

# Writing papers and thesis using L<sup>A</sup>T<sub>E</sub>X2e

## Part 0: Introduction to L<sup>A</sup>T<sub>E</sub>X

Krishna Kumar <sup>\*1</sup>

<sup>1</sup>Cockrell School of Engineering  
The University of Texas at Austin

L<sup>A</sup>T<sub>E</sub>X for Beginners

---

<sup>1</sup>krishnak@utexas.edu

# Outline

## 1 World outside the WYSIWYG bubble

## 2 Introduction to $\text{\LaTeX}2\text{e}$

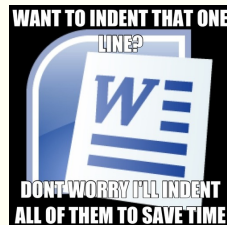
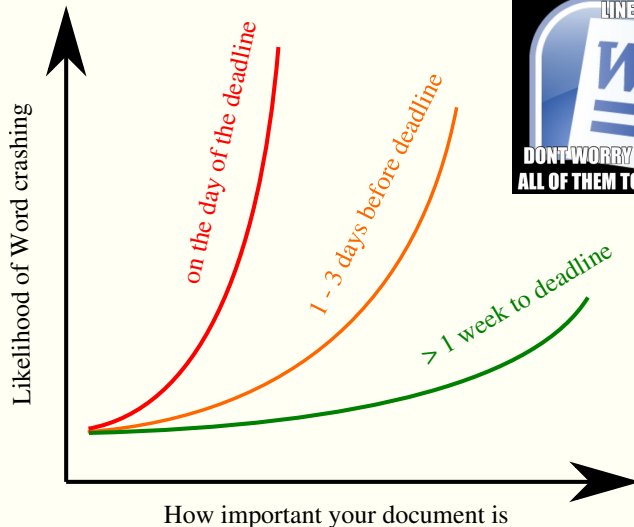
## 3 What is $\text{\LaTeX}$

- How  $\text{\LaTeX}$  works
- $\text{\LaTeX}$  Pros and Cons
- Structure

## 4 Typesetting

## 5 Error handling

# Why you shouldn't use Word to write your thesis



# Can you see beyond the WYSIWYG bubble?

At first sight it must seem intolerably degrading for Zen — however the reader may understand this word — to be associated with anything so mundane as archery. Even if he were willing to make a big concession, and to find archery distinguished as an “art,” he would scarcely feel inclined to look behind this art for anything more than a decidedly sporting form of prowess. He therefore expects to be told something about the amazing feats of Japanese trick-artists who have the advantage of being able to rely on a time-honored and unbroken tradition in the use of bow and arrow. For in the Far East it is only a few generations since the old means of combat were replaced by modern weapons, and familiarity in the handling of them by no means fell into disuse, but went on propagating itself, and has since been cultivated in ever widening circles. Might one not expect, therefore, a description of the special ways in which archery is pursued today as a national sport in Japan?

Nothing could be more mistaken than this expectation. By archery in the traditional sense, which he esteems as an art and honors as a national heritage, the Japanese does not understand a sport but, strange as this may sound at first, a religious ritual. And consequently, by the “art” of archery he does not mean the ability of the sportsman, which can be controlled, more or less, by bodily exercises, but an ability whose origin is to be sought in spiritual exercises and whose aim consists in hitting a spiritual goal, so that fundamentally the marksman aims at himself and may even succeed in hitting himself.

At first sight it must seem intolerably degrading for Zen — however the reader may understand this word — to be associated with anything so mundane as archery. Even if he were willing to make the big concession, and to find archery distinguished as an “art,” he would scarcely feel inclined to look behind this art for anything more than a decidedly sporting form of prowess. He therefore expects to be told something about the amazing feats of Japanese trick-artists who have the advantage of being able to rely on a time-honored and unbroken tradition in the use of bow and arrow. For in the Far East it is only a few generations since the old means of combat were replaced by modern methods, and familiarity in the handling of them by no means fell into disuse, but went on propagating itself, and has since been cultivated in ever widening circles. Might one not expect, therefore, a description of the special ways in which archery is pursued today as a national sport in Japan?

Nothing could be more mistaken than this expectation. By archery in the traditional sense, which he esteems as an art and honors as a national heritage, the Japanese does not understand a sport but, strange as this may sound at first, a religious ritual. And consequently, by the “art” of archery he does not mean the ability of the sportsman, which can be controlled, more or less, by bodily exercises, but an ability whose origin is to be sought in spiritual exercises and whose aim consists in hitting a spiritual goal, so that fundamentally the marksman aims at himself and may even succeed in hitting himself.

# Can you see beyond the WYSIWYG bubble?

mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off – then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it,

whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off – then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or

mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off – then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree,

Word vs. InDesign vs. L<sup>A</sup>T<sub>E</sub>X

fire flower fjörd

Figure: MS Word

fire flower fjörd

Figure:  $\text{\LaTeX}$

D.Taraborelli (2008), The Beauty of  $\text{\LaTeX}$

# Ligatures, smallcaps, kerning

grafiet efficiënt fles souffleur fjord

gra**f**iet e**ff**iciënt **f**les sou**ff**leur **fj**ord

Ligatures

AAa BB CC DD

AAa BB CC DD

Smallcaps

Tafel AVA AVA

Tafel AVA AVA

Kerning

# Outline

1 World outside the WYSIWYG bubble

2 Introduction to  $\text{\LaTeX}2\text{e}$

3 What is  $\text{\LaTeX}$

- How  $\text{\LaTeX}$  works
- $\text{\LaTeX}$  Pros and Cons
- Structure

4 Typesetting

5 Error handling



# Outline

1 World outside the WYSIWYG bubble

2 Introduction to  $\text{\LaTeX}2\text{e}$

3 What is  $\text{\LaTeX}$

- How  $\text{\LaTeX}$  works
- $\text{\LaTeX}$  Pros and Cons
- Structure

4 Typesetting

5 Error handling

# What is L<sup>A</sup>T<sub>E</sub>X?

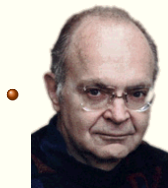
- L<sup>A</sup>T<sub>E</sub>X is a document preparation system for the T<sub>E</sub>X typesetting program.
- Programmable desktop publishing, which automates most of the typesetting.
- L<sup>A</sup>T<sub>E</sub>X produce beautiful documents, especially mathematics

$$i\hbar \frac{\partial}{\partial t} \Psi(r, t) = \left[ \frac{-\hbar^2}{2\mu} \nabla^2 + V(r, t) \right] \Psi(r, t)$$

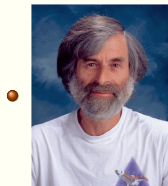
$$E^2 = (pc)^2 + (m_0 c^2)^2$$

- L<sup>A</sup>T<sub>E</sub>X is WYSIWYM (What You See is What You Mean)

It all started with Donald Knuth and “The Art of Computer Programming”



Donald Knuth, 1977,  $\text{T}_{\text{E}}\text{X}$ - a computer language used for typesetting math and other technical material



Leslie Lamport,  $\text{\LaTeX}$ - a higher-level method of accessing the power of  $\text{T}_{\text{E}}\text{X}$

# Getting started with L<sup>A</sup>T<sub>E</sub>X

- **Typesetting**

- T<sub>E</sub>XLive - full version
- MiK<sub>T</sub>E<sub>X</sub>- Windows (Basic installer)

- **Off-line editors**

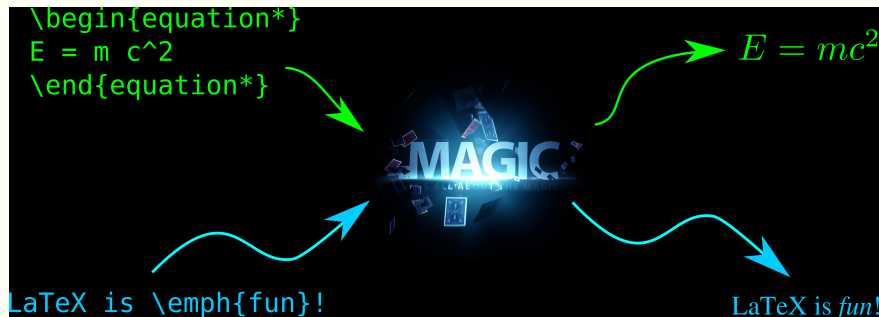
- T<sub>E</sub>XStudio
- T<sub>E</sub>XMakerX

- **Online editors & L<sup>A</sup>T<sub>E</sub>Xcompilers**

- Overleaf

# How L<sup>A</sup>T<sub>E</sub>X works? - The Magic

- You write your document in plain text with commands that describe its structure and meaning.
- The L<sup>A</sup>T<sub>E</sub>X program processes your text and commands to produce a beautifully formatted document.



## Pros

- It's free and works on Macs, Windows, Unix/Linux.
- LaTeX files are ASCII and are portable.
- The typesetting is better, especially the maths.
- Style changes are neater in LaTeX.

## Cons

- Special/Modern Font selection is difficult, but one can use XeTeX.
- LaTeX encourages (almost insists on) structured writing and the separation of style from content. This is not the way that many people (especially non-programmers) are used to working.
- Without a WYSIWYG front end, it's not always easy to find out how to do things.

# More examples of commands and their output...

```
\begin{itemize}
\item Despicable Me
\item Wall-E
\item Tangled
\end{itemize}
```

- Despicable Me
- Wall-E
- Tangled

```
\begin{figure}
\includegraphics{figs/minion}
\end{figure}
```



```
\begin{equation}
\alpha = \beta + 1
\end{equation}
```

$$\alpha = \beta + 1 \quad (1)$$

# Getting Started

- A minimal  $\text{\LaTeX}$  document:

```
\documentclass{article}
\begin{document}
Hello World! % your content goes here...
\end{document}
```

- Commands start with a *backslash* `\`
- Every document starts with a `\documentclass` command.
- The *argument* in curly braces `{ }` tells  $\text{\LaTeX}$  what kind of document we are creating: an article.
- A percent sign `%` starts a *comment* —  $\text{\LaTeX}$  will ignore the rest of the line.



# Declarations and Environments

## Declaration and commands...

- Are stated once
- Take effect until further notice
- Can optionally be constrained

Eg., `\documentclass` or `\includegraphics`

## Environments...

- Have matching begin and end declarations
- Must be constrained

Eg., `\begin{document}` ... `\end{document}`

# Arguments

## Required arguments...

- Are contained in curly braces
- Must be provided

Eg., `\documentclass{article}`

## Optional arguments...

- Are contained in square bracket
- Can be left out, in which case default value is assumed
- Give you more control over the commands

Eg., `\documentclass[12pt]{article}`

# Let's try that ...

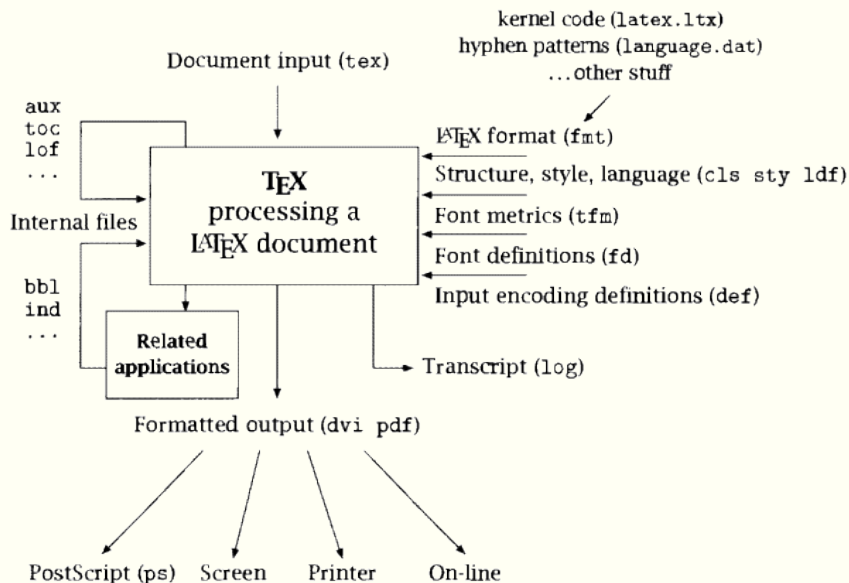
- write $\text{\LaTeX}$  is a website for writing documents in  $\text{\LaTeX}$ .
- It 'compiles' your  $\text{\LaTeX}$  automatically to show you the results.

Click here to open the example document in **Overleaf**

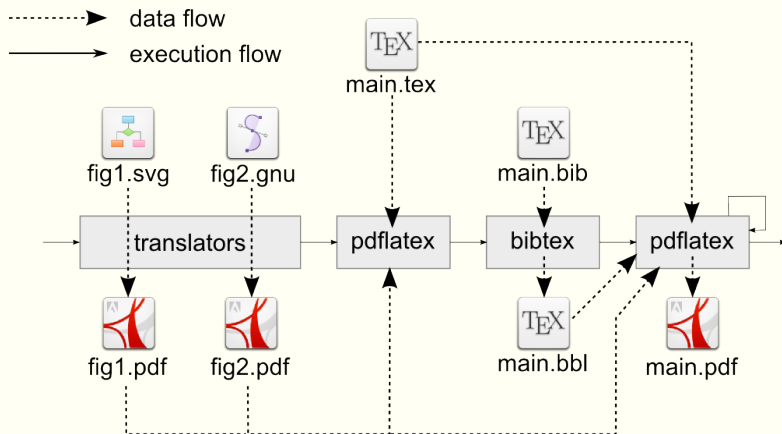
Or go to this URL: <https://www.overleaf.com/docs/1778557gcvcyt/clone>  
For best results, please use Google Chrome or a recent FireFox.

- If you would like to try out the exercise on your machine. Go to **Exercises**  
/ **Ex1\_Hello.tex**

# LaTeX Structure - The Magic



# LaTeX - Tool chains



---

minimal	Is as small as it can get. For debugging purposes.
letter	For writing letters.
article	articles in journals, documentation, invitations, ...
proc	A class for proceedings based on the article class.
report	For longer reports containing several chapters ...
book	For real books.
memoir	For advanced book style.
beamer	For writing presentations

---

# Packages

Packages allow you to further customize L<sup>A</sup>T<sub>E</sub>X

The command:

```
\usepackage{amsmath}
```

## Common packages

Environment	Packages
Maths	amsmath, amsfonts, amssymb
Maths Times Font	mathptx
Figures	graphicx, epsfig
Table	tabularx, booktabs
Pagelayout	geometry
Hyperlinks	hyperref
Algorithms and code	algpseudocode, algorithm, listings
Color	color, xcolor

# Outline

- 1 World outside the WYSIWYG bubble
- 2 Introduction to  $\text{\LaTeX}2\text{e}$
- 3 What is  $\text{\LaTeX}$ 
  - How  $\text{\LaTeX}$  works
  - $\text{\LaTeX}$  Pros and Cons
  - Structure
- 4 Typesetting
- 5 Error handling



# Typesetting Caveats

- Quotation marks are a bit tricky: use a backtick ``` on the left and an apostrophe `'` on the right.

Single quotes: ``text'`.

Double quotes: ```text''`.

Single quotes: `'text'`.

Double quotes: `"text"`.

- Some common characters have special meanings in  $\text{\LaTeX}$ :

<code>%</code>	percent sign (comment)
<code>#</code>	hash sign (macro parameter #1)
<code>&amp;</code>	ampersand (align)
<code>\$</code>	dollar sign (in-line math)

- If you just type these, you'll get an error. If you want one to appear in the output, you have to *escape* it by preceding it with a backslash.

`\$ \% \& \#`

`$\%&\#`

## Exercise 2: Typesetting

Typeset this in L<sup>A</sup>T<sub>E</sub>X: <sup>a</sup>

<sup>a</sup>[http://en.wikipedia.org/wiki/Economy\\_of\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Economy_of_the_United_States)

In March 2006, Congress raised that ceiling an additional \$0.79 trillion to \$8.97 trillion, which is approximately 68% of GDP. As of October 4, 2008, the “Emergency Economic Stabilization Act of 2008” raised the current debt ceiling to \$11.3 trillion.

Click to open this exercise in **Overleaf**

- Hint: watch out for characters with special meanings!
- Once you’ve tried, [click here to see my solution](#).

# Outline

- 1 World outside the WYSIWYG bubble
- 2 Introduction to  $\text{\LaTeX}2\text{e}$
- 3 What is  $\text{\LaTeX}$ 
  - How  $\text{\LaTeX}$  works
  - $\text{\LaTeX}$  Pros and Cons
  - Structure
- 4 Typesetting
- 5 Error handling

# Handling errors

- $\text{\LaTeX}$  can get confused when it is trying to compile your document. If it does, it stops with an error, which you must fix before it will produce any output.
- For example, if you misspell `\emph` as `\meph`,  $\text{\LaTeX}$  will stop with an “undefined control sequence” error, because “meph” is not one of the commands it knows.

## Advice on Errors

- 1 Don't panic! Errors happen.
- 2 Fix them as soon as they arise — if what you just typed caused an error, you can start your debugging there.
- 3 If there are multiple errors, start with the first one — the cause may even be above it.

# Exercise 3: Errors and Warnings

- Class not found
- Too many }'s
- Undefined control sequence
- Warning: Undefined hbox
- Warning: Overfull hbox

Click to open this exercise in **Overleaf**

- Hint: solve one issue at a time, start with the first error  
click here to see my solution .

# Acknowledgements

This  $\text{\LaTeX}$ for Beginners course is loosely based on and examples from:

- John Miller's An interactive introduction to  $\text{\LaTeX}$ :  
<https://www.overleaf.com/blog/7>
- WikiBook on  $\text{\LaTeX}$ : <https://en.wikibooks.org/wiki/LaTeX>
- Overleaf Learn: <https://www.overleaf.com/learn>
- CUED Textprocessing: <http://www.eng.cam.ac.uk/help/tpl/textprocessing/>
- UCS Course on  $\text{\LaTeX} 2_{\epsilon}$ :  
<http://www.ucs.cam.ac.uk/docs/course-notes/unix-courses/earlier/latex>