LaTeX Basics

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Adapter from Mini Course on LaTeX by David Diez

Outline

- Intro to LaTeX interface
- Working with text
- Tabbing and tables
- Figures

Installing LaTeX

Mac Installation. Download MacTeX, which can be found on http://www.tug.org/mactex/. LaTeX can then be accessed via the program TeXShop, which is included in this installation.

Windows Installation. Download proTeXt, which can be found on http://www.tug.org/protext/[1]. LaTeX can be accessed via TeXnicCenter, which is included in this installation.

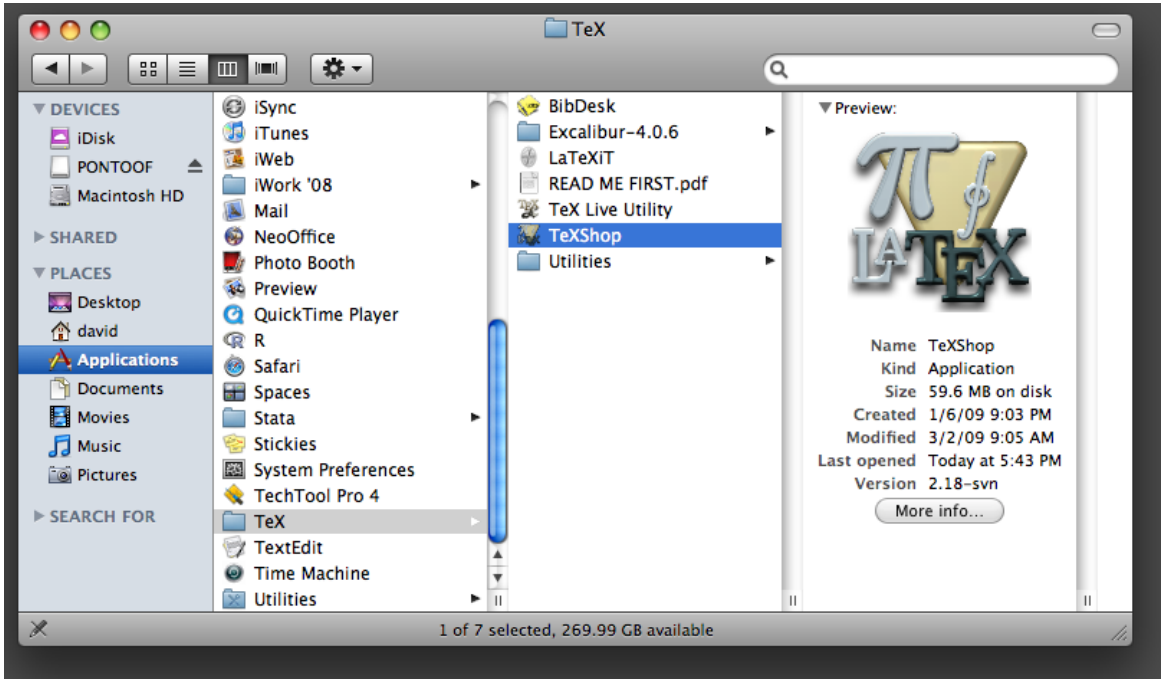
Both the MacTeX and proTeXt downloads are very large: 1.2GB and 540MB, respectively.

The interfaces for Macs and PCs are different, however, the LaTeX "code" works for both.

[1] Another option: http://www.winshell.de/. (Winshell and MikTeX)

Opening TeXShop

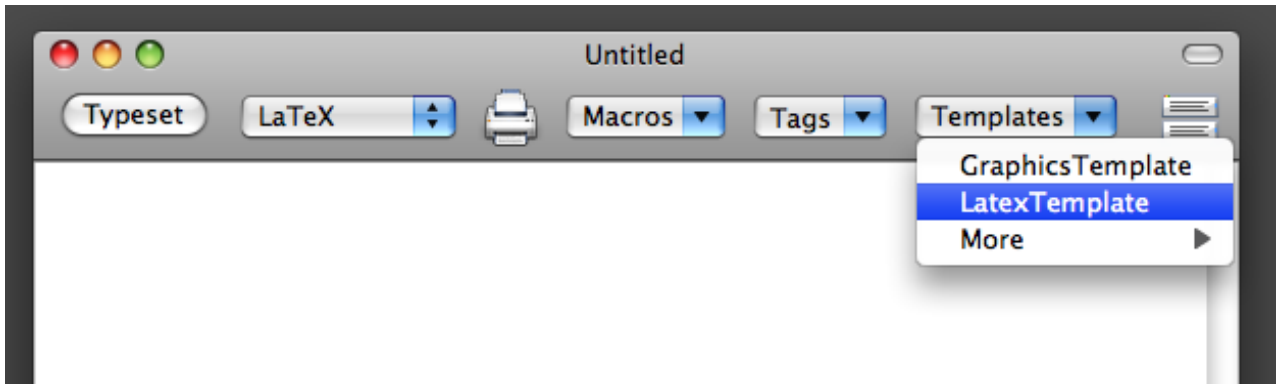
Finder (icon:) → Applications > TeX > TeXShop



Creating a basic document

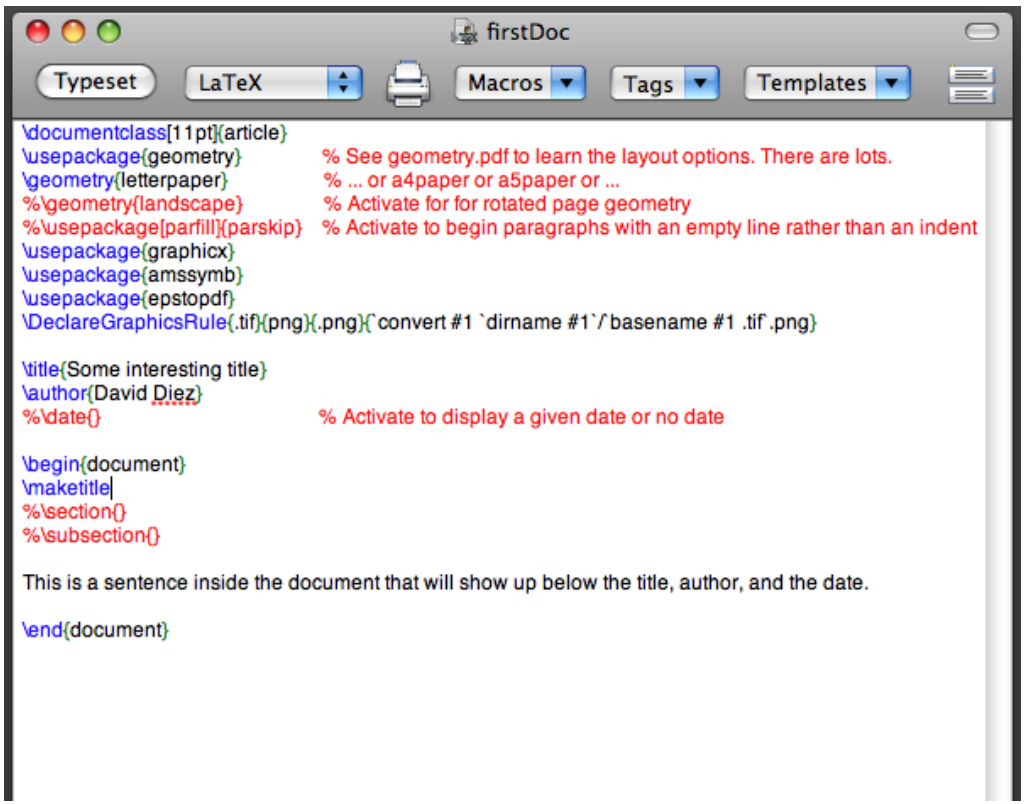
Open a file. Use File > New or command-N (*apple*-N) to open a new document if one isn't already open.

Templates. Choose the LatexTemplate.



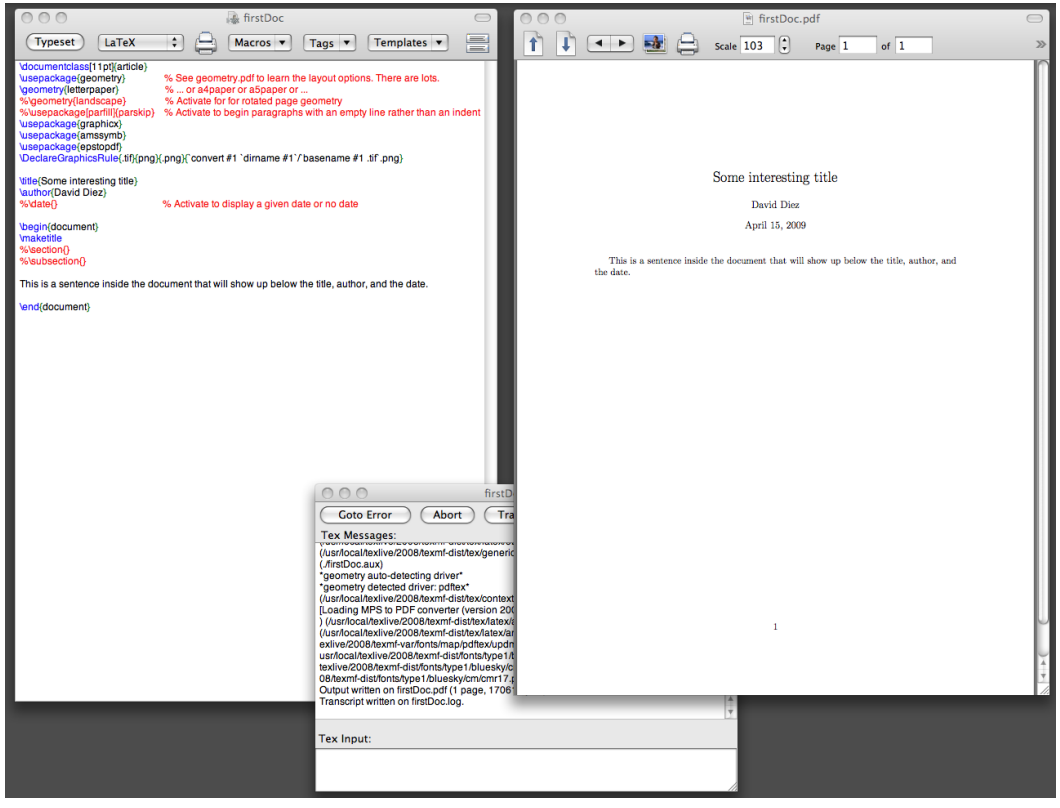
Creating a basic document

Update the \title, \author, and then type a sentence above the last line, i.e. type right above \end{document}. Create a folder on the desktop and then save this file into that folder.



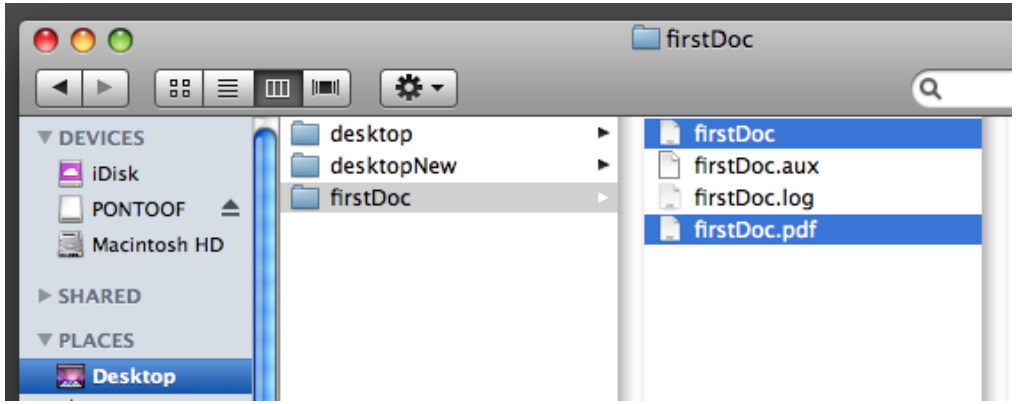
Typesetting / Compiling

Hit command-T or click the Typeset button in the upper left of the window. After typesetting, double-click on the PDF page to magnify. Try triple-clicking... and quadruple-clicking.



Extra files

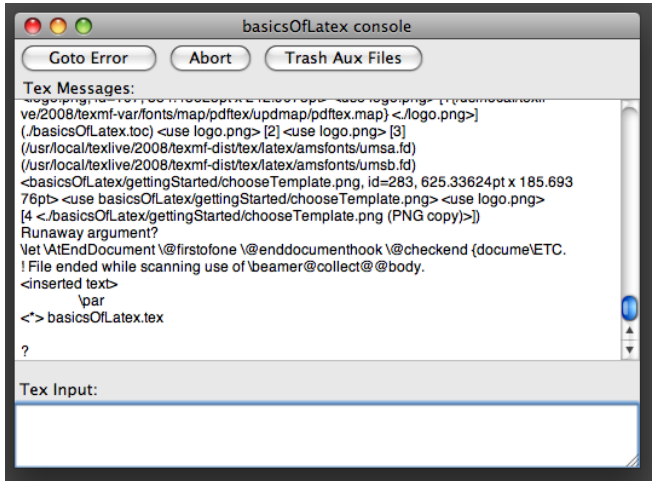
Typesetting creates a bunch of other files.



While each of these files has a purpose, only one file – in addition to the original LaTeX file – is of interest: the PDF. As more methods of LaTeX are used, this list of LaTeX output files might grow... but again, they (except the .tex and .pdf files) can just be ignored for the vast majority of LaTeX use.

Console

When the code was typeset, two windows popped up. The console tells you what LaTeX is doing when it runs through the document. If there is an error (or just something LaTeX doesn't like), the console will tell you. If the error is critical, LaTeX will stop compiling:



While it is always good to fix the problem immediately (hit Goto Error), some errors can be ignored by hitting return on the keyboard.

Errors are inevitable

Errors are common in LaTeX. To help identify errors, it is recommended that you typeset frequently. Typeset every few sentences to verify your output matches what you anticipated. You can keep working while LaTeX processes your document.

Common errors that will make more sense as we go along...

- Misspelling a command
- Not escaping special characters
- Not balancing {braces}
- Not balancing $'s
- Not balancing out beginning/ending environments (e.g. `\begin{document}` and `\end{document}`)

Commenting

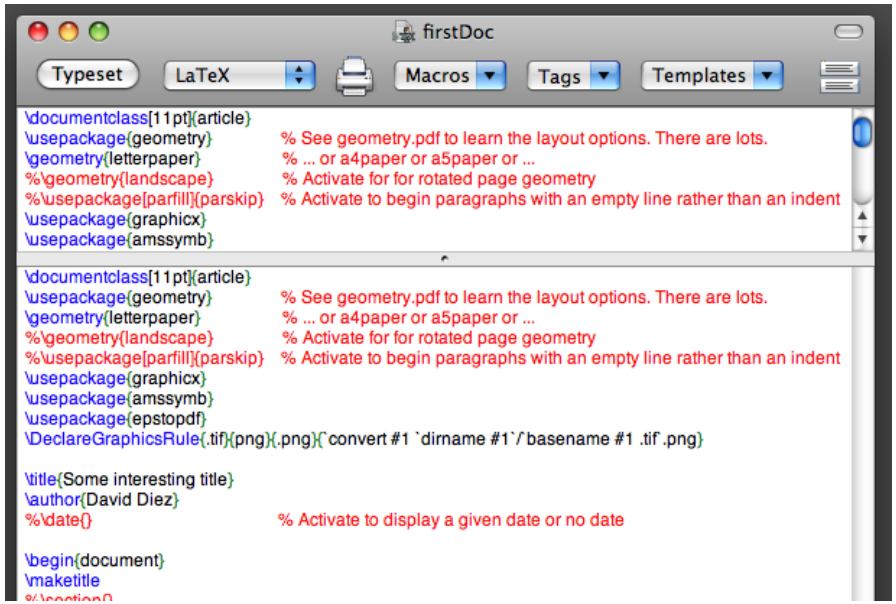
Return to the basic file you just created. What's with all the red (or gray in Windows)? These are comments, which is writing that will be ignored by LaTeX. Comments are made by using the percent symbol: %.

```
text text text text text text text text text text text text text text
text text text text text text text text text text text text text text
% 92rj9/ *\ U(Q/ * U/@# (*U{QFK<GS... this would be ignored...
%      even though it is nonsense
text text text text text text text text text text text text text text
text text text text text text text text text text text text text text
```

Any text following a % on *that line only* will be ignored by LaTeX.

Dual screens

In TeXShop, there is also the option to have dual screens by clicking on the icon to the right of Templates: 



This can be very useful when writing or editing a long document.

Example template

Download the following zipped folder[2] to your desktop

http://www.stat.ucla.edu/~david/latexTemp.zip

Unzip the file (on a Mac, double-click). latexTemp's notable contents:

- Sample document (latexTemp.tex)
- PDF of this presentation
- figures folder
- UCLA thesis template files: uclathes-1.2 and uclathesUse

latexTemp.tex follows the most of this presentation and is filled with examples and extra comments. Open this file now.

[2] If this URL no longer works, find the zip file on http://scc.stat.ucla.edu/ in the mini-course section.

Document type

The first command in every LaTeX document is the \documentclass command, which basically says what kind of document you are making.

```
\documentclass[11pt]{article}
```

The default is the `article` class.

Other classes: `letter`, `beamer` (presentations), `book`. Examples and help can be found online for these other classes.

Alter `[11pt]` to change the default font size for the document, if desired.

Packages

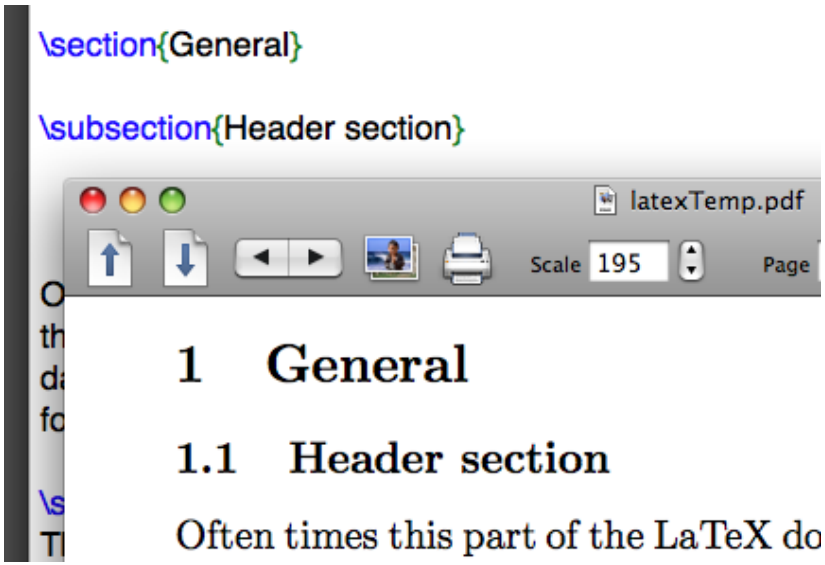
Packages supply extra features and are generally free. They are always loaded at the start of the document.

```
\usepackage{geometry}
\geometry{letterpaper}
\usepackage{graphicx}
\usepackage{amssymb}
\usepackage{epstopdf}
\usepackage{amsmath}
\usepackage{color}
```

Many common packages are included in a LaTeX installations, however, many other packages are not. Additional packages can be downloaded and installed, as needed (we won't cover this).

Sections and subsections

Documents are often broken up into sections and subsections, and this hierarchy will automatically be numbered by LaTeX.



Paragraphs

To end a paragraph and create a new one, do a double "enter" and this creates a line break.

To put an extra line space between paragraphs, use the \\ command followed by a double line break in the `.tex` document.

```
A new paragraphs can be created simply by creating two blank lines
between between the text. For instance, this paragraph is ended by
hitting ``enter'' twice (see the .tex document)...
This is not a new paragraph...

But this is a new paragraph. If an extra space is desired between
paragraphs, use the double-backslash command and hit ``enter''
twice... \\

The PDF will now insert a space between the last paragraph and this
one. \\
```

Indentation and space

Indentation. To create an indent use `\indent`, and to prevent an indent use `\noindent`. Indenting can be suppressed via `\setlength{\parindent}{0in}`.

Space. To create horizontal space, use `\hspace{1cm}`. Similarly, use the `\vspace{0.5cm}` command, or to add extra space after a line break (more than the default), use `\\[1cm]`. Negative distances may also be used.

Playing with the font

Emphasize (italicize). Use the command `\emph`, e.g. `\emph{emphasize}`, to *emphasize* (italicize) a single word.

More manipulation. Text can also be **bolded** via `\textbf` or colored via `{\color{red}colored}` (need package color). Font can be made to look `typewriterish` via `\texttt`.

Font size. Text can also be made tiny, scriptsize, footnotesize, small, large, Large, LARGE, etc. via `\tiny`, `\scriptsize`, etc.

Lists

Lists can be created via

```
\begin{itemize}
\item Spacing
\item Text
\item Macros
\end{itemize}
```

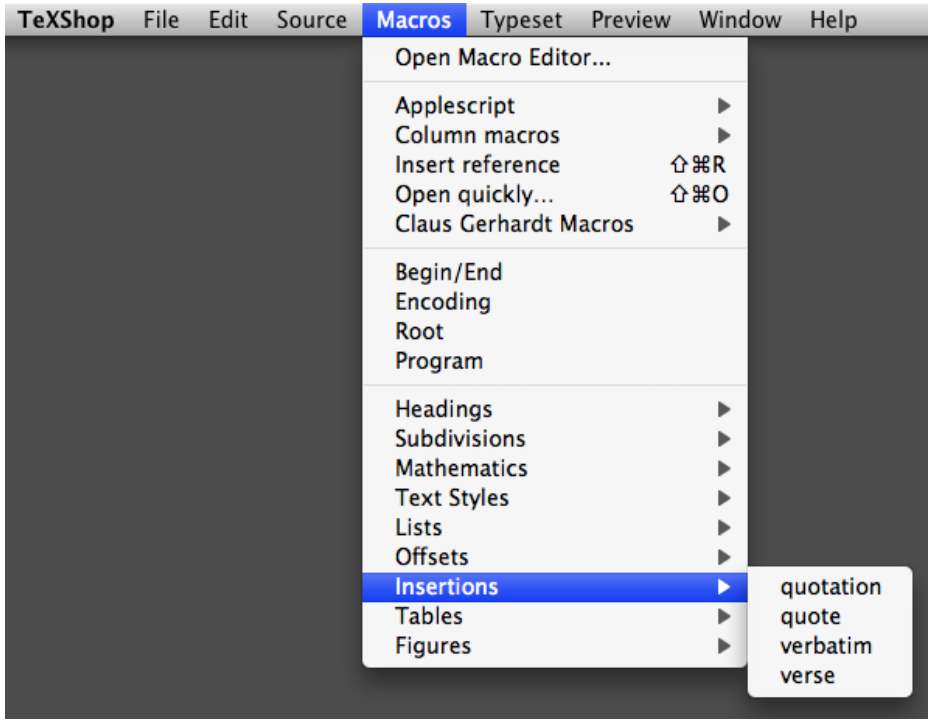
which results in a bulleted list such as the following:

- Spacing
- Text
- Macros

A couple additional examples are in latexTemp.tex.

Macros

Many more text alterations can be done using the Macros.



Macros offer many many options to alter text.

Practice

Write two short paragraphs that includes a few words or phrases that have been *italicized* and also some that have been **bolded**.

What should you do if you want a line break between the paragraphs? What if you only want the second paragraph indented?

Add the package color and add color to some of your text. For instance, try `{\color{red}Some text that will be colored red.}`

Tabbing

Like in other text editors, LaTeX offers tabbing. While this environment tends to rarely be used (at least by me), it can be very useful under particular conditions.

Test Name	**Description**	**Total number of trials**
Fixed Size	Upon collection of the data, if $\|Z_k\| \geq 1.96$ stop, reject H_0 otherwise stop, DNR H_0.	$n_f(\alpha, \beta, \delta, \sigma^2)$
Pocock	After group $k = 1, ..., K-1$ if $\|Z_k\| \geq C_P(K, \alpha)$ stop, reject H_0 otherwise continue testing, after group K (the last group) if $\|Z_K\| \geq C_P(K, \alpha)$ stop, reject H_0 otherwise stop, DNR H_0.	$n_f R_P(K, \alpha, \beta)$

See latexTemp.tex for a brief introduction to tabbing and a few examples.

Basic tables

Tables are created using the `tabular` environment. The `{lcr}` gives the alignment. The ampersands (`&`) are used to define when to go to the next column.

```
\begin{tabular}{lcr}
   Left & Center & Right \\
   1    & 2      & 3  \\
\end{tabular}
```

The `\\` command tells LaTeX to start a new row.

The result:

Left	Center	Right
1	2	3

Centering and adding lines

Building the table up:

```
\begin{center} % center the table
\begin{tabular}{l | rrrr} % the second 'l' is a vertical bar
  \hline % add a horizontal line here
                & Estimate & Std. Error & t value & Pr($>$$|$t$|$) \\
  \hline
(Intercept) & -0.2852  & 0.8434   & -0.34   & 0.7452 \\
x           & 0.4192   & 0.1499   & 2.80    & 0.0266 \\
   \hline
\end{tabular}
\end{center}
```

The result:

	Estimate	Std. Error	t value	Pr($>\|$t$\|$)
(Intercept)	-0.2852	0.8434	-0.34	0.7452
x	0.4192	0.1499	2.80	0.0266

Floating table with a caption

To add a caption or label, the table must be *floated* (i.e. add on the `table` environment). Then `\caption` can be used:

```
\begin{table}[htbp]
% [htbp] pushes the table to different spots on the page
   [all the LaTeX from the last slide]
\caption{A regression summary.}
\end{table}
```

The output:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.2852	0.8434	-0.34	0.7452
x	0.4192	0.1499	2.80	0.0266

Table: A regression summary.

The table is numbered when a caption is added in the `article` document class.

Referencing

Suppose we are writing a document and refer to Table 4 in our text. Two days later, we decide to add another table earlier in the document. Now Table 4 is actually Table 5 and we need to change all the 4s to 5s (and 5s to 6s, and so on).

Instead, we tag each table with a unique label. We reference the label, not the number.

```
\caption{A regression summary.}
\label{regressTable}
\end{table}
```

`\label{regressTable}` labels the table and then this table can be referenced using the LaTeX code `Table~\ref{regressTable}`.

Using the R package xtable

Inside R:

```
> library(xtable) # may need install.packages('xtable')
> x <- 1:9
> z <- rnorm(9)
> y <- x/7 + z^2 + rnorm(9)
> xtable(summary(lm(y ~ x+z)))
...  output that can be copied/pasted into LaTeX ...
```

R output directly copied/pasted into LaTeX:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.1563	0.6243	-0.25	0.8107
x	0.1094	0.1145	0.96	0.3760
z	2.6170	0.4308	6.08	0.0009

Practice

Produce the following result:

	mean	sd	n
S1	6.5	1.3	17
S2	12.2	1.4	25

Some examples may be utilized in `latexTemp.tex`.

Basic figures

Add figures using the \includegraphics command.

```
\includegraphics{lower40} % no extension needed

% can easily control the size of the image
\includegraphics[height=1.0in]{figures/lower82/lower82}
```

The first file is stored in the same folder as the LaTeX file. The second is a couple folders away.

The files and folder names used should have no spaces.

`[height=1.0in]` is an optional argument to control the figure size.

Figure centering

Just like tables, a figure can be centered:

```
\begin{center}
\includegraphics[height=1.0in]{figures/lower82/lower82}
\end{center}

\begin{figure}[htbp]
  \centering % another method to center the figure
  \includegraphics[height=2.0in]{figures/lower82/lower82}
\end{figure}
```

How does the second method look similar to the floating tables? (This is a floating figure.)

Adding a caption and referencing

Just like in the floating `table` environment, a floating figure can have a caption and reference.

```
\begin{figure}[htbp]
  \centering
  \includegraphics[height=2.0in]{figures/figureTemplate}
  \caption{Where to find your figure template.}
  \label{figureTemplate}
\end{figure}
```

Just like with tables, the `\label` command must come after the `\caption` command for the reference to work properly.

Figure~\ref{figureTemplate} is where to find your figure template.

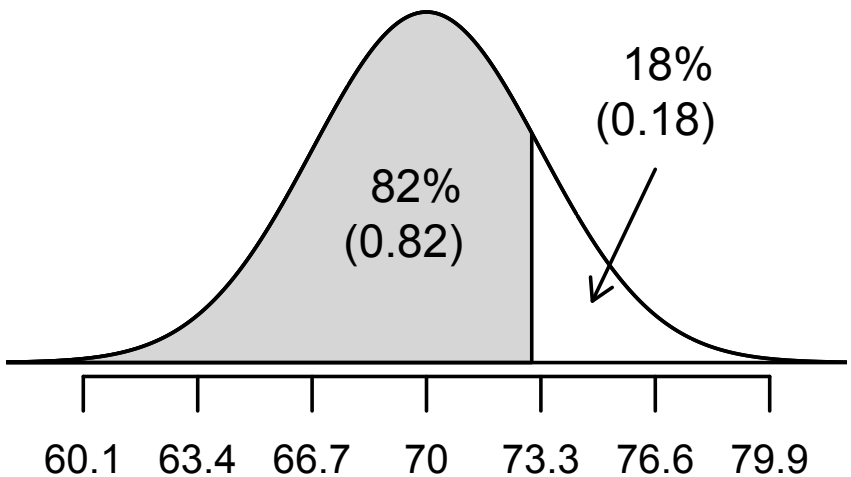
Keeping organized

Some tips to keeping organized when using LaTeX:

- One LaTeX document per folder.
- When choosing a `\label` name for a figure, have it match the figure file name.
- Organize figure files into folders.
- If you use code to produce a figure, save it to the same folder as the figure and with the same name (but a different extension, of course).
- Remember, no spaces in file or folder names.

Practice

Using the image in `latexTemp/figures/lower82/`, produce the following plot. Make it 0.8 inches tall, center it, add a caption, and add a reference. Be sure to write a sentence that references the Figure and compile your LaTeX document twice so the reference works.



Feel free to utilize examples in `latexTemp.tex` or to use the LaTeX Float Figure template.

Usage LaTeX in Browser

Besides using LaTeX on desktops, there is a great possibility to bring the same experience into browsers. Benefits of using LaTeX (especially math/equation part) directly inside browsers is hard to overestimate.

LaTeX in Web - Tools

Number of software tools and libraries are available to deal with LaTeX directly in browser.

- MathJax - Most popular JavaScript library
- KaTeX - JavaScript library from Khan Academy
- ...

LaTeX in Web - Examples

Some example

- Interactive LaTeX Editor
- MathJax Live Demo
- Jupyter Notebook (former IPython)

Materials

Useful tools

- LaTeX Tables Generator
- LaTeX Table Editor

Books

- *Guide to LaTeX*, by Helmut Kopka and Patrick W. Daly

Homework

If you are taking this course for credit, turn in the following at the start of the next class. Include both the raw LaTeX + the PDF. Printing two pages on *each* side of the paper is encouraged to reduce paper waste. Alternatively, email the files.

Write a 2 page document in LaTeX (or transfer another document not in LaTeX into LaTeX). The document must include (a) 2 or more paragraphs, (b) at least one figure, (c) at least one table, and (d) text references using \labels to the figure and table.