Learning LaTeX

Dr. G. H. J. Lanel

March 23, 2017

Outline

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Introduction

- TEX is a low-level markup and programming language, created to typeset documents attractively and consistently.
- LATEX is a package based on TEX, its purpose is to simplify TeX typesetting.
- LATEXis a high-quality typesetting system.
- It includes features designed for the production of technical and scientific documentation. Today widely used for publications.

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- You can't see the final result straight away.
- Everything is controlled with written commands.
- The document is written in a self-chosen text editor and saved in a .tex-file and finally converts .tex-file into a .pdf/dvi-file.

Advantages:

- The layout, fonts, tables etc. are consistent throughout.
- Mathematical formulae can be easily typeset.
- Indexes, footnotes and references are generated easily.

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Software examples

Requirements:

1. Text Editor
2. LaTeX-binaries
3. Output viewer for DVI/PDF files

Windows:

1. Notepad, TeXnicCenter, Winshell
2. MiKTeX

Mac OS X:

1. TeXShop
2. MacTeX or TeX-live

Linux:

1. Emacsen, gvim, Texmaker, Kile
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Document structure

The structure of a .tex-file:

```
\documentclass [ 12pt ] { article }
\begin{document }
. . .
% Document text
. . .
\end{document }
```

Page Layout

The document class command:

```
\documentclass [ options ] {class}
```

Example:

```
. . . [ a4paper , twoside , twocolumns ] {article}
```

or

```
\documentclass [ 1 1 pt , a4paper , oneside ] { report}
```

Some document classes: article, report, letter, beamer, book

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Title

Title (inserted right after\begin{document}):

---

title {Introduction to LaTeX}

\ **author** {[Your name]}\ \

date {\today}

maketitle

Introduction to LaTeX
Your name
March 23, 2017

Title

Title (inserted right after\begin{document}):

---

title {Introduction to LaTeX}

\ **author** {[Your name]}\ \

date {\today}

maketitle

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March 23, 2017

Document structure

Sections and hierarchy

Sectioning commands:

\part { title}

\chapter { title }

\section { title}

\subsection { title}

\subsubsection { title}

\paragraph { title}

\subparagraph { title}

Document structure

Sections and hierarchy

Sectioning commands:

part { title}

chapter { title }

section { title}

subsection { title}

subsubsection { title}

paragraph { title}

subparagraph { title}

Document structure for the article

Sections and hierarchy

This article has nine sections and some subsections so, we need to use \ **section** { title} and \ **subsection** { title} commands.

For example if we look at the 7^{th} section of the article we can write it as follows:

\ **section** { Special Symbols}

\ **subsection** { Common Greek letters}

. . .

% Document text

. . .

\ **subsubsection** {Special symbols}

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\section { Special Symbols}
    \subsection { Common Greek letters}
    . . .
    % Document text
    . . .
    \subsubsection {Special symbols}
```

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\ **section** { Special Symbols}

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. . .

% Document text

. . .

subsubsection {Special symbols}

Document structure for the article

Sections and hierarchy

So, we can obtain the following output.

6 Special Symbols

6.1 Common Greek letters

These commands may be used only in math mode. Only the most common letters are included here.

$$\alpha, \beta, \gamma, \Gamma, \delta, \Delta, \epsilon, \zeta, \eta, \theta, \Theta, \kappa, \lambda, \Lambda, \mu, \nu, \xi, \Xi, \pi, \Pi, \rho, \sigma, \tau, \phi, \Phi, \chi, \psi, \Psi, \omega, \Omega$$

6.2 Special symbols

Formatting

paragraph spacing and indenting

Document text placed between

\begin {document} and \end {document}

- Line break : \ \ (2*backslashes)
- Paragraph separation : Two breakspaces (2*enter)
- Line of comment : Begins with %

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We can skip some space by using commands such as

```
\bigskip    \medskip    \smallskip    \vspace{1pc}
```

The space can be negative.

Document structure

Mathematics

- $ math $: Math in text paragraph

```
\section{Equations}

Let us see how easy it is to write equations

$\Delta =\sum_{i=1}^N w_i (x_i - \bar{x})^2 $ .

It is a good idea to number equations, but
we can have an equation without a number by writing.
```

Then the output will be as follows:

2 Equations

Let us see how easy it is to write equations, $\Delta = \sum_{i=1}^{N} w_i(x_i - \bar{x})^2$. It is a good idea to number equations, but we can have a equation without a number by writing.

Document structure

Mathematics

- \ begin{equation} math \end{equation}:
  Math centered, separated from text and labeled

```
\section{Equations}

Let us see how easy it is to write equations.

\begin{equation}
\Delta =\sum_{i=1}^N w_i (x_i - \bar{x})^2 .
\end{equation}
```

Then the output will be as follows:

2 Equations

Let us see how easy it is to write equations.

$$\Delta = \sum_{i=1}^{N} w_i (x_i - \bar{x})^2. \qquad (1)$$

- We can also have an equation without a number by writing using the following command.

```
\begin{equation}
P(x) = \frac{x - a}{b - a} , \nonumber
\end{equation}
```

Then the output will be as follows:

$$P(x) = \frac{x - a}{b - a}$$

- We can give an equation a label so that we can refer to it later, using the command \label{...} when writing the equation and then ~ \eqref{...} command in the paragraph to refer the equation.

```
\begin{equation}
\label{eq:ising}
E = -J \sum_{i=1}^N s_i s_{i+1} ,
\end{equation}

Equation~\eqref{eq:ising} expresses
the energy of a configuration
of spins in the Ising model.
```

Then the output will be as follows:

$$E = -J \sum_{i=1}^{N} s_i s_{i+1},$$

Equation (2) expresses the energy of a configuration of spins in the Ising model.

- We also can align several equations using the following commands:

```
\begin{align }
a & = b \\
c & = d,
\end{align }
```

Then we get the following output

$$a = b$$

$$c = d,$$

Examples of more complicated equations:

- $$I = \int_{-\infty}^{\infty} f(x)\,dx.$$

  In order to obtain the above equation we have to use the following commands.

```
\begin{equation*}
I = \! \int_{-\infty}^\infty f(x)\,dx
\label{eq:fine}.
\end{equation*}
```

Document structure

Mathematics – continued

$$m(T) = \begin{cases} 0 & T > T_c \\ \left(1 - [\sinh 2\beta J]^{-4}\right)^{1/8} & T < T_c \end{cases}$$

In order to obtain the above equation we have to use the following commands.

```
\begin{equation*}
\label{eq:mdiv}
m(T) =
\begin{cases}
0 & \text{$T > T_c$} \\
\bigl(1 - [\sinh 2 \beta J]^{-4} \bigr)^{\! 1/8}
& \text{$T < T_c$}
\end{cases}
\end{equation*}
```

Document structure

Mathematics – continued

$$\mathbf{T} = \begin{pmatrix} T_{++} & T_{+-} \\ T_{-+} & T_{--} \end{pmatrix},$$

In order to obtain the above matrix we have to use the following commands.

```
\begin{align*}
\textbf{T} &=
\begin{pmatrix}
T_{++} \hfill & T_{+-} \\
T_{-+} & T_{--} \hfill
\end{pmatrix} , \nonumber \\
\end{align*}
```

Document structure

Floats

- Free, floating objects; position is only partly defined by the user (here, bottom, top, p: separate page).
- Automatically numbered, label used for referencing.
- Captions can be added.

Float syntax:

\ **begin** { figure or table } [placement specifier]

. . . figure contents . . .

\ **end** { figure or table }

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\ **begin** { figure or table } [placement specifier]

. . . figure contents . . .

\ **end** { figure or table }

Table code example:

```
\begin{table}[h]
\begin{center}
\begin{tabular}{|l|l|r|l|}
\hline
lattice & $d$ & $q$ & $T_{\rm mf}/T_c$ \\
\hline
square & 2 & 4 & 1.763 \\
\hline
triangular & 2 & 6 & 1.648 \\
\hline
diamond & 3 & 4 & 1.479 \\
\hline
simple cubic & 3 & 6 & 1.330 \\
\hline
bcc & 3 & 8 & 1.260 \\
\hline
fcc & 3 & 12 & 1.225 \\
\hline
\end{tabular}
\end{center}
\end{table}
```

The result :

lattice	d	q	T_{mf}/T_c
square	2	4	1.763
triangular	2	6	1.648
diamond	3	4	1.479
simple cubic	3	6	1.330
bcc	3	8	1.260
fcc	3	12	1.225

Listing using bulleting

Bulleting code example:

```
\begin{itemize}
  \item Tom
  \item Dick
\end{itemize}
```

Listing using bulleting

The output is:

- Tom
- Dick

Listing using numbering

Numbering code example:

```
\begin{enumerate}
  \item bread
  \item cheese
\end{enumerate}
```

Listing using numbering

The output is:

1. bread
2. cheese

Supported image file types: JPG, PNG and PDF

Figure code example:

```
\begin{figure}[h]
\begin{center}
\includegraphics{fig1.jpg}
\caption{\label{fig:typical}Show me a sine.}
\end{center}
\end{figure}
```

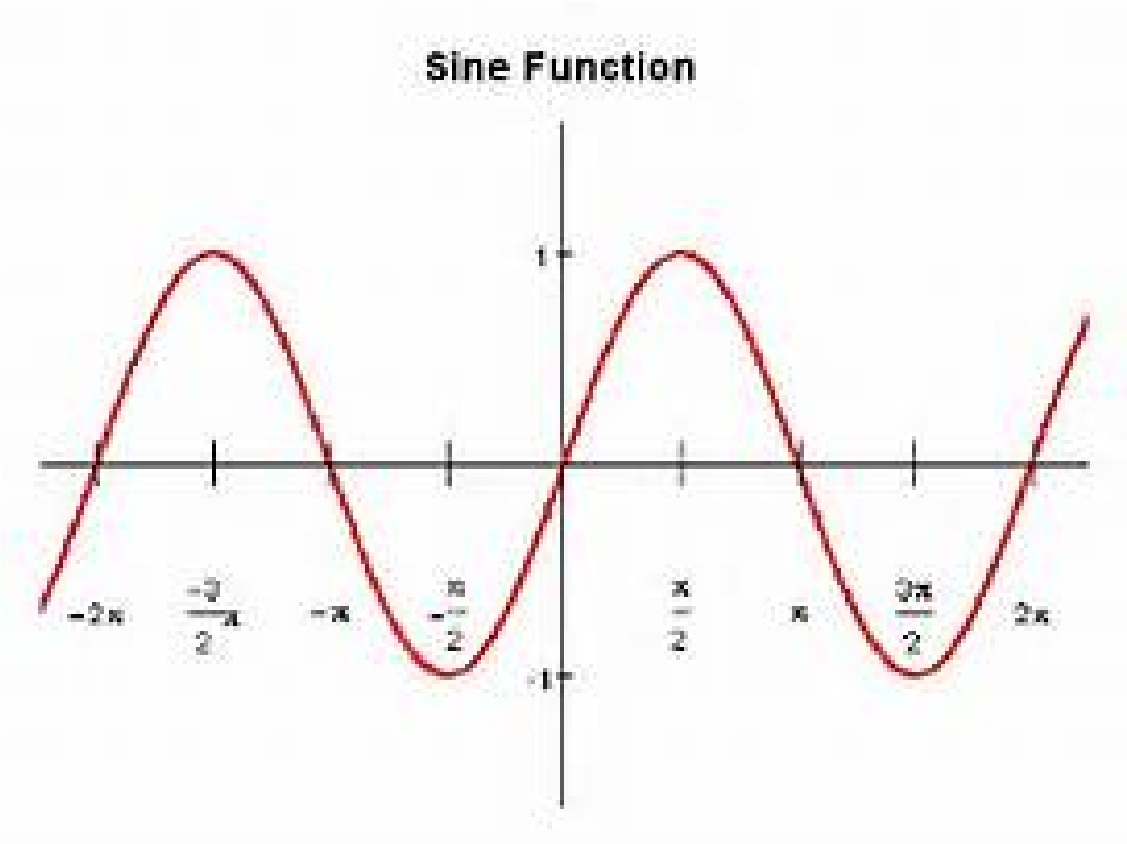

Figure : Sine curve.

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Common Greek Letters

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Only the most common letters are included here.

```
$\alpha,
\beta, \gamma, \Gamma,
\delta,\Delta,
\epsilon, \zeta, \eta, \theta, \Theta, \kappa,
\lambda, \Lambda, \mu, \nu,
\xi, \Xi,
\pi, \Pi,
\rho,
\sigma,
\tau,
\phi, \Phi,
\chi,
\psi, \Psi,
\omega, \Omega$
```

$$\alpha, \beta, \gamma, \Gamma, \delta, \Delta$$

$$\epsilon, \zeta, \eta, \theta, \Theta, \kappa$$

$$\lambda, \Lambda, \mu, \nu, \xi, \Xi$$

$$\pi, \Pi, \rho, \sigma, \tau, \phi$$

$$\Phi, \chi, \psi, \Psi, \omega, \Omega$$

The derivative and limit are defined as;

```
\begin{equation}
\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{\Delta y}
{\Delta x}
\end{equation}
\begin{equation}
f(x) \to y \quad \mbox{as} \quad x \to
x_{0}
\end{equation}
```

$$\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} \tag{1}$$

$$f(x) \to y \quad \text{as} \quad x \to x_0 \tag{2}$$

$$f(x) \underset{x \to x_0}{\longrightarrow} y \tag{3}$$

Order of magnitude;

```
\log_{10}f \sim n
\end{equation}
\begin{equation}
f(x)\sim 10^{n}
\end{equation}
\end{frame}
```

$$\log_{10} f \sim n \tag{4}$$

$$f(x) \sim 10^{n} \tag{5}$$

Approximate equality;

```
\begin{equation}
f(x)\simeq g(x)
\end{equation}
```

$$f(x) \simeq g(x) \tag{6}$$

LaTeX is simple if we keep everything in proportion:

```
\begin{equation}
f(x) \propto x^3 .
\end{equation}
```

$$f(x) \propto x^3. \tag{7}$$

Outline

Formatting

Text styles

\emph{...} *I want to emphasize*

\textbf{...} **Bold**

\texttt{...} `Fixed width teletypefont`

\textsc{...} SMALL CAPITALS

Formatting

Text size

\tiny{...}	sample text
\Scriptsize{...}	sample text
\footnotesize{...}	sample text
\small{...}	sample text
\normalsize{...}	sample text
\large{...}	sample text
\Large{...}	sample text
\LARGE{...}	sample text
\huge{...}	sample text
\Huge{...}	sample text

Formatting

colours

There are several elements in LaTeX whose colour can be changed to improve the appearance of the document.

Colours can be manually defined to a desired tone using several models.

The simplest manner to use colours in your LaTeX document is by importing the package color or xcolor.

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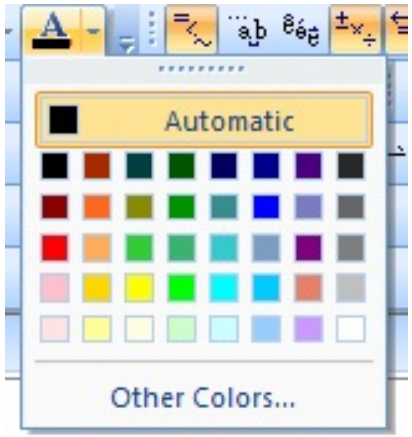
The simplest manner to use colours in your LaTeX document is by importing the package color or xcolor.

Some waysof using colours in LaTeX ;

1. Using the command

```
\begin{itemize}
\color{blue}
\item First item
\item Second item
\end{itemize}
```

2. Using toolbar



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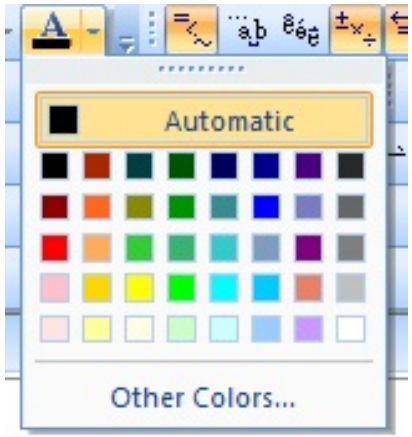

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Conclusions

- Learning LATEX is done by doing.
- Use external resources for command and syntax help.
- Compile the PDF frequently.
- Helps error debugging in the code.
- Let the floats (tables, figures) position themselves.
- Create a dedicated directory for each project.

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Thank You!