Outline	Introduction	Generating a do
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LATEX Fundamentals

Luyao Peng

Sponsored by GradQuant

10/27/2015

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Outline

Introduction

Backgroud of LATEX Comparing LATEX and MS

Generating a document

Basic Document Structure Typesetting in the body Making Table Importing Figure

Math Mode in LATEX

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Backgroud of LATEX			

What is $\[Mathef{MTEX}\]$

▶ LATEXis pronouced "lay-tech" or "lah-tech", not "la-teks".

LATEX is document preparation for high quality typesetting.

 LATEX is most often used to produce technical or scientific documents.

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Backgroud of LATEX

Why use LATEX?

- Designed to accommodate academic use.
- Mathematic symbols and equations are easily integrated.
- Even complex tables, references, footnotes can be easily generated.
- ► Forces author to focus on logical structure of a document.

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Generating a document

Comparing LATEXand MS



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Comparing LATEXa	nd MS		

In T_EX:

Formula 1

$$\rho = \int 1 - \frac{2p^2 + 3p - 1}{6(p+1)(k-1)(n-k)} \left(\sum_{i=1}^k \frac{n-k}{n_i - 1} - 1\right) x dx.$$

In MS Word:

Formula 2 $\rho = \int -\frac{2p^2 + 3p - 1}{6(p+1)(k-1)(n-k)} \left(\sum_{i=1}^k \frac{n-k}{n_i - 1} - 1\right) x dx$

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Outline	Introduction	Generating a document 000000 000000000000 0000000 0	Math Mode in LAT _E X
Comparing LATEXand MS			
In T _E X:			
Formula	3		
		0	
	$0 \longrightarrow \mathcal{O}_C \xrightarrow{i}$	$\mathcal{E} \xrightarrow{\rho} \mathcal{L} \longrightarrow 0$	D
		$\downarrow \phi \qquad \qquad \downarrow \psi$ $= \mathcal{O}_{D} \stackrel{\delta}{\longrightarrow} B^{1}f(\mathcal{O}_{Y}(-D)) \implies 0$	
		$\int \theta_{i\otimes\gamma^{-1}} d\eta_{i\otimes\gamma^{-1}} d\eta_{i\otimes\gamma^{-1}}$	
		$R^1f_*(\mathcal{O}_V(-iM))\otimes\gamma^{-1}$	
		Û Û	

In MS Word:Oh, you gotta be kidding me ...

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Comparing LATEXand MS

Installing LATEX

- Windows: Check out the proTeXt system; this allows you theinstall a full TEX system, including LATEX. https://www.tug.org/protext/
- MacOS: MacTeX.then you get everything you need.https://tug.org/mactex/
- Linux: Your system distribution or vendor has probablyprovided a TEX system including LATEX.

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Generating a document •00000 Math Mode in LATEX

Basic Document Structure

Basic Document Structure

- In the preamble
 - documentclass
 - Packages
 - title/author
- In the body: contents
- In the back matter: bibliography

% This is myfile.tex	- 1
% notes to yourself can go here	
\documentclass[options]{style optional specifications — e.g., declaring use of package	:} :s
\begin{document}	
\end{document}	

Anything following % is ignored (used for comments).

Preamble (blank lines do not matter)

Body This is the document environme

All that follows is ignored (could be used for comments).

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Basic Document Structure

In the preamble

- Specify document class
 - we can use:

\documentclass[12pt]{article}

- document class: article, book,letter, report and slides.
- Specify package to be used

for example:

\usepackage[margin=1in]{geometry} \usepackage{setspace}

 \square Note: Backslash at the beginning of command

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Generating a document

Math Mode in LATEX

Basic Document Structure

In the preamble, cont.

- \title{First document}
- \author{Mary}
- \thanks{Funded by...}
- \date{October 2015}

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Basic Document Structure

\begin{titlepage} \ maketitle \end{titlepage} \begin{abstract} This is a simple paragraph \end{abstract}

Generating a document 000000 To make title page and abstract

Math Mode in LATEX

documentclass[12pt]{article} \usepackage{amsmath} usepackage{array} \usepackage{setspace} doublespacing \title{First Document} author{Mary} date{February 2014} \begin{document} begin{titlepage} maketitle end{titlepage} \begin{abstract} This is a simple paragraph... end{abstract} \newpage

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Basic Document Structure

In the body

```
To begin a new section:
define parindent and parskip in the preamble
\setlength{\parindent}{4em}
\setlength{\parskip}{0.5em}
```

```
\section{This is a section}
\subsection{This is a subsection}
```

```
This is the body of the subsection.
I can move to a new \underline{line} anytime, and I can put
in a \boxed{lot} of blanks with no
\textbf{\textit{effect}}.\par
```

This is another

```
\subsection{Here is another subsection}
Welcome!...
```

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Basic Document Structure

Results: 1 This is a section

1.1 This is a subsection

This is the body of the subsection. I can move to a new <u>line</u> anytime, and I can put in a <u>lot</u> of blanks with no *effect*.

This is another

1.2 Here is another subsection

Welcome!...

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Typesetting in the body

Font and Paragraph

Font and paragraph: Environment

```
\begin{center}
The text is centered because I have entered the center environment.
Text remains centered as long as we remain in this environment.
\end{center}
\begin{flushleft}
Now we are out of the centering environment, and have begun the
flushleft environment.
\end{flushleft}
This is another paragraph, but in the flushright environment.
You will have occasion to use all four paragraph positions.
\end{flushright}
I am back to normal justification. The added space you see between
the above paragraphs is due to entering those environments.
```

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Typesetting in the body

Result:

The text is centered because I have entered the center environment. Text remains centered as long as we remain in this environment.

Now we are out of the centering environment, and have begun the flushleft environment.

This is another paragraph, but in the flushright environment. You will have occasion to use all four paragraph positions.

I am back to normal justification. The added space you see between the above paragraphs is due to entering those environments.

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Generating a document

Math Mode in LATEX

Typesetting in the body

Font Style

What you write				How it appears			
This	is	\textbf{boldface}.	⇒	This is boldface .			
This	is	\textit{italic}.	\Rightarrow	This is <i>italic</i> .			
This	is	\textrm{roman}.	⇒	This is roman.			
This	is	\textsc{small caps}.	⇒	This is SMALL CAPS.			
This	is	\textsf{sans serif}.	⇒	This is sans serif.			
This	is	\textsl{slanted}.	⇒	This is slanted.			
This	is	\texttt{typewriter}.	\Rightarrow	This is typewriter.			

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Generating a document

Math Mode in LATEX

Typesetting in the body

Font Size

We can use

You can make the text {\large large} or {\Large larger} or even {\LARGE larger still}. You can also make it {\huge huge}. You might want to make something {\small small} or {\footnotesize smaller} or even {\scriptsize smaller still}. You can make it really {\tiny tiny}.

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Generating a document

Math Mode in LATEX

Typesetting in the body

Results:

You can make the text large or larger or even larger still. You can also make it huge. You might want to make something small or smaller or even smaller still. You can make it really tiny.

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Math Mode in LATEX

Typesetting in the body

Level of Skipping

We can use This is first line. \bigskip

This is second line. \medskip

This is third line. \smallskip

This is fourth line.

An ordinary line

Results:

This is first line.

This is second line.

This is third line.

This is fourth line.

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An ordinary line

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Math Mode in LATEX

Typesetting in the body

Footnote

Let's try: This is first line.\bigskip

This is third line. \smallskip

This is ordinary \footnote{footnotes working fine} line

We can also make footnote to a table, see making table section...

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Typesetting in the b	ody		
List			

There are three intrinsic list environments, distinguished by what appears at the beginning of each item: number, bullet, or your description.

- \begin{itemize}
- \begin{enumerate}
- \begin{description}

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Generating a document

Math Mode in LATEX

Typesetting in the body

List-Description

```
We can use:
```

```
\begin{description}
   \item [Basic Body Structure] Basic Body Structure
   \item [Typesetting in \LaTex] Typesetting in \LaTex
   \item [Math Mode] Math Mode
  \end {description}
```

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Math Mode in LATEX

Typesetting in the body

Results:

Basic Body Structure Basic body structure

Typesetting in LATEX Typesetting in LATEX

Math Mode Math Mode

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Typesetting in the body

List-Itemize

```
We can use:
\begin{itemize}
    \item This is item 1
    \item This is item 2
        \begin{itemize}
        \item This is sub-item 1
        \item This is sub-item 2
        \end{itemize}
\end{itemize}
```

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Math Mode in LATEX

Typesetting in the body

Results:

- This is item 1
- This is item 2
 - This is sub-item1
 - This is sub-item2

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Generating a document

Math Mode in LATEX

Typesetting in the body

List-Enumerate

```
We can use:
\begin{enumerate}
    \item This is item 1
    \item This is item 2
        \begin{enumerate}
        \item This is sub-item 1
        \item This is sub-item 2
        \end{enumerate}
\end{enumerate}
```

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Generating a document

Math Mode in LATEX

Typesetting in the body

Results:

- 1. This is item 1
- 2. This is item 2
 - (a) This is sub-item1
 - (b) This is sub-item2

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Making Table			

```
A table is made with the tabular environment, which has the
following syntax:
\begin{tabular}{column specs}
first row spec\\
.
.
last row spec\\
\end{tabular}
```

As indicated, each row ends with two backslashes. Each column specification can be left, center or right, abbreviated by just one character: I, c or r. In the body of the table, each column is separated by &.

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Making Table	2				
Exa	mples	5:			
_1	How	it appear	rs	What you wi	rite
				tabu	lar}{lcr}
	left	center	right	left & cer	nter & right \\
	1	2	3	1 & 2	& 3
				tabula	ar}
_					

```
Try:
\begin{tabular}{|l|c|r|} \hline
left & center & right \\\hline
1 & 2 & 3 \\\hline
\end{tabular}
```

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Outline	Introduction 00 0000	Generating a document ○○○○○ ○○○○○○○○○○○○○ ○○○○○○○○ ○○○○○○	Math Mode in LATEX
Making Table			

Examples of making table with fixed length:

```
First call package in the preamble: 
\usepackage{array}
```

```
Then, we can use:
begin{tabular} | m{5em} | m{1cm} | m{1cm} | \}
\hline
cell1 dummy text dummy & cell2& cell3
\hline
cell1 dummy text dummy & cell5 & cell6
\hline
cell7 & cell8 & cell9
\hline
\end{tabular}
```

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Making Table

Examples of combining rows and columns: \usepackage{array}

```
Then, we can use:
begin{tabular} | m{5em} | m{1cm} | m{1cm} | } hline
\multicolumn{3}{|c|}{Country List} \\[2ex]
\hline
cell1 dummy text dummy & cell2& cell3
\hline
cell1 dummy text dummy & cell5 & cell6
\hline
cell7 & cell8 & cell9
\hline
\end{tabular}
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Generating a document

Math Mode in LATEX

Making Table

Results:

Country List			
cell1			
dummy	coll9	coll2	
text	Cell2	cens	
dummy			
cell1			
dummy	cell5	coll6	
text	ceno	Cello	
dummy			
cell7	cell8	cell9	

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Making Table			

Examples of positioning, caption and footnote in a table:

```
\begin{table}[h!]
    \centering
    \begin{tabular}{ | m{5em} |m{1cm} | m{1cm} | }
        \hline
        \multicolumn{3}{|c|}{Country List \footnotemark[2]}\\ [3ex]
        \hline
        cell1 dummy text dummy & cell2 & cell3 \\
        \hline
        cell1 dummy text dummy & cell5 & cell6 \\
        \hline
        cell7 & cell8& cell9 \\
        \hline
    \end{tabular}
    \caption{Table to test}
    \label{table:1}
    \end{table}
    \footnotetext[2]{Second footnote}
```

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Making Table

• cols : Defines the alignment and the borders of each column. It can have the following values:

1	left-justified column
с	centred column
r	right-justified column
p{'width'}	paragraph column with text vertically aligned at the top
m{'width'}	paragraph column with text vertically aligned in the middle (requires array package)
b{'width'}	paragraph column with text vertically aligned at the bottom (requires array package)
	vertical line
H	double vertical line
*{num}{form}	the format form is repeated num times; for example $\{3\}\{ 1\} $ is equal to $ 1 1 1 $

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Outline	Introduction 00 0000	Generating a document	Math Mode in LAT _E X
Importing Figure			

Inserting Figures

In the preamble, we need to $\space{graphicx}$

```
%Importing figures
\newpage
\begin{figure}[t]]
   \centering
   \includegraphics[scale=0.5]{../LaTeX}
   \caption{\LaTeX}
   \label{fig:1}
\end{figure}
```

```
Figure \ref{fig:1} shows a photograph of a gull.
```

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LATEXallows two writing modes for mathematical expressions: the inline mode and the display mode.

Inline:

The equation $E = mc^2$ was discovered in 1905.

Display: The equation

$$E = mc^2$$

was discovered in 1905.

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Outline

We can use:

```
The equation E = mc^2 was discovered in 1905.
The equation E = mc^2 was discovered in 1905.
OR
\begin{equation}
E = m^2
```

 $end{equation}$

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Some Mathematical Operations:

		Example			
Operation	Symbol	How it appears	What you write		
subscript	-	x_3	x_3		
superscript	^	x^3	x^3		
multiply	\times	$a \times b$	a\times b		
divide	\div	$a \div b$	a\div b		

The braces enclose an expression that can be used to define a more complex operand. For example, x_{a+b} is written as x_{a+b} and x^{a^2} is written as x^{a^2} . The order of subscripts and superscripts does not matter:

 $x_{a+b}^{c+d} \Rightarrow x_{a+b}^{c+d}$ $x^{c+d}_{a+b} \Rightarrow x_{a+b}^{c+d}$

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What it is	How it appears	What you write
empty set	Ø	\emptyset
intersection	Ω	\cap
union	U	\cup
set minus	\	\setminus
element in	E	\in
subset (proper)	С	\subset
subset or equal	\subseteq	\subseteq
superset (proper)	5	\supset
superset or equal	⊇	\supseteq

Preceding any symbol by **\not** puts the line through the symbol, as in the following examples:

A	A\not\subseteq			\Rightarrow	$A \not\subseteq B$
x'	not\in	A\cup	в	\Rightarrow	$x \notin A \cup B$
A\setminus	B\not\s	supset	B	⇒	$A \setminus B \not\supset B$

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Greek Letters:

To produce $\alpha - \beta = \Delta - \delta$, we can write: \alpha - \beta = \Delta -\delta

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List of Greek Letters:

αA	\alpha A	νN	\nu N
βB	\beta B	ξΞ	\xi\Xi
$\gamma\Gamma$	\gamma \Gamma	оО	o 0
$\delta \Delta$	\delta \Delta	$\pi \Pi$	\pi \Pi
$\epsilon \varepsilon E$	\epsilon \varepsilon E	$\rho \varrho P$	\rho\varrho P
ζZ	\zeta Z	$\sigma\Sigma$	\sigma \Sigma
ηH	\eta H	τT	\tau T
$\theta \vartheta \Theta$	\theta \vartheta \Theta	$v\Upsilon$	\upsilon \Upsilon
ιI	\iota I	$\phi \varphi \Phi$	\phi \varphi \Phi
κK	\kappa K	χX	\chi X
$\lambda\Lambda$	\lambda \Lambda	$\psi \Psi$	\psi \Psi
μM	\mu M	$\omega \Omega$	\omega \Omega

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Mathematical Operation Symbols:

Operation	How it appears	What you write
sum	\sum_{n}	\sum
	$\sum_{i=1}^{n} x_i$	\sum_{i=1}^n x_i
integral	S	\int
	$\int_a^b f(x)dx$	\int_a^b f(x)dx
parentheses	0	\left(\right)
	$\left(\frac{x}{1+y}\right)$	<pre>\left(\frac{x}{1+y} \right)</pre>
braces	0	\left\{ \right\}
	$\left\{\sum_{i} x_{i}\right\}$	<pre>\left\{\sum_i x_i \right\}</pre>
brackets	0	\left[\right]
	$\left[\int_0^\infty f(x)dx\right]$	<pre>\left[\int_0^\infty f(x)dx\right]</pre>

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Some examples: Variable size style:

$$\sqrt{rac{\prod_{n=1}^N \left(\sum_{i\in I_n} x_i^n
ight)}{\sqrt[3]{\sum_{i\in I_\infty} x_i}}}$$

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Display style:



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Logical Term	How it appears	What you write
existential quantifier	Э	\exists
universal quantifier	A	\forall
negation	7	lneg
disjunction	V	\vee
conjunction	^	\wedge
implication	\rightarrow	\rightarrow
	\Rightarrow	\Rightarrow
equivalence	⇔	\Leftrightarrow
	=	\equiv
such that	Э	\ni

 $(x \in A \Rightarrow x \in B) \Leftrightarrow (A \subseteq B).$

write \[(x\in A\Rightarrow x\in B) \Leftrightarrow (A\subseteq B). \]

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Other resources:

http://www.tablesgenerator.com/

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Other resources:

- http://www.tablesgenerator.com/
- https://www.sharelatex.com/learn/

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Other resources:

- http://www.tablesgenerator.com/
- https://www.sharelatex.com/learn/
- https://en.wikibooks.org/wiki/LaTeX

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Math Mode in LATEX

The End.

Thank You!!

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