

LaTeX tutorial 2011

Emmanouil Benetos, Iftekharul Mobin, Wenxuan Tang
QMUL IEEE Student Branch

<http://ieeesb.elec.qmul.ac.uk/>

March 30, 2011

(Original material: Amélie Anglade)

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

Why using \LaTeX ?

- 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 \LaTeX 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, \LaTeX takes charge of the layout for you!

Outline

- 1 Introduction
- 2 Installation**
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

Installation

- 1 You will need at least a **L^AT_EX compiler**
- 2 To make life easier you can use a **L^AT_EX editor**
- 3 For more advanced uses of L^AT_EX you might need to install some **other packages**

Installation

MS Windows:

- 1 \LaTeX compiler: **MiKTeX** <http://miktex.org/2.9/setup>
- 2 Preferred \LaTeX editor: **Texmaker**
<http://www.xmlmath.net/texmaker/download.html>
- 3 Advanced packages: installation from **MiKTeX option menu**

Mac OS X:

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

Linux (Debian, Ubuntu):

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

Configuration

For opening Texmaker go to:

Start → Programs → Public → 11-Maths and Stats → LaTeX Editor

Configure the 'Quick Build' as follows:

- 1 In the left arrow in the menu select 'PdfLaTeX'
- 2 In the left arrow in the menu select 'View PDF'

Download and extract examples:

<http://ieeesb.elec.qmul.ac.uk/wp-content/uploads/2011/03/LaTeX2011.zip>

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document**
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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 %).

Note: 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**

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations**
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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 \mathbb{R} and $\forall x \in \mathbb{R}$ we get $e^x > 0$

The function e^x is strictly growing on \mathbb{R} and $\forall x \in \mathbb{R}$ 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

Note: you can find them in the menu '**Math**'

- 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 `< >`, etc.

Example

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

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

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

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

Use the menu '`() .`' on the left-hand side 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

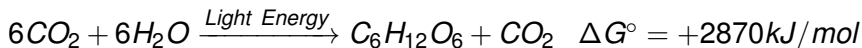
- You can group equations using an array and `\left\{` combined with `\right.`.

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

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!

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



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" in the menus on the left: \div , \Rightarrow , \forall , etc.

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

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables**
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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

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

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists**
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

Lists

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

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

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures**
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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. \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

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References**
- 9 Bibliography
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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`

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography**
- 10 Tables of references
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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**

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references**
- 11 Using \LaTeX to...
- 12 To continue with \LaTeX

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`

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using L^AT_EX to...**
- 12 To continue with L^AT_EX

Using LaTeX to write an article

Almost all the conferences and journals provide a L^AT_EX 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 L^AT_EX to write a report

When you write a report of more than a dozen pages in L^AT_EX 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 L^AT_EX have a look at the example of L^AT_EX report written by Chris Harte (provided in the directory '**examplereport**').

*To compile it use '**L^AT_EX**', followed by '**DVI** → '**PDF**' and then '**View PDF**'*

Using LaTeX to write your thesis

- Apparently there is no L^AT_EX 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 2010 University of London Research Degree Regulations (and modify it if needed):
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

Using LaTeX to give a presentation

- This presentation has been prepared with Beamer, a L^AT_EX package for slides.
- Write Beamer presentation using the same syntax as for your reports and articles in L^AT_EX.
- 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.



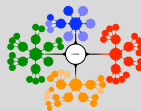
Copyright by Guillaume Blanchard, GNU Free Documentation License, Low Resolution

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.

Syntax versus Semantik

Till Tantau



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

Outline

- 1 Introduction
- 2 Installation
- 3 Structure of a document
- 4 Equations
- 5 Tables
- 6 Lists
- 7 Figures
- 8 References
- 9 Bibliography
- 10 Tables of references
- 11 Using L^AT_EX to...
- 12 To continue with L^AT_EX**

To continue with L^AT_EX

- 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/
- 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 L^AT_EX session in January to deal with more advanced uses of L^AT_EX.
It will be an informal discussion: people will bring their advanced problems and their own L^AT_EX 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 **ieeeqmul@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/>