Packages and Classes

Math 351

1 Packages

Packages extend the functionality of LaTeX in some way. The packages we have introduced in our course so far, listed below, are among the most frequently used LaTeX packages.

Package	Purpose
amsmath	Typesetting mathematics
amssymb	Math symbols and fonts
amsthm	Theorem and proof environments
hyperref	Hyperlinks and clickable references
geometry	Control margins
graphicx	To include outside graphics
makeidx	Indexes
mathptmx	Times font (one of many font packages)
tikz	Create graphics

This is just a small sampling of the over 5000 available LaTeX packages! Widely used packages we have yet to see include:

Package	Purpose
microtype	Micro-typographic extensions for evenly spaced lines
enumitem	Improved enumerate and itemize environment
booktabs	Improved tabular environment
IEEEtrantools	Improved multiline math (see pages 64–67 of our text)
fancyhdr	Improved headers and footers
fontenc	Improved typesetting for accented characters
inputenc	Allows keyboard input of accented characters
babel	Support for other languages
textpos	Absolute positioning of text
listings	For automatic typesetting of computer code
pgfplots	2D/3D plots and graphics
natbib	An alternative to BibTeX
pgfornament	Ornamental flourishes

Most of the packages listed here are shipped with many versions of LaTeX and probably can be accessed using `\usepackage{name}` in the preamble.

If they are not already installed, these and many other packages can be downloaded from the "Comprehensive TEX Archive Network", online at https://www.ctan.org. This is also where you can find the documentation for the packages listed above. The first step in using any of the above packages is to actually read the documentation!

How to use a package that is not already installed:

1. Find the package at https://www.ctan.org or elsewhere.
2. Read the readme or the documentation.
3. See pages 89–90 of the text on how to install. Another good resource on how to install an extra package is at https://en.wikibooks.org/wiki/LaTeX/Installing_Extra_Packages. As a shortcut, if all that is needed is a `.sty` file, then you can try copying the `.sty` files into the folder which contains the `.tex` file.
4. Use by including `\usepackage{name}` in the preamble.

Some third party software packages automate this procedure, possibly doing it automatically as soon as a package is loaded with `\usepackage` in the preamble.

It is considered bad form to load many packages and then not use them. Loading obscure packages makes the `.tex` less portable and increases the chance that packages will conflict with one another. Packages also tend to become obsolete. As a general rule, use a minimum number of packages.

2 Classes

Class files are loaded by placing the `\documentclass{class}` command in the first line of the `.tex` file. Classes tend to have their own specialized commands; for example, the familiar `article` class provides commands such as `\section`, `\tableofcontents`, and `\author`.

The document classes we have seen in our course so far are listed below:

Class	Purpose
`article`	Articles and much more
`beamer`	Presentation slides
`tikzposter`	Conference posters

There are many different class files. The most popular are prepackaged with LATEX and can probably be accessed using `\documentclass{class}`. If not already present, class files can be found on https://www.ctan.org and installed in a similar way that packages are installed. Sometimes it is possible to simply place the desired `.cls` file in the folder containing the `.tex` file.

Of course one should read the documentation and look at example files to learn how to use any particular class!

A sampling of widely used class files is below:

Class	Purpose
amsart	`article` alternative
paper	`article` alternative (used in this document)
book	Books
memoir	`book` alternative; an excellent choice for books/theses
letter	Formal letters
scrlttr2	`letter` alternative; one of many Koma-Script classes
moderncv	Curriculum vitae
exam	Exams
standalone	cropped `.pdf` output for use with TikZ

3 Three notable new packages

This section includes examples of packages that we have yet to see in our course.

The `microtype` package probably should be loaded most of the time. This package expands the fonts widths by at most 2% to the create more evenly spaced lines.

The `booktabs` package improves the spacing and overall look of tables, and was used to create the tables in this document. As stated in the manual, vertical lines within a `booktabs` table are discouraged.

A third notable new package is somewhat more specialized; the `listings` package is a wonderful tool for typsetting computer code. It reads code directly from a file to automatically typset the code. It can recognize an number of different languages. For example, we include code from the file `351Code.py`:

```
# python code to generate a random walk in TikZ

import random

directions = [(1,0), (-1,0), (0,1), (0,-1)]

steps = 2000

tikz =  "\\begin{tikzpicture}[scale = .1]\n"
tikz += "\draw [black!10] (-50,-50) grid (50,50);\n"
tikz += "\draw [->] (-51,0) -- (51,0);\n"
tikz += "\draw [->] (0,-51) -- (0,51);\n"
tikz += "\draw [ultra thick, red] (0,0)"
for i in range(steps):
    tikz += " -- ++" + str(random.choice(directions))
tikz += ";\n\end{tikzpicture}"

print(tikz)
```

This is python code which produces a TikZ figure, drawing a random walk in the plane, starting at the origin: