

# LaTeX tutorial 2008

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November 27, 2008

# Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
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- 11 Using  $\LaTeX$  to...
- 12 To continue with  $\LaTeX$

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# Why using L<sup>A</sup>T<sub>E</sub>X ?

- Page Setting : automatic classes, styles
- It looks Awesome straight away! (Professional, that is)
- Easy to type **mathematical equations** and other usually tricky scientific items such as chemical formula.
- Handles perfectly tables, figures, bibliography, table of contents, etc. . .
- Adaptable to countless languages and texts (accents, alphabets).
- Once tamed, a real time saver (macros)
- Customizable

# How does L<sup>A</sup>T<sub>E</sub>X work?

- Markup tags
- Compiled Language:
  - 1 source file: **.tex**
  - 2 output file: **.pdf** (or .dvi and .ps)
- Sets the global layout on a finished source file, using typographical rules.
- Asks you to forget one's old habits taken from WYSIWYG editors:
  - ▶ don't try to modify fonts, colors, layout for a single paragraph!
  - ▶ concentrate on the content, L<sup>A</sup>T<sub>E</sub>X takes charge of the layout for you!

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# Installation

- 1 You will need at least a **L<sup>A</sup>T<sub>E</sub>X compiler**
- 2 To make life easier you can use a **L<sup>A</sup>T<sub>E</sub>X editor**
- 3 For more advanced uses of L<sup>A</sup>T<sub>E</sub>X you might need to install some **other packages**

# Installation

## MS Windows:

- 1  $\text{\LaTeX}$  compiler: **MiKTeX** <http://miktex.org/2.7/setup>
- 2 Preferred  $\text{\LaTeX}$  editor: **Texmaker**  
<http://www.xm1math.net/texmaker/download.html>
- 3 Advanced packages: can be installed from the **option menu in MiKTeX**

## Mac OS X:

- 1  $\text{\LaTeX}$  compiler: **MacTeX** <http://www.tug.org/mactex/>
- 2 Preferred  $\text{\LaTeX}$  editor: **Texmaker**
- 3 Advanced packages: most of them are automatically installed with **MacTeX**

## Linux (Debian, Ubuntu):

- 1  $\text{\LaTeX}$  compiler: **TeXLive-bin**
- 2 Preferred  $\text{\LaTeX}$  editor: **Texmaker** (other good editor: Kile)
- 3 Advanced packages: in TeXLive and its extensions

# Configuration

If you use Texmaker I strongly encourage you to configure the 'Quick Build' as follows:

- 1 Go into Texmaker Preferences
- 2 Click on Quick Build
- 3 Choose the third option 'PdfLaTeX + View PDF'

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# Basic structure of a document

```
\documentclass{article}  
\begin{document}  
Hello World!  
\end{document}
```

Let's try to open it in Texmaker: Basic\_example/**basic\_example.tex**  
and to compile it: use the **Quick Build button** or the other buttons

# Classes

Several different default classes, extendable by modules or packages:

- Article
- Report
- Letter
- Book

Let's try them out on **example2.tex**

**Warning** : the class Letter does not support sections, abstract and tables and Book does not support abstract (comment these lines using %).

You might need to compile several times to get everything right (especially table of contents and table).

# Sections

```
\chapter{name} %only with books and reports  
\section{name}  
\subsection{name}  
\subsubsection{name}  
\paragraph{name}
```

Notice that there is a very useful **menu in Texmaker** for the sections:  
**'LaTeX -> Sectioning'**

# Basic Commands

- Line break:
  - ▶ `\\` or `\newline` does a carriage return.
  - ▶ `\\ \\` leaves a blank line without starting a new paragraph
  - ▶ Leaving a blank line between 2 lines of text begins a new paragraph (i.e. with indentation)
- Page break : `\newpage`
- Font size: It's also very easy to change the font size:  
`{\tiny some text}` or  
`\begin{tiny} some text\end{tiny}`  
Notice that there is a special menu in Texmaker that helps you find these font size commands: tiny
- Font Style: `\textbf{some text}`  
There is a special menu in Texmaker that helps you find these font style commands: **LaTeX** → **Font Styles**

## Example

Open LaTeXExamples/**textExample.tex**

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## Maths Mode

- For some operators you will need to include the package `amsmath` (simply write `\usepackage{amsmath}` at the beginning of your document after `\documentclass{}`)
- **Inline symbols/equations:** use the special character '\$'

The function  $e^x$  is strictly growing on  $\Re$  and  $\forall x \in \Re$  we get  $e^x > 0$

The function  $e^x$  is strictly growing on  $\Re$  and  $\forall x \in \Re$  we get  $e^x > 0$

- **Equation Environment:** breaks the line, centers it and gives it a number.

```
\begin{equation}
\int_0^{+\infty} x^n e^{-x} \, dx = n!
\end{equation}
```

$$\int_0^{+\infty} x^n e^{-x} \, dx = n! \quad (1)$$

# Mathematical symbols

- Basic symbols:

- ▶ subscript: `_`

example 1: `$x_1$` gives  $x_1$

example 2: `$x_{1,2}$` gives  $x_{1,2}$

example 3: `$$\sum_{x \in E} f(x)$$` gives

$$\sum_{x \in E} f(x)$$

- ▶ superscript: `^`

example 1: `$$a^{f(x)}$$` gives  $a^{f(x)}$

example 2: `$$\int_0^{10} f(x) \, dx$$` gives

$$\int_0^{10} f(x) \, dx$$

# Mathematical symbols

- Some other basic symbols:

- ▶ fraction: `\frac{ }{ }`

example:  `$\frac{x(x-1)}{f(x)e^x}$`  gives

$$\frac{x(x-1)}{f(x)e^x}$$

- ▶ square root: `\sqrt{ }`

example :  `$\sqrt{\frac{a}{b}}$`  gives

$$\sqrt{\frac{a}{b}}$$

- ▶ integral: `\int`

- ▶ summation: `\sum`

- ▶ product: `\prod`

- ▶ infinity: `\infty`

- ▶ limit: `\lim`

# Brackets in mathematical formula

Use `\left` and `\right` before any bracket `()`, curly bracket `{}`, square bracket `[]`, angle bracket `\langle \rangle`, etc.

## Example

`$(\frac{a}{b})$` gives

$$\left(\frac{a}{b}\right)$$

but `$(\left(\frac{a}{b}\right))$` gives

$$\left(\left(\frac{a}{b}\right)\right)$$

Use the menus `\left(` and `\right)` in Texmaker.

# Arrays and Matrices

To create arrays and matrices use the menu '**Wizard** → **Quick Array**' in Texmaker.

- Array:

```
 $\begin{array}{cc} a & b \\ c & d \end{array} $
```

gives 
$$\begin{array}{cc} a & b \\ c & d \end{array}$$

- Matrices:

- ▶ `matrix:` 
$$\begin{array}{cc} a & b \\ c & d \end{array}$$

- ▶ `pmatrix:` 
$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

- ▶ `bmatrix:` 
$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

- ▶ `vmatrix:` 
$$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$$

- ▶ `Vmatrix:` 
$$\left\| \begin{array}{cc} a & b \\ c & d \end{array} \right\|$$

## More advanced maths uses

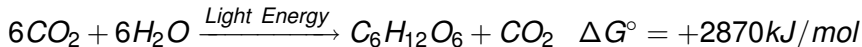
- You can group equations using an array and `\left\{` combined with `\right.`.

```
$f(x) = \left\{\begin{array}{cl}0 & x \leq 0 \\ 1 & x > 0\end{array}\right.$
```

gives  $f(x) = \begin{cases} 0 & x \leq 0 \\ 1 & x > 0 \end{cases}$

- And you can even write chemical formulae using the mathematical mode!

```
$6CO_2+6H_2O\xrightarrow{Light\sim Energy}C_6H_{12}O_6+CO_2\sim\sim\sim\Delta G^{\circ}=+2870kJ/mol$
```



## More advanced maths uses

### Example

Some examples can be found in LaTeXExamples/**equations.tex**

**Note also that arrows, common mathematical symbols, greek letters, etc. can be found in Texmaker on the bottom left-hand corner.**

In the files provided for this tutorial there is a more complete Maths guide for  $\text{\LaTeX}$ : **short-math-guide.pdf**

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# Tables

- The easiest way is to use the menu **‘Wizard → Quick Tabular’**
- To write a table:
  - ▶ use `\begin{table}` and `\end{table}`
  - ▶ use `\begin{tabular}` and `\end{tabular}`
  - ▶ just after `\begin{tabular}` indicate the number of columns, if they are separated by vertical lines and the alignment in these columns.

## Example

`\begin{tabular}{| c | r | l |}` indicates that this tabular will contain 3 columns all separated by vertical lines symbolized by `|` and the content of the first column will be centered (`c`), the content of the second one will be aligned on the right (`r`) and the content of the third one aligned on the left (`l`).

- ▶ fill in the content of your table row by row
- ▶ separate the content of two cells by `&`
- ▶ end a line with `\\`
- ▶ if you want a line separating your rows write `\hline` between the content of your lines

# Tables

## Example

```
\begin{table}
\begin{tabular}{| l | r | r |}
\hline Town & Temperature & Pluviometry \\
\hline York & 22 & 0mm \\
\hline London & 23 & 10cm \\
\hline Aberdeen & 20 & 5mm \\
\hline
\end{tabular}
\end{table}
```

Town	Temperature	Pluviometry
York	22	0mm
London	23	10cm
Aberdeen	20	5mm

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# Lists

To create lists use `itemize` or `enumerate` (in Texmaker in the menu '**LaTeX** → **Lists**')

## Example

```
\begin{enumerate}
\item Open the .tex file
\item Copy and paste the source code LaTeX
\item Compile the file thanks to the compiler
\item Visualize the result
\end{enumerate}
```

- 1 Open the .tex file
- 2 Copy and paste the source code LaTeX
- 3 Compile the file thanks to the compiler
- 4 Visualize the result

# Lists

## Example

```
\begin{itemize}  
\item Slackware  
\item Debian  
\item Redhat  
\item Mandrake  
\end{itemize}
```

- Slackware
- Debian
- Redhat
- Mandrake

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# Figures and graphics

- You need to include the package `graphicx`: simply write `\usepackage{graphicx}` **after** `\documentclass`
- Use the menu 'LaTeX' → `\includegraphicsfile` to import your graphics.  
Important: you can only import `.png`, or `.jpg` or `.pdf` files when you use the compiler PDFLaTeX.
- To add a caption to your graphic:
  - 1 encapsulate your `\includegraphics{...}` with `\begin{figure}` and `\end{figure}`
  - 2 after of before `\includegraphics{...}` (it depends if you want your caption to be after of before the graphic) put `\caption{This is the text of the caption.}`
  - 3 you can also center your figure: encapsulate `\includegraphics{...}` with `\begin{center}` and `\end{center}`

# Figures and graphics

## Example

```
\begin{figure}
\begin{center}
\includegraphics[scale=1]{slackweb.jpg}
\caption{This is the text of the caption.}
\end{center}
\end{figure}
```

- **Please don't try to change the position of your figure.  $\text{\LaTeX}$  puts the figure at the best place in your document given its size.** It might be 3 pages later than the text referring to it but you can not modify that.  
To refer to a figure use references as explained in the next slide.
- For more advanced uses of the graphics cf. the wiki book: [en.wikibooks.org/wiki/LaTeX/Importing\\_Graphics](http://en.wikibooks.org/wiki/LaTeX/Importing_Graphics)

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# References

Using the tag `\label{labelName}` you can make reference to

- a figure (put `\label{}` **between** `\begin{figure}` and `\end{figure}`)
- a table
- an equation
- a section (put `\label{}` **after** `\section`)
- etc.

Then make reference to them in the text of your document using `\ref{labelName}`.

## Example

Open the file `LaTeXExamples/figures.tex`

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# Bibliography

To write a bibliography in  $\LaTeX$

- 1 Create a new file named `nameBibliographyFile.bib`
- 2 In this `.bib` file put the articles, books, etc. you want to make reference to using the Bibliography menu in Texmaker.
- 3 Don't forget to fill in the first field just after `@article{` or `@InProceedings{` etc. It contains the key you will use to cite this item in your paper.
- 4 To cite the paper with the key 'Einstein' use `\cite{Einstein}` in your `.tex` file.
- 5 At the end of your `.tex` file (before `\end{document}`) write:

```
\bibliographystyle{plain}  
\bibliography{nameBibliographyFile}
```

# Bibliography

## To compile your bibliography

- 1 Compile the .tex file once.
- 2 Compile the .bib file once (to compile a .bib file use the Texmaker menu '**Tools** → **BibTeX**').
- 3 Compile at least twice the .tex file again.

### Example

Open the files LaTeXExamples/**bibliographyExample.tex** and **bibliographyExample.bib**

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# Tables of references

- Table of content: just write `\tableofcontent` at the beginning of your document
- Table of figures: `\listoffigures`
- List of tables: `\listoftables`

**Important: Compile at least twice your .tex file to get them right!**

## Example

Open the file `LaTeXExamples/referenceTable.tex`

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# Using LaTeX to write an article

Almost all the conferences and journals provide a  $\text{\LaTeX}$  template to write an article that respects their preferred layout.

- Most of the time this template includes a Tex file (.tex) and a Style file (.sty) or Class file (.cls).
- Write your article in the .tex file.
- Make sure to keep the .sty or .cls file in the folder in which you save and modify the .tex file

## Example

**IEEEtran** is the official LaTeX class for authors of the IEEE transactions journals and conferences.

It is included in the directory '**IEEEtran Folder**' given to you.

## Using LaTeX to write a report

When you write a report of more than a dozen pages in  $\text{\LaTeX}$  it is better to write your chapters in different files:

- Create a main file (e.g. `myReport.tex`) which contains the document class, packages, `\begin{document}` and `\end{document}`, etc.
- Create your chapter files (e.g. `Intro.tex`, `chapter2.tex`, `ch3.tex` etc.) with no `\begin{document}` and `\end{document}` or packages
- Link your chapter files to your main file: put `\input{chapterName.tex}` in your main file for each chapter file

### Example

For more details on how to write a report in  $\text{\LaTeX}$  have a look at the example of  $\text{\LaTeX}$  report written by Chris Harte (provided in the directory '**examplereport**').

# Using LaTeX to write your thesis

- Apparently there is no  $\text{\LaTeX}$  template for Queen Mary, University of London theses.
- In 2005 a student in Electronic Engineering (Thomas) wrote a LaTeX template respecting the University of London regulations for his thesis. This template is included in the directory '**Thesis Template**' given to you.
- But don't forget to check that it conforms to the 2008 University of London Research Degree Regulations (and modify it if needed):  
**[http://www.london.ac.uk/research\\_degrees.html](http://www.london.ac.uk/research_degrees.html)**  
In particular check the following document:  
**[http://www.london.ac.uk/fileadmin/documents/students/postgraduate/binding\\_notes.pdf](http://www.london.ac.uk/fileadmin/documents/students/postgraduate/binding_notes.pdf)**

# Using LaTeX to give a presentation

- This presentation has been prepared with Beamer, a  $\text{\LaTeX}$  package for slides.
- Write Beamer presentation using the same syntax as for your reports and articles in  $\text{\LaTeX}$ .
- You can obtain very different styles and colors.
- Find out more about Beamer:  
**<http://latex-beamer.sourceforge.net/>**

## Finding pp-partitions of genotype matrices.

Now comes the general case:

- The inputs  $M$  are **genotype matrices**.
- The inputs  $M$  **do not allow a perfect phylogeny**.
- What is  $\chi_{PP}(M)$ ?

### Example

$M$ :

2	2	2	2
1	0	0	0
0	0	0	1
0	0	1	0
0	2	2	0
1	1	0	0

Perfect phylogeny

Perfect phylogeny

$$\chi_{PP}(M) = 2.$$

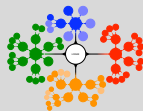
# Beobachtungen zu einem ägyptischen Text.



Copyright by Guillaume Blanchard, GNU Free Documentation License, Low Resolution

## Beobachtungen

- Wir haben keine Ahnung, was der Text bedeutet.
- Es gibt aber **Regeln**, die offenbar eingehalten wurden, wie »Hieroglyphen stehen in Zeilen«.
- Solche Regeln sind **syntaktische Regeln** – man kann sie überprüfen, ohne den Inhalt zu verstehen.



## Ziele und Inhalt

### Was ist Syntax?

Syntax  
natürlicher Sprachen

Syntax von  
Programmiersprachen

Syntax  
logischer Sprachen

### Was ist Semantik?

Semantik  
natürlicher Sprachen

Semantik von  
Programmiersprachen

Semantik  
logischer Sprachen

### Grundlage der Syntax: Text

Alphabete

Worte

Sprachen

### Zusammenfassung

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# To continue with $\text{\LaTeX}$

- There are lots of examples illustrating the different things we saw today and much more in the **directory LaTeXExamples**. Try them out!
- Find lots of tricks and explanations in the wiki book: [en.wikibooks.org/wiki/LaTeX/](http://en.wikibooks.org/wiki/LaTeX/)
- If you don't have access to internet, in the files provided for this tutorial there is an introduction to LaTeX:  
**The\_Not\_So\_Short\_Introduction\_To\_LaTeX.pdf**
- We will organize another  $\text{\LaTeX}$  session in January to deal with more advanced uses of  $\text{\LaTeX}$ .  
It will be an informal discussion: people will bring their advanced problems and their own  $\text{\LaTeX}$  tricks and will work together on them. And we'll be here to help of course!

# To contact the QMUL IEEE Student Branch

- For any question regarding this tutorial do not hesitate to contact us at **[ieeqmul@googlemail.com](mailto:ieeqmul@googlemail.com)**
- To learn more about the activities of the QMUL IEEE Student Branch and become a member have a look at our website: **<http://ieeesb.elec.qmul.ac.uk/>**