Writing in \LaTeX: An Introduction

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Outline

- What is \LaTeX?
- Why should I use \LaTeX?
- What do I need to get started?

Basics
- Text
- Mathematical Equations
- Arrays and Matrices

Special Features
- Tables
- Figures
- Labeling and Referencing

Prosper / Slide Show
What is \LaTeX?

\LaTeX\ is a document preparation program built upon the \TeX\ program created by Donald Knuth.
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- `\TeX` pioneered the writing of scientific and mathematical documents by allowing the user to program the mechanical appearance without being forced to adhere to a set of factory standards.
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\TeX also allowed users to write mathematical formulae without the limitations or constraints imposed by some type-setting programs.
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$\text{LaTeX}$ simply adds to the commands of the $\text{TeX}$ language in a somewhat more user-friendly style. $\text{LaTeX}$ was originally written by Leslie Lamport.
Why Should I Use $\LaTeX$?

$\LaTeX$ is second to none for writing mathematically intensive papers.

- Gives user complete control of making equations, tables and figures, and does the formatting for you.
Why Should I Use \texttt{LATEX}?

\textbullet \quad \texttt{LATEX} is second to none for writing mathematically intensive papers.

\textbullet \quad \text{Gives user complete control of making equations, tables and figures, and does the formatting for you.}

\textbullet \quad \text{Some scholarly journals require or prefer documents submitted in \texttt{LATEX}.}

\textbullet \quad \text{Society for Industrial and Applied Mathematics (SIAM) Journals.}

\textbullet \quad \text{Annals of Probability, The American Statistician, e.g.}
Why Should I Use LaTeX?

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- Gives user complete control of making equations, tables and figures, and does the formatting for you.
- Some scholarly journals require or prefer documents submitted in LaTeX.
  - Annals of Probability, The American Statistician, e.g.
- You may be required to write your thesis in LaTeX.

http://sci.odu.edu/sci/about/information/thesis/Thesis_Templates.shtml
What Do I Need to Use LATEX?

You will need to download the following items:

- Ghostscript and Ghostview (GSView), allow user to generate pdf files.
  
  http://pages.cs.wisc.edu/~ghost/
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- Miktex, is the implementation program for Windows operating systems.

  http://miktex.org

- Winedit ($30 for students) or Scientific Workplace, are user interface programs.

  http://www.winedt.com/
One of the benefits of using \textit{\LaTeX} over other word processing units is that it is much easier to use Greek letters and symbols. For instance, instead of using your mouse to search through a window of characters, you can simply write the code

\begin{verbatim}
\alpha \Rightarrow \alpha \quad \sum \Rightarrow \sum
\beta \Rightarrow \beta \quad \infty \Rightarrow \infty
\gamma \Rightarrow \gamma \quad \Gamma \Rightarrow \Gamma
\delta \Rightarrow \delta \quad \Delta \Rightarrow \Delta
\lambda \Rightarrow \lambda \quad \Lambda \Rightarrow \Lambda
\star \Rightarrow \star \quad \circledR \Rightarrow \circledR
\propto \Rightarrow \propto \quad \in \Rightarrow \in
\end{verbatim}
Basics

There are also many special commands in \LaTeX{} that make word processing much easier.

\texttt{today} \quad \rightarrow \quad January 31, 2008

These \texttt{\ldots cdots} \quad \rightarrow \quad These \ldots \cdots \ddots and \ddots are various ellipses

There are also various accents that are easy to implicate.

\texttt{\b{o}} \quad \Rightarrow \quad \circ \quad \texttt{\hat{a}} \quad \Rightarrow \quad \hat{a}

\texttt{o'} \quad \Rightarrow \quad o' \quad \texttt{\tilde{a}} \quad \Rightarrow \quad \tilde{a}

\texttt{\c{o}} \quad \Rightarrow \quad \circ \quad \texttt{\d{a}} \quad \Rightarrow \quad \acute{a}
Basics

You can also write in many different type-sizes

\{\tiny Math\} \rightarrow Math
\{\scriptsize Math\} \rightarrow Math
\{\footnotesize Math\} \rightarrow Math
\{\small Math\} \rightarrow Math
\{\normalsize Math\} \rightarrow Math
\{\large Math\} \rightarrow Math
\{\Large Math\} \rightarrow Math
\{\LARGE Math\} \rightarrow Math

as well as \texttt{\huge} and \texttt{\Huge}.
The following is a list of fonts:

\{\texttt{rm} Math\}  \rightarrow  Math
\{\texttt{it} Math\}  \rightarrow  Math
\{\texttt{sc} Math\}  \rightarrow  MATH
\{\texttt{em} Math\}  \rightarrow  Math
\{\texttt{sl} Math\}  \rightarrow  Math
\{\texttt{tt} Math\}  \rightarrow  Math
\{\texttt{bf} Math\}  \rightarrow  Math
\{\texttt{sf} Math\}  \rightarrow  Math
Basics

Portions of a document can be easily formatted by using the following commands:

Centering $\Rightarrow \begin{center}
\cdot \\
\cdot \\
\end{center}$

Itemize $\Rightarrow \begin{itemize}
\cdot \\
\cdot \\
\end{itemize}$

Enumerate $\Rightarrow \begin{enumerate}
\cdot \\
\cdot \\
\end{enumerate}$

Documents can also be partitioned merely by specifying $\texttt{part}$, $\texttt{chapter}$, $\texttt{section}$, $\texttt{subsection}$, etc.
Mathematical Equations

Where \LaTeX really shines is in writing mathematical equations or formulas, which can be done in either the "\begin{equation}" or "\begin{eqnarray}" settings. The "equation" command numbers equations automatically, while the "eqnarray" command gives you the option of not numbering by specifying "\nonumber".
Where \textsc{LATEX} really shines is in writing mathematical equations or formulas, which can be done in either the \texttt{\begin{equation}} or \texttt{\begin{eqnarray}} settings. The \texttt{equation} command numbers equations automatically, while the \texttt{eqnarray} command gives you the option of not numbering by specifying \texttt{\nonumber}.

You can also write equations within text by wrapping dollar signs ($) around an equation, such as:

\$4 \times 8 = 32\$ \rightarrow 4 \times 8 = 32.$
Mathematical Equations

There are also many mathematical symbols that make writing equations easy. For example:

\[ \sqrt[3]{4xy} \quad \Rightarrow \quad 3\sqrt[3]{4xy} \]
\[ \frac{x}{1-x} \quad \Rightarrow \quad \frac{x}{1-x} \]
\[ (r)^{2t-1} \quad \Rightarrow \quad (r)^{2t-1} \]
\[ A_1 - A_2 = A \quad \Rightarrow \quad A_1 - A_2 = A \]
\[ \sum_{i=1}^{n} p^i \quad \Rightarrow \quad \sum_{i=1}^{n} p^i = \frac{p-p^{n+1}}{1-p} \]
\[ \frac{p-p^{n+1}}{1-p} \]
\[ x \nleq y \quad \Rightarrow \quad x \nleq y \]

These symbols can be used in both the text and “equation” environments.
Mathematical Equations

An example:

\begin{eqnarray}
S & = & \frac{(1-\rho)(1+\rho+\rho^2+\ldots+\rho^{n-1})}{(1-\rho^n)}
\nonumber \\
& = & \frac{(1-\rho)(1-\rho^n)}{(1-\rho^n)(1-\rho)} = 1
\end{eqnarray}
Mathematical Equations

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S & = & \frac{(1-\rho)(1+\rho+\rho^2+\ldots+\rho^{n-1})}{(1-\rho^n)} \\
& = & \frac{(1-\rho)(1-\rho^n)}{(1-\rho^n)(1-\rho)} = 1
\end{eqnarray}

Gives us the following aligned equation.

\begin{align*}
S & = \frac{(1-\rho)(1+\rho+\rho^2+\ldots+\rho^{n-1})}{(1-\rho^n)} \\
& = \frac{(1-\rho)(1-\rho^n)}{(1-\rho^n)(1-\rho)} = 1
\end{align*}
One useful feature for mathematicians and statisticians is the use of arrays. One particular example of this is in designing matrices. For example:

\[
\begin{eqnarray}
\left(\begin{array}{l|ccc}
1 & \rho & \rho^2+2 \\ \\
\rho+2 & 1+\alpha & \alpha \\ \\
\rho^2+\rho-1 & \alpha^2-\alpha+8 & 1-\alpha\rho+\rho
\end{array}\right)
\end{eqnarray}
\]
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\begin{array}{l|cr}
1 & \rho & \rho^2 + 2 \\
\hline
\rho + 2 & 1 + \alpha & \alpha \\
\rho^2 + \rho - 1 & \alpha^2 - \alpha + 8 & 1 - \alpha \rho + \rho
\end{array}
\end{eqnarray}

yields

$$\begin{pmatrix}
1 & \rho & \rho^2 + 2 \\
\rho + 2 & 1 + \alpha & \alpha \\
\rho^2 + \rho - 1 & \alpha^2 - \alpha + 8 & 1 - \alpha \rho + \rho
\end{pmatrix}$$
LaTeX is also good for making tables. For example:

\begin{center}\begin{tabular}{c|c|c|c}\hline\hline Parameter & $\phi$ & $\rho$ & $\alpha$ \\ \hline MLE & 0.520 & 0.425 & 0.348 \\ & (0.009) & (0.028) & (0.021) \\ & < 0.001 & < 0.001 & < 0.001 \\ QLS & 0.519 & 0.324 & 0.390 \\ & (0.009) & (0.042) & (0.021) \\ & < 0.001 & < 0.001 & < 0.001 \hline \end{tabular}\end{center}
\textbf{Special Features}

\LaTeX{} is also good for making tables. For example:

\begin{verbatim}
\begin{center}\begin{tabular}{c|c|c|c}\hline\hline
Parameter & $\phi$ & $\rho$ & $\alpha$ \\
\hline
MLE & 0.520 & 0.425 & 0.348 \\
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QLS & 0.519 & 0.324 & 0.390 \\
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\hline \end{tabular}\end{center}
\end{verbatim}

yields

<table>
<thead>
<tr>
<th></th>
<th>$\phi$</th>
<th>$\rho$</th>
<th>$\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLE</td>
<td>0.520</td>
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<td>0.348</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
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</tr>
<tr>
<td></td>
<td>&lt; 0.001</td>
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</table>
Special Features

Importing figures is also very strait forward. For example

```
\begin{center}\begin{Figure}
  \includegraphics[width=2.0in]{Figures/2areMLMOrho}
\end{Figure}\end{center}
```
Special Features

Importing figures is also very straightforward. For example
\begin{center}\begin{Figure}
\includegraphics[width=2.0in]{Figures/2areMLMOrho}
\end{Figure}\end{center}
yields

Note you must save pictures as “.eps” files within the same folder as the LaTeX file.
One of the most useful features of \LaTeX{} is that it allows you to label equations, Figures and Tables that you wish to have numbered, so that you only need to make reference to the equation (rather than the number). For instance, the following code labels an equation:

\begin{eqnarray}
Y=2X-3 \label{eq:line}
\end{eqnarray}

And the following code references it \texttt{\ref{eq:line}}, such that we can now reference equation (2), which is found below.

(2) \quad Y = 2X - 3
Prosper

The Prosper class of documents, incorporated with the command `\documentclass{prosper}`, allows you to make a slide show. Like creating a paper or thesis, using LaTeX to make a slide show gives you a lot of freedom and flexibility. This is especially true if your work is mathematically intensive.
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Writing text and mathematical equations, and incorporating Tables and Figures is the same in Prosper as it is in other document classes. However, there are a few differences.
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Writing text and mathematical equations, and incorporating Tables and Figures is the same in Prosper as it is in other document classes. However, there are a few differences.

Slides are created by first typing `\begin{slide}{title}`, entering the material to be found on the slide, and then typing `\end{slide}`.
Prosper has many different transition styles to change from one slide to the next. For instance:

\begin{slide}\[Split]\{title\}:
\begin{slide}\[Blinds]\{title\}:
\begin{slide}\[Box]\{title\}:
\begin{slide}\[Wipe]\{title\}:
\begin{slide}\[Dissolve]\{title\}:
\begin{slide}\[Glitter]\{title\}:
\begin{slide}\[Replace]\{title\}:
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- \texttt{\begin{slide}[Split]{title}}: causes two lines to sweep across the screen.
- \texttt{\begin{slide}[Blinds]{title}}: \textbf{causes} multiple lines to sweep across screen.
- \texttt{\begin{slide}[Box]{title}}:
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Latex – p. 34/39
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- \texttt{\textbf{\begin{slide}\[Glitter]\{title\}:}} causes an effect similar to the “dissolve” command.
- \texttt{\textbf{\begin{slide}\[Replace]\{title\}:}} simply replaces the old slide with the new.
Prosper

- You can also overlay slides, so that information appears sequentially.
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For instance, by writing the “overlay{n}{}” before the slide and including the “FromSlide{i}” command for the $i$th new slide . . .
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. . . you can post $n$ overlays onto the same slide.
Now onto the examples!