A first set of LaTeX 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 `amsmath`[4] and `amssymb`.[5]

I also use `amsthm`[6] 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 `caption`[10] 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 `hyperref`[12] (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 `url`[14] (but `hyperref` has its own facility, so if you are using `hyperref` then omit `url`).

I do code listings with `listings`[15] (although `minted`[16] 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

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[1] `ctan.org`
[2] `ctan.org/pkg/geometry`
[3] `ctan.org/pkg/multicol`
[4] `ctan.org/pkg/amsmath`
[5] `ctan.org/pkg/amssymb`
[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 XƎLATEX 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 XƎLATEX 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