Hello, LaTeX

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Abstract

This paper is a sample intended to introduce you to the basics of formatting a document with LaTeX. Read the TEX file, and not just the PDF, since there are valuable comments.

1 Getting started with LaTeX

LaTeX is designed to separate presentation details from the actual content. Although the two are mixed together in the file, reformatting for different style guides is fairly straightforward. Different organizations may offer their own custom Latex formatting templates. For instance, there is a Latex template for SJSU Master's theses; if you use it, the formatting details will (mostly) be covered for you, and you can simply focus on the content itself.

Note the `documentclass` command at the top of the tex file:

```
\documentclass{article}
```

This command lets you specify the format of your document. A variety exist, such as:

- `article`

- `book`

- `letter`

- `beamer` for presentations

There are generally additional options for customizing the formatting. For instance, you might decide that your would prefer that the article used two columns for each page. To change the formatting, you would update the `documentclass` command to:

```
\documentclass[twocolumn]{article}
```

where the square brackets denote optional, additional formatting details[1]

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[1]The use of square brackets to specify optional arguments is a standard convention in LaTeX.

2 Sections

LaTeX allows you to divide up a document into different subheadings. Sections are the top level in articles, and are typically numbered, (but this is configurable like everything else in LaTeX). Sections are specified with the following command:

```
\section{Section name}
```

2.1 Subsections

Subsections allow you to further divide a section.

```
\subsection{Section name}
```

2.1.1 Subsubsections

And subsubsections allow us to go one level deeper.

```
\subsubsection{Section name}
```

3 Labels & References

Section 2 shows us how to create new sections and subsections. Often, we will need to refer to a different section. However, as we reorganize the document it might quickly get unmanageable to update all of these references. Fortunately, LaTeX makes our lives a little easier. Instead of hard-coding a section number, we can attach a *label* to identify the section, and then use a *ref* to refer to it. LaTeX will update the references and save us the trouble.

Here is the tex to identify the previous section:

```
\section{Sections}\label{sec:section}
```

To later refer to this section in our document, we type:

```
Section~\ref{sec:section}
```

You might have noticed the ˜. This character creates a non-breaking space. It is not required, but is generally looks better if the section number is on the same line as the word "Section".

Also, the use of `sec:` in the label name is just a convention, indicating that it refers to a section, and not a table or figure.

3.1 Updating references

One note of warning: when references change, you typically will need to run latex multiple times.

1. The first time you run latex, it will note all missing references.

Figure 1: A sample figure

```
\begin{figure}\caption{A sample figure}\label{fig:sampleFig}
...
\end{figure}
```

2. The second time you run latex, it will fill in the references appropriately (if it can find them).

Additional passes of latex might be needed if you are using bibtex, discussed in Section 7.

4   Math

The major benefit of LaTeX lies in the ease with which we represent mathematical formulas. For instance, we could represent one of our operational semantics rules as:
$$x, \sigma \Downarrow \sigma(x), \sigma$$
which was produced using the following tex code:

```
\[
    x,\sigma \Downarrow \sigma(x),\sigma
\]
```

This version is useful, but there might be times where you would want to inline statements like $x, \sigma \Downarrow \sigma(x), \sigma$. In this case, dollar signs can be used instead:

```
$x,\sigma \Downarrow \sigma(x),\sigma$
```

Both variants switch latex into *math mode*.

5   Commands

You might find that you are repeating the same series of commands over and over again. if that is the case, you can create a new *command*. For instance, if I want to produce some text three times, I could create the following command:

```
\newcommand{\threetimes}[1]{#1#1#1}
```

Now, I can use \threetimes{hello there! } to produce: hello there! hello there! hello there!

You can pass as many arguments as you like. Commands end up being a huge timesaver if you need to typeset repetitive mathematical proofs.

6 Figures and Tables

You may wish to inject some results, tables, code examples, etc. into your tex documents. Figure 1 shows the syntax to create a new figure with a label.

In LaTeX, you will often want to present results in a tabular format. A sample table is given here:

1	2	3
4	5	6
7	8	9

This latex code is:

```
\begin{tabular}{| l c r |}
\hline
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9 \\
\hline
\end{tabular}
```

The & character is used as a separator, and the \\is used to delimit rows. The \hline creates a horizontal line, giving the upper and lower borders for our table. In the first tabular line, pipe symbols (|) are used to indicate vertical rows. The letters l, c, and r indicate whether each field is left-justified, centered, or right-justified.

To create a grid, we could instead write: This latex code is:

```
\begin{tabular}{| l | c | r |}
\hline
1 & 2 & 3 \\
\hline
4 & 5 & 6 \\
\hline
7 & 8 & 9 \\
\hline
\end{tabular}
```

Resulting in:

1	2	3
4	5	6
7	8	9

7   More references and Bibtex

To learn more about LaTeX, see Leslie Lamport's text [2]. Knuth [1] discusses literate programming, which was a concept inspired by his work on TeX.

Note that we are using bibtex to track these references. We store our references in a separate file. Latex will determine which citations are used, and will format them according to our specifications. To use bibtex:

1. Use the latex command to get the references needed.

2. Use bibtex to pull the citation details.

3. Use latex again to update the references in the text.

4. Run latex one last time to ensure that all references are in sync.

Some types of BibTeX entries:

- `article` – An article from a journal or magazine.

- `book` – A published book.

- `inproceedings` – An article in conference proceedings.

- `mastersthesis` – Hopefully obvious.

- `phdthesis` – Also, hopefully obvious.

- `proceedings` – The proceedings (i.e., all of the accepted papers) for a conference.

- `misc` – None of the above.

Note that the above list is not exhaustive.

References

[1] Donald E. Knuth. Literate programming. *Comput. J.*, 27(2):97–111, 1984.

[2] Leslie Lamport. *LaTeX - A Document Preparation System: User's Guide and Reference Manual, Second Edition.* Pearson / Prentice Hall, 1994.