Producing Beautiful Documents With TEX and LATEX

An Extremely Brief Introduction

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What is TeX and LaTeX?

TeX is a very mathematically savvy typesetting engine produced in the 1980's by Donald Knuth from Stanford.

It is open-source (which means it is free, and freely available); implemented for every conceivable operating system; it is currently in Version 3.141592, so it is, in effect, now "fixed" forever.

Extra Credit: can you tell why it is essentially "fixed"? And what will be the version number when Knuth dies?

LaTeX is a set of macros sitting on top of TeX that makes our task easier.

It was produced by Leslie Lamport in the middle 1980's; it is also open-source and delivered conjointly with any TeX system. The current version is LaTeX2e and is under constant development and extension.

TeX and LaTeX work together, with LaTeX helping produce what is called the document mark-up, and TeX then being called upon to do the actual typesetting.

Features and Advantages

- Why you should use TeX and LaTeX —
- In contrast to word-processing methods such as Word, you do not worry about the visual formatting of your document. You are concerned only about the content. In other words, you separate content from layout.
- The file you produce is `ascii`, the simplest you can have with no special symbols; it includes general commands for what you wish to do in the document.

- The subtext: you don't need to support the evil empire in Redmond Washington, use their proprietary file formats, and make Bill Gates even richer than he already is.

I handed out as a hard-copy item, the piece by Allin Cottrell, *Word Processors: Stupid and Inefficient*.

Read and enjoy, and then use LaTeX.

- Many places of publication (and now universally in any source that has even the slightest quantitative tinge), ask for manuscripts to be submitted as a LaTeX `ascii` file (usually, along with a corresponding typeset `.pdf` file, i.e., one in portable document format).

  This might include the use of what is called a “class file” that specifies and controls the unique appearance of the document for the intended publication source.

- Class files all have the extension `.cls` (so be sure to turn on the "show file types" option if you are using windows; it is off by default), and, in effect, drive the formatting of a document and provide special commands to use, whenever necessary, for the document at hand.

  Class files are typically provided to you, or more likely, you will need to download these from some provided web site.

- Although the quantitative journals in psychology typically have their own class files now (e.g., *Psychometrika*, *Journal of Mathematical Psychology*), we will mention several which may be germane to all of you.

  These, we might note, are in addition to the standard LaTeX classes:

  `article.cls`; `report.cls`; `book.cls`; `slides.cls`; `letter.cls`

- `apa.cls` (guess what this class is for? Also, we now have `apa6.cls`)
- `uiucthesis.cls` (let's hope some of you get to use this one)
- `beamer.cls` (this replaces `prosper.cls`, which is the class I'm using to produce these slides)
- `letter.cls` (although a standard LaTeX class, I still use this for my letters of recommendation; I change the address to whom the letter is going, and typeset again)

- You can get anything TeX and LaTeX related (for free) from the CTAN archive: The Comprehensive TeX Archive Network:

  `http://www.ctan.org/tex-archive`
- For example, the apa stuff is at:

  `/macros/latex/contrib/apa`
- for the UI thesis class, see:

  `/macros/latex/contrib/uiucthesis`
- for the newer beamer class:

  `/macros/latex/contrib/beamer`

- If you have *any* reasonable mathematics in way of formulae to put into a manuscript;
- or if you have tables that you would like to include and manage well;
- or if you would like to easily “repurpose” your prose for other uses at times (a nice word, don’t you think);
- or if you would like to see your document in many forms easily (e.g., double-spaced rough draft; two-column final look, and so on);

- or if you have some simple graphics that you would like to include by way of text itself using the `picture` environment (as opposed to including a `.eps` or `.pdf` figure, which you can also do);
- you are a *fool* (hear me, a *fool*) if you don't consider using TeX and LaTeX.

- There is a very nice integration with all the modern file formats. The `ascii` markup file has traditionally used the extension `.tex`, and when typeset produces a `.dvi` (device independent) file, which could then be printed or viewed.
- The situation is true to the present, but we now have a route to going from `.tex` to `.pdf` directly (or to `.ps` and then to `.pdf`; or first to `.dvi` and then `.ps` or `.pdf`).

Because I like to use `.eps` for my included graphics, I generally go from `.tex` to `.div` to `.pdf` (this is easy to do and has no glitches; but many other paths are possible).

There are html file options (`.htm`) as well; much of this is now being replaced by the direct use of `.pdf`

- There are very nice tools for long projects:
  automated indexing (including multiple indices such as Subject and Author — I've done these using the package `multind.sty`);

  automatic construction and inclusion of Tables of Contents, Tables of Figures, and Tables of Tables;

  easier preparation of Proceedings Volumes and Journals where the "chapters" are actually separate manuscripts;

- if you really get into this, you can use BibTeX, which generates bibliographies from a master file (a `.bib` file) where you maintain *all* your references (from birth).

  You can have bibliographies generated automatically by referencing according to a label placed in your text;
- if the bibliography entries need to be in a particular form, you can generate the appropriate style using a bibliographic style file (one with a `.bst` extension);

for example, Erik Meijer has produced the package `apacite.sty` and assorted items you need for APA citation practice:

`/biblio/bibtex/contrib/apacite`

- When one does mathematics or statistics in any form, there is just *no* substitute for using TEX and LATEX.

  The quality of production is incredibly high, even for very complicated mathematical presentation.

  If you use `apa.cls` (or `apa6.cls`) and put `jou` in the document class options, the resulting manuscript will typeset two-column (like APA) and look exactly like a printed reprint;

in fact, it is so good, maybe we should just skip the submission/review/resubmission process.

Many journals (including, for example, *Psychometrika*) now use LaTeX markup to generate all the necessary files for printing the journal.

- TeX considers the paragraph as the unit of typesetting, with the manner in which lines are set and broken, and how hyphenation is done, based on a very nice dynamic programming algorithm (one of my own research areas).

  The only Desktop Publishing Program that uses such a method is Adobe's InDesign.

  If you wish, I could tell you my experiences with typesetting by hand in 8^{th} grade shop — we used what was called the “first-fit” method.

- There are many add-on packages (all free, and with a file extension of `.sty`) that provide collections of new commands and environments for various purposes.

  Also, there is language/font support for literally hundreds of languages (see the `babel` packages):

  `/macros/latex/required/babel`

  A search on my MikTex distribution for `.sty`, gets over 3000 hits; these packages were automatically included during a full install.

Packages are continually under development and an installation such as Miktex has a mechanism for updating its distribution.

Also, when you use a `.sty` file that may not be in the distribution as yet, MikTex is so smart that it goes out to the Web, gets the package, and installs it for you.

This all says, by the way, that we need to be on high-speed internet access to function effectively. No more dirty-dialup.

- Packages are included with the command `\usepackage{}`, placed in the preamble (the area between `\documentclass{}` and `\begin{document}`;

  the ones I routinely use are:

  `curves.sty` (this adds a few nice drawing capabilities to the `picture` environment);

  `graphicx.sty` (the standard for incorporating and manipulating all sorts of graphics into a manuscript);

`multind.sty` (for creating both subject and author indices);
`amsmath.sty`, `latexsym.sty`, `amsfonts.sty` (these add new symbols from the American Mathematical Society).

GNU (Gnu is not Unix, recursively) —

The newest extension of the `picture` environment is loaded with `pgf.sty` and `tikz.sty` (portable graphics format).

TikZ ist kein Zeichenprogram

Just as `beamer.cls` is all the rage now for slides, TikZ/pgf has a similar appeal for drawing your diagrams and pictures. These are written by the same person (apparently, with a lot of time on his hands) — Till Tantau

Resources and Documentation

There are a few sources that we all should have available. The first costs money ($45.00):

Leslie Lamport, *LaTeX: A document preparation system*, 1994, Addison-Wesley.

and three are free as `.pdf`:

The not so short introduction to LaTeX2e:

`/info/lshort/english/lshort.pdf`

A beginner's introduction to typesetting with LaTeX:

`/info/beginlatex/beginlatex-3.6.pdf`

The Comprehensive LaTeX Symbol List

`/info/symbols/comprehensive`
`/symbols-letter.pdf`

Two other Addison-Wesley products are worth buying if you have the money:

Frank Mittelbach and Michel Goosens, *The LaTeX companion (2nd Edition)*, 2004.

Helmut Kopka and Patrick Daly, *Guide to LaTeX (4th Edition)*, 2003.

Also, from George Grätzer (author of *Math Into Latex*), we have a short course from his book:

`math_into_latex_short_course.pdf`

and videos in

`mil4-video-presentations`

There is no better place for all things $\TeX$ and $\LaTeX$ than the TeX Users Group (TUG):

`http://www.tug.org`

The group's printed journal (TUGboat) and online source (PracTeX) are available for free, as well as all sorts of other information and items. I am a member for $75.00; students pay $45.00.

You get a lot of stuff for this price (TexLive; Tugboat; CTAN snapshots; etc.).

I have put a few items up on my web site that you can access. We will use some in the demonstrations to follow:

`cda.psych.uiuc.edu/multivariate_fall_2012/latex_class_material`

- `latex_presentation.tex` (the source file for the slides you are now looking at);
- `latex_presentation.pdf` (the actual file I am showing to you now);
- `wp.html` (Allin Cottrell's piece on Stupid and Inefficient Word Processors)

An aside on file names —

Make sure your titles are meaningful. We are no longer limited to less than or equal to eight characters in our file names. Always use the extensions. It will make things much easier to find (later as well as more immediately).

The underscore mark is very helpful in avoiding the use of spaces (which still can cause problems, so avoid them). Also, remember that names are generally case-sensitive, so I generally only use lower-case.

Files for the Demonstration

- `ED2007.cls` (the class file for Edwin Diday's Festschrift)
- `ED2007manuscripts.pdf` (instructions on how to use the class file)
- `ED2007manuscripts.tex` (the source file)
- `diday_rev.pdf` (the Hubert and Köhn paper for the Festschrift)
- `diday_rev.tex` (the source file)
- `AR_Monte_Carlo_box_plots_all.eps` (the included `.eps` file for the paper, with name violating my lower-case rule)

The Mechanics

An Editor and a Distribution

For the Mac:

`http://www.tug.org/mactex`

Download the large image file (in `MacTex.pkg` [2.1G]) and install (easily by clicking). You are given Texshop as an editor and interface (see the file: `WelcomeToMacTex.pdf`).

For Windows:

First download and do a complete install of the typesetting engine MikTex from:

`http://miktex.org` (Version 2.9 now)

For your (Zen-like, and chroma-coded) editor, use WinEdt and download from

`http://winedt.com` (Version 5.5 for the license immediately below; the current Version is 7 with licence to follow that for 5.5)

After installed, call up the Registration box (under Help), and enter exactly as stated (including spaces and capitals):

Name: UIUC Psychology (50-user Site License)

Code: 7431692338750581620

Version 6 or 7:

Name: Lawrence Hubert

Code: 54442012337988851783

This is good forever ...

For Linux/Unix:

You already know what to do and use.

Some Parting Comments

LyX is a free visual document processor (they call it WYSIWYM) that can export LaTeX processable files and uses LaTeX itself as a backend:

`http://www.lyx.org`

A (rather expensive) commercial version of a LyX-type system is Scientific Word from MacKichan Software:

`http://www.mackichan.com`

I have some Lucida fonts that I bought from PcTeX; I think these are just beautiful and will give an example later.

You use them by putting a `usepackage[]{}` statement in your document (in the preamble), and then use the two options of `lucidasmallscale` and `nofontinfo` and the package name of `lucimatx`.

The only problem for me is that I haven't figured out (as yet) how to use them outside of PcTeX; I get an error message about not all fonts being located when I try within WinEdt, for example.

Once you know how to makeup a document in LaTeX, you can write questions in simple email that might involve formulas using these same LaTeX commands (this is the nerd version of text messaging).

Also, if you are adventuresome, you can use your knowledge of LaTeX commands to ask for, among other things, dates: `\dinner`

This is read "backslash dinner?" —