Learn how to [learn] \LaTeX

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This document is available at http://web.mit.edu/jgross/Public/2010cluedump/Slideshow.pdf.
Outline

Getting Started
   Installing \LaTeX
   What is \LaTeX?
   Getting Help
   Basic Setup

Good Practices
Optional (but useful) packages
\LaTeX{} and Math
Basic math typesetting
Ways to get into math mode
A few common math things
A few not so common math things

Things to watch out for
Other environments

Basics
Intermediate
Advanced

GUI
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Miscellaneous
- Things to watch out for
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LaTeX on Linux

- Usually comes preinstalled
- TeXLive can be downloaded from http://www.tug.org/texlive/
- Use your favorite text editor (vim, emacs, etc.), OR
- Specialized editors for \LaTeX, e.g. kile (http://kile.sourceforge.net/)
  - sudo apt-get install kile okular
\LaTeX{} on Windows

- pro\TeX{}t installs MiK\TeX{} and \TeX{}nicCenter
- Download from http://www.tug.org/protext/
LaTeX on Mac

- MacTeX (http://www.tug.org/mactex/)
- TeXShop (http://pages.uoregon.edu/koch/texshop/)
What \LaTeX is

- A typesetting system
What \LaTeX is

- A typesetting system
- Aimed at math and text
What \LaTeX is

- A typesetting system
- Aimed at math and text
- Extensible
What \LaTeX{} is

- A typesetting system
- Aimed at math and text
- Extensible
- A macro-based Turing complete programming language
What $$\text{LaTeX}$$ is not

- A WYSIWYG editor
What \LaTeX{} is not

- A WYSIWYG editor
- A programming language

```c
int *a = malloc(n);
int *b = malloc(n);
int *c = malloc(n);

A_desc = chi_alloc_surface(A, X1000_INPUT, n, 1);
B_desc = chi_alloc_surface(B, X1000_INPUT, n, 1);
C_desc = chi_alloc_surface(C, X1000_OUTPUT, n, 1);
#pragma omp parallel target x1000 shared(A, B, C)
  descriptor(A_desc, B_desc, C_desc) private(i)
  for (i=0; i<n; i++)
    for (j=0; j<n; j++)
      for (k=0; k<n; k++)
        for (l=0; l<n; l++)
          for (m=0; m<n; m++)
            for (p=0; p<n; p++)
              for (q=0; q<n; q++)
                for (r=0; r<n; r++)
                  for (s=0; s<n; s++)
                    for (t=0; t<n; t++)
                      for (u=0; u<n; u++)
                        for (v=0; v<n; v++)
                          for (w=0; w<n; w++)
                            for (x=0; x<n; x++)
                              for (y=0; y<n; y++)
                                for (z=0; z<n; z++)
                                  a[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] = b[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] + c[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] + d[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] + e[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] + f[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z] + g[i][j][k][l][m][p][q][r][s][t][u][v][w][x][y][z]
```
Finding Help

- lshort: This is the biggest beginner help file available on the web for \LaTeX. Go to http://mirror.ctan.org/info/lshort/english/lshort.pdf. Alternatively, Google lshort and it will come up.

- Google: One of the best help files out there. Google anything you want to accomplish along with \LaTeX and you will get something. Unless of course you type "Build a time machine" latex.

- http://www.ctan.org: Gives the full documentation for any package, the source code, etc.

Document Structure

\documentclass{document class}
\begin{document}
document body
\end{document}
Document Structure

\documentclass{article}
\usepackage{amsmath}
\begin{document}
    Your stuff goes here!
\end{document}
The default given is the article document type, but there are others available: report, book, letter, slides. You can also set options for your document: \documentclass[11pt, letterpaper, landscape, twoside]{article}. Refer to the help files for more details.
Guiding Principles I

▶ You’re not a professional typesetter! Don’t override \LaTeX’s default formatting (including font sizes) unless you have a very good reason for doing so.

▶ The default margins are large. It is easier to read papers if there are no more than 80 characters on a line; this is why newspapers have multiple columns.

▶ \LaTeX{} (mostly) ignores duplicated white space. If you have two or more returns in a row, this makes a new line. Don’t tell \LaTeX{} to make multiple blank lines because it knows how to make things more readable. The one major exception to this rule is math mode.
Guiding Principles II

- Every so often in the source code press enter (to make it readable - about every 80 characters). This won’t affect your output because \texttt{LaTeX} doesn’t render single line breaks.

- Use logical structure in your documents. Don’t hardcode (too much) formatting into your document; use predefined \texttt{LaTeX} commands (like \texttt{\subsection{}}, etc.).

- (For advanced \texttt{LaTeX} users) Don’t define too many macros, use obscure packages not on CTAN, and do other weird things like that. If you do, publishers won’t like you very much.
Optional (but useful) packages

Packages provided added functionality for your \LaTeX code. To include a package use the command \texttt{\usepackage\[(\textit{optional})\texttt{ Options}\}{\texttt{\textit{Package \textit{name}}}}.

<table>
<thead>
<tr>
<th>Package name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>amsmath</td>
<td>Gives an environment for typsetting math formulas. Namely \begin{equation}\end{equation}, among other things.</td>
</tr>
<tr>
<td>amssymb</td>
<td>Gives mathematical symbols that may not be built into \LaTeX</td>
</tr>
<tr>
<td>amsthm</td>
<td>Gives an environment for typing theorems in a standard format</td>
</tr>
</tbody>
</table>
## Optional (but useful) packages

<table>
<thead>
<tr>
<th>Package name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>graphicx</td>
<td>Can insert pictures from .jpg, .pdf, .png, .eps, among others using the <code>\includegraphics[(optional) Options]{filename}</code></td>
</tr>
<tr>
<td>hyperref</td>
<td>Lets you make hyperlinks</td>
</tr>
<tr>
<td>geometry</td>
<td>Lets you change the margins</td>
</tr>
<tr>
<td>enumerate</td>
<td>Lets you control the enumerate environment for lists and outlines</td>
</tr>
</tbody>
</table>

You’ll want to load `amsmath` and `amssymb` for any sort of math typsetting.
Ways to get into math mode

- As you are typing regular text, put any math mode commands (or math) between $$ like so: $$\frac{3}{4}$$ (this will look like $\frac{3}{4}$). This can be inserted right in the middle of text: The answer is $x = 3$.

- Use the package amsmath and then use \begin{equation}\end{equation} (numbers your lines between the two commands) or \begin{equation*}\end{equation*} (does not number your lines).

- Place math between \[insert math here\] or $$insert math here$$ to get it centered on a new line.
A few common math things

A more exhaustive list can be found through the lshort reference.

- Fractions: $\frac{1}{4}$, $\frac{1 + \frac{1}{3}}{2x + \frac{1}{5}}$

- Exponents and subscripts: $x_1^2 + x_2^2 + \cdots + x_{11}^2$

- Trig functions: $\cos (\sin x)$

- Summations: $\sum_{i=0}^{5} (ar^n)$

- Integrals: $\int_{0}^{\pi/2} e^x \ln x \, dx$

- Square roots and $n$th roots: $\sqrt{x^2 + 1}$, $\sqrt[3]{8} = 2$

- Greek letters: $\pi$, $\Omega$, $\omega$
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- **Exponents and subscripts:** \( x_1^2 + x_2^2 + \cdots + x_{11}^2 \), \( (3x + 7)^{100} \)
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- Exponents and subscripts: \(x_1^2 + x_2^2 + \cdots + x_{11}^2\), \((3x + 7)^{100}\)
- Trig functions: \(\cos(\sin x)\)
- Summations: \(\sum_{i = 0}^5 (ar^n)\)
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- Square roots and \( n \)th roots: \( \sqrt{x^2 + 1}, \sqrt[3]{8} = 2 \)
- Greek letters: \( \pi, \Omega, \omega \)
A few not so common math things

Spaces in math mode are tricky. Here are some ways to fix up spaces:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Code</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>x ! y</td>
<td>xy</td>
</tr>
<tr>
<td>,</td>
<td>x , y</td>
<td>x y</td>
</tr>
<tr>
<td>:</td>
<td>x : y</td>
<td>x y</td>
</tr>
<tr>
<td>;</td>
<td>x ; y</td>
<td>x y</td>
</tr>
<tr>
<td>\</td>
<td>x \ y</td>
<td>x y</td>
</tr>
<tr>
<td>\quad</td>
<td>x \quad y</td>
<td>x y</td>
</tr>
<tr>
<td>\qquad</td>
<td>x \qquad y</td>
<td>x y</td>
</tr>
</tbody>
</table>

How to box an answer (only in text mode):
\framebox[width] [position (l, c, r)] {text}

For example, Einstein said, $E = mc^2$!
Just a few reminders/cautions:

- \LaTeX is case-sensitive (for the most part), so if you are getting strange compiler errors, check your capitalization.
- Some characters are only available in math mode (e.g. \textless, \textgreater)
- Special characters that \LaTeX will get angry about: #, $, %, ^, &, _, {, }, ~, \. To typeset these, use this instead: \#, \$, \%, ^{}, &, _, {, }, ~{}, \textbackslash
The list environment

- Lists: Here are two examples of lists and their output:

\begin{itemize}
  \item Math
  \item Chemistry
  \item Physics
\end{itemize}
Another list environment

\begin{enumerate}
  \item Math
  \item Chemistry
  \item Physics
\end{enumerate}
The tabular environment

- Tables:

\begin{tabular}{l|cc}
  Number & Numeral & Roman \\
  \hline
  Five & $5$ & $V$ \\
  Ten & $10$ & $X$ \\
\end{tabular}
Aligned equations:
\begin{align}
  f(x) & = 9y^2 - 6y \\ 
  & = (9y^2 - 6y + 1) - 1 \\
  & = (3y - 1)^2 - 1 \\
\end{align}

\[ f(x) = 9y^2 - 6y = (9y^2 - 6y + 1) - 1 = (3y - 1)^2 - 1 \] (1)
The section command

- Sections:

\section{Scientists}
\subsection{Euler}
He knew everything.
\subsection{Newton}
He knew gravity.
\section{Students}
\section{MIT Students}
\subsubsection*{Jason}
He knows \LaTeX.
\subsubsection*{Piper}
She’s running cluedumps.

1 Scientists
1.1 Euler
He knew everything.
1.2 Newton
He knew gravity.

2 Students
2.1 MIT Students
Jason
He knows \LaTeX.
Piper
She’s running cluedumps.
The simplest way is to \usepackage{graphicx} and then \includegraphics{file name}. For example,

\begin{center}
\includegraphics[height=0.5\textwidth]{grumpyfuzzball}
\end{center}

gives me
\setlength{\unitlength}{0.8cm}
\begin{picture}(6,5)
\thicklines
\put(1,0.5){\line(2,1){3}}
\put(4,2){\line(-2,1){2}}
\put(2,3){\line(-2,-5){1}}
\put(0.7,0.3){$A$}
\put(4.05,1.9){$B$}
\put(1.7,2.95){$C$}
\put(3.1,2.5){$a$}
\put(1.3,1.7){$b$}
\put(2.5,1.05){$c$}
\put(0.3,4){$F=\sqrt{s(s-a)(s-b)(s-c)}$}
\put(3.5,0.4){$s:=\frac{a+b+c}{2}$}
\end{picture}
\begin{tikzpicture}[scale=2]
\clip (-0.1,-0.2) rectangle (1.8,1.2);
\draw[step=.25cm,gray,very thin] (-1.4,-1.4) grid (3.4,3.4);
\draw (-1.5,0) -- (2.5,0);
\draw (0,-1.5) -- (0,1.5);
\draw (0,0) circle (1cm);
\filldraw[fill=green!20!white,draw=green!50!black] (0,0) -- (3mm,0mm) arc (0:30:3mm) -- cycle;
\end{tikzpicture}
Getcoebra

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Learn how to [learn] LATEX
Geogebra

Graph showing a geometric diagram with marked points and labels.

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Learn how to (learn) \LaTeX
Geogebra

- Exports to pgf/tikz, pdf, png, and others.
- Great for geometrical figures.
- Allows labeling with (almost) arbitrary LaTeX formulas.
- Sometimes requires a bit of manual tweaking.
Inkscape + inkscape2tikz + TeXText

- Great for arbitrary vector graphics.
- Good when you want to draw a diagram by hand.
- Doesn’t seem to support exporting text as tikz, though TeXText lets you insert LaTeX for export as pdf.
Asymptote

- Standard for \LaTeX\ diagrams
- Extraordinarily powerful
- Requires an extra program to \TeX\ your documents
- Good for very large files
- Old and not very good interface
- Steep learning curve
Exercises

- Should take you 2–20 hours
- Email me if you want help
- Can be found at http://web.mit.edu/jgross/Public/2010cluedump/exercises.pdf
Thank You!