

CME 211: Lecture 9

Tuesday, October 23, 2018

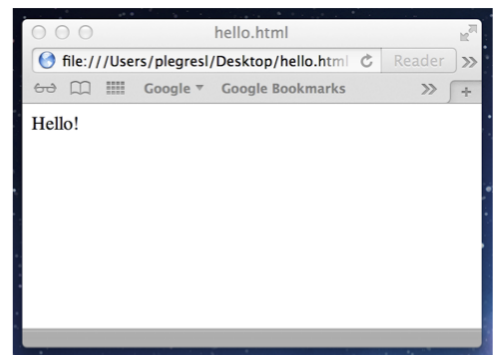
Topics: Introduction to LaTeX

LaTeX

- LaTeX is a document markup language
- HTML is also a document markup language targeting web browsers
- LaTeX targets high quality print documents
- LaTeX commands are also now used to typeset equations on the web

```
<html>
Hello!
</html>
```

hello.html



```
\documentclass{article}
\begin{document}
Hello!
\end{document}
```

hello.tex



Hello!

hello.pdf

Figure 1: fig

How to obtain

- Windows: <http://miktex.org/about>
- Mac OSX: <https://tug.org/mactex/>
- Ubuntu: `$ sudo apt-get install texlive`
- Fedora: `$ sudo yum install texlive-scheme-medium`

Note: on Linux distributions, you may have to install other `texlive` packages to get the full TeXLive distribution. Ubuntu has the package `texlive-full`. Fedora has the package collection `texlive-scheme-full`. These are large downloads. Be prepared to wait. Don't install TeX at the last moment!

TeXLive is installed on `corn.stanford.edu`. The primary access point for CME 211 will be the command line program `pdflatex`.

Equations in LaTeX

```
\begin{equation}
\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}
\label{eq:integral}
\end{equation}
```

Label to be used for referring
to this equation from the text

From `demo.tex`



$$\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

Figure 2: fig

Hello world

See: `tex/hello.tex`:

```
\documentclass{article}
\begin{document}
Hello
\end{document}
```

Typesetting instructions (from this directory):

```
$ cd tex
$ pdflatex hello.tex
```

This creates `hello.pdf`.

Document class

Quite a few options:

- `article` - general purpose class for publications, reports, etc.
- `proc` - proceedings
- `report` - longer reports, short books, etc.
- `book` - books

- `slides` - presentation slides
- `letter` - writing letters
- etc.

Various organizations will also distribute customized document classes for various purposes. For example:

- SIAM LaTeX: <https://www.siam.org/journals/auth-info.php>
- Stanford PhD thesis template: <https://library.stanford.edu/research/bibliography-management/latex-and-bibtex>

White space

White space is normalized so 1 to n spaces are treated the same

```
\documentclass{article}
\begin{document}
There      are      lots      of      spaces      here.
\end{document}
```

`spaces.tex`



There are lots of spaces here.

Figure 3: fig

Paragraphs

Special characters

There are several reserved characters in LaTeX:

`# $ % ^ & _ { } ~ \`

Comments

Groups

Pairs of curly brackets denote a group and are typically used to limit the scope of switches:

```

\documentclass{article}
\begin{document}
This is the first paragraph.
In this first paragraph we provide an introduction to the document.

After the blank line we start a new paragraph. For the second
paragraph we provide
more information about the topic of the document.
\end{document}

```

Blank line denotes new paragraph

paragraphs.tex



This is the first paragraph. In this first paragraph we provide an introduction to the document.

After the blank line we start a new paragraph. For the second paragraph we provide more information about the topic of the document.

Figure 4: fig

```

\documentclass{article}
\begin{document}
% This is a comment and will not appear in the rendered document.
This is the first line of text that will appear in the document.
84% of statistics are just made up on the spot.
Unfortunately I don't think I wrote this correctly.

If I really want to put a percent symbol in my document I need to
escape it. This is almost 90\% of the way done.
\end{document}

```

Line starts with % and is all a comment

This is all being treated as a comment

The % symbol is escaped and actually rendered

comments.tex



This is the first line of text that will appear in the document. 84Unfortunately I don't think I wrote this correctly.

If I really want to put a percent symbol in my document I need to escape it. This is almost 90% of the way done.

Figure 5: fig

```

\documentclass{article}
\begin{document}
{
\bf This is in bold.

This is also in bold.
}
But this is not in bold.
\end{document}

```

groups.tex



This is in bold.
This is also in bold. But this is not in bold.

Figure 6: fig

Commands

General form of a LaTeX command is

```
\commandname[option1,option2,...]{argument1}{argument2}...
```

Command example

```

\documentclass{article}
\begin{document}
Some of this text has been \emph{emphasized}. Other parts have not.
\end{document}

```

emph.tex



Some of this text has been *emphasized*. Other parts have not.

Figure 7: fig

Environments

```

\begin{environmentname}
Text to be influenced by this environment
\end{environmentname}

```

```

\begin{equation}
\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}
\label{eq:integral}
\end{equation}

```

From demo.tex



$$\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

Figure 8: fig

Equation environment

Bulleted list

Latex packages

Many LaTeX environments are defined in packages. To include a package use the `\usepackage` command in the document preamble. The `tex/demo.tex` document uses a few:

```

\usepackage{graphicx}
\usepackage{algorithm2e}

```

This comes before the `\begin{document}` command.

- `graphicx` provides the `\includegraphics` command for figures
- `algorithm2e` provides an environment for displaying algorithms

Figures

Table

Algorithm

Referencing labels

Use `\label` and `\ref`:

The first pass of LaTeX will produce an unresolved reference:

The second pass of LaTeX will resolved the reference:

```
\begin{itemize}  
\item The first item  
\item And the second item  
\item etc.  
\end{itemize}
```

From demo.tex



- The first item
- And the second item
- etc.

Figure 9: fig

```

\begin{figure}[htb] Placement control (more on this later)
\begin{center}
\includegraphics[width=0.85\linewidth]{maze1.pdf}
\caption{Maze} Scale the image to 85% of
\label{fig:maze1} the line width
\end{center}
\end{figure}

```

From demo.tex



Figure 1: Maze

Figure 10: fig


```

\begin{table} [htb]
\begin{center}
\caption{Dataset Characteristics}
\begin{tabular}{|c|c|c|} Three centered columns with vertical lines around them
\hline
Dataset number & Reference length & Number of reads \\ \hline
1 & 100 & 60 \\ \hline
2 & 1000 & 600 \\ \hline
3 & 10000 & 6000 \\ \hline
\end{tabular}
\label{table:datasets}
\end{center}
\end{table}

```

From demo.tex



Table 1: Dataset Characteristics

Dataset number	Reference length	Number of reads
1	100	60
2	1000	600
3	10000	6000

Figure 11: fig

```

\begin{algorithm}[H]
\SetAlgoLined
\KwData{this document}
\KwResult{how to use \LaTeX2e }
initialization\;
\While{not at end of this document}{
  read current\;
  \eIf{understand}{
    go to next section\;
    current section becomes this one\;
  }{
    go back to the beginning of current section\;
  }
}
\caption{How to read this document}
\end{algorithm}

```

From demo.tex

Data: this document
Result: how to use \LaTeX2e
 initialization;
while *not at end of this document* **do**
 read current;
 if *understand* **then**
 go to next section;
 current section becomes this one;
 else
 go back to the beginning of current section;
 end
end

Algorithm 1: How to read this document

Figure 12: fig

With LaTeX you can create equations
 as shown in Equation~\ref{eq:integral}:

Reference the equation by label

```

%
\begin{equation}
\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}
\label{eq:integral}
\end{equation}

```

Give the equation a unique label

From demo.tex

Figure 13: fig

Unresolved reference

formatting. With LaTeX you can create equations as shown in Equation [??](#):

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2} \quad (1)$$

Figure 14: fig

Resolved reference

formatting. With LaTeX you can create equations as shown in Equation [1](#):

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2} \quad (1)$$

Figure 15: fig

Controlling placement

- By default figures, tables, etc. will “float” around to where they best fit
- You can also specify preferences about placement
- Floating environments take a parameter in square brackets: `\begin{figure}[?]`. The options are:
- `h` for “float here”
- `t` for “top of page”
- `b` for “bottom of page”
- `H` for “put here, don’t float”
- Good figure placement often requires some experimentation.
- Advice: write the document first. Make it look nice second. Things will change as you add more text and figures.

BibTeX

- Companion program for managing citations of papers, books, websites, etc.
- Start by creating a `.bib` file

`.bib` file

See `tex/references.bib`:

Typesetting with BibTeX reference

This is really annoying!

```

\begin{figure}[htb]
\begin{center}
\includegraphics[width=0.85\linewidth]{maze1.pdf}
\caption{Maze}
\label{fig:maze1}
\end{center}
\end{figure}

```

From demo.tex

Figure 16: fig

```

@article{Ronaghi:2001:Pyrosequencing,
  Author = {Mostafa Ronaghi},
  Journal = {Genome Research},
  Pages = {3--11},
  Title = {Pyrosequencing Sheds Light on DNA Sequencing},
  Volume = {11},
  Year = {2001}}

@misc{CME211:2013:FinalProjectPart1,
  Author = {CME211},
  Howpublished = {http://coursework.stanford.edu},
  Month = {November 15},
  Title = {Final Project: Part 1},
  Year = {2013}}

```

references.bib

Figure 17: fig

```
$ pdflatex demo
$ bibtex demo
$ pdflatex demo
$ pdflatex demo
```

Many TeX editors do this for you with one button click. See

- TeXShop
- TeXWorks
- TeXMaker

I use a GNU makefile to drive TeX.

Bibliography management

- Any text editor can be used to create, edit, and manage a .bib file
- Some editors will recognize the file extension and enable a BibTeX specific mode
- There are also applications specifically for doing this:
- BibDesk (Mac OS X only): <http://bibdesk.sourceforge.net>
- JabRef (Windows / Mac OS X / Linux): <http://jabref.sourceforge.net>
- Mendeley: <http://www.mendeley.com>

Citations

Citation in LaTeX:

```
\section{Citation Example}

If you want to cite a publication, you use the cite
command~\cite{CME211:2013:FinalProjectPart1}.
      Label must match the label in the .bib file
\section{Conclusions}

Hope you enjoyed your tour of \LaTeX.  Have a good day!

% Reference section
\bibliographystyle{unsrt}
\bibliography{references}
Specify style (unsrt) and name
of .bib file (e.g. references.bib)

\end{document}
```

From demo.tex

Figure 18: fig

Resulting PDF:

2 Citation Example

If you want to cite a publication, you use the cite command [1].

3 Conclusions

Hope you enjoyed your tour of L^AT_EX. Have a good day!

References

- [1] CME211. Final project: Part 1. <http://coursework.stanford.edu>, November 15, 2013.

From demo.pdf

Figure 19: fig

A note on LaTeX errors

LaTeX will dump error messages and start a prompt on errors:

```
$ pwd
/Users/nwh/Dropbox/courses/2015-Q4-cme211/lecture-prep/lecture-13-work/tex
nwh-mbpro:tex nwh$ pdflatex demo
This is pdfTeX, Version 3.14159265-2.6-1.40.16 (TeX Live 2015) (preloaded format=pdflatex)
.....
) (./demo.aux) (/usr/local/texlive/2015/texmf-dist/tex/latex/base/omscmr.fd)
! Undefined control sequence.
1.35 \includegraphics
      [width=0.85\linewidth]{../fig/maze.pdf}
?
```

LaTeX is wanting you to guide the typesetting at this point. I have no idea what to do here. I input a capital X to get back to the shell. I then fix the error in the .tex file. In this case, I forgot `\usepackage{graphicx}` in the preamble.

LaTeX references

- Google
- Guide to LaTeX by Kopka and Daly:
<http://proquest.safaribooksonline.com/book/graphic-design/9780321617736>
- **Detexify**: a web tool to go from symbol drawing to TeX command:
<http://detexify.kirelabs.org/classify.html>

- LaTeX Wikibook: <https://en.wikibooks.org/wiki/LaTeX>