Basic LaTeX Usage

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LaTeX is a *document preparation system*. It is a collection of programs that together have the functionality of a word processor such as OpenOffice, Microsoft Word, or WordPerfect—and much, much more!

LaTeX is an extension of TeX, a typesetting language invented by Don Knuth. With LaTeX, you only need to worry about the *structure* and *content* of your document, and not the actual layout or appearance. It is universal among mathematicians, physicists, computer scientists, and (to a lesser extent) other flavors of scientists.

How do you write a LaTeX file?

LaTeX files are plain text, which means they can be read on any computer platform. LaTeX files are somewhat like HTML files, so if you know how to write HTML you have a head start!

- Extra space between words is irrelevant. Both lines below would produce the same output:

```
The quick red fox jumped
 The     quick red        fox  jumped
```

- New paragraphs are indicated by one or more blank lines.

- Inline math mode—math in the middle of a sentence—is indicated with a pair of dollar signs:

```
therefore $x^2 + 1 = y$, and...
```

  becomes "therefore $x^2 + 1 = y$ and..."

- Displayed math mode—an equation set on its own line and centered—is indicated with two dollar signs or \[(backslash-square bracket):

```
our main equation is
 $$
 a^2 + b^2 = c^2
 $$
 which we will use to prove...
```

  "our main equation is

$$a^2 + b^2 = c^2$$

  which we will use to prove..."

- You can make accented characters like so: \'e for é, \"a for ä, etc.

- You get curly quotation marks with backticks (the key to the left of the 1 key), and apostrophes: ‘x’ is “backtick x apostrophe”. For the double quotation marks just used, use two backticks or apostrophes.

The structure of a LaTeX document

A LaTeX document always begins with `\documentclass{something}`. The "something" is usually "article". What I'm writing right now has a documentclass of "slides".

Usually following the documentclass are some other commands that get things set up before we start writing. Those things together are the *preamble* of the document. You start writing your masterpiece with `\begin{document}` and end it with `\end{document}`.

The preamble often includes the `\usepackage` command, which can alter the look of the document and define new commands. Probably the two most common packages are amsmath, which sets up a lot of convenient math commands, and amsfonts, which loads some of the fonts used by the amsmath package.

```
\documentclass{article}
\usepackage{amsmath, amsfonts}
\usepackage[margin=1in]{geometry}

\begin{document}

% the percent sign makes LaTeX ignore
% everything on that line

\section{The first section}

Type some cool stuff here. And   here.

Now start a \emph{new} paragraph.

\end{document}
```

Building and viewing a LaTeX document

We usually give latex documents the extension `.tex`, so your document will be in a file called `somefile.tex`. Once you have written this file, you will want to view it somehow. In order to have nice output you must compile your document.

There are several common ways to do this.

`latex somefile.tex` will produce a dvi file which you can view with `xdvi`.

`pdflatex somefile.tex` will produce a pdf file which you can view with `xpdf` or `acroread`.

Common math commands

You can use the following commands in math mode. If they aren't enclosed by dollar signs (or double dollar signs), LaTeX will complain when you typeset your document.

```
exponents: x^{2n}
subscripts: y_{m+1}
fractions: \frac{numerator}{denominator}
trig functions: \sin \cos \tan \exp \ln \log
integrals: \int_a^b
series: \sum_a^b
greater/lesser than or equal to: \ge \le
centered dots: \cdots
'lowered' dots: \ldots
matrices: \begin{pmatrix}
            a_1  &  a_2 \\
            a_3  &  a_4 \\
          \end{pmatrix}
infinity: \infty
```

```
Greek letters: \alpha, \beta, \gamma, etc
uppercase Greek letters: \Gamma, \Delta, etc
binomial coefficient: \binom{n}{k}
square roots: \sqrt{stuff}
nth roots: \sqrt[n]{stuff}
limits: \lim_{n \to 5} x^n
curly brackets: \{ and \}
```

Now let's try some examples. Use the file you made above and typeset the math on the next slide. . .

Since $x^4 = \sqrt{y+1}$, we know that

$$(-1)^n(2n)! \sum_{k=0}^{n} \frac{(2x)^{2k}}{(n-k)!}.$$

This is turn means that

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}.$$

Find $\tan(\alpha\beta\cdots\omega)$ then multiply by 6.

The Slides and Seminar packages

In order to create a slide show in latex, which uses all the beautful latex formating abilities, we will use the slides package. There are several important commands for making slides

The commands `\begin{slide}` and `\end{slide}` control the start and end of each slide.

Other useful commands include `\begin{centering}` and `\end{centering}` and `\begin{description}` and `\end{description}`

To create a presentation in portrat mode, use *slides*, to use landsape use *seminar*.

```
\documentclass{slides}
\usepackage{amsmath, amsfonts}
\usepackage[margin=1in]{geometry}

\begin{document}

% the percent sign makes LaTeX ignore
% everything on that line

\begin{slide}
  The first slide.
\end{slide}

\begin{slide}
  The second slide.
  \begin{description}
    \item Item 1
    \item Item 2
      \item Item 3
  \end{description}
\end{slide}

\end{document}
```

Including pictures

In the program you used to create the picture, save it as an *eps file*.

Once you have the .eps file, put it in the same directory as your .tex file. In the preamble of your document, put `\usepackage{graphicx}` (yes, that's an 'x') and where you want your picture to go, put `\includegraphics{filename}`, like so:

```
My beautiful picture:

\includegraphics[scale=.75]{filename}

Isn't it nice?
```

The "scale" stuff allows you to shrink and enlarge the picture to look right on the page.

Tables and arrays

In order to make a table in latex we use variants on the commands

```
\begin{pmatrix}
\end{pmatrix}
```

The general varients are *pmatrix*, *bmatrix*, *vmatrix*, *Bmatrix*, and *Vmatrix*, which are all varients of *array* with different borders. The use of *array* is more complicated ...

The command

```
\begin{array}{|c|c|}
i & 2^i \\
\hline
0 & 1 \\
1 & 2 \\
2 & 4 \\
3 & 8 \\
4 & 16 \\
\end{array}
```

creates the matrix formated text

i	2^i
0	1
1	2
2	4
3	8
4	16

Making PDFs

If you want to post something on the web, the .dvi files that LaTeX produces are only useful to people who have a full LaTeX installation on their computer. It's much better to make PDFs, which are viewable on all platforms. Fortunately, that's easy: just use `pdflatex` instead of `latex`. It works the same way, but produces nice PDFs which you can post on the web.

Note that if you have .eps pictures, you'll have to convert them to put them into the resulting PDF. At a command line, type `$ epstopdf filename.eps` and it will produce `filename.pdf`. If you *didn't* include the .eps extension in your `includegraphics` command, when you run `pdflatex` it will automatically include the picture into the PDF.

Further resources

Your classmates.

The library has/will have soon LaTeX books on 2-hour reserve!

"The Not-So-Short Introduction to LaTeX"; google for "lshort.pdf" and you'll find it. It's a very nice introduction and includes lots of material I didn't cover today.

To get LaTeX on a Windows machine at home: download a LaTeX distribution from `miktek.org`.