Optimal Broadcasting Strategies

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A Brief Tour of LaTeX

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Part II
A Brief Tour of LaTeX

- Introduction to LaTeX

- Installation

- LaTeX Document Basics

- Mathematical Expressions

- Tables

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Introduction to LaTeX

- LaTeX is a document typesetting system which is especially suited to accommodating mathematical expressions.

- It is easy to customize and program, and source files are small.

- It is extremely popular in scientific communications, both in academia and industry.

- Its first widely used version (LaTeX2.09) came out in 1985.

- The current widely used version is called LaTeX2ϵ.

How to Install LaTeX

To "install LaTeX", you need to download

- a compiler (probably MiKTeX)

- an editor (I suggest TeXNicCenter)

- possibly a DVI previewer (probably YAP)

These are all available as freeware, and are already on all computers in all 2nd floor D-building labs.

Precise instructions for installing MiKTeX and TeXNicCenter are at

  `http://www.ucfv.ca/math/faculty/mathclub`

Document Structure

Every LaTeX document has:

- A "documentclass" description (usually article or report)

- If desired, a few "usepackage" commands, to draw in fancy library packages

- If desired, definitions of a few new commands - typically shortcuts or page formatting

- A "begin{document}" command

- Document Content

- An "end{document}" command

A Sample Document

```
\documentclass[12pt]{article}

\usepackage{amsmath}
\usepackage{color}

\newcommand{\red}{\textcolor{red}}

\begin{document}

Here is the content of my article.  I like
to use color, \red{especially red}.

\end{document}
```

You get:

Here is the content of my article. I like to use color, especially red.

LaTeX Commands

As you saw on the last page, the "\" character plays a big role in LaTeXcode. It signals the start of most commands.

Some other protected characters:

"%" signals the start of documentation (ignored by compiler).

"&" is used for tabbing.

"$" signals start/end of a math expression.

"_" and "^" are for subscripts and superscripts.

"{" and "}" are used to group symbols.

Mathematical Expressions

There are a lot of ways to indicate to the compiler that an input expression should be interpreted as math.

1. In-line math mode:

   You type:
   Notice that $(x+1)^2$ is x^2+2x+1.

   You get:
   Notice that $(x + 1)^2$ is $x^2 + 2x + 1$.

2. Centered math mode:

   You type:
   Notice that $$3^{n+1}=3(3^n)$$

   You get:
   Notice that

   $$3^{n+1} = 3(3^n)$$

3. Equation Array mode:

```
\begin{eqnarray}
\sum_{i=1}^n i &=& 1+2+...+n \\
&=& \frac{n(n+1)}{2}
\end{eqnarray}
```

You get:

$$\sum_{i=1}^{n} i = 1 + 2 + ... + n \qquad (1)$$

$$= \frac{n(n+1)}{2} \qquad (2)$$

The commands "\begin" and "\end" signal the start and end of an environment - in this case an "eqnarray" environment.

The "eqnarray*" environment is similar but doesn't number the lines.

Mathematical Symbols

Pretty much every math symbol you can think of exists as a command in LaTeX. Here are some web pages for reference:

- amath.colorado.edu/documentation/LaTeX/Symbols.pdf

- www.artofproblemsolving.com/LaTeX

Please don't avoid using math symbols!

	Code	Result
Bad	`cos(2x)`	cos(2x)
Bad	`$cos(2x)$`	$cos(2x)$
Good	`$\cos(2x)$`	$\cos(2x)$

Matrices, Arrays, Vectors

Arrays are easy to make, and they'll allow me to showcase the "\left" and "\right" commands.

You type:

```
Define the matrix $M=
\left[
\begin{matrix}
1 & 2 & 3 \\
4 & 5 & 6
\end{matrix}
\right] $
```

You get:

Define the matrix $M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

Tables

To describe a table, you must enter a "tabular" environment.

Not surprisingly, tables are constructed much like arrays, although they do not live in math code.

- "&" and "\\" are "tab" and "end-of-line".

- After "\begin{tabular}", you must specify the column alignments and vertical separator lines. (See example on the next page.)

- To insert a horizontal line below a row, include "\hline" after the "\\".

A Sample Table

You type:

```
\begin{tabular}{l|r|c||r}
Item & Cost(\$) & Number & Total(\$) \\ \hline
Fob & 0.12 & 40 & 4.80 \\
Cog & 0.20 & 10 & 2.00
\end{tabular}
```

You get:

Item	Cost($)	Number	Total($)
Fob	0.12	40	4.80
Cog	0.20	10	2.00

Notice how concisely the column alignments (left, right, or center) and separator bars are defined.

Colors

To bring color into LATEX, request the color package ("\usepackage{color}") after defining your document class.

You type: `I like the \textcolor{blue}{sky}.`

You get: I like the sky.

LATEX only knows a few basic colors. To design your own color, specify the cyan, magenta, yellow, shade contents. All four parameters must lie in the $[0, 1]$.

You type: `Cyan and yellow make`
`\textcolor[cmyk]{1,0,1,0}{this color}.`

You get: Cyan and yellow make this color.

Importing Pictures

To work with pictures in LaTeX, request the graphicx package ("\usepackage{graphicx}") after defining your document class.

The main command for importing pictures is \includegraphics.

.eps pics can compile to .dvi or .pdf

.jpg, .png, .pdf pics must compile to a .pdf file

You type:

```
\includegraphics[scale=0.1]{IMG_3540.jpg}
```

You get:

Rotate, Reflect, Resize

You type:

```
\includegraphics[height=2in,angle=45]
{IMG_3540.jpg}
```


You get:

You type:

```
\reflectbox{\includegraphics[width=1in]
{IMG_3540.jpg}}
```


You get:

Useful References

The book I use a lot:

- Lamport, Leslie, LaTeX: A Document Preparation System, 2nd edition, Addison-Wesley, 1994

Some good web sites:

- amath.colorado.edu/documentation/LaTeX

- www.artofproblemsolving.com/LaTeX

- www.math.harvard.edu/texman/