LaTeX Workshop
TUG 2020 Conference

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July 2020

Contents

Abstract

LaTeX is widely used in typesetting mathematics. In this workshop you will review the basic LaTeX commands as well as ways to use LaTeX to fit your needs.

1 Creating a LaTeX Document

When creating a LaTeX document, you begin with an input file that has a `.tex` extension (i.e., `filename.tex`), with the editor of your choice.

Let's get started by typing the following in your input file.

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

\usepackage{amsthm,amsmath,amsfonts,amssymb}

\begin{document}

\end{document}
```

This sets your skeleton template. The information above the `\begin{document}` is the preamble. This is where you will add the usepackages that may be needed to produce the document. There are many packages which are available, a few example of them are used in this document.

The first line (i.e., `\documentclass[12pt]{article}`) sets the documentclass style file for your paper. In this case we are using the "article" as the class file. You can

alter this file and re-name it to suit your needs. The other standard style files are "report", "book", "slides", and "letter". You can add options by using `[ ]` after the `\documentclass`. Common `documentclass` options are as follows: 10pt/11pt/12pt (font size), letterpaper/a4paper (paper size), twocolumn (using two columns), twoside (setting margins for two-sided documents), landscape (orientation), and draft (which sets the document in double spacing).

In LaTeX when you start an environment there is always a beginning and an end. This is either by using `\begin{something} ... \end{something}` or by using `\somedefinition{}`. In this last example the command begins with a `\` and takes arguments within `{braces}`.

2   Creating Numbered Section Headings

When you type your first section, LaTeX automatically begins numbering with 1 as the default style. The next section will be numbered 2, and so on. The way to create a section heading is to type the following `\section{Text}`. If you want to change the number to be in Roman numerals, type the following:

`\renewcommand{\thesection}{\Roman{section}}`.

The next time you use `\section{}` the number will be in Roman numerals.

III Creating a Section That uses Roman Numeral Numbering

IV Still Using `Roman` Numbering for Sections

The numbering will stay in Roman numerals until you change it back.

`\renewcommand{\thesection}{\arabic{section}}`

5 Changing Numbering Back to `arabic`

This section numbering goes back to arabic numbering because `\renewcommand{\thesection}{\arabic{section}}` was typed before we did our next section.

5.1 Creating Subsection Headings

When you type `\subsection{}` the default numbering will start with 1.1, then 1.2, etc.

There is also a `\paragraph{}` and a `\subparagraph{}`. They look like this:

Paragraph This is the paragraph.

Subparagraph This is the subparagraph.

6 Creating Footnotes

Creating a footnote[1] is done by adding `\footnote{}` and putting the text you want between the braces. The default is automatically numbered starting with the number 1.

---

[1]This is an example of a footnote.

7 Changing Font Styles

Your text is now in the default of TimesRoman. You can simply change the style of a word or words. For example **boldface**, SanSerif, *Italics*, SMALLCAPS, and so on.

The code for the above: `\textbf{boldface}`, `\textsf{SanSerif}`, `\textit{Italics}`, and `\textsc{smallcaps}`.

8 Marking the Margin of a Paragraph

By typing `\marginpar{\rule[-17.5mm]{1mm}{18mm}}` it will mark the current paragraph with a line in the margin. You might want to do this if you want to bring attention to a specific paragraph in your paper.

You can also add words in the margin.

`\marginpar{See this statement.}`

See this statement.

9   Text in Columns

You can typeset a paper in regular paragraph form or you can change the number of columns.

```
\begin{multicols}{2}
...
\end{multicols}
```

   Now you can continue gle column format, it will typing as usual only the change to the amount of column will not be in sin- columns you assign.

```
{\setlength{\columnseprule}{2pt}
\begin{multicols}{3}
...
\end{multicols}
}
```

Now you can continue typing as usual only the column will not | be in single column format, it will change to the amount of | columns you assign.

```
{\setlength{\columnseprule}{0pt}
\begin{multicols}{3}
...
\end{multicols}
}
```

Now you can	be in single	columns you
continue typing	column format, it	assign.
as usual only the	will change to the	
column will not	amount of	

10   Creating a Table of Contents

You can add a table of contents to your paper very easily. All you need to do is add `\tableofcontents`. The table of contents will give you all the sections and subsections, etc., with their page numbers. However, sometimes you need to add extra information to the table of contents that you only want on the contents page and not in the main document. You do this by adding `\addcontentsline`. The following line is what would be used in the body of your document.

```
\section{Section Heading}
\addcontentsline{toc}{subsection}{Text}
```

Note: the table of contents will appear in the paper where the `\tableofcontents` is in the text.

Adding to Contents

The above section heading above was created by typsetting `\section*{}` when this is used, it gives the same

definition of `\section{}` without the automatic numbering. Because of this, the section will not automatically be added to the contents page. If you want to add this unnumbered section to the contents page, add the follownig information.

`\addcontentsline{toc}{section}{Text}`

`\addcontentline` is the definition, `{toc}` means the table of contents page, the `{section}` means in the section format, and the words `{Text}` is what will be added on the contents page.

11   Itemizing, Enumerating, and Nesting

Itemizing is a way to list items. The default symbol for the itemizing is a bullet. For example,

```
\begin{itemize}
\item This is my first line.
\item This is my second line.
\item This is my third line
\end{itemize}
```

creates the following:

- This is my first line.

- This is my second line.

- This is my third line

If you want to change the default symbol, you put the character (in $ signs if necessary) inside two square brackets, for example

```
\begin{itemize}
\item[$\oplus$] This is my first line.
\item[$\curlyvee$]  This is my second line.
\item[$\Cup$]  This is my third line.
\end{itemize}
```

creates the following:

⊕ This is my first line.

⅄ This is my second line.

⊍ This is my third line.

You can use any symbol math or non-math instead of a bullet. Just remember the math symbols need $ signs and the non-math symbols do not. But they all have to be with a [and a].

Enumerating is very similar to itemizing, however, as the name infers, it numbers the lines instead of using bullets.

```
\begin{enumerate}
\item This is my first line.
\item This is my second line.
\item This is my third line.
\end{enumerate}
```

creates the following:

1. This is my first line.

2. This is my second line.

3. This is my third line.

Nesting is basically the same; it is a list within a list. For example,

```
\begin{enumerate}
\item This is the first line. \label{itm:first}
\item This is my second line. \label{itm:second}
\begin{enumerate}
\item This is the first line of nesting.
\begin{itemize}
\item Here is the first line of another nesting.
\item Here is the second line of another nesting.
\end{itemize}
\item This is the second line of nesting.
\end{enumerate}
```

```
\item Now this is the third line of the original
      enumeration.
\end{enumerate}
```

creates the following:

1. This is the first line.

2. This is my second line.

   (a) This is the first line of nesting.

       - Here is the first line of another nesting.
       - Here is the second line of another nesting.

   (b) This is the second line of nesting.

3. Now this is the third line of the original enumeration.

You can also label and reference your information by using label after your item and then reference that item where you want it in your document. For example see Item 1.

12   Theorems, Lemmas, etc.

When you need to add a Theorem, Lemma, Proposition, etc., you will need to create the appropriate environment. For example:

```
\newtheorem{theorem}{Theorem}
```

and

```
\newtheorem{lemma}{Lemma}
```

the above line(s) are needed in the preamble. Note: the usepackage `amsthm` will also be needed. To get your Theorems, Lemmas, etc., type the following:

```
\begin{theorem}
This is the first theorem.
\end{theorem}

\begin{theorem}
This is the second theorem.
\end{theorem}

\begin{lemma}
This is the first lemma.
\end{lemma}
```

The output for the above code is:

Theorem 1. *This is the first theorem.*

Theorem 2. *This is the second theorem.*

Lemma 1. *This is the first lemma.*

You can add extra comments to the Theorem, etc.,

```
\begin{theorem}[Add this]
This is the third theorem.
\end{theorem}
```

Theorem 3 (Add this)**.** *This is the third theorem.*

13   Basic Tables

The following are some simple examples of the tabular environment. The tabular environment is usually used to create tables. The `\begin{tabular}` starts the environment and the `\end{tabular}` ends the environment. The `{lcr}`, for instance, is the justification of the column(s). `l` is for left justified, `c` is for centering the column and `r` is for right justified.

```
\begin{tabular}{lcr}
Mary & Joe & Jane \\
Joe & Jane & Mary \\
Jane & Mary & Joe
\end{tabular}
```

Mary	Joe	Jane
Joe	Jane	Mary
Jane	Mary	Joe

```
\begin{tabular}{|l|c|r|}
Mary & Joe & Jane \\
Joe & Jane & Mary \\
Jane & Mary & Joe
\end{tabular}
```

Mary	Joe	Jane
Joe	Jane	Mary
Jane	Mary	Joe

```
\begin{tabular}{|l|c|r|}
\hline
Mary & Joe & Jane \\
\hline
Joe & Jane & Mary \\
\hline
Jane & Mary & Joe \\
\hline
\end{tabular}
```

Mary	Joe	Jane
Joe	Jane	Mary
Jane	Mary	Joe

```
\begin{tabular}{|l|c|r|}
\hline
Mary & Joe & Jane \\
\cline{1-2}
Joe & Jane & Mary \\
\cline{2-3}
Jane & Mary & Joe \\
\hline
\end{tabular}
```

Mary	Joe	Jane
Joe	Jane	Mary
Jane	Mary	Joe

14 Simple Mathematics and Creating Equations

To create mathematics you put the math text in math mode. This is done in the line of text by surrounding the math with dollar signs (i.e., x), which give the output x. There are several ways to put the mathematics in display form. One example is with double dollar signs before the equation and after the equation `$$ x - y $$`. Below are several ways to create text in math mode.

`This is math in a line of text $a+b, a - b$.`

This is math in a line of text $a + b, a - b$.

LaTeX does not care how many space are between the dollar signs, the output will be the same.

```
$$\frac{1+2x}{x+y+xy}$$
```

$$\frac{1 + 2x}{x + y + xy}$$

14.1   Subscripts and Superscripts

```
\begin{equation}\label{eq:xyz}
x_{1}, y^2, z^{i_1}
\end{equation}
```

$$x_1 + y^2 + z^{i_1} \tag{1}$$

If you notice in the above example the equation is numbered. If you number an equation you can refer to it later.

You do this by creating a label (i.e., `\label{...}`. Later on you can refer to that label `\eqref{...}` make sure the label and reference match. This is very useful when you add and delete equations throughout the paper. For example the following code `\eqref{eq:xyz}` is used to produce (1). In this case we use `\eqref{}` which produces () around the equation number.

You can also label and reference sections, subsections, etc. by using `\label{}` and then using `\ref{}`, as well as `\pageref{}`.

14.2 Accents

```
\begin{equation*}
\hat{a}, \acute{b}, \breve{c}, \vec{d}, \bar{e}
\end{equation*}
```

$$\hat{a}, \acute{b}, \breve{c}, \vec{d}, \bar{e}$$

In the above example `\begin{equation*}` was used this puts the text in equation mode without the numbering. This is a good habit to get into in case later on you want that equation numbered.

14.3 Binomial Coefficients

```
$$\binom{a}{b+c}$$
```

$$\binom{a}{b+c}$$

In the above example `$$` were used. These are used for display mode just like `\begin{equation*}`.

```
\[\binom{\frac{n^2-1}{2}}{n+1}\]
```

$$\binom{\frac{n^2-1}{2}}{n+1}$$

14.4   Congruence

```
$$a\equiv v \pmod{\theta}$$
```

$$a \equiv v \pmod{\theta}$$

```
$$a\equiv v \bmod{\theta}$$
```

$$a \equiv v \bmod \theta$$

14.5   Delimiters

\[and \] can also be used instead of a $$ sign for display mode.

```
\[ \left(\frac{1+x}{2+y2}^2\right)\]
```

$$\left(\frac{1+x}{2+y2}^2\right)$$

$$\left|\frac{a+b}{2}\right|, \left\|A^2\right\|$$

$$
\left|\frac{a+b}{2}\right|, \|A^2\|
$$

$$
M_{n,e}=\left(\frac{4G_nm_{n,e}}{\epsilon}\right)^2.
$$

$$
M_{n,e} = \left(\frac{4G_n m_{n,e}}{\epsilon}\right)^2.
$$

14.6   Operators

$$\sin x \equiv \theta \equiv \alpha$$

$$
\sin x \equiv \theta \equiv \alpha
$$

$$\lim_{x\rightarrow 0}f(x)=0$$

$$
\lim_{x\to 0} f(x) = 0
$$

14.7   Ellipses

$$F(x_1, x_2, \dots, x_n)$$

$$
F(x_1, x_2, \ldots, x_n)
$$

14.8 Integral

```
$$
\int_0^\pi \sin x, ab =2
$$
```

$$\int_0^\pi \sin x, ab = 2$$

14.9 Sum

```
$$\sum_n+x_2 + \dots + dx=2$$
```

$$\sum_n +x_2 + \cdots + dx = 2$$

14.10 Matrices

```
$$
\begin{matrix}
a+b +c & uv & x-y & 27\\
a+b &u+v&z &234\\
\end{matrix}
$$
```

$$
\begin{matrix}
a+b+c & uv & x-y & 27\\
a+b & u+v & z & 234
\end{matrix}
$$

```
$$
\begin{pmatrix}
a+b +c & uv\\
a+b &u+v\\
\end{pmatrix}
\begin{pmatrix}
x-y & 27\\
z &234\\
\end{pmatrix}$$
```

$$
\begin{pmatrix}
a+b+c & uv\\
a+b & u+v
\end{pmatrix}
\begin{pmatrix}
x-y & 27\\
z & 234
\end{pmatrix}
$$

15 How to do Bibliographies

One example of doing a bibliography is by adding it to the end of your file. Use the command `\cite{}` with the label of your reference in between the braces. For example, see `\cite{pon-dem}`. Your output will show the references as they are presented.

```
\begin{thebibliography}{99}
\bibitem{pon-dem} Cheryl Ponchin and
 Sue DeMeritt. \LaTeX\  2019.
\end{thebibliography}
```

You can also add bibliographies using BibTeX. You will use the term `\cite{}` with the label of your reference in between the braces in your .tex document. For example (see `\cite{pon-dem}`).

An example of the entry in the .bib file (`myrefs.bib`) is as follows:

```
@misc{pon-dem,
      author = "Cheryl Ponchin and
                 Sue DeMeritt",
      title = "{\LaTeX\ Lessons for
                Palo Alto, CA}",
      year = "2019"
}
```

The output will show up as [**?**] in your document.

```
\bibliographystyle{plain}
\bibliography{myrefs}
```

16   Getting an Output

Now that you have a file (`filename.tex`) it would be nice to produce an output. Depending on what editor you are using, the procedure of how you do it might vary, however, the steps themselves are the same. The following steps are:

1. `pdflatex filename`

2. `bibtex filename`

3. `pdflatex filename`

4. `pdflatex filename`

You might be wondering why you had to use pdflatex more than once. This is so your table of contents, section, subsections, etc., as well as your bibliographies will appear properly. The first time you pdflatex the paper it reads that you have sections, subsections, etc., then you would BibTeX the paper, if needed. The second and third time you pdflatex your paper it places the sections

and subsections in the table of contents for the output. You will have a file called `filename.pdf` which will be ready for viewing.