

A first set of L^AT_EX packages

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Abstract

This describes a curated list of packages that covers most of what beginners want to do. It seeks to name one package in each area that is capable and reliable.

1 Overview

At TUG 2019 I reported on using social media to help understand the needs of today's beginners^[1]. Often they just need a pointer to the right package. This describes a package list suited to those users.

A list that is exhaustive wouldn't help here; I have kept the document to two sides of a page. Of course that involved making choices. I am sorry that this leaves off some first-quality work, but in any event, the packages named are capable and basically bug-free.

Beyond solving problems, the criteria for inclusion in the list is that a package should be in the distributions and popular. I also value documentation, particularly if it has helpful examples.

Part of the reason for this article is to solicit feedback. I have already made improvements in response to comments on a draft from social media, in^[2]. The end product will be a document in PDF, HTML, and video. The PDF will be on CTAN.

Below I will go over the choices. The document core consists of a few sections classifying areas, intended to help a user find packages, which is reproduced below. Each package name is a hyperlink, with a terse description. (There are a few extra comments in parentheses that come up in conjunction with the recommendations.)

Before those is an introduction. It mentions CTAN,¹ the target of almost all the links here. It also mentions using `texdoc` to read local documentation. Finally, it notes that if a person is writing for a journal or institution then they should ask if there is a house package.

2 Every document

To change page size, margins, and orientation, use geometry.² Get multiple columns with multicol.³

Any document containing significant amounts of mathematics should use the American Mathematical Society's packages amsmath⁴ and amssymb.⁵

¹ ctan.org

² ctan.org/pkg/geometry

³ ctan.org/pkg/multicol

⁴ ctan.org/pkg/amsmath

⁵ ctan.org/pkg/amssymb

I also use amsthm⁶ for producing theorem environments. Notes: (1) amssymb inputs amsfonts so you don't need to load the latter, (2) load amsthm after amsmath, (3) don't load amsmath directly, instead get it by loading mathtools,⁷ which adds some useful improvements.

You can toss in microtype.⁸ My eye can't spot the improvements but I appreciate that often when I use it, fewer lines need rewriting for overfull boxes.

3 Inside a document

To tweak lists, use enumitem.⁹

Enhance captions with caption¹⁰ and control floating environments with float.¹¹ (In particular, if you want an option that overrides automatic float placement and puts something exactly where you ask, this package provides the option 'H'.)

Get hyperlinks and turn references into links with hyperref¹² (this should be the last or next to last package loaded). Make cross-references say 'Theorem 1.2' instead of just '1.2' with cleveref,¹³ load this after hyperref. Have urls and file paths that can linebreak with url¹⁴ (but hyperref has its own facility, so if you are using hyperref then omit url).

I do code listings with listings¹⁵ (although minted¹⁶ also has a lot going for it). Make single quotes inside verbatim text come out correctly with upquote.¹⁷

(A tangent: copy and paste for computer code listings would be especially convenient. This is a start for the listings package.

```
\lstset{basicstyle=\ttfamily,keepspaces=true,
        columns=fullflexible}
```

But it is not a full solution. For one thing, the result depends on the PDF viewer. Worse, it loses initial spaces in a line—if your code line begins with four blank spaces then after a copy and paste those spaces are gone.)

For code in Python have a look at pythontex,¹⁸ which, besides showing the code listings, also allows you to execute Python and put the results in your output. Do the same for the *Sage* mathematics

⁶ ctan.org/pkg/amsthm

⁷ ctan.org/pkg/mathtools

⁸ ctan.org/pkg/microtype

⁹ ctan.org/pkg/enumitem

¹⁰ ctan.org/pkg/caption

¹¹ ctan.org/pkg/float

¹² ctan.org/pkg/hyperref

¹³ ctan.org/pkg/cleveref

¹⁴ ctan.org/pkg/url

¹⁵ ctan.org/pkg/listings

¹⁶ ctan.org/pkg/minted

¹⁷ ctan.org/pkg/upquote

¹⁸ ctan.org/pkg/pythontex

suite with `sagetex`¹⁹ and similar systems exist for R, Haskell, and Scheme.

There are many packages that add table capabilities such as multirow entries and breaking across pages. I most often use `array`,²⁰ which lets you define custom column types. For units, use `siunitx`²¹ (which also has a table column type for aligning on a decimal point).

To make boxes that are colored or framed, such as boxes for theorems, I use `mdframed`.²²

Finally, when developing a document I often want some filler text. I use `lipsum`.²³

4 Graphics and color

To include graphics in files and to do simple manipulation such as resizing, use `graphicx`.²⁴ Use the JPG format for photos, PNG for other kinds of raster graphics, and PDF for vector graphics. If your graphic is in another format then convert it to one of the three. (Usually you give the file name without the extension, as with `\includegraphics{graph}`.) Include parts of a PDF document with `pdfpages`.²⁵ Include video or sound using `media9`.²⁶

To get colors, use `xcolor`²⁷ (although the documentation can be hard to make out).

For plots and graphics I use *Asymptote*,²⁸ a development of METAPOST with three-dimensional features. However, many people instead use `TikZ`²⁹ to draw graphics inside the document.

5 Front and back matter, headers, footers

To style chapter and section titles, use `titlesec`.³⁰ For page headers and footers, reach for `fancyhdr`.³¹ You can tweak the format of tables of contents, lists of figures, etc., with `tocloft`.³²

Write answers to exercises to an external file so you can read them in later with `answers`.³³ I like footnotes at the page bottom, so I use `footmisc`³⁴ (but I had to hack to change the space between a footnote mark and the footnote). Make an index

with `makeindex`.³⁵ Bibliographies are a thorny area, with lots of strict requirements. CTAN is a big help here since it has many styles for both `BIBTEX`³⁶ and `BIBLATEX`.³⁷

6 Special documents

Make exams and problem sets with the `exam`³⁸ class.

There are many, many resume and CV packages. Have a look at CTAN's `cv` tag.³⁹

To make presentations, use the `beamer`⁴⁰ class. (But with this package you are entering another world, where many of the packages discussed here do not work. For example, section title styling happens via a completely different mechanism.)

7 Fonts and engines

To see options besides the default Computer Modern fonts, visit the `LATEX` Font Catalogue,⁴¹ which includes copy and paste code to make each one work.

Beyond that list, you can also use any font that your computer has (which usually works well only if your document does not have much mathematics). To convert `LATEX` source to PDF there are three main programs, called engines. Most people use `pdfLATEX`. The `XYLATEX` engine and the `LuaLATEX` engine can leverage the `fontspec`⁴² package to use your system's fonts. (A word about the preprint site `arXiv.org`. If your document was produced with `XYLATEX` or `LuaLATEX` then you can only submit a PDF, not the document source.)

8 What's missing?

Again, I would be glad to hear suggestions for making this list better.

References

- [1] J. Hefferon. What do today's newcomers want? *TUGboat* 40(2):106–108, 2019. tug.org/TUGboat/tb40-2/tb125heff-newusers.pdf
- [2] Various Reddit users. A First List of `LATEX` Packages. old.reddit.com/r/LaTeX/comments/hpal2i/a_first_list_of_latex_packages/.

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¹⁹ ctan.org/pkg/sagetex

²⁰ ctan.org/pkg/array

²¹ ctan.org/pkg/siunitx

²² ctan.org/pkg/mdframed

²³ ctan.org/pkg/lipsum

²⁴ ctan.org/pkg/graphicx

²⁵ ctan.org/pkg/pdfpages

²⁶ ctan.org/pkg/media9

²⁷ ctan.org/pkg/xcolor

²⁸ asymptote.sourceforge.io

²⁹ ctan.org/pkg/pgf

³⁰ ctan.org/pkg/titlesec

³¹ ctan.org/pkg/fancyhdr

³² ctan.org/pkg/tocloft

³³ ctan.org/pkg/answers

³⁴ ctan.org/pkg/footmisc

³⁵ ctan.org/pkg/makeindex

³⁶ ctan.org/topic/bibtex-sty

³⁷ ctan.org/topic/biblatex

³⁸ ctan.org/pkg/exam

³⁹ ctan.org/topic/cv

⁴⁰ ctan.org/pkg/beamer

⁴¹ tug.org/FontCatalogue

⁴² ctan.org/pkg/fontspec