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Administrivia

- Reminder: Homework 6 due Wednesday.
- Homework 7 on the Web. Due next Monday.

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Minute Essay From Last Lecture

- For plotting, most people use Excel, though there were several mentions of R and a few of other tools.
- A few people thought `gnuplot` sounded interesting, especially if input is in text form. One person mentioned using another tool that generated input for `gnuplot(!)`.

Homework 5 Essays

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- Several people commented on trouble with that last problem. It was hard. One said the expression he came up with “made my head hurt” (I totally relate!).
- Others mentioned annoyances: Many tools use regular expressions, but details of syntax vary. And when you need escape characters — it almost seems arbitrary. (But at least some tools have a way to specify that you’re using a form in which they’re not required.)

What are T_EX and L^AT_EX?

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- T_EX — program for typesetting mathematics, developed by Knuth (1978) for his book *The Art of Computer Programming* and made freely available. (How it came to be — a “side project” that turned into much more!)
- L^AT_EX — extensive set of macros for T_EX originally written by L^Ampport (1985), that provide functionality needed for scholarly papers. Extended over the years by many people.
- These are “text formatters” not “word processors”, and as such don’t include a built-in editor. (But there are IDE-like programs for working with them.)
- Basic idea — you write “source code” for your document (text and markup) with a text editor, then use T_EX or L^AT_EX to turn it into a formatted document.
- Both available in zero-cost form for many platforms.

Basics (Under UNIX)

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- You write “source” (`foo.tex`) with a text editor of your choice. It includes your text plus “logical markup” — e.g.,
`\section{A Section Heading}`.
(What about checking spelling? Use a separate tool — “each program should do one thing, and do it well.” `ispell` and `aspell` are common ones.)
- Traditionally, you use the command `latex` to generate a `.dvi` file, then `dvips` to generate PostScript, then (if desired) convert to PDF with `ps2pdf`. You can also go directly to PDF with `pdflatex`.

Isn't That a Lot of Trouble?

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- In some ways, yes — there is a learning curve, and there are many “gotchas”.
- For some jobs (where visual layout matters more than logical structure), \LaTeX is probably the wrong tool.
- But if you persevere . . .

Why It Might Be Worth the Trouble

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- Output looks good — math in particular.
- Logical structure of document is clearly spelled out. (You can sort of do this with, e.g., MS Word, but it's less transparent.)
- Cross-referencing, bibliographic references, footnotes, tables of contents, indexing, etc., “just works”.
- Documents are stable — only way to “corrupt” a document is to mess up with your text editor. Very old documents usually still compile, and if they don't the content is still accessible.
- Once you figure out how to do a particular trick, it's there in the `.tex` source for future reference.
- If you want to generate a formatted document programmatically, \LaTeX source may be a good target.

Basics, Continued

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- \LaTeX provides a small set of “document classes” — article, report, book, etc. These classes group definitions for section headers, lists, etc., in a way that everything looks good together. Also can have “packages” that group together related customizations, provide extra features.
- Basic document structure (look at example):
 - `\documentclass[options]{foo}`
 - Additional global definitions, packages, etc.
 - `\begin{document}`
 - Your text. “Paragraphs” delimited by blank lines.
 - `\end{document}`

Some Features

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- “Sectioning commands” provide consistent layout and automatic numbering. Also can be used to generate table of contents.
- “Environments” provide support for lists, tables, centered text, “verbatim”, etc.
- Predefined macros provide simple markup, e.g., `\textit{foo}`.
- Math — a bit cryptic, but IMO not worse than point-and-click equation editor.
- Graphics can be included. Some details next time.

More Features

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- Figures and tables can “float” (\LaTeX will put them where they fit). More next time. (Footnotes also are placed where they fit.)
- Lots of cross-referencing features — declare symbolic label (for section, figure, etc.) with `\label{foo}`, reference with `\ref{foo}`.
- Support for bibliography / list of references — usually use companion package `BIB \TeX` . More next time.
- Support for indexes. (Also glossaries, through add-on packages.)
- Facilities to define your own “commands” and “environments”. Makes it easy to get consistent formatting; also can provide convenient shorthand ways of doing things. More next time.

Gotchas

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- Some characters have special meaning and must be “escaped”: backslash, brackets, #, %, <, >, |, caret (^), underscore (_), tilde (~).
- Quotation marks should be entered as, e.g., `\"'foo'\"`. A single minus sign is a hyphen; to get a dash use `--` (“en dash”, suitable for connecting numbers, e.g., 1–100) or `---` (“em dash” — between words).
- Spaces after periods in the middle of a sentence should be followed by something to suppress intersentence space. I generally like just replacing the space with a non-breaking space `~`. (In fact I do this fairly often to avoid awkward line breaks.)

Advice For Getting Started

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- Get hold of an example that looks somewhat similar to what you want to produce, plus some sort of documentation — a guide from online or a book.
- Tinker with the example, putting in your prose and other stuff.
- When something doesn’t work — I used to say “ask a local expert”, and that should work, but these days a Web search may well turn up good suggestions.

Using L^AT_EX

- On our machines, the latest version (probably the most complete) is “TeXLive”. To access it,

```
module load tex-latest
```

(Put this in your `.bashrc` if you use it often.)

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- Documents that include crossreferences and some other constructs need to be processed more than once (as with C, compilers aren’t required to be very smart). Command `latexmk` automates that (re“compiles” as many times as needed).
- If you want to install on your machine, be advised that the above needs kind of a lot of disk space.

Minute Essay

- What do you currently use to produce formatted documents? What do you like/dislike about it?
- Have you tried L^AT_EX? If so, what do/did you like/dislike about it? Anything you’d like to know how to do but don’t?

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