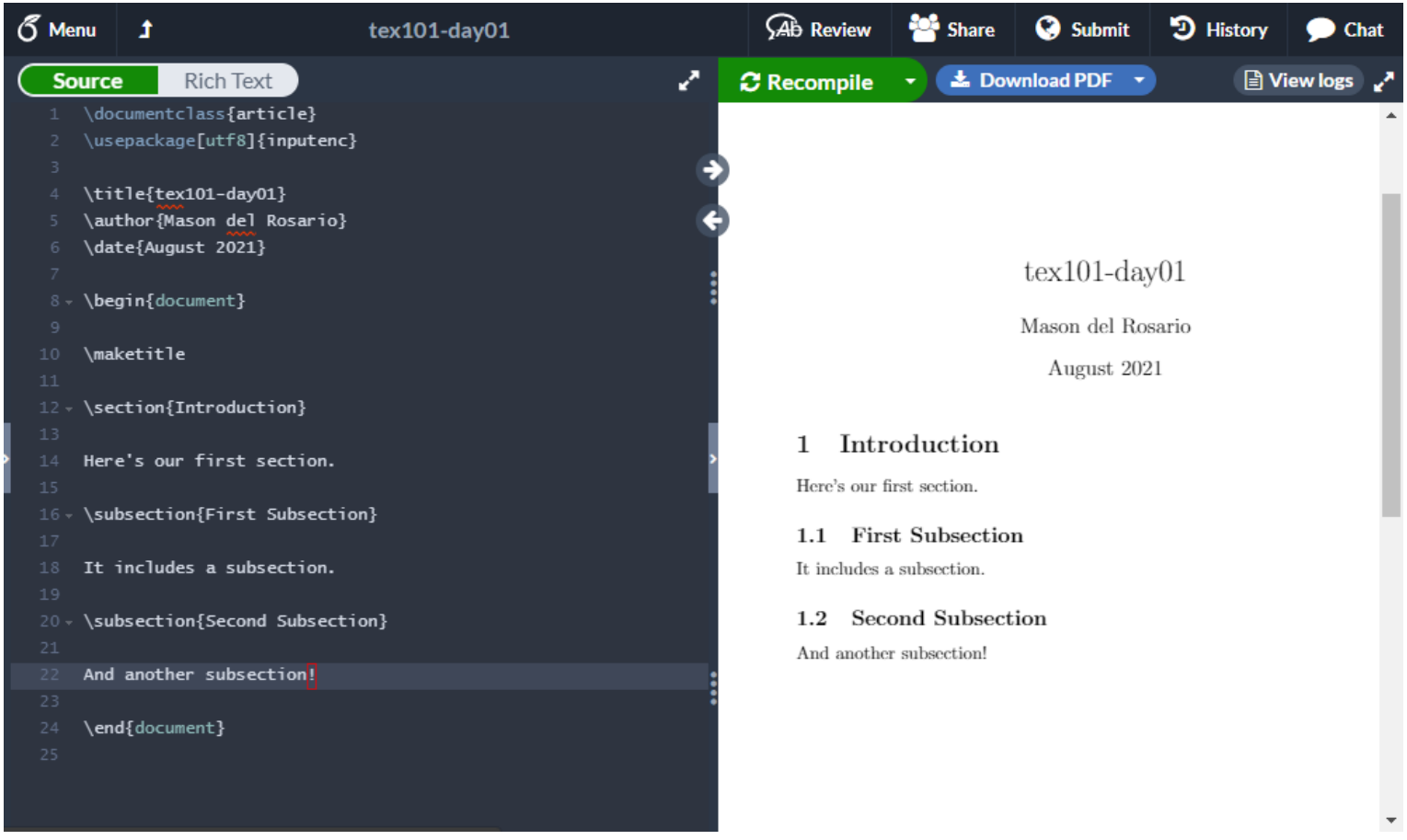


Figure 12: Numbers for different (sub)sections are automatically generated.

Sectioning commands

Different section levels available:

- `\chapter` (for `\documentclass{book}`, `\documentclass{report}`)
- `\section`
- `\subsection`
- `\subsubsection`
- `\paragraph` (rarely used!)

Lists in LaTeXcan be unordered or ordered:

- First unordered item
- Second unordered item
- Third unordered item

1. First ordered item
2. Second ordered item
3. Third ordered item

List commands: `itemize/enumerate` environments + `\item` commands per each line.

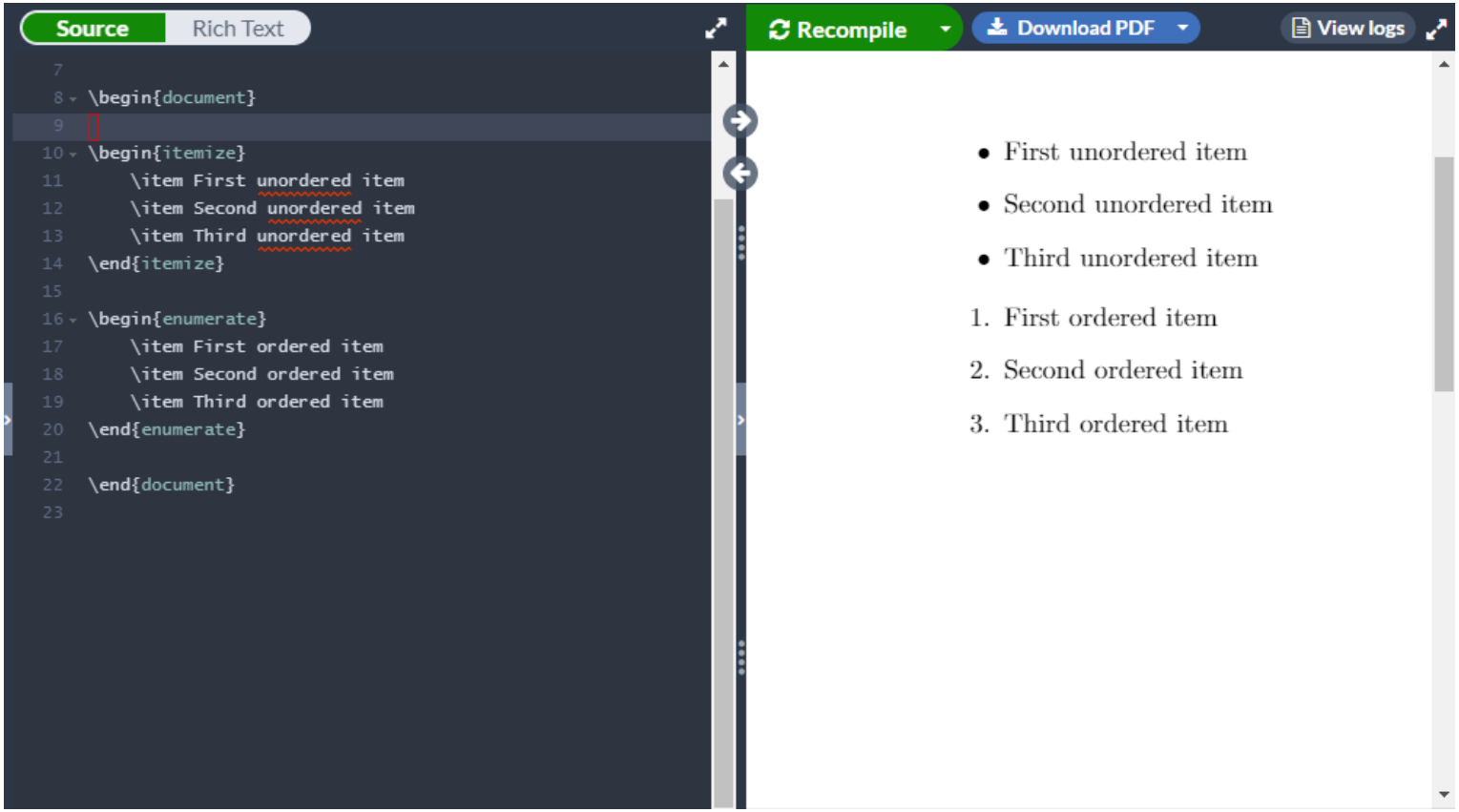


Figure 13: Numbers for different (sub)sections are automatically generated.

Exercises

- Experiment with different sectioning levels. Try using `\documentclass{report}` instead of `\documentclass{article}` and adding `\chapter` commands. How do they look?
- Try out `\paragraph` and (even) `\subparagraph` to see they work: by default, they don't add numbers.
- Make some lists, and nest one list inside another. How does the format of the numbers or markers change? You can only go to four levels with standard LaTeX, but more than four nested lists tends to be a bad sign anyway!

Document Classes

Base classes, function-rich classes(?), presentations

What `\documentclass` does

Controls general layout of document, changing:

- Design (margins, fonts, spacing, etc.)
- Sectioning (e.g., `\chapter`)
- Title location (top of page vs. separate page)
- Add new commands (e.g., `frame` environments for slides)

What `\documentclass` does

Controls general layout of document, changing:

- Design (margins, fonts, spacing, etc.)
- Sectioning (e.g., `\chapter`)
- Title location (top of page vs. separate page)
- Add new commands (e.g., `frame` environments for slides)

Can manually set global options (i.e., `\documentclass[<options>]{<name>}`).

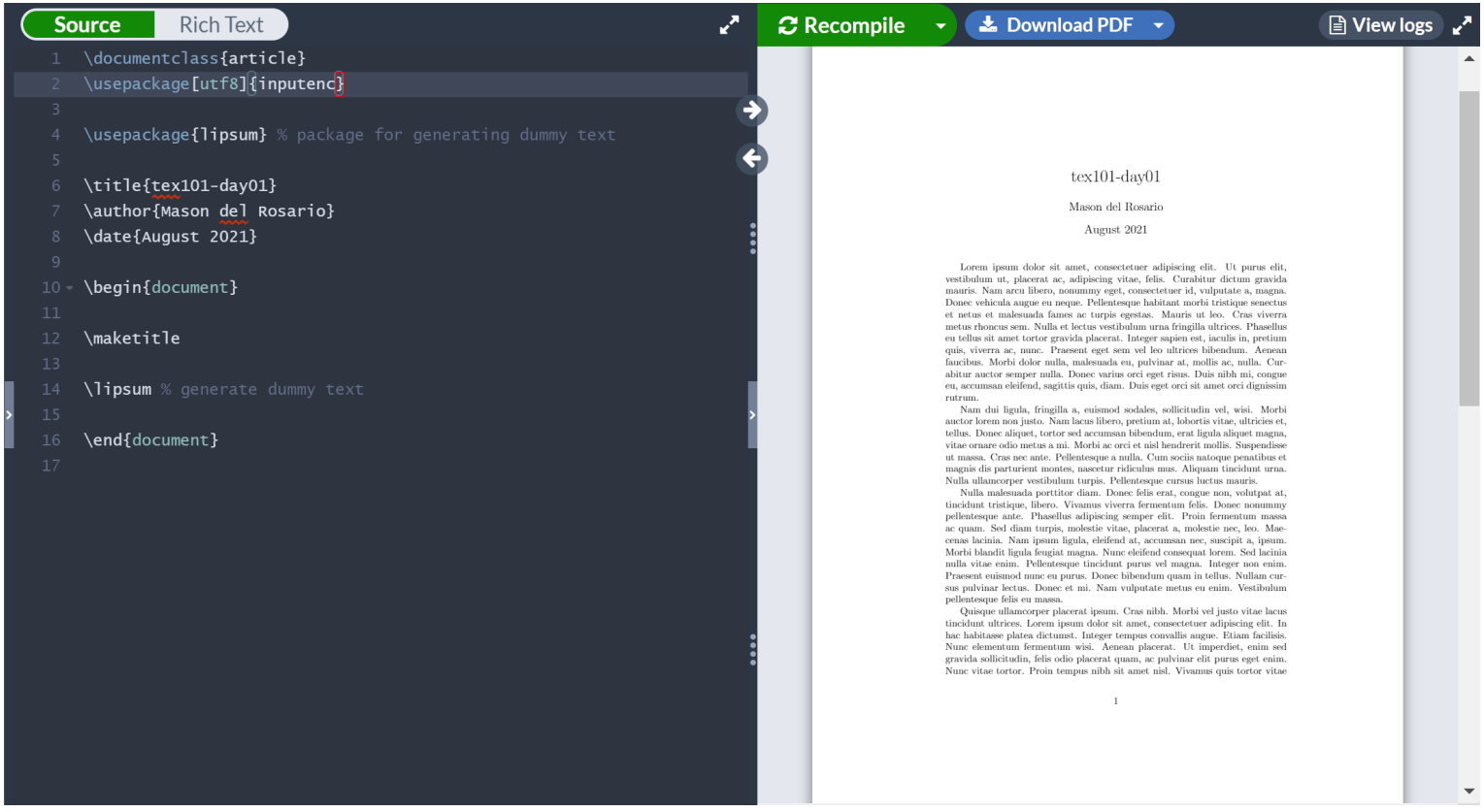


Figure 14: Our starter project is an `article` class.

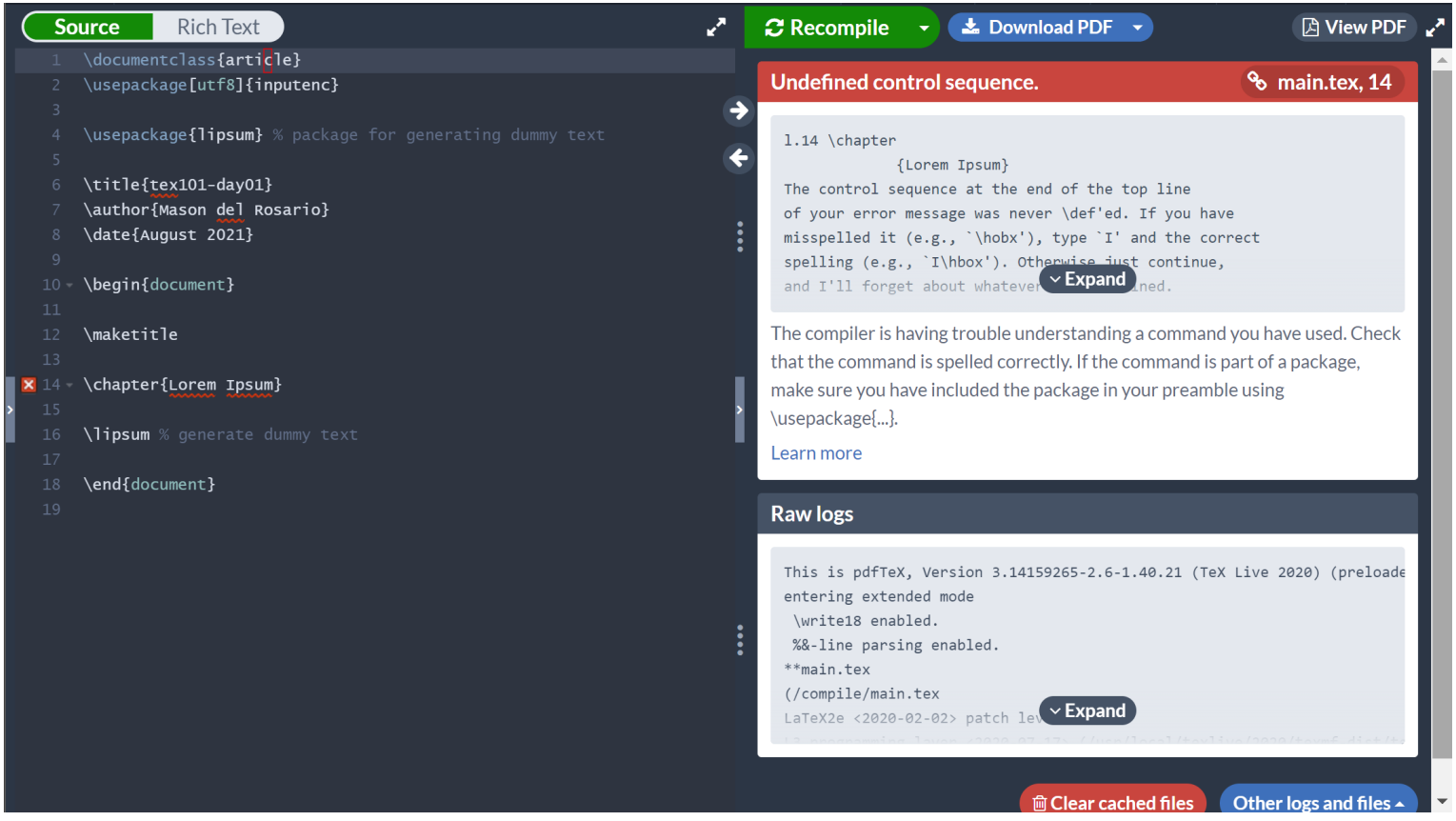


Figure 15: Adding a `\chapter` section causes an error.

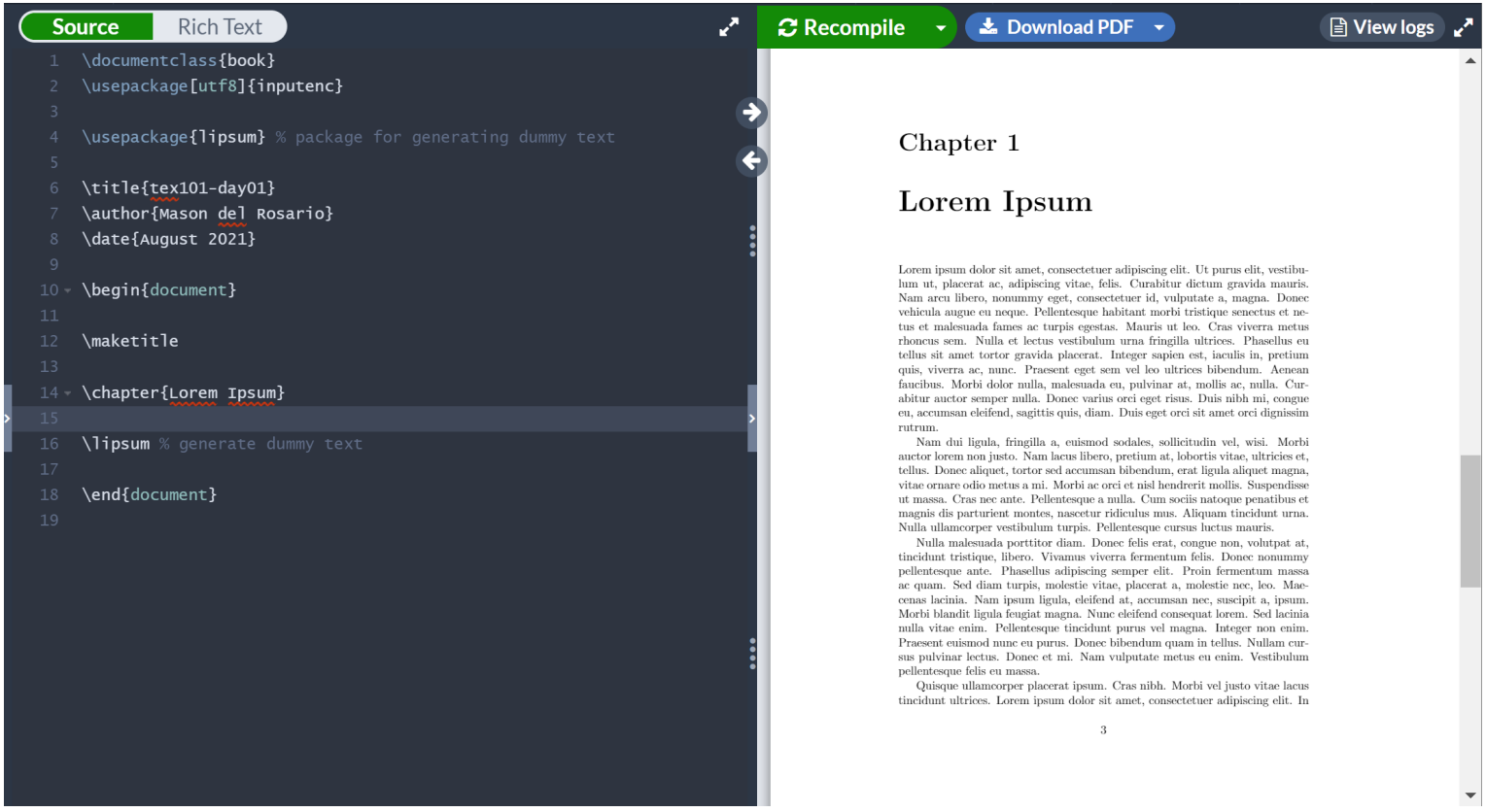


Figure 16: Changing to `\documentclass{book}` enables `\chapter`.

Default `\documentclasses` provided by LaTeX:

- `article` - short documents without chapters
- `report` - longer documents with chapters, single-sided printing
- `book` - longer documents with chapters, double-sided printing, front-/back-matter (e.g., index)
- `letter` - correspondence with no sections
- `slides` - for presentations (not used in practice; will explain!)

- Explore changing the document class between base classes, the KOMA bundle and memoir. How do these affect the appearance of the document?
- Using the square brackets (`[]`), add the option `twocolumn`. How does this affect the layout of the document?

Packages and Definitions

Base LaTeXdoesn't do everything. Packages add more functionality, including:

- Change how parts of LaTeXwork
- Add new commands (e.g. `\lipsum` package for filler text)
- Change document design

Example: `babel` – rule sets for different languages.

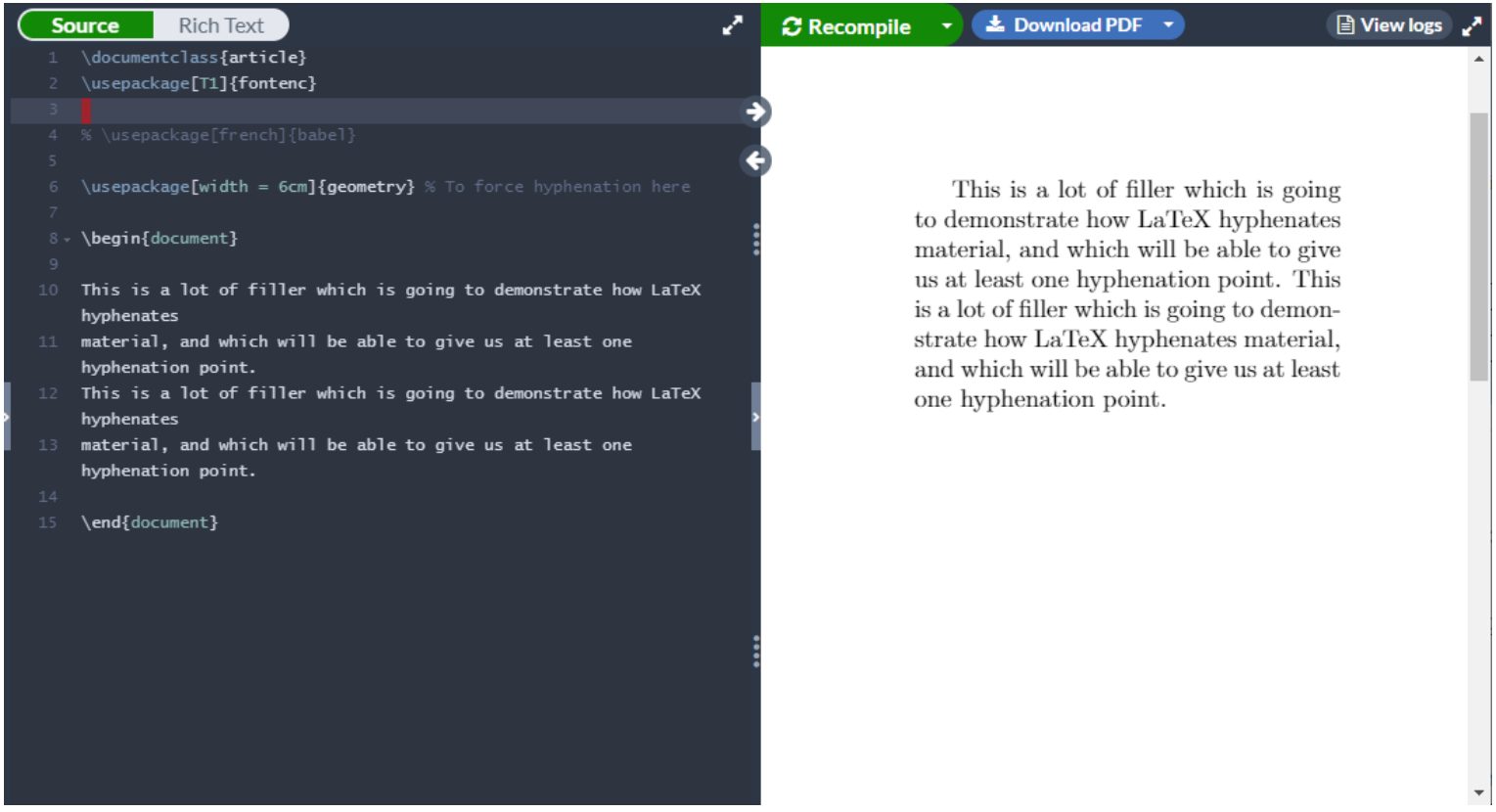


Figure 17: `babel` package with french option changes hyphenation.

Example: `babel` – rule sets for different languages.

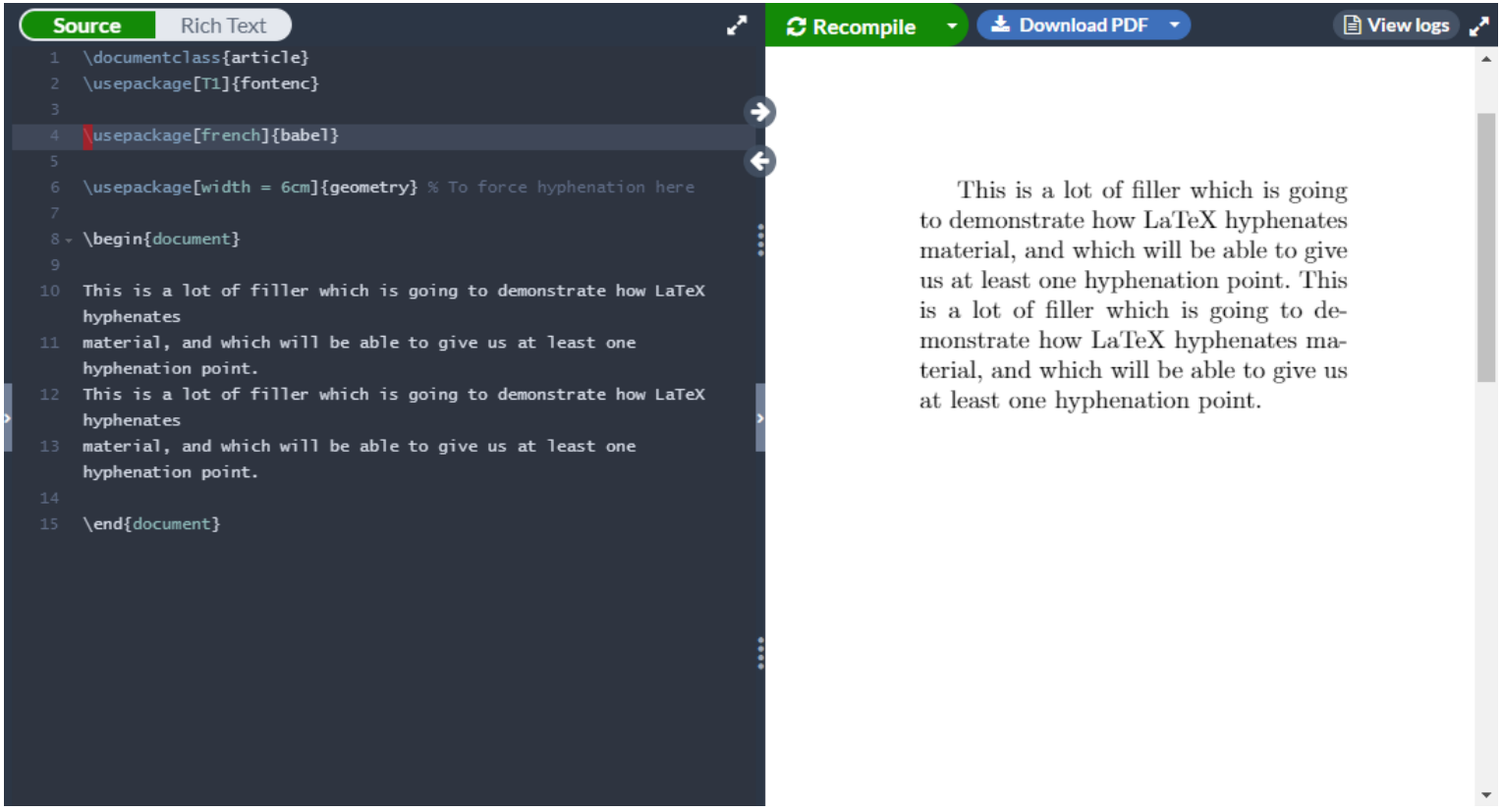


Figure 18: `babel` package with french option changes hyphenation.

Example: `geometry` – enables direct control of margins, borders, line spacing, etc.

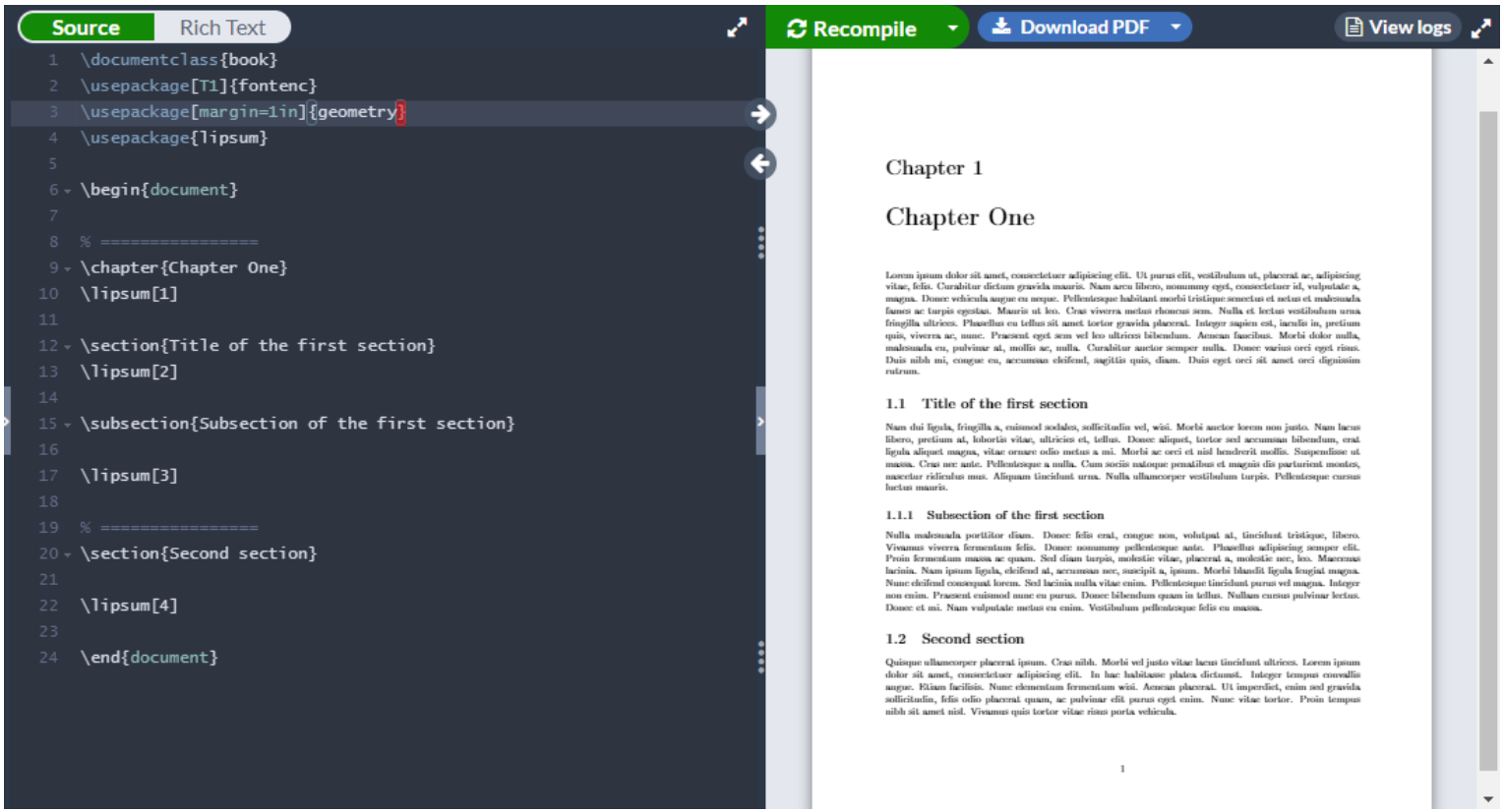


Figure 19: `geometry` package with 1" page margins.

Example: `geometry` – enables direct control of margins, borders, line spacing, etc.

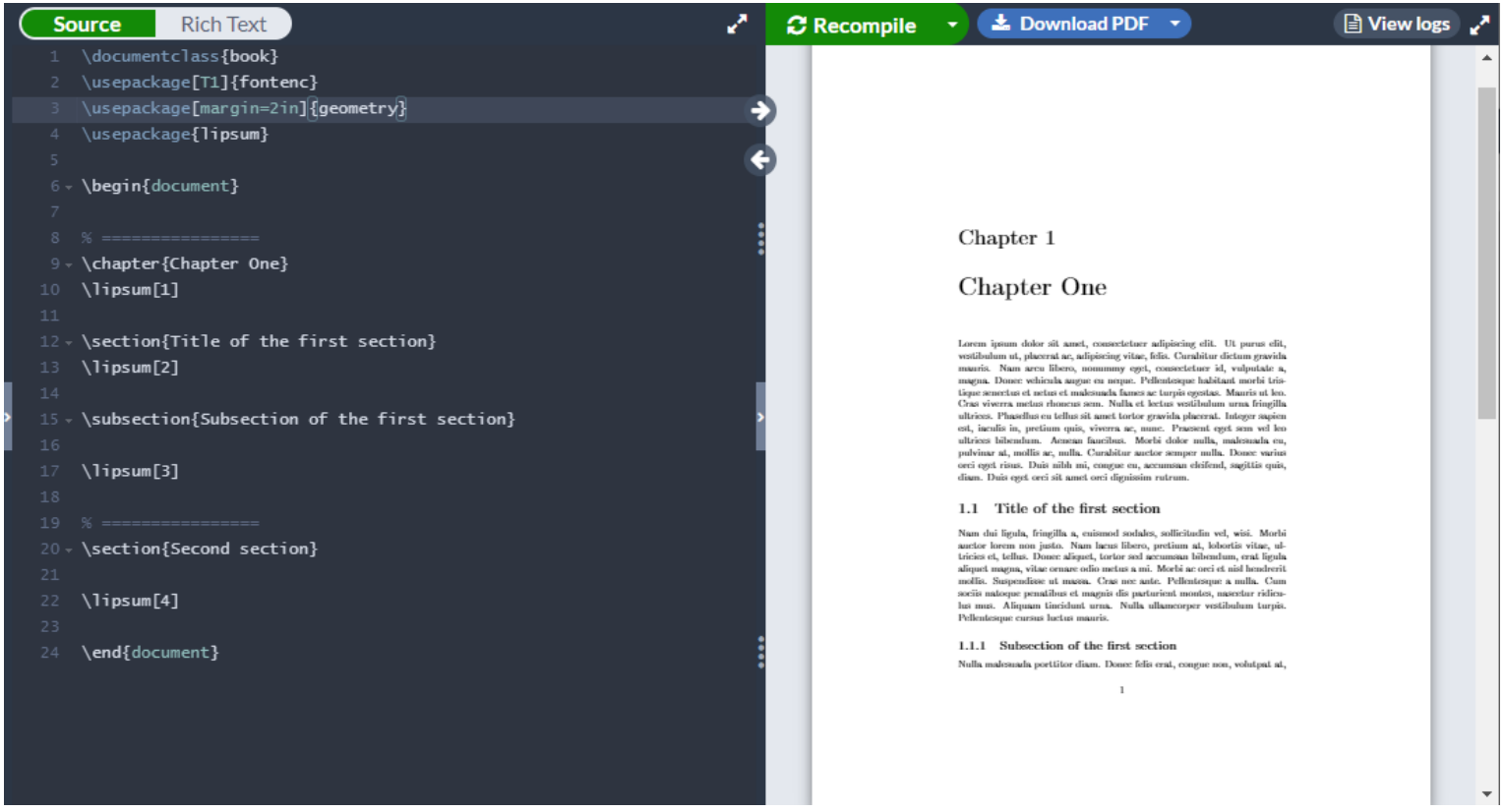


Figure 20: `geometry` package with 2" page margins.

Can't find a command you want? Want to avoid repeating yourself?

Use definitions to define your own commands!

Line 6 `\newcommand` defines a `\kw` command.

- `\newcommand\kw` → assign `kw` as command name
- `[1]` → number of arguments
- `#1` → first argument supplied to command

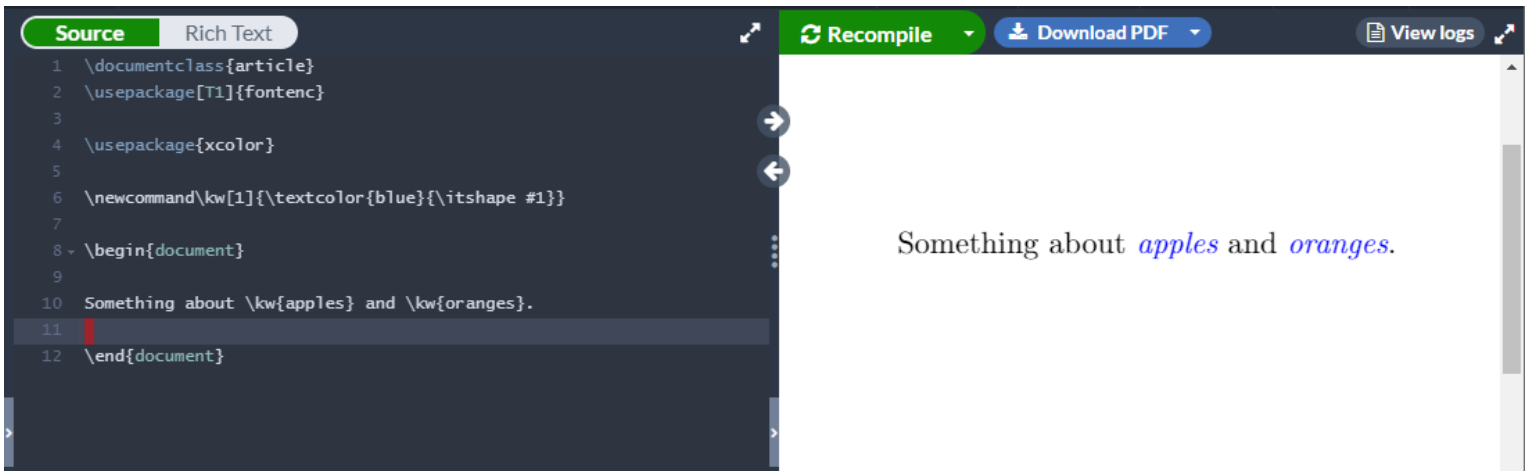


Figure 21: A definition for a custom 'keyword' command `\kw`.

Figures

Including images, resizing, positioning

The graphicx package provides the \includegraphics command.

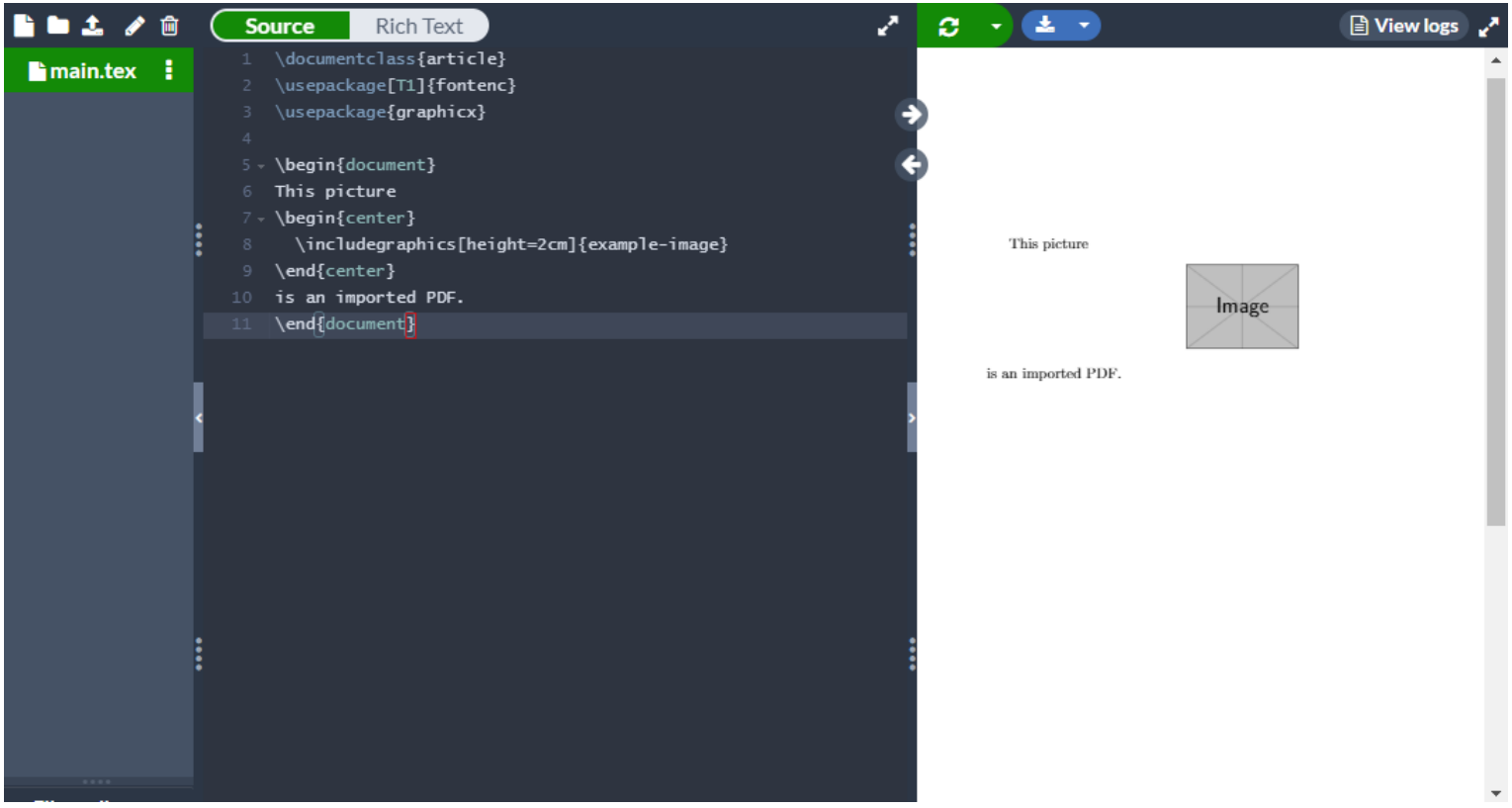


Figure 22: example-image is provided by default in most LaTeXdistributions.

- `\includegraphics` takes optional arguments for scaling
- Common commands: `\textheight`, `\textwidth`

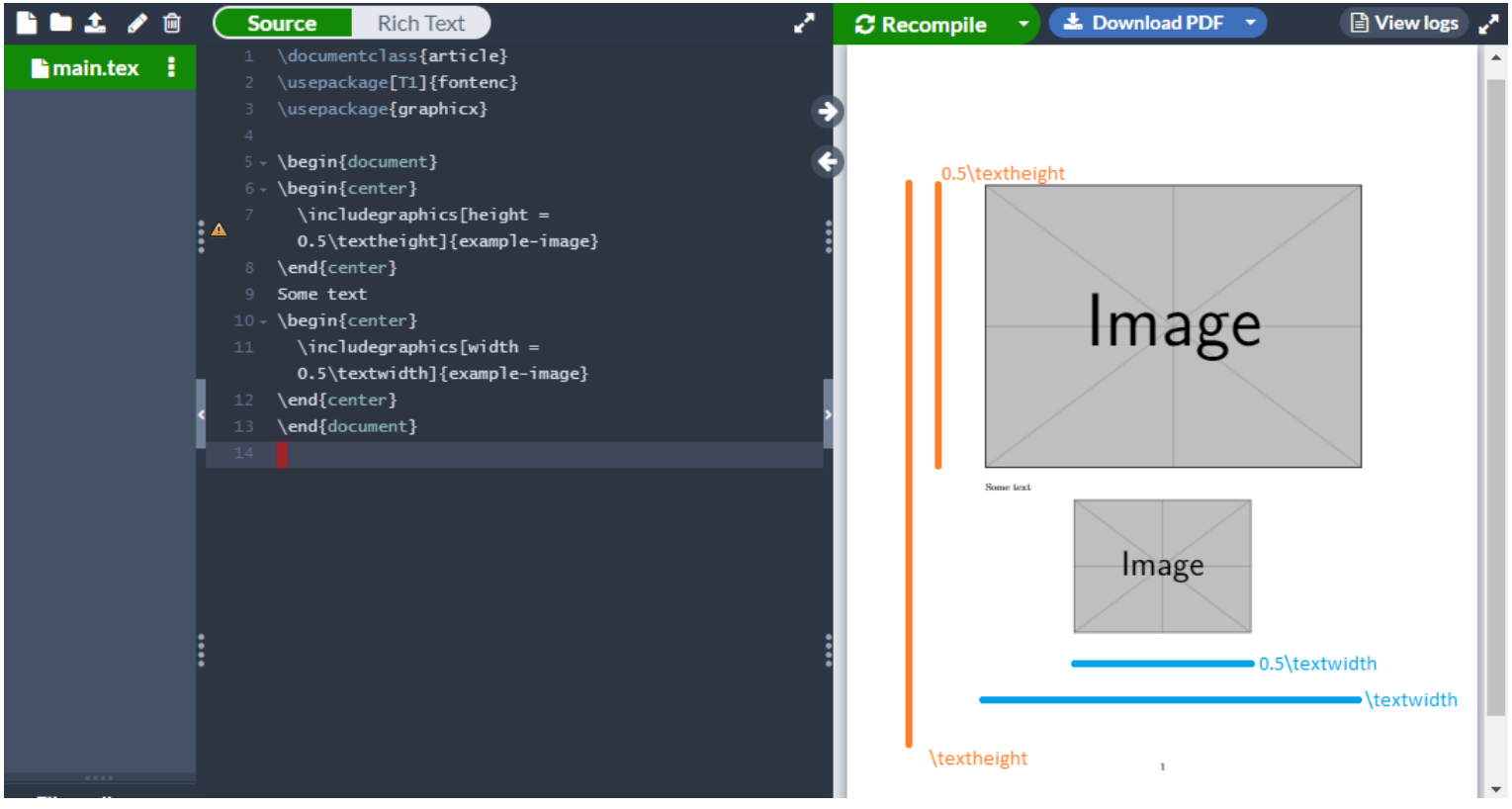


Figure 23: Optional arguments to change `width` and `height` of graphics.

`\includegraphics` takes optional arguments for clipping and rotating

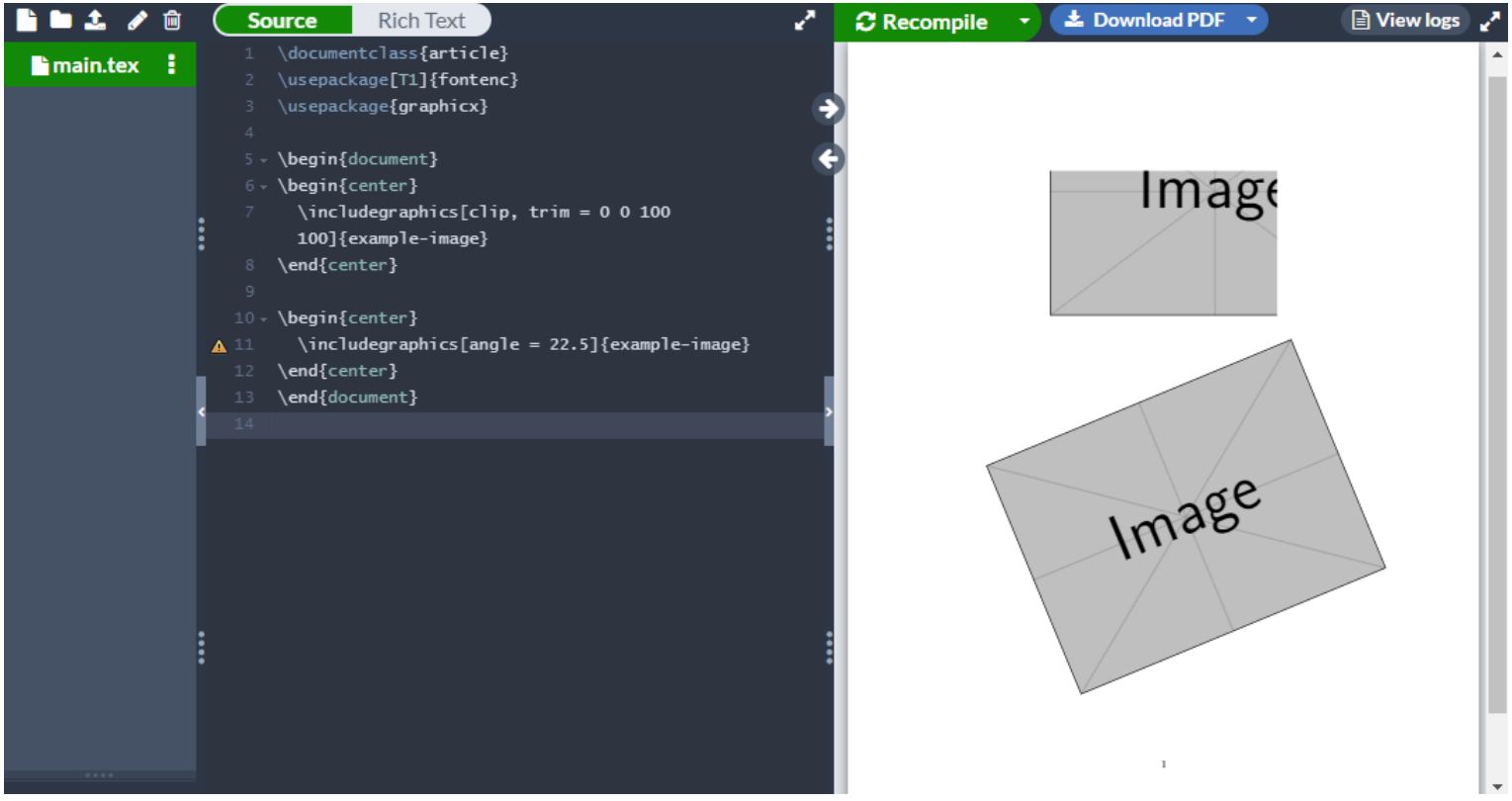


Figure 24: Optional arguments `clip`, `trim`, and `angle`.

Including images can lead to large gaps in text.

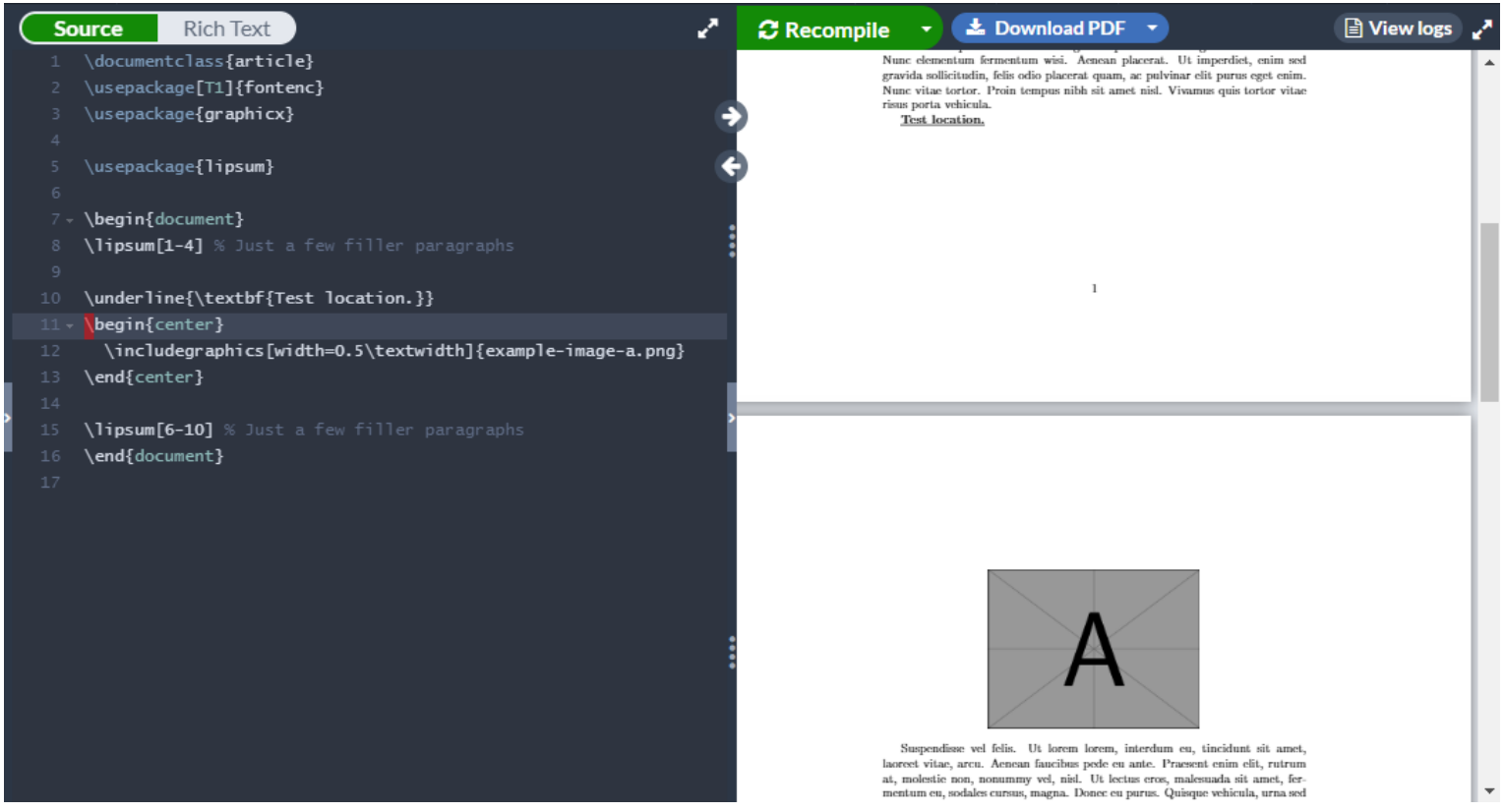


Figure 25: `\includegraphics` causing a gap on Page 1

.

Floats - an image environment (e.g., `figure`) that dynamically adjusts its position.

Figure 26: `figure` environment causes text to wrap properly

.

Optional arguments `[h]`ere, `[t]`op, `[b]`ottom, `[p]`age control float placement.

Figure 27: `figure` with `[hb]` optional argument placed on bottom of page

Tables

Including images, resizing, positioning

The array package provides commands for tables.

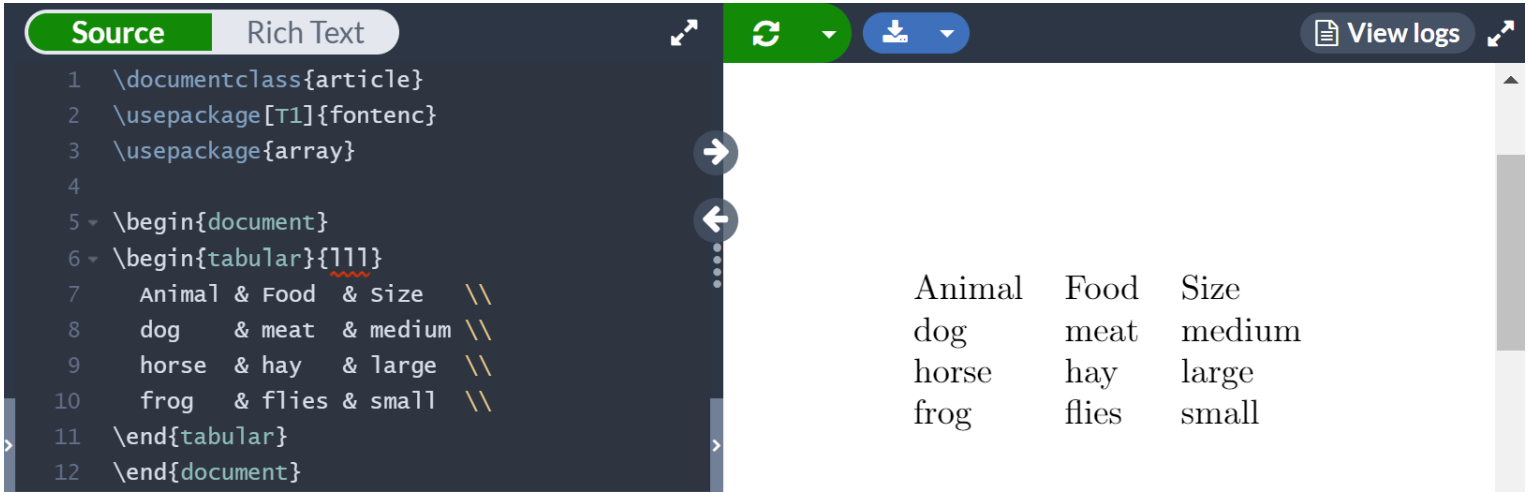


Figure 28: A tabular environment provided by array packages.

Argument to `tabular` changes alignment – `{l}`eft, `{c}`enter, `{r}`ight.

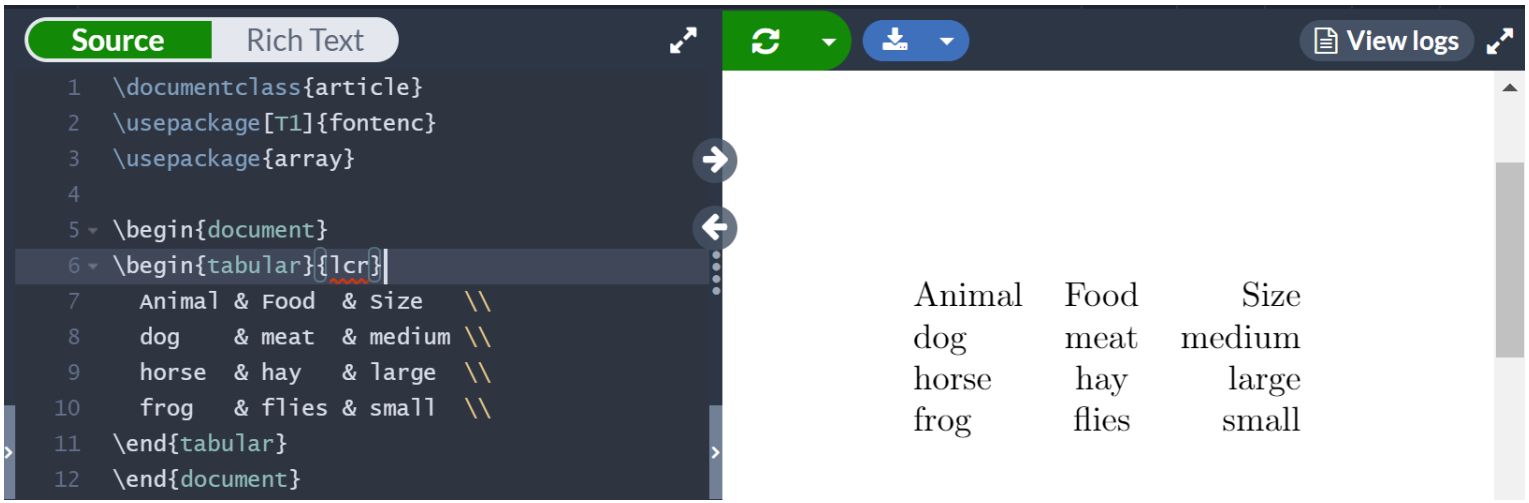


Figure 29: Same table with left, center, and right (`{lcr}`) column alignments.

(`{lcr}`) columns will typeset into single row, even if they are wider than the page.

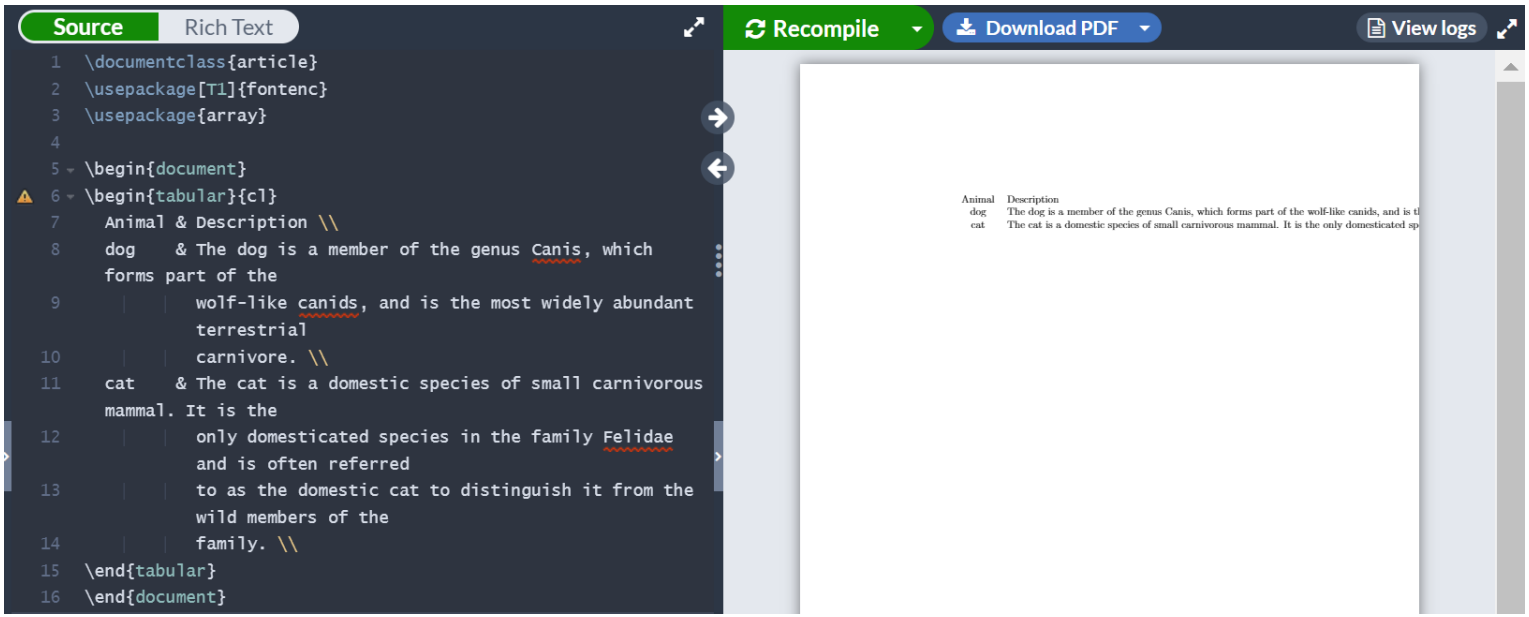


Figure 30: A runaway `l` column.

(`{p}`) columns are forced to a given width.

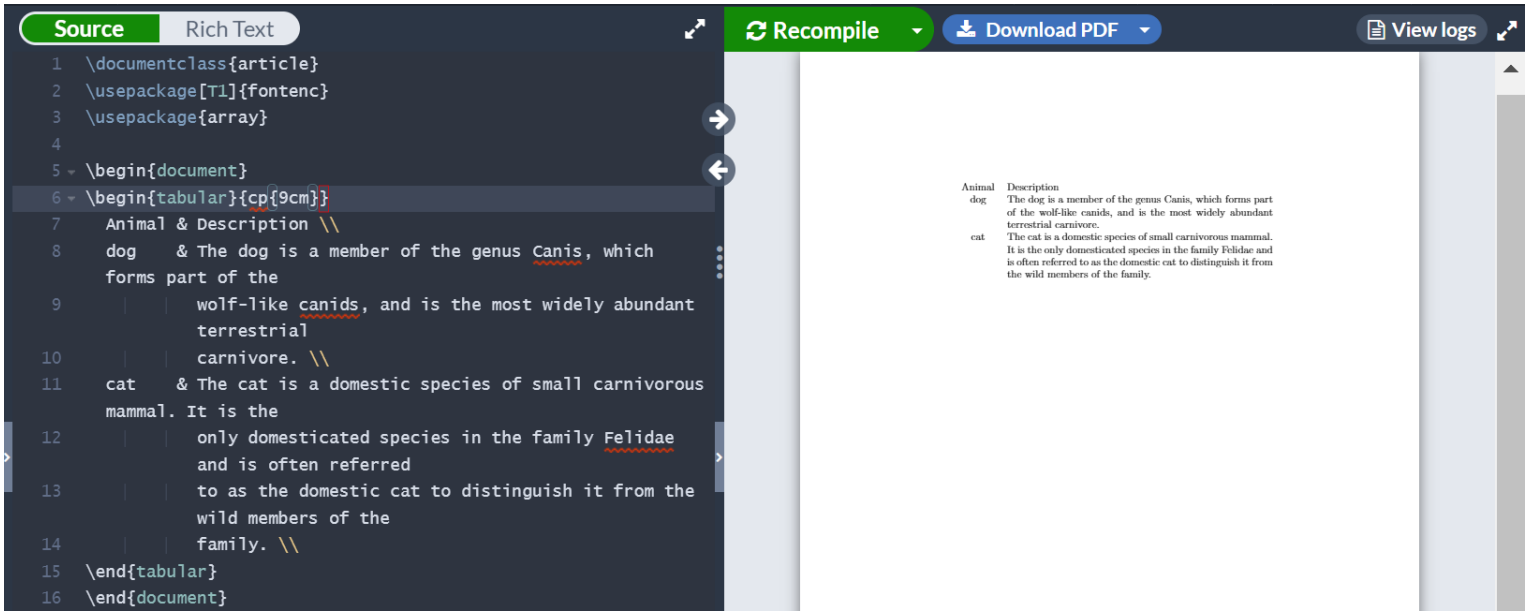
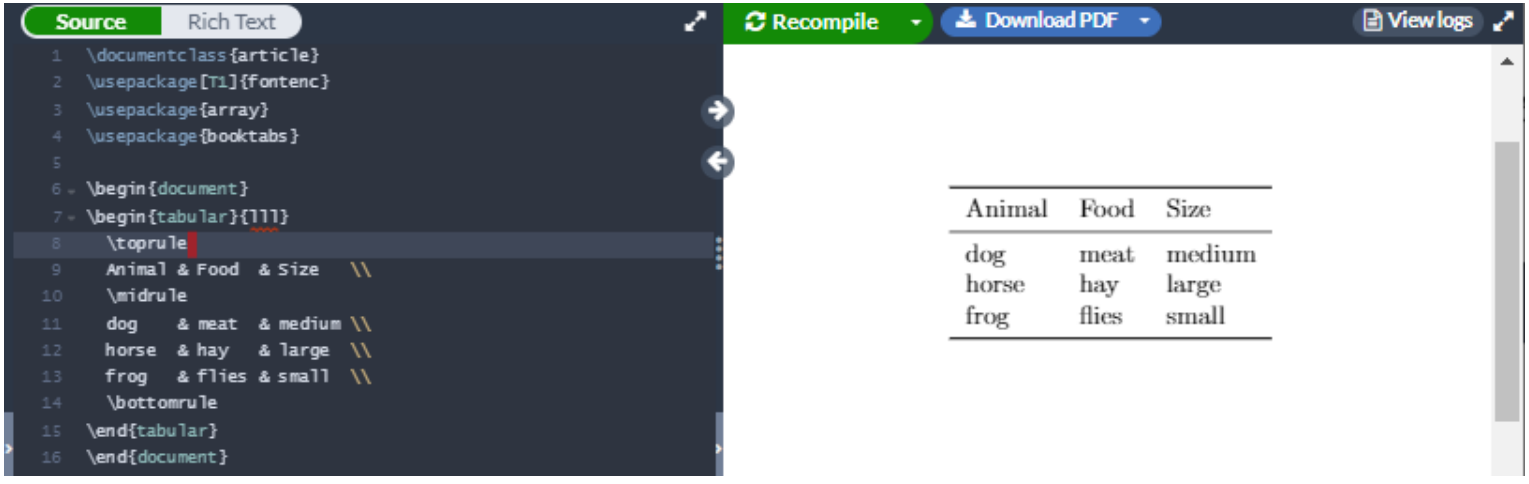


Figure 31: Same text in a `p` column with wrapped text.

Adding rules

Rules (lines) are enabled with the `booktabs` package.



Adding rules

`\cmidrule` spans a subset of columns.

Source | Rich Text

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{lll}
  \toprule
  Animal & Food  & Size   \\
  \midrule
  dog    & meat  & medium \\
  \cmidrule{1-2}
  horse  & hay   & large  \\
  \cmidrule{1-1}
  \cmidrule{3-3}
  frog   & flies & small  \\
  \bottomrule
\end{tabular}
\end{document}
```

Recompile | Download PDF | View logs

Animal	Food	Size
dog	meat	medium
horse	hay	large
frog	flies	small

Adding line space

`\addlinespace` useful for more subtle separation.

Source | Rich Text

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{cp{9cm}}
  \toprule
  Animal & Description \\
  \midrule
  dog    & The dog is a member of the genus Canis, which
forms part of the
           wolf-like canids, and is the most widely abundant
           terrestrial
           carnivore. \\
  \addlinespace
  cat    & The cat is a domestic species of small carnivorous
mammal. It is the
           only domesticated species in the family Felidae
           and is often referred
           to as the domestic cat to distinguish it from the
           wild members of the
           family. \\
  \bottomrule
\end{tabular}
\end{document}
```

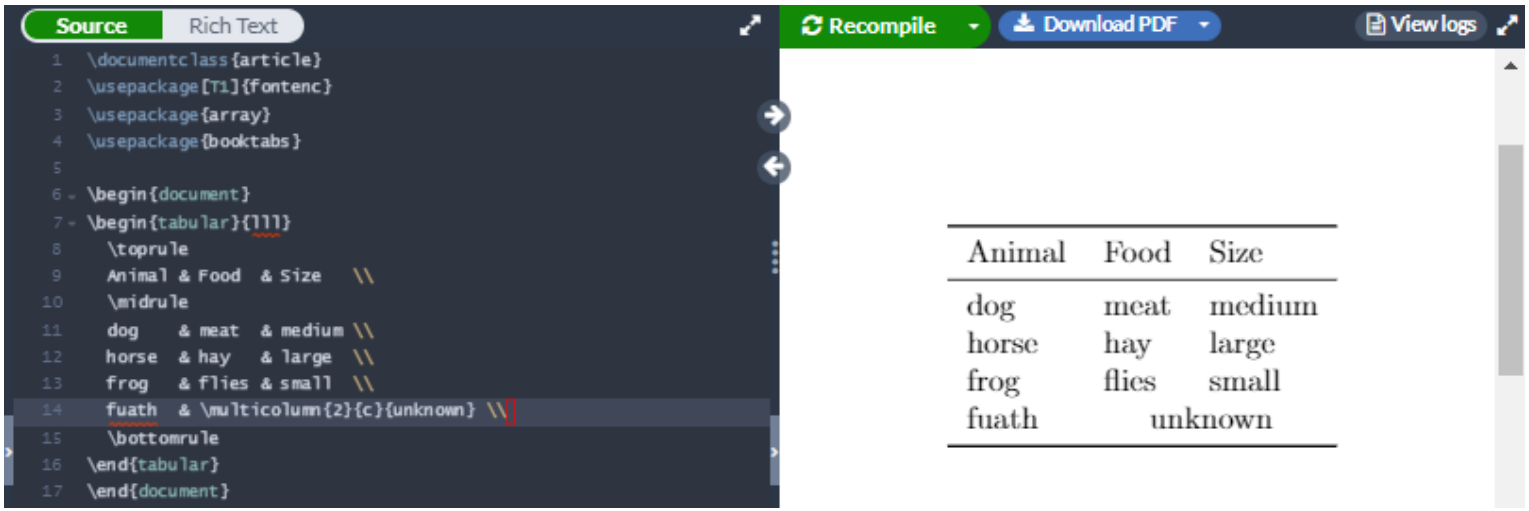
Recompile | Download PDF | View logs

Animal	Description
dog	The dog is a member of the genus Canis, which forms part of the wolf-like canids, and is the most widely abundant terrestrial carnivore.
cat	The cat is a domestic species of small carnivorous mammal. It is the only domesticated species in the family Felidae and is often referred to as the domestic cat to distinguish it from the wild members of the family.

Merging cells

`\multicolumn` creates cells spanning multiple columns. Arguments include:

1. Number of columns cell spans
2. Alignment of cell
3. Contents of cell



Merging cells vertically

No support for vertical merging. Workaround: use blank cells!

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{array}
\usepackage{booktabs}

\begin{document}
\begin{tabular}{lll}
  \toprule
  Group     & Animal & Size   \\
  \midrule
  herbivore & horse  & large  \\
            & deer   & medium \\
            & rabbit & small  \\
  \addlinespace
  carnivore & dog    & medium \\
            & cat    & small  \\
            & lion   & large  \\
  \addlinespace
  omnivore  & crow   & small  \\
            & bear   & large  \\
            & pig    & medium \\
  \bottomrule
\end{tabular}
\end{document}
```

Group	Animal	Size
herbivore	horse	large
	deer	medium
	rabbit	small
carnivore	dog	medium
	cat	small
	lion	large
omnivore	crow	small
	bear	large
	pig	medium

Useful utility for table creation:
`https://www.tablesgenerator.com/`.

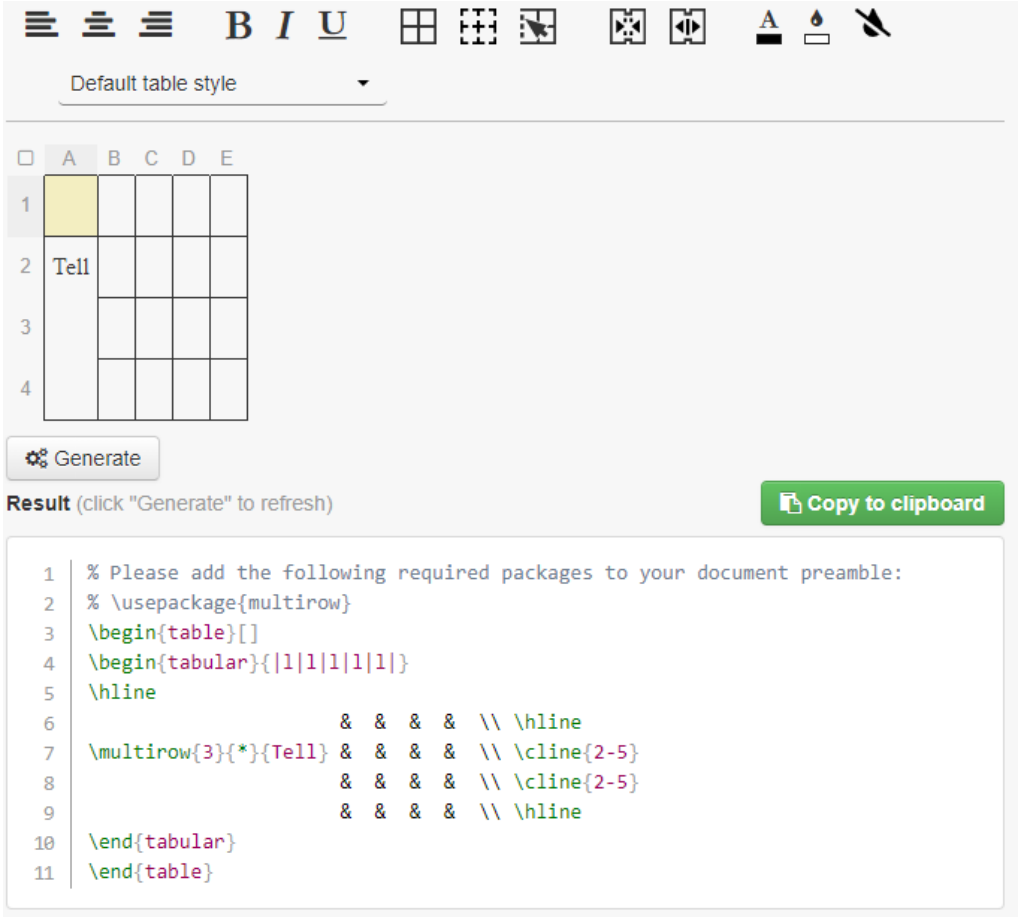


Figure 32: Generate code for table based on WYSIWYG editor.

End of Day 01

- Finished Lessons 1-8 from `learnlatex.org`
- Tomorrow: Lessons 9-16 from `learnlatex.org`
- Questions? Ask on the Slack channel! (#latex101)