Org-mode Latex Export Example

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Contents

1 Front matter and version information

Make sure that you read this document in its raw source form. If you are looking at a rendered representation, e.g. in github, you will not be able to see the org source code.

- Emacs version

```
Emacs version: GNU Emacs 27.2 (build 1, x86_64-pc-linux-gnu, GTK+ Version 3.22.30)
 of 2021-08-29
org version: 9.5.2
```

- LaTeX version

```
pdfTeX 3.14159265-2.6-1.40.18 (TeX Live 2017/Debian)
kpathsea version 6.2.3
Copyright 2017 Han The Thanh (pdfTeX) et al.
There is NO warranty.  Redistribution of this software is
covered by the terms of both the pdfTeX copyright and
the Lesser GNU General Public License.
For more information about these matters, see the file
named COPYING and the pdfTeX source.
Primary author of pdfTeX: Han The Thanh (pdfTeX) et al.
Compiled with libpng 1.6.34; using libpng 1.6.34
Compiled with zlib 1.2.11; using zlib 1.2.11
Compiled with poppler version 0.62.0
```

2 Debugging

- Org removes some of the intermediate files if the variable `org-latex-remove-logfiles` is set to true. So, for debugging, it makes sense to set it to nil. I have done this locally in this document's local variables.
- Use `pdflatex` with the option synctex=1. This option creates `*.synctex.gz` files which can be used by a viewer to jump to the respective text in the Tex file upon mouse clicking within the PDF. This is very useful to check the resulting LaTeX code when doing tests. Here is my own setting of the `org-latex-pdf-process` emacs configuration variable.

```
(setq org-latex-pdf-process
      (let
  ((cmd (concat "pdflatex -shell-escape -interaction nonstopmode"
" --synctex=1"
" -output-directory %o %f")))
(list cmd
      "cd %o; if test -r %b.idx; then makeindex %b.idx; fi"
      "cd %o; bibtex %b"
      cmd
      cmd)))
```

3 Major document elements

3.1 Equations

- Nice link for mathematical symbols on wikipedia:

the following example uses escaped angular parentheses quoting `\[...\]`. This is short for putting the equation into a displaymath environment

```
\begin{displaymath}
...
\end{displaymath}
```

The rendered equation:

$$cores_{extrapol} = cores_{intern2013} \cdot offl\% \cdot \frac{gf \cdot (volume_{user} + volume_{intern})}{volume_{intern}}$$

Note: You should not use the double dollar quoting `$$...$$` (q.v. this stackexchange answer) and the deadly sins description.

Here follows an example for an equation embedded in the text. This is reached by either using the escaped round parentheses syntax `\(...\)` or the single dollar sign syntax `$...$`. $cores_{extrapol} = cores_{intern2013} \cdot offl\% \cdot \frac{gf \cdot (volume_{user} + volume_{intern})}{volume_{intern}}$ The text continues after the formula.

Here follows a numbered equation that also can be referenced like in the following parentheses (eq 1). Note that we have to rely here on standard latex syntax, since org mode does not offer equations as a native element that we can mark up with #+NAME tags, etc.

$$cores_{extrapol} = cores_{intern2013} \cdot offl\% \cdot \frac{gf \cdot (volume_{user} + volume_{intern})}{volume_{intern}} \quad (1)$$

from an article by Stefaan Lippens on on using *textnormal* for including normal text correctly in a math environment.

$$\int_1^9 xdx \qquad \text{this is textrm}$$

$$\sum_1^9 y \qquad \textsf{this is textsf}$$

$$\prod_1^9 z \qquad \text{this is textnormal}$$

Only textnormal will guarantee that the text appears in the default font of the document.

3.2 Figures

I can reference the figure like this: Fig. 1.

Note

- there must be no empty line between the picture's link and the meta definitions for name, caption, etc.
- The figure must have a caption if it is to be included in a list of figures (see `\listoffigures` statement at the end of the document), because the caption will trigger exporting to a LaTeX *figure* environment.
- Without a caption, an image can still be exported as a floating image by using the `:float` option.
- The OPTION `tex:t` must be set for references to work.

Table 1: Floating environment specifiers

Specifier	Permission
h	Place the float here, i.e., approximately at the same point it occurs in the source text (however, not exactly at the spot)
t	Position at the top of the page.
b	Position at the bottom of the page.
p	Put on a special page for floats only.
\!	Override internal parameters LaTeX uses for determining "good" float positions.
H	Places the float at precisely the location in the LaTeX code. Requires the float package, e.g., \usepackage{float}. This is somewhat equivalent to h!.

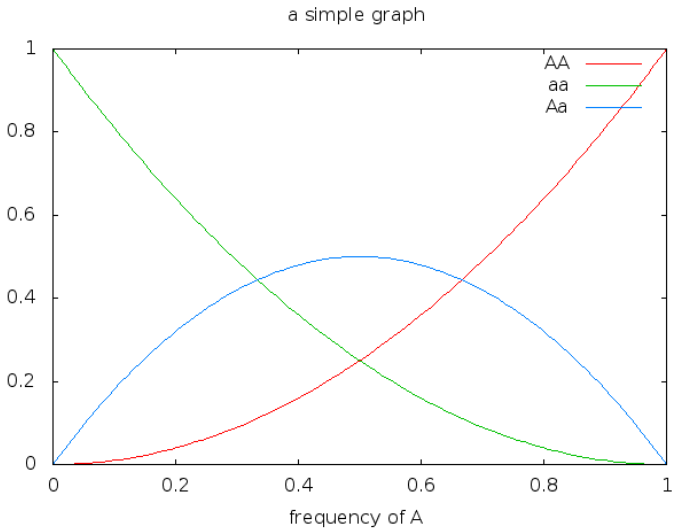

Figure 1: A simple graph

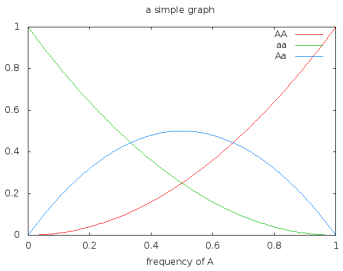

Figure 2: A simple graph at half the width

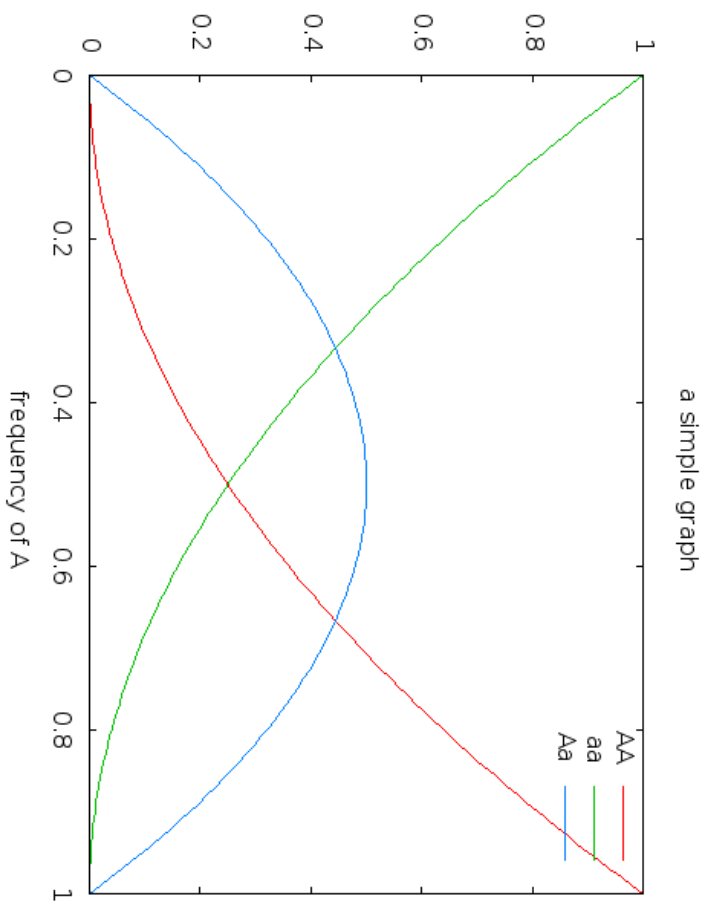

Figure 3: A simple graph rotated 270°

A pdf can be included the same way, e.g. by specifying

```
#+ATTR_LATEX: :options page=10 :width 10cm
[[file:myfig.pdf]]
```

3.2.1 inclusion of SVG graphics

q.v. my my plantuml example documentation.

3.3 Tables

- Documentation
  - Very nice overview: https://en.wikibooks.org/wiki/LaTeX/Tables

3.3.1 nicer table formatting using booktab style

Some interesting tips for booktab style tables by M. Püschel.

Booktabs can be turned on by default for all tables by setting this variable for the document or globally:

```
org-latex-tables-booktabs: t
```

Whether table captions appear above or below the table can be configured using this variable setting:

```
org-latex-table-caption-above: nil
```

Table 2: default table

Column 1	Column 2	Column 3	Column 4
1	10	100	1000
2	11	101	1001
3	12	102	1002
4	13	103	1003
5	14	104	1004
15	60	510	5010

Table 3: table using booktabs style

Column 1	Column 2	Column 3	Column 4
1	10	100	1000
2	11	101	1001
3	12	102	1002
4	13	103	1003
5	14	104	1004
15	60	510	5010

3.3.2 Math in tables

Use *math* or *inline math* together with *array* environment.

Here we use the simple math mode

$$\begin{array}{ll} Column1 & Column2 \\ \hline \sin(x) & \tan(x) \end{array}$$

This uses the `inline-math` mode $\begin{array}{ll} Column1 & Column2 \\ \hline \sin(x) & \tan(x) \end{array}$

3.3.3 Table font size

The font size is determined by the `:font` switch in the `#+ATTR_LATEX` line.

Column 1	Column 2
Some text	Some other text
10	20

Sidenote:

- When a caption is used, the latex export uses a `table` environment.
- The previous captionless table generates a `tabular` environment.

Table 4: Table small size

Column 1	Column 2
Some text	Some other text
10	20

Table 5: Table footnotesize

Column 1	Column 2
Some text	Some other text
10	20

Table 6: Table scriptsize

Column 1	Column 2
Some text	Some other text
10	20

Table 7: Table tiny size

Column 1	Column 2
Some text	Some other text
10	20

3.3.4 Sidewaystable

Use the `float: sideways` ATTR option (The `float: sidewaystable=` has been deprecated since Org 8.3, q.v. info:org#Tables in LaTeX export) Using the sidewaystable together with a `:placement [H]` specifier requires that the `rotfloat` package is loaded.

Table 8: A sidewaystable

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1	10	100	1000	example	result
2	11	101	1001	example	result
3	12	102	1002	example	result
4	13	103	1003	example	result
5	14	104	1004	example	result
6	15	105	1005	example	result
7	16	106	1006	example	result

This text comes after the sidewaystable (we want to check whether the placement modifier was observed).

Even though in the info documentation it reads: "Note: :placement is ignored for :float sideways tables.", the modifier `[H]` is observed, as can be confirmed in the resulting TEX code.

3.3.5 Table over multiple pages with long text wrapped to cell width

Use the longtabu environment. This requires that you have loaded the tabu and longtable packages.

Table 9: A multi-page table with automatic text wrapping

100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these

101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
103	repetition ahead
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
101	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
102	bla bla
100	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
98	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
96	bla bla
94	repetition ahead
92	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
90	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
88	bla bla
86	repetition ahead
84	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
82	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
80	bla bla
78	repetition ahead
76	Some extremely long sentence which surely needs a linebreak if I add some additional words like these
74	Some other extremely long sentence which surely needs a linebreak if I add some additional words like these
72	bla bla

3.3.6 Tables with colored rows using xcolors and colortbl

A very nice reference for color in tables is proviced by Xavier on the texblog.org:
https://texblog.org/2018/01/15/color-table-series-part-2-xcolor-package/

One can use the `\rowcolors` command to define coloring of alternating rows.
In front of the table use the following

```
#+LATEX: \rowcolors[]{2}{blue!10}{blue!25}
```

The arguments translate to

- `[2]` start coloring in the second row
- `{blue!10}{blue!25}` definition of the two colors for odd and even rows according to the xcolors package

In order to prevent spillover of the rowcolors definition into later table, I wrap the whole table in `#+LATEX: {` and `#+LATEX: }` definitions.

Table 10: A table with alternate line colors

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1	10	100	1000	example	result
2	11	101	1001	example	result
3	12	102	1002	example	result
4	13	103	1003	example	result
5	14	104	1004	example	result
6	15	105	1005	example	result
7	16	106	1006	example	result

3.3.7 TODO Tables with colored rows using tabu

This needs the **tabu** and **xcolor** packages to be loaded. Use the LaTeX command `\taburowcolors` to define the colors right before the table.

```
#+LATEX: \taburowcolors[2]2{lightgray..white}
```

The options in this command translate to

- `[2]` start coloring in 2nd row
- `2` : use 2 colors (so, if set to 2 then it is just alternating)
- `{lightgray..white}` defines the first and last color in the color range. This is a color series definition provided by the **xcolor** package.

Table 11: A table with alternate line colors

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1	10	100	1000	example	result
2	11	101	1001	example	result
3	12	102	1002	example	result
4	13	103	1003	example	result
5	14	104	1004	example	result
6	15	105	1005	example	result
7	16	106	1006	example	result

`Booktabs` style does not mix well with this. The caption is too near to the table ruler, so here some work would need to be invested to get an aesthetically pleasing layout.

Table 12: A table with alternate line colors

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1	10	100	1000	example	result
2	11	101	1001	example	result
3	12	102	1002	example	result
4	13	103	1003	example	result
5	14	104	1004	example	result
6	15	105	1005	example	result
7	16	106	1006	example	result

Here, for comparison, a colored table produced by an inline LaTeX fragment. Q.v. this stackexchange discussion to understand the color series.

Note: I need to do some more testing to get a better understanding of how the color ranges are defined. E.g. here in the 5th row there is suddenly a yellow color pouring in.

Row1	1
Row2	2
Row3	3
Row4	4
Row5	5

Row1	1
Row2	2
Row3	3
Row4	4
Row5	5

3.3.8 Radio tables and skipping columns and rows

Radio tables allow to send a modified representation of an org source table to a target location. Here, we send the same table to the 2 target locations below, once using a send function to LaTeX and once to an org function.

This can be useful e.g. if one wants to skip some columns that are only used for intermediate results.

First test: Exporting to a native LaTeX table

Month	items	items per day
Jan	55	2.4
Feb	16	0.8
March	278	12.6

Second test: Exporting to an org mode table

Table 13: test radio table

Month	items	items per day
Jan	55	2.4
Feb	16	0.8
March	278	12.6

3.4 Source code

In order to get nice source code formatting and markup, one needs to add the **minted** package. I add here the relevant excerpt from my emacs initialization file (listing 1), which also serves as a first lisp code example

TODO: I was not yet able to figure out how to force org to place the source code listing exactly here in the text. While the documentation accepts a `:float t` attribute (and every source block with a caption automatically becomes a float), the placement modifier seems not to get translated

```
#+ATTR_LaTeX: :float t :placement [H]
```

```
(eval-after-load "ox-latex"
  '(progn
     ;; we want source code blocks to be syntax colored when exporting
     ;; via latex.  We configure latex minted which uses python
     ;; pygments
     (add-to-list 'org-latex-packages-alist '("" "minted"))
     (setq org-latex-listings 'minted)
     ;; define mappings of src-code-language to lexer that minted shall use
     ;;(add-to-list 'org-latex-listings-langs '(ipython "Python"))
     (add-to-list 'org-latex-minted-langs '(ipython "python"))))
```

Listing 1: emacs init.el snippet for including code markup by minted

I also add listing 2 as an example for C code markup:

```
#include "stdlib.h"
int main(int argc,char **argv) {
  printf("Hello World");
  exit(0);
}
```

Listing 2: C code markup example

4 Text features

4.1 Text font size

Text Example Huge Text Example huge
Text Example LARGE Text Example Large Text Ex-

ample large Text Example normalsize Text Example small Text Example footnotesize Text Example scriptsize Text Example tiny

4.2 Footnotes and margin notes

Examples for footnotes: This is a text with a footnote [1]. The footnote will be displayed on the bottom of the current page. One can also place all footnotes in a separate chapter called *footnotes* at the end of the org file[2].

Footnotes definitions can be placed within an org section using the `[fn:1]` syntax and observing that no leading indentation is allowed on such a line. Alternatively the footnotes can be collected in a special section called "Footnotes". I recommend reading the respective INFO entry (e.g. there is also the possibility to define footnotes inline). When using `C-c C-x f` to insert footnotes a lot of the work is taken over by org itself (also allows footnote renumbering, etc.). One can jump between the footnote reference and its definition by the usual `C-c C-o` combination.

Margin notes can be inserted by directly inlining the LaTeX command as demonstrated in the source code for this section. By default the margin notes are justified. This often looks awkward. Using this stackexchange answer, I define a macro which yields:

a default margin note

I like the margin notes to be left aligned instead of being justified.

a left aligned margin note that looks nicer

4.3 References to sections, figures, tables, equations

Here, we show the usage of links to the text sections: Examples for References to figures are also found in chapter 3.2, to tables in chapter 3.3, and to equations in chapter 3.1.

Other references

- Figures can be referenced like this: Fig. 1.
- These are references to table 2 and table 3.
- And an example of an equation reference: eq 1. This reference requires latex syntax and a latex label as target. All the other links work based on org link syntax can use the name given to the elements via a leading `#+NAME:` line.

4.4 TODO Fontifying SRC BLOCK results

One can use an org source block that contains a named source block and the matching named results tag, and then put latex instructions inside as shown in this example (thanks for the idea to a mail from Eric S Fraga)

5 some interesting links

- Hyperlink formatting
  - described in the LaTeX hyperref manual.

[1] This is the footnote text
[2] this is another footnote

  - This is an example of how to get links that are not framed by red rectangles, but just have a blue font color

    ```
    #+LaTeX_HEADER: \hypersetup{colorlinks=true, linkcolor=blue}
    ```

- Building a LaTeX Document Class
  - http://tutex.tug.org/pracjourn/2005-4/hefferon/hefferon.pdf

6 Index creation

Must be solved by including LaTeX source commands:

- Requires in the preamble
  - `\usepackage{makeidx}`
  - `\makeindex`
- Mark up words by `\index{word}`
- At the location where the index should apear, use `\printindex`
- to render the document, a call to the `makeindex` binary needs to be added in the build command. I use the following definition in my `init.el`.

```
(setq org-latex-pdf-process
      (let
          ((cmd (concat "pdflatex -shell-escape -interaction nonstopmode"
                        " -output-directory %o %f")))
        (list cmd
              "cd %o; if test -r %b.idx; then makeindex %b.idx; fi"
              cmd
              cmd)))
```

7 References

Some important org references that also display that citations directly following each other will be combined [3, 1]. And another single reference [2].

The `#+BIBLIOGRAPHY:` command inserts the reference list at the location where it is placed. It requires the name of the bib-file (without .bib extension) and the name of a style (e.g. plain).

If no citations are created, make sure that the bibliography file is really found. You may have to run "bibtex myfile.aux" yourself, and for that you need to make sure that the AUX file is not removed after org runs (q.v. 2 section).

For HTML exports one can also pass options to the `bibtex2html` binary (look at the comments section of `ox-bibtex.el` and also the bibtex2html man page).

Multiple options can be combined as follows:

```
option:-d option:-r
```

To get the citations correctly processed rendered, one needs to add a bibtex invocation to the LaTeX command chain:

Table 14: bibtex2html options

option	functionality
-d	sort by date
-a	sort as BibTeX (usually by author) **default**
-u	unsorted i.e. same order as in .bib file
-r	reverse the sort
-t	limit to entries cited in document

```
(setq org-latex-pdf-process
      (let
          ((cmd (concat "pdflatex -shell-escape -interaction nonstopmode"
                        " --synctex=1"
                        " -output-directory %o %f")))
        (list cmd
              "cd %o; if test -r %b.idx; then makeindex %b.idx; fi"
              "cd %o; bibtex %b"
              cmd
              cmd)))
```

To just produce a bibliography of all items in the bib file, one can use the following LaTeX snippet. The `\nocite{*}` command includes an item that has not been cited in the document; a star matches all documents, so all get included (q.v. this link).

```
#+BEGIN_LATEX
  \documentstyle{amsart}
  \begin{document}
  \nocite{*}
  \bibliographystyle{amsplain}
  \bibliography{bib-filename}
  \end{document}
#+END_LATEX
```

References

[1] Dominik, C. *The Org Mode 7 Reference Manual-Organize your life with GNU Emacs*. Network Theory Ltd., 2010.

[2] Feichtinger, D., and Plattner, D. A. Direct proof for $o = mn^V$ (salen) complexes. *Angewandte Chemie International Edition in English 36*, 16 (1997), 1718–1719.

[3] Schulte, E., Davison, D., Dye, T., and Dominik, C. A multi-language computing environment for literate programming and reproducible research. *Journal of Statistical Software 46*, 3 (2012), 1–24.

8 Indexes and tables of contents

List of Tables

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Emacs 27.2 (Org mode 9.5.2)