LaTeX Template

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Introduction

Welcome to LaTeX. The purpose of this document is to serve as a template. While there are whole books written about formatting in LaTeX, I've tried to keep this document minimalistic, only introducing the necessary commands and environments. Ideally, you should compare the `.tex` file with the printed output to learn how to use some useful LaTeXcommands. Further reference material is given in the bibliography.

Introduction to LaTeX

LaTeX (pronounced lay-tek or lah-tek) is the industry standard for scientific and mathematical manuscripts. It enables users to rely on standardized templates and puts the majority of the formatting decisions in the hands of the professionals who write the layout packages. Although, learning the program does have a steep learning curve, once you are familiar with LaTeX's basic features, it is fairly straight forward to make your documents look professional.

The Windows implementation of LaTeX is called MikTeX and is available for free here. However, most users will also prefer to use a GUI when editing their documents, for Windows I recommend TeXnicCenter (downloadable here). I've included a screenshot of TeXnicCenter in Fig. **??**. The use of a GUI allows one to more easily edit their documents (especially for beginners), often times one can use drop down menus to insert graphics, symbols, or tables, instead of having the commands memorized. You will need to install both MikTeX and TeXniCenter on your computer.

For Mac users, the LaTeX implementation is TeX Live and a good GUI is TeXShop. You can get those both in one large package, called the MacTeX package, and is available for download from this site, or you can chose to download TeX Live and TeXShop independently from here and here.

General Formatting

subsection `\paragraph{1.1}` defines a paragraph with a printed label of 1.1, but it will be referenced by ex:1 (defined with `\label{ex:1}`). The benefit of this option, is you can reference
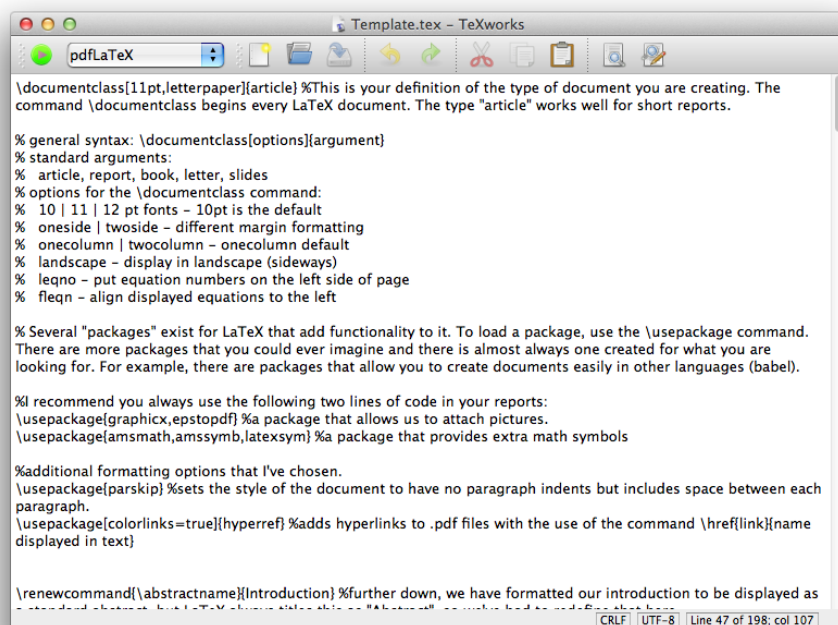
Figure 1: Screenshot of the TEXnicCenter GUI.

this paragraph later by using the command `\nameref{ex:1}` as shown in 1.2 below. Labels will be discussed in more detail in the following paragraph.

1.2 Another way to format your exercise questions would be to just use bold font for 1.2. Compare this to the formatting in **??**, above. It's up to you which you prefer.

One really nice thing about LATEX is the way it handles internal references. In the example above, I labeled a paragraph with the name "ex:1" (short for exercise 1), with the command `\label{ex:1}`. This can be done with paragraphs, sections, figures, equations, tables, etc. To call up a named reference (as in we named that paragraph "1.1"), type `\nameref{ex:1}`. Check the `.tex` file to see what I have done. Named references are quite uncommon, you mostly will encounter numeric reference.

Each figure, table or equation will have a numeric label associated with it (unless you chose to suppress this). The first figure will be Fig. 1, the second will the Fig. 2, and so on. Instead of keeping track of which figure you have put where, LATEX handles the numbering and you just refer to the figure (or table or equation) by a descriptive name. Often times a figure label is written as `\label{fig:example}`, where the label for a table or equation are written as `\label{tb:example}` and `\label{eq:example}`. You define the label of an object when you first introduce it. If you ever want to call upon that object, for example "a screen shot of TEXnicCenter is shown in Fig. **??**", you use the same descriptive name within the command `\ref`. This will only include the numeric label associated with this object, you must manually type "Fig." before a figure reference. You

will see more standard referencing examples in the following sections. One thing to note, when a reference goes bad, LaTeX will spit out two question marks: **??**.

If you are following along in the `.tex` file, you may have noticed I used a tilde ($\sim$) symbol after "Fig.". This symbol is used in LaTeX to put space between two letters/words without that you do not want to separate. LaTeXhas a few other reserved special symbols (# \$ % ˆ & _ { } ˜ \\).

Another thing to be aware of is how LaTeX treats space. I can include as many spaces or tabs as I want between words, but LaTeX will always reduce it to one "space". Also, one line break will not start a new paragraph. You need an empty line between two lines of text to define the end of a paragraph (be careful when typing equations for this reason). More than two empty lines will be treated in the same way as one empty line.

Footnotes are fairly easy to implement.[1]

Equations

One of the main motivations to learn to use LaTeX is to learn how to type beautiful equations. At the beginning, typing out equations will be tedious and time consuming because you are not yet familiar with the symbols/notation, but soon it will become second nature. Most TeX editors (TeXnicCenter at least) will have a pull-down menu with common symbols which is a nice alternative to typing in the command. There are two categories for entering math, in line or displayed. An in line formula goes right in the paragraph like this, $P = V^2/R$. Where as a displayed equation looks like

$$P = \frac{V^2}{R}. \tag{1}$$

To get fancy, let's write out Schrodinger's equation:

$$i\hbar\frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m}\frac{\partial^2 \psi}{\partial x^2} + V(x). \tag{2}$$

And using the reference option I have described previously, we can refer to Eq. **??** by typing `\ref{eq:Schrodinger}`.

You can get a lot trickier when typing out equations, especially with alignment, but this should get you started. [**?**] has a great discussion of the math environment and how to get fancy with it.

Figures

Let's take a look at inserting figures. In TeXnicCenter, you have an option to click on and "insert Picture", which will allow you to search for the file, define a label, and input a caption. Most other TeX editors require you to type out the appropriate commands to insert a figure, and after you've become familiar with LaTeX, you will probably find you prefer this. Let's insert a figure, please follow along in the `.tex` file to see the correct commands.
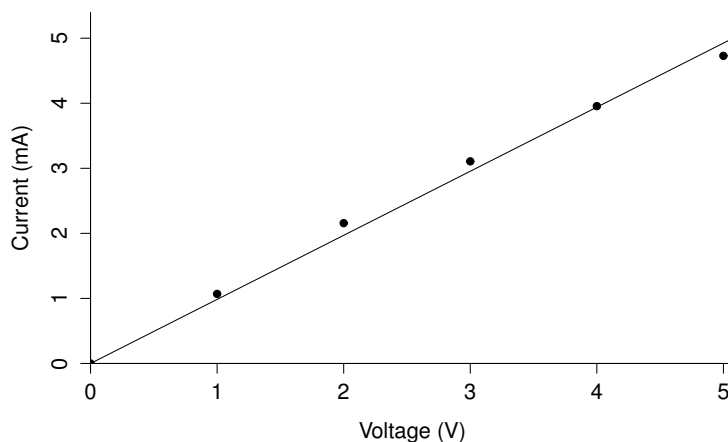
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[1]This is a footnote.

Figure 2: This plot shows the linear relationship between current and voltage, given by Ohm's Law: $V = IR$.

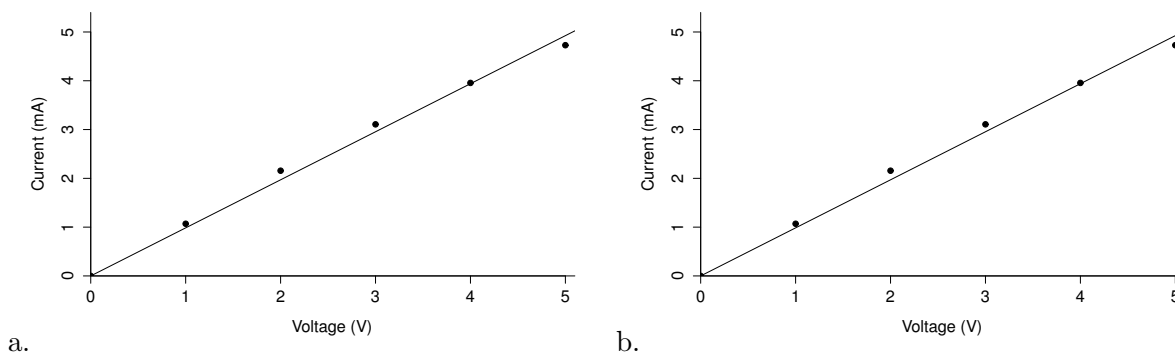You can also include two plots side-by-side.

Figure 3: Two figures can be displayed side-by-side.

Here, using the command [htp] I have asked LATEXto place the figure either "here" relative to the text in the .tex document, at the top of the page, or on a new page designated for figures (p for page is a useful designation for reports with lots of plots). LATEX sees these as suggestions, if it feels that the picture would be better suited in another location, it will be place there. LATEX will never display figures out of order or before the text in which you refer to it (if you have a figure, always have a reference to it in your text!).

One often get frustrated with LATEX because it will place your figures where it thinks is appropriate, and sometimes there is nothing you can do about it. You will find you have more control when you have more text in between figures. This is something that you will have to grow accustom to, but have faith, LATEX does know what it's doing.

Tables

Tables are a particularly tricky environment in LaTeX. So, I have included a standard one here that should be fairly easy to edit.

#	Nominal Value	Measured Value (Ω)	%Diff
1	22Ω	22.27	-1.1
2	22Ω	21.39	-2.8
3	22Ω	23.02	4.6
4	$1k\Omega$	997.9	-0.2
5	$1k\Omega$	977.6	-2.0
6	$1k\Omega$	980.34	-2.0
7	$470k\Omega$	443.1×10^3	-5.7
8	$470k\Omega$	465.6×10^3	-0.9
9	$470k\Omega$	485.9×10^3	3.4

Table 1: Here is an example of a table for comparing the nominal and measured values of a resistor.

Conclusions

I hope that this was a useful brief introduction to LaTeX. If you have any questions google is a great place to start.

References

[1] *LaTeX/Document Structure*, Wikibooks.

[2] Tobias Oetiker, Hubert Partl, Irene Hyna & Elisabeth Schlegl, *The Not So Short Introduction to LaTeX 2_ε*, www.ctan.org/tex-archive/info/lshort/english/lshort.pdf.

[3] *LaTeX/Floats, Figures and Captions*, Wikibooks.

[4] Steve Dodge, *Physics 332 LaTeX Report Template*, September 2008.