Day 02: Intro to LaTeX(continued)

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LaTeX101

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- **Inspiration** – https://www.learnlatex.org/.
  - Day 1 – `learnlatex.org` lessons 1-6 (**Done!**)
  - Day 2 – `learnlatex.org` lessons 7-12.
  - Day 3 – Specific templates (resume, presentations). Inkscape for graphics with embedded LaTeX.
- **Slides Available** – https://github.com/mdelrosa/latex-101.
  - Template based on Clara Pavillet's Oxford Template
- **Slack back channel**
  - UC Davis Slack channel

UCDAVIS

Figures

Including images, resizing, positioning

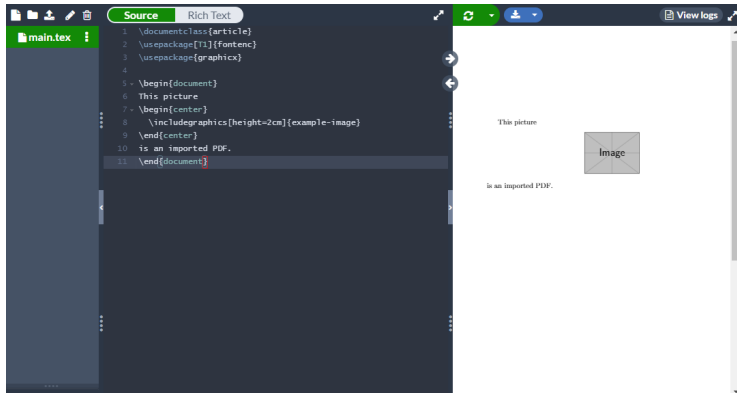The `graphicx` package provides the `\includegraphics` command.

Figure 1: `example-image` is provided by default in most LaTeX distributions.

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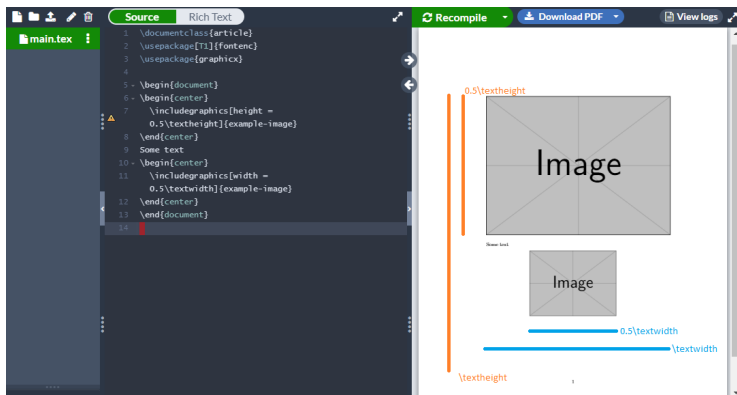- ▶ Common commands: \textheight, \textwidth

Figure 2: Optional arguments to change width and height of graphics.

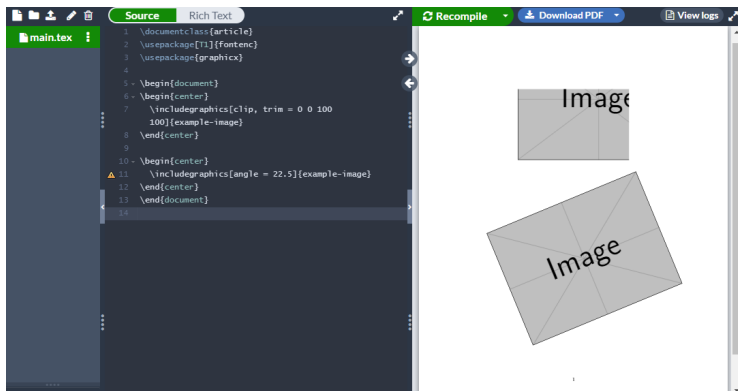\includegraphics takes optional arguments for clipping and rotating

Figure 3: Optional arguments clip, trim, and angle.
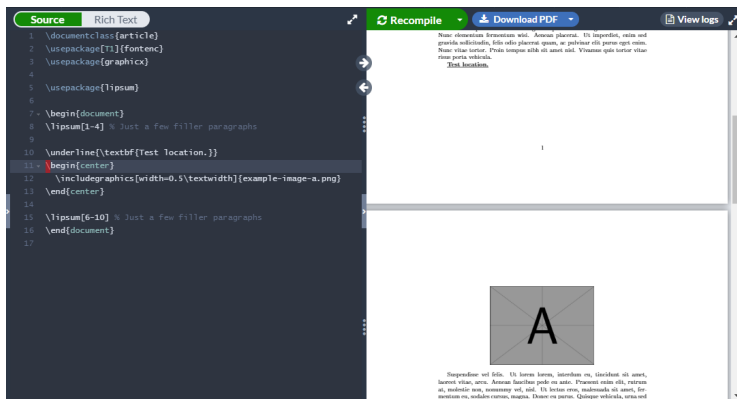
Including images can lead to large gaps in text.

Figure 4: \includegraphics causing a gap on Page 1

.

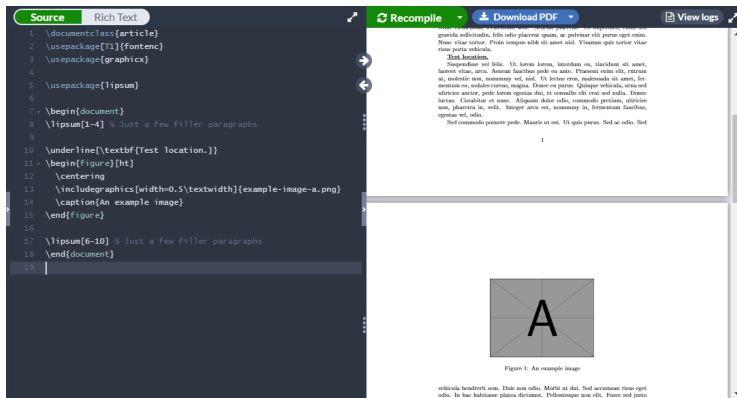<u>Floats</u> - an image environment (e.g., `figure`) that dynamically adjusts its position.

Figure 5: `figure` environment causes text to wrap properly

.

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

Figure 6: `figure` with `[hb]` optional argument placed on bottom of page

Tables

Including images, resizing, positioning
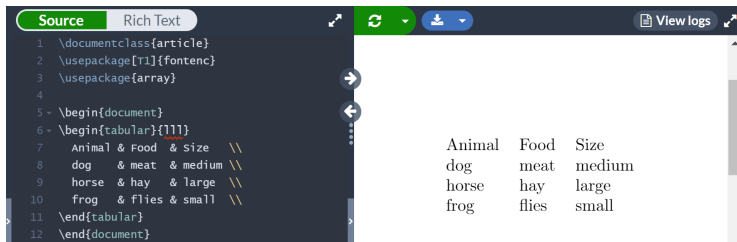
The `array` package provides commands for tables.


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

\begin{document}
\begin{tabular}{lll}
  Animal & Food  & Size   \\
  dog    & meat  & medium \\
  horse  & hay   & large  \\
  frog   & flies & small  \\
\end{tabular}
\end{document}
```

Figure 7: A `tabular` environment provided by `array` packages.

Argument to `tabular` changes alignment – `{l}`eft, `{c}`enter, `{r}`ight.
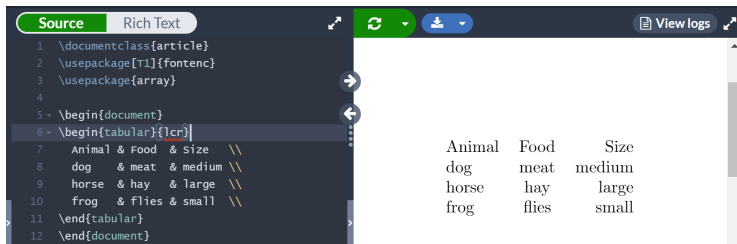
Figure 8: Same table with left, center, and right (`{lcr}`) column alignments.

(`{lcr}`) columns will typeset into single row, even if they are wider than the page.
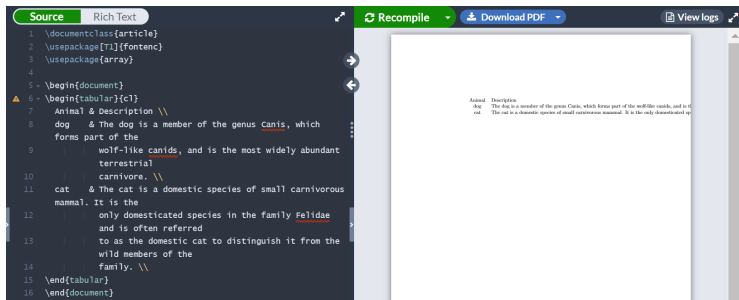
Figure 9: A runaway `l` column.
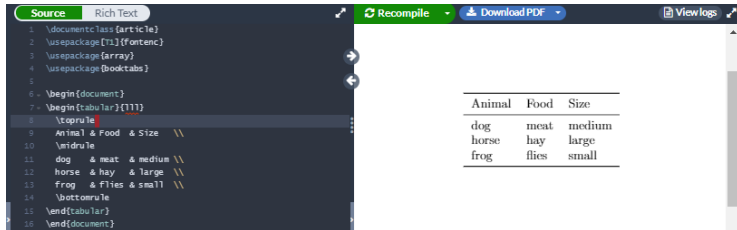
({p}) columns are forced to a given width.
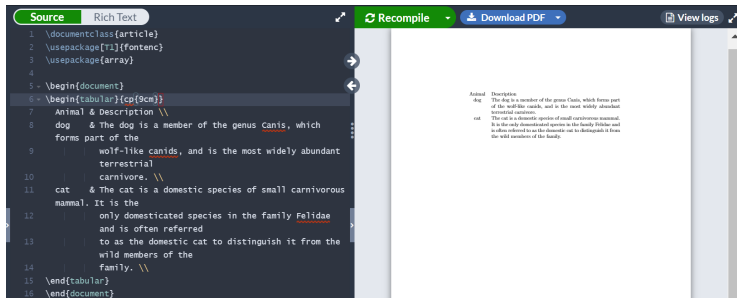
Figure 10: Same text in a p column with wrapped text.
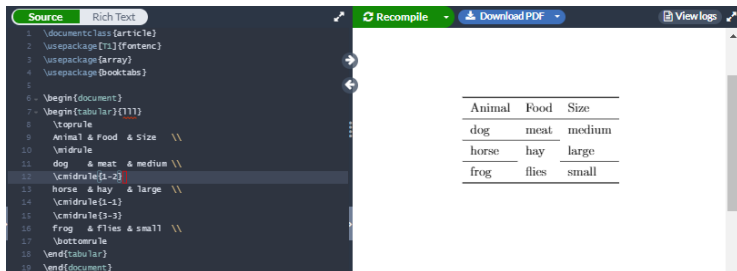
Rules (lines) are enabled with the `booktabs` package.

\cmidrule spans a subset of columns.

`\addlinespace` useful for more subtle separation.

\multicolumn creates cells spanning multiple columns. Arguments include:

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

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

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

Figure 11: Generate code for table based on WYSIWYG editor.

Cross Referencing

Smart references for figures, tables, sections, etc.

- \label commands assign ID to the most recent numbered element.
- \ref commands display number corresponding to label with same ID.
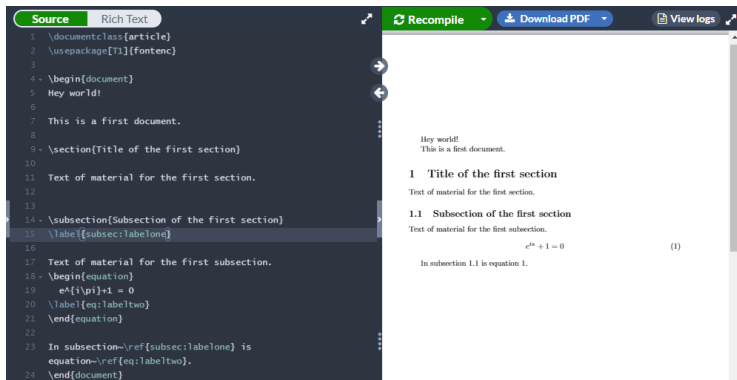
Figure 12: \label and ref commands used to number section and equation environments.

`\label` and `\ref` accept any text as arguments.

Good to name labels after corresponding elements, for example:

- ▶ `\label{eq:...}` for equations
- ▶ `\label{sec:...}` for sections
- ▶ `\label{tab:...}` for tables

Mathematics

Inline vs. display equations

LaTeX's biggest feature: *math mode.* Two categories of math mode equations:

1. **Inline**: Does not break paragraph. Denoted by $\$\ldots\$$ or $\backslash(\ldots\backslash)$.

2. **Display**: Breaks paragraph, centers equation. Denoted by $\backslash[\ldots\backslash]$, equation environment, or align environment.

Figure 13: Example.

Customary to write *all* math symbols in math mode. For example,

- ▶ 2 and -2 (using inline math mode)
- ▶ 2 and -2 (without inline math mode)

Be careful about plaintext copied from other files that include:

- ▶ $ (interpreted as math mode delimiter!)
- ▶ _ (subscript symbol)

Common mathematical constructs:

- ▶ Subscripts ($\_$) and superscripts ($\hat{}$). Pay attention to curly braces ($\{\}$)!
- ▶ Specialist symbols (\sin, \log, \theta, so many more!)

Figure 14: Examples of mathematical symbols.

Display math environments are treated as part of a paragraph. Cannot end a paragraph (i.e., no newline within display environment).

Figure 15: Error arising from blank line in display math environment.

Whitespace delimited by specific control characters (e.g., $\backslash$,).

Figure 16: Whitespace in math environment requires control characters!

Numbered equation environments enable cross-referencing.

Figure 17: Same math in equation environment

To suppress numbers, add asterisk (*)

Figure 18: `align` environment with number suppressed.

align environments also enable cross-referencing plus control of line alignment.

- ▶ \\: Force a newline
- ▶ & : Location to align between two lines

Figure 19: Two lines in align environment

align environments also enable cross-referencing plus control of line alignment.

- ▶ \\: Force a newline
- ▶ & : Location to align between two lines


```
1  \documentclass{article}
2  \usepackage{amsmath}
3  \usepackage[T1]{fontenc}
4  \begin{document}
5  A paragraph about a larger equation
6  \begin{align}
7  \int_{-\infty}^{+\infty} & e^{-x^2} \, dx \\
8  \int_{-\infty}^{+\infty} & \sin(-y^2) \, dy
9  \end{align}
10 \end{document}
```
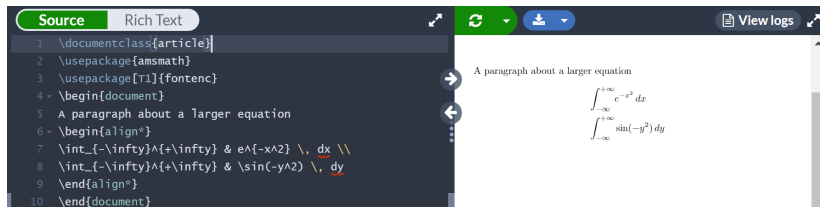
A paragraph about a larger equation

$$\int_{-\infty}^{+\infty} e^{-x^2}\, dx \tag{1}$$

$$\int_{-\infty}^{+\infty} \sin(-y^2)\, dy \tag{2}$$
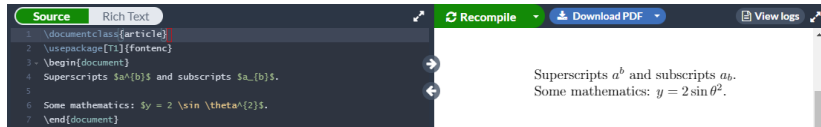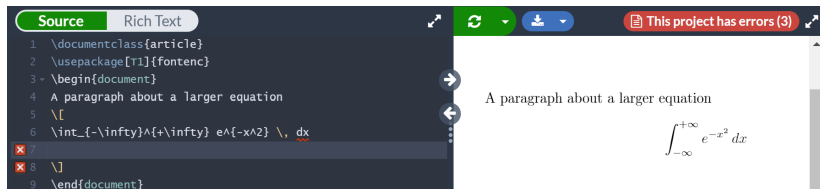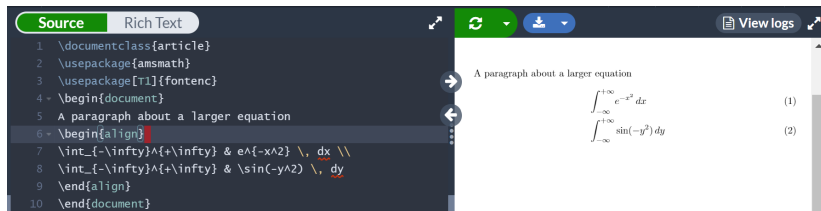
Figure 20: Two lines in align environment

To suppress number in `align` or `equation`, add an asterisk (i.e., `align*`, `equation*`)

Figure 21: `align` without number.

amsmath provides three matrix environments:
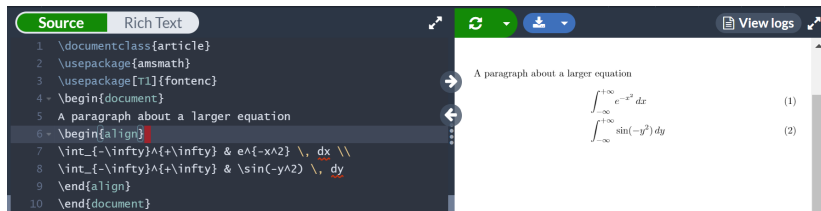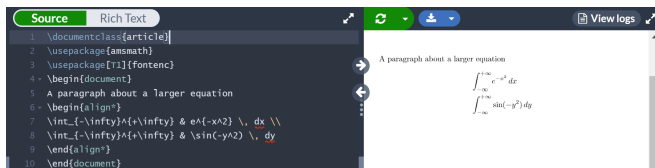
1. matrix – Matrix with no brackets
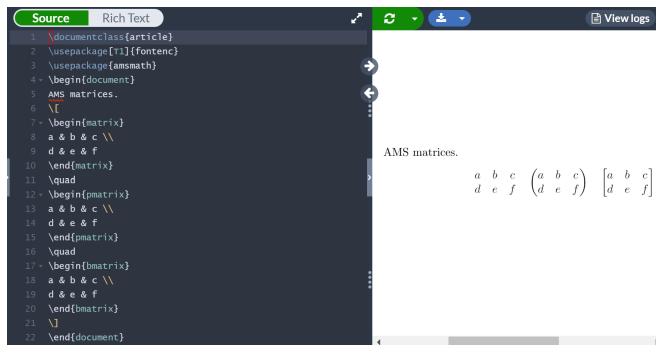2. pmatrix – Matrix with parentheses
3. bmatrix – Matrix with square brackets

Figure 22: Different matrices with different delimiters.

Math fonts can convey specific meaning. Available math fonts are:

Name	Command	Example
Roman	\mathrm	R
Italic	\mathit	*R*
Boldface	\mathbf	**R**
Sans serif	\mathsf	R
Monospaced/typewriter	\mathtt	R
Double-struck/blackboard bold	\mathbb	$\mathbb{R}$

To use plain font in a math environment:

- ► \text to match outer font.
- ► \mathrm roman font (regardless of outer font).

Figure 23: Plain font in math environment.

So many math symbols! If you're lost, detexify
(http://detexify.kirelabs.org/classify.html) can help.

Figure 24: Returned matches for a hand-drawn gamma (γ) symbol.

Fonts + Spacing

Paragraph spacing, newlines, explicit spacing/formatting

Behavior for new paragraphs:

- ▶ Default: indents, no blank line between paragraphs
- ▶ `parskip`: no indents, blank line between paragraphs

Figure 25: New paragraph behavior using `parskip`.

- For default text, newlines between paragraphs should be automatically added by including 'blank lines'
- In certain environments, need \\ to force newlines
  - End of table rows
  - Inside of center environments
  - Inside of verse environments (poetry)

For more fine-tuned whitespace:

- ► \, – thin space (text mode)
- ► \., \:, \; – different sized spaces (math mode)
- ► \hspace, \vspace – explicit horizontal, vertical space
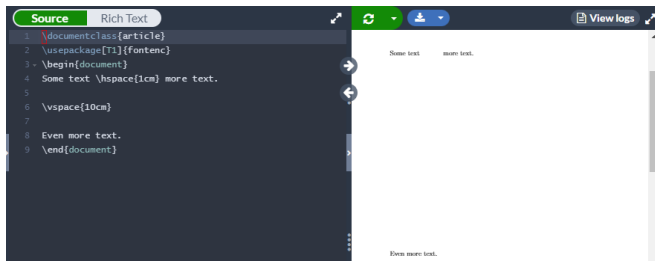

Figure 26: Examples of \hspace, \vspace.

For short pieces of text, the following formatting commands are
available:

Name	Command	Example
Roman	\textrm	Format
Italic	\textit	*Format*
Boldface	\textbf	**Format**
Sans serif	\textsf	Format
Monospaced	\texttt	`Format`
Small caps	\textsc	FORMAT

- Group = anything in curly braces ({}). Use with large blocks of text.
- \itshape and \bfseries used to make groups italic and bold face, respectively.

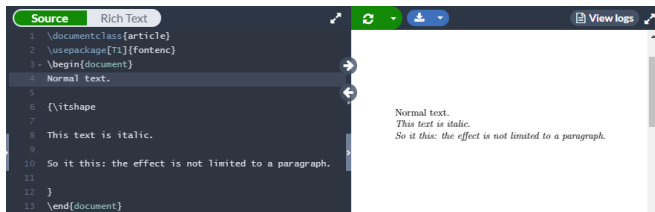Figure 27: Example of \itshape used with a group.

- ► Relative font size within a group – \huge, \large, \normalsize, \small, \footnotesize, \tiny.
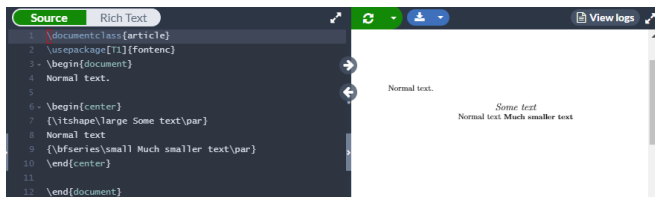
- ► \par – end of paragraph

Figure 28: Example of \large, \small commands used with groups.

Citations + References

.bib files,

Reference Databases (aka, bibliography files, `.bib` files) –

- ▶ Contain bibliography entries/references (e.g., `book`, `article`, etc.)
- ▶ Each entry contains multiple *fields.*
- ▶ `author` field: contains all authors separated by **and** (important!).

```
1  @article{oetiker1995not,
2   title={The {N}ot so {S}hort {I}ntroduction to {LATEX}2$\varepsilon$},
3   author={Oetiker, Tobias and Partl, Hubert and Hyna, Irene and Schlegl, Elisabeth},
4   journal={Electronic document available at http://www. tex. ac. uk/tex-archive/info/
           lshort},
5   year={1995},
6   publisher={Citeseer}
7  }
```

Figure 29: Example .bib entry.

T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, "The Not so Short Introduction to LATEX2ε," *Electronic document available at http://www. tex. ac. uk/tex-archive/info/lshort*, 1995

Behind the scenes, three steps:

1. Compile document; creates list of cited references in document (not always everything in the database!).

2. Run a program (BibTeX or Biber); takes cited references, matches them to database entries, puts them in order.

3. Compile document again; resolves citations in document.

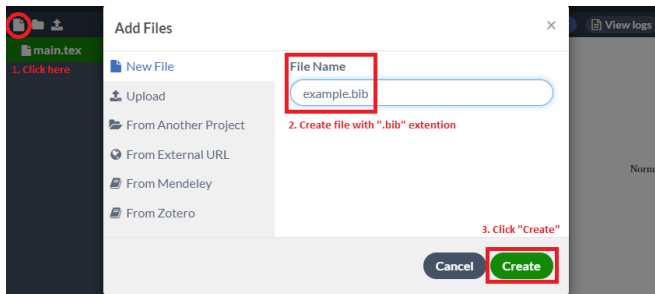**Note**: Overleaf will abstract out this process. Only need to hit "Compile."

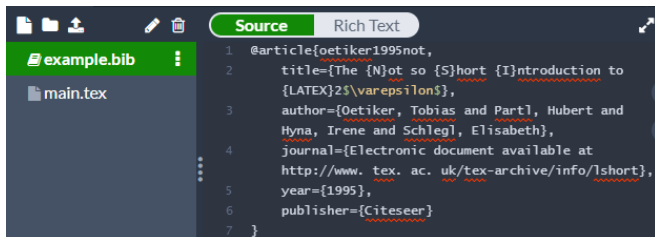Figure 30: Creating a new `.bib` file in Overleaf.

Figure 31: `.bib` file with a single entry.

- ▶ Using `natbib` package (BibTeX-based)
- ▶ Parenthetical citation (\citep) vs. Textual citation (\citet)

Figure 32: Textual vs. parenthetical citations using `natbib`.

- ▶ Finished: Lessons 1-6 (Day 01) and 7-12 (Day 02) from `learnlatex.org`
- ▶ Lessons 13 to 16 – can ask questions re: these on the Slack channel! (#latex101)
- ▶ Next time: Resume/CV templates, Beamer, Inkscape

UCDAVIS

T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, "The Not so Short Introduction to LATEX2ε," *Electronic document available at http://www. tex. ac. uk/tex-archive/info/lshort*, 1995.