Getting started with Latex

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What is Latex?

Latex is a mathematical typesetting language. Essentially, when you are using Latex to produce a document, you are writing code that is then understood by a compiler. There are various forms of output.

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The important thing to realize is that Latex is a tool for creating polished documents for immediate distribution. Yes, one can use other word-processors for producing mathematical documents, but the end-product is not always as polished as a document compiled by a Latex compiler.

What is Latex good for?

EVERYTHING! (It even makes you coffee in the morning, does your gardening and balances your checkbook).

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Why it's awesome for you:

- Well-crafted cover letters and vitas
- Homework assignments
- Presentations in a format other than Powerpoint, Keynote or similar product
- Immense amount of control over how your mathematics is presented in an article, thesis and other professional documents you will be typing

What is Latex good for?

Why it's awesome for your students:

- Notes from class can be provided as a PDF
- Quizzes and quiz solutions can be typed in a format/style that the students are use to from their text book(s)
- Exams can also be prepared using Latex

The various file types you need to know about

And none that you don't

- The tex file: this is your source code
- The dvi file: this is what the Latex compiler produces
- The ps/pdf file: additional compilers can be used (and are typically part of a Latex front-end)

Latex front-ends and what you need first

First, you will need either MikTex (Windows) or MacTex (Apple OS)

To get MikTex:

- Go to http://www.miktex.org and download the MikTex Package (admin rights may be required)
- Go to http://pages.cs.wisc.edu/ ghost/ and download the viewer and converter Ghostscript and Ghostview (resp.)

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To get MacTex:

- Go to http://www.tug.org/mactex/ and download the MacTex Package (admin rights may be required)
- Once the download is finished, load the disk image (if it doesn't happen automatically) and run the installer (MacTeX-2010.mpkg) contained within.

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Why do you need a front-end program? Because without it, you're basically using the most rudimentary methods of Latex-ing: typing in a text file with a *.tex extension and compiling using DOS or some Unix variant. Yeah, I did it. It sucks. Get a front-end program.

Latex front-ends and what you need first

Below are a few different front-end programs that are either free or cost only a small amount.

- Windows
  - WinEdt (small price)
  - TexnicCenter (free)
- Texpad (small price) - Apple
- Gmacs (free) - Linux/Unix

These are definitely not the only front-end programs available, but they are the ones I have had the most experience with.

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The wizard is a small little part of the program that helps you set up everything if you're a first-time user. Mainly, the wizard helps you get the front-end program to locate your various compilers.

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NOTE: If you don't know exactly what a compiler is, that's no big deal. What you do need to know is what to do when Latex asks.

Installing a front-end program

Luckily, each front-end program I have listed for either Windows or Apple has a great page on what to do when the wizard asks you to supply certain information.

- WinEdt - http://winedt.com/installing.html
- TexnicCenter - http://texniccenter.sourceforge.net/configuration.html
- Texpad - the configuration is automatic, I think...yeah, pretty sure

Your first Latex document

Since we are programming, isn't it only appropriate that our first 'program' somehow output 'hello world!'?

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Since we are programming, isn't it only appropriate that our first 'program' somehow output 'hello world!'? Yes, it is very appropriate.
So, start up your Latex front-end program and create a new document. In this document, type the following as shown:

```
\documentclass{article}
\begin{document}
hello world!
\end{document}
```

Your first Latex document

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hello world!
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```

Then compile your document.

Packages

Packages are additional modules of code that make your life a WHOLE lot easier. Think of packages like add-ons and upgrades that come for free.

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- `\usepackage{amssymb}`
- `\usepackage{mathrsfs}`
- `\usepackage{graphicx}`

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We will discuss these in more detail later (hopefully).

Essential environments

Now that we have made our first ‘program’, let’s figure out how to put in more complicated features.

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- Itemized and enumerated lists
- Mathematics
- Equations
- Aligned equations

Essential environments

Itemized and enumerated lists

```
\begin{itemize}
\item{Itemized and enumerated lists}
\item{Mathematics}
\item{Equations}
\item{Aligned equations}
\end{itemize}
```

Essential environments

Itemized and enumerated lists

```
\begin{enumerate}
\item{Itemized and enumerated lists}
\item{Mathematics}
\item{Equations}
\item{Aligned equations}
\end{enumerate}
```

Essential environments

Itemized and enumerated lists

1. Itemized and enumerated lists
2. Mathematics
3. Equations
4. Aligned equations

Mathematics! Finally, what we've all be waiting for!

How do we get something of the form `3x^2+2x-5+sin(pi/2)` to look like this: $3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right)$.

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How do we get something of the form `3x^2+2x-5+sin(pi/2)` to look like this: $3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right)$.

Like this:

```
$3x^2+2x-5+\sin\left(\frac{\pi}{2}\right)$
```

The dollar sign on the left indicates where the math begins and the dollar sign on the right indicates where the math ends.

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Using `$...$` to put math into your document is great for when you want mathematics *part* of the text. But when you want your mathematics to be centered and apart from the text, there are ways to accomplish this.

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\begin{equation}
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right)
\end{equation}
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```
\begin{equation}
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right)
\end{equation}
```

This looks like,

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) \tag{1}$$

Mathematics! Finally, what we've all be waiting for!

But what if we want to have more than one line? The equation environment is not the best to use.

We should use the `align` environment.

```
\begin{align}
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right) &=
   \tan\left(5y\right)\\
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right)
   -\tan\left(5y\right)&=0
\end{align}
```

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) = \tan\left(5y\right) \tag{2}$$

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) - \tan\left(5y\right) = 0 \tag{3}$$

Mathematics! Finally, what we've all be waiting for!

Notice how the equations are aligned along the equal signs. We could just have well placed the & symbol anywhere to align each line as we so pleased.

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) = \tan(5y) \tag{4}$$

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) - \tan(5y) = 0 \tag{5}$$

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For example,

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) = \tan(5y) \tag{6}$$

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) - \tan(5y) = 0 \tag{7}$$

Mathematics! Finally, what we've all be waiting for!

Also, notice how the lines in our align environment continue to be numbered and that the line in the equation was also numbered. How do we get lines of equation and align environments to not be numbered? Easy! Here's how:

```
\begin{equation*}
...
\end{equation*}
```

and

```
\begin{align*}
...
\end{align*}
```

Mathematics! Finally, what we've all be waiting for!

For example,

```
\begin{align*}
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right) &=
   \tan\left(5y\right)\\
3x^2+2x-5+\sin\left(\frac{\pi}{2}\right)
   -\tan\left(5y\right)&=0
\end{align*}
```

looks like this:

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) = \tan\left(5y\right)$$

$$3x^2 + 2x - 5 + \sin\left(\frac{\pi}{2}\right) - \tan\left(5y\right) = 0$$

More math!

Sometimes you need to make things look really fancy.

- Black-board fonts
- Curly braces
- Left and right

```
$\mathbb{R}$
$\{...\}$
$\left\{\frac{n}{2}\}_{n=0}^\infty$
```

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```
$\mathbb{R}$
$\{...\}$
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$\mathbb{R}$
$\{...\}$
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We could go on and on!

There are many more things to be aware in Latex. For example, tables are very nice and using Latex to make diagrams is always a good idea. But, we don't want to cover EVERYTHING about Latex. I hope what I've covered so far is enough to get you off the ground.

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There are many more things to be aware in Latex. For example, tables are very nice and using Latex to make diagrams is always a good idea. But, we don't want to cover EVERYTHING about Latex. I hope what I've covered so far is enough to get you off the ground.

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Luckily, if you're trying to do something in Latex, someone else has already done it, figured it out and wrote all about it on the internet.

Hence, when you're stuck trying to make something awesome happen in Latex and can't figure it out, turn to the internet. Adding the term "latex" to any search will usually point in the wrong direction. Of course, I am not liable for any faulty searches that lead you astray!

But before we go...

We will discuss how to insert graphics.

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First, and foremost, you want to make sure you have the command

```
\usepackage{graphicx}
```

in your *preamble*, the section of your tex document before

```
\begin{document}
```

and after

```
\documentclass{article}.
```

Including graphics

The basic structure is as follows:

```
\begin{figure}
\begin{center}
\includegraphics{graphic.eps}
\end{center}
\caption{An example of a figure.}
\label{fig:graphic}
\end{figure}
```

Including graphics

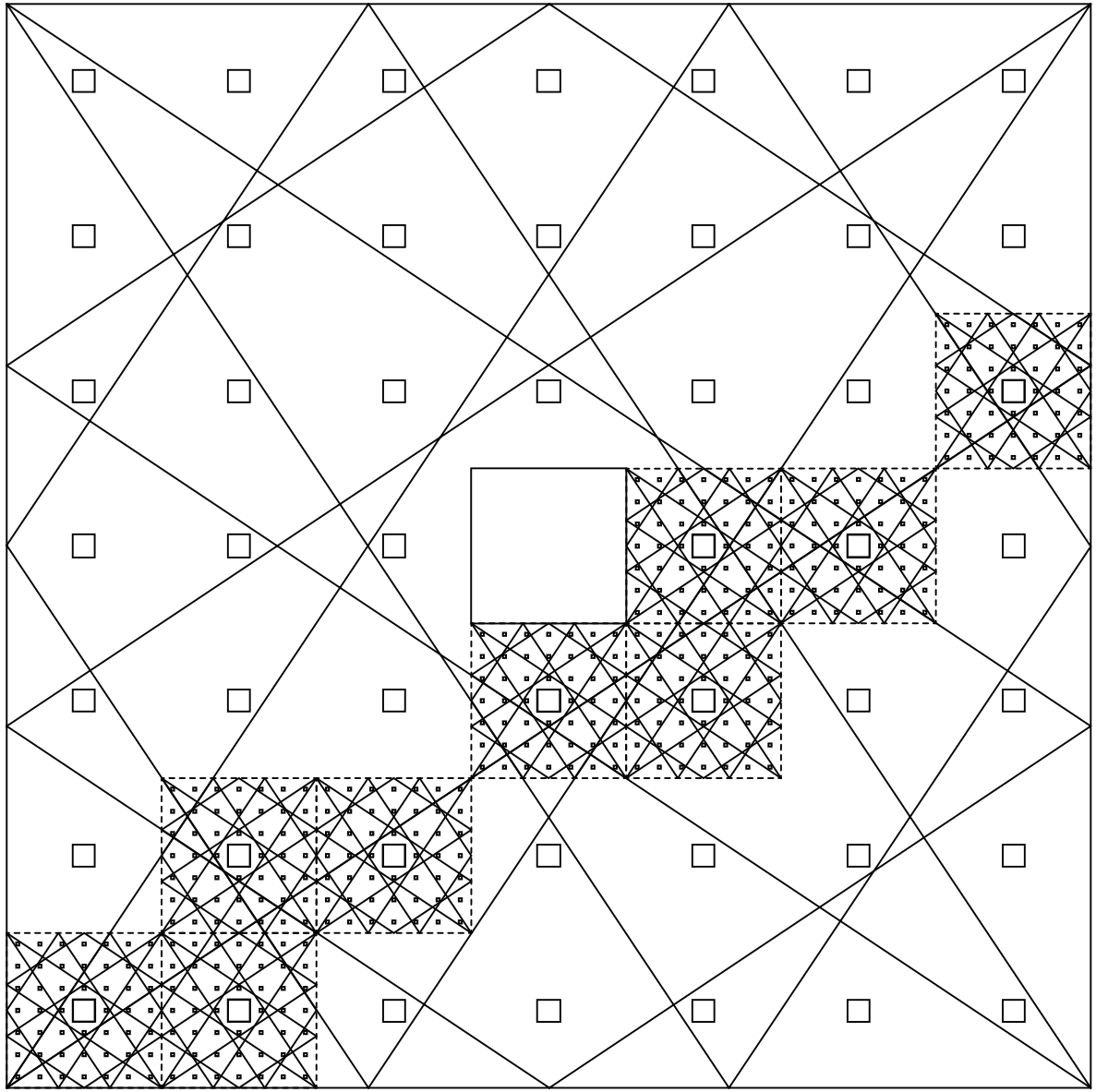

Figure: An example of a figure.

Including graphics

OH NO! It's too big!

Including graphics

OH NO! It's too big! So let's scale it down a bit.

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```
\begin{figure}
\begin{center}
\includegraphics[scale=.75]{graphic.eps}
\end{center}
\caption{An example of a figure.}
\label{fig:graphic}
\end{figure}
```

Including graphics

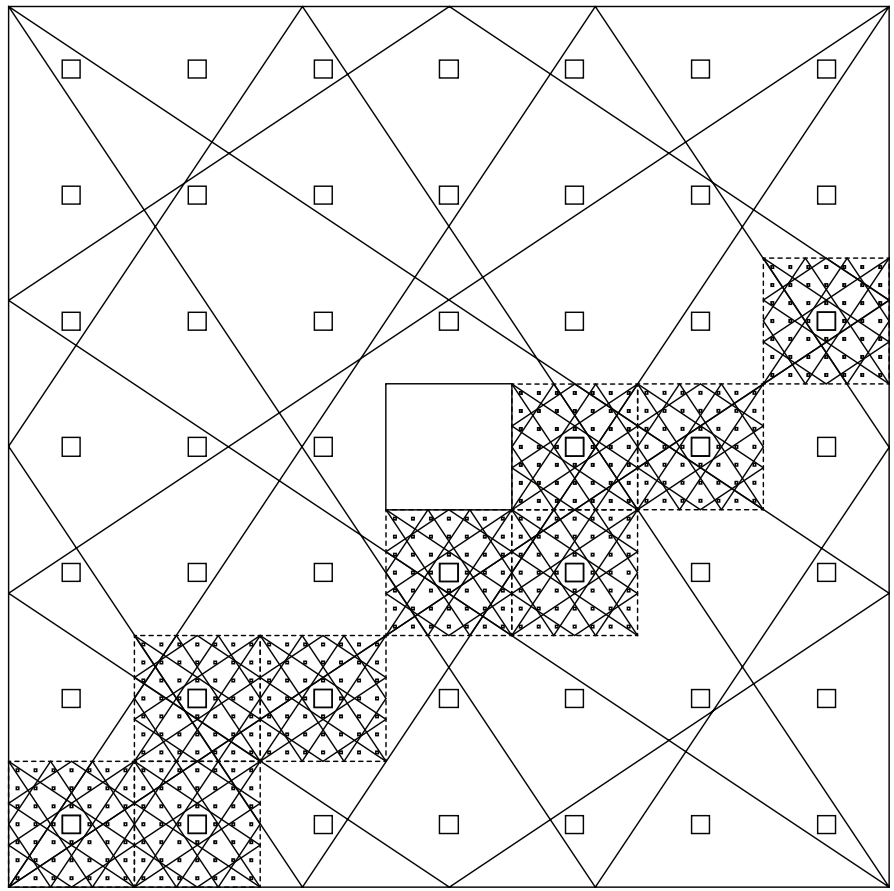

Figure: An example of a figure.

Some common mistakes

The most common mistakes are the following (or at least, the common mistakes I make):

- Leaving off a dollar sign or including too many
- Not including the \\ at the end of a line of an align environment
- Not including a or including too many curly braces
- Misspelling a command

All of these mistakes will keep your document from compiling correctly. In most front-end programs, an error message will be displayed, but you'll be left to hunt for the location of the error. Sometimes Latex is helpful in locating the error. Other times it is not.

Thank you!