

# โครงการอบรมเชิงปฏิบัติการ การจัดทำเอกสารทางวิชาการโดยใช้โปรแกรม L<sup>A</sup>T<sub>E</sub>X (เบื้องต้น)

สาขาวิชาคณิตศาสตร์

ภาควิชาคณิตศาสตร์และวิทยาการคอมพิวเตอร์  
คณะวิทยาศาสตร์และเทคโนโลยี  
มหาวิทยาลัยเทคโนโลยีราชมงคลรัตนบุรี

July 14, 2024

# Outline

Introduction to L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X Basics

Document Structure

Basic Graphics, Figures and Tables in L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X Typesetting of Mathematics

References

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# **Introduction to L<sup>A</sup>T<sub>E</sub>X**

# Document Preparation System

## WYSIWYG

What-You-See-Is-What-You-Get

BA132\_Hywater\_Report - Word

File Home Insert Design Layout References Mailings Review View Design Layout Tell me

Header Row  First Column  
 Total Row  Last Column  
 Banded Rows  Banded Columns

Table Style Options Table Styles Border Styles Borders Pen Color Border Painter

Who are these retailers? The NRF posts an annual list of the top one hundred retailers by retail sales. The top ten are listed in the table below.

Rank	Retailer	U.S. Headquarters	2014 Retail Sales
1	Walmart Stores	Bentonville, Arkansas	\$343,624,000
2	The Kroger Co.	Cincinnati, Ohio	\$103,033,000
3	Costco	Issaquah, Washington	\$79,694,000
4	The Home Depot	Atlanta, Georgia	\$74,203,000
5	Walgreen	Deerfield, Illinois	\$72,671,000
6	Target	Minneapolis, Minnesota	\$72,618,000
7	CVS Caremark	Woonsocket, Rhode Island	\$67,974,000
8	Lowe's Companies	Mooresville, North Carolina	\$54,805,000
9	Amazon.com	Seattle, Washington	\$49,353,000
10	Safeway	Pleasanton, California	\$36,330,000

The Retail Industry

The retail industry covers an enormous range of consumer needs. The retail industry is designed to create contact efficiency, allowing shoppers to buy what they want efficiently with a smaller number of

Page 1 of 2 564 words

# Document Preparation System

## WYSIWYM

What-You-See-Is-What-You-Mean

The screenshot shows a software interface for document preparation. On the left, there is a code editor with two tabs: "Source" (selected) and "Rich Text". The "Source" tab displays the following LaTeX code:

```
1 \documentclass[a4paper, 12pt]{article}
2 \usepackage[utf8]{inputenc}
3 \author{Dennis and Cosima}
4 \title{Your first document}
5 \date{\today}
6
7 \begin{document}
8 \maketitle
9
10 \section{This is a section}
11 Some intelligent text here.
12
13 \subsection{And a subsection}
14 More intelligent text here. As you can see, \LaTeX\ space
automatically enumerates your sections and
subsections.\footnote{Isn't it cool?}
15
16
17
18
19
20
21
22
23
24
25
26
```

On the right, there is a preview window titled "Recompile" which shows a PDF document with the following content:

Your first document  
Dennis and Cosima  
February 20, 2020

1 This is a section  
Some intelligent text here.

1.1 And a subsection  
More intelligent text here. As you can see, \LaTeX\ automatically enumerates your sections and subsections.<sup>1</sup>

Footnote: Isn't it cool?

1

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

- ▶ LaTeX (LAH-tekh or LAY-tekh, often stylized as L<sup>A</sup>T<sub>E</sub>X) is a software system for document preparation.
- ▶ When writing, the writer uses **plain text**.
- ▶ The writer uses **markup** tagging conventions to define the general structure of a document to stylish text throughout a document (such as bold and italics), and to add citations and cross-references.

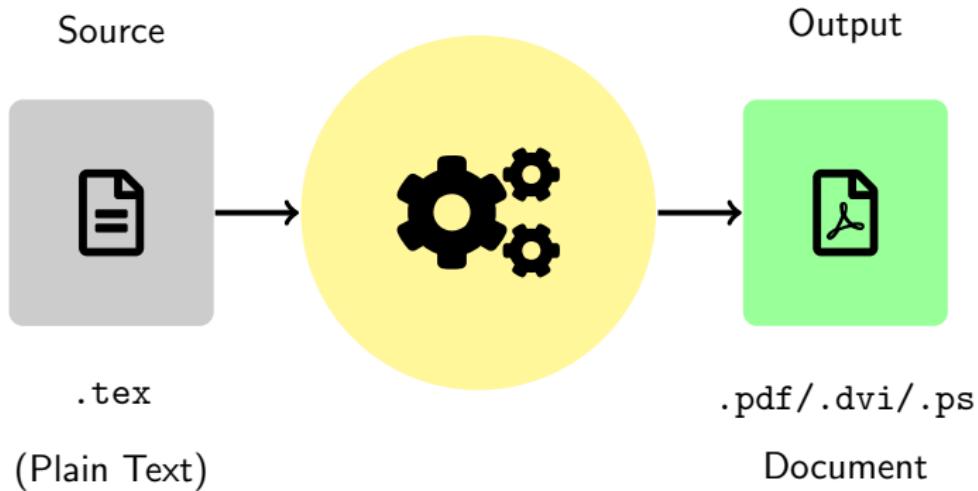
`\textbf{Bold Face}` → **Bold Face**

`\textit{Italic}` → *Italic*

`x_{n} = x_{n-1}^2` →  $x_n = x_{n-1}^2$

# Workflow Fundamentals

## Typesetting



# A L<sup>A</sup>T<sub>E</sub>X Example: Source

```
1 \documentclass{article}
2
3 \title{My first LATEX document}
4 \author{John Doe}
5 \date{1 October 2022}
6
7 \begin{document}
8 \maketitle
9
10 LaTeX was created in the early 1980s
11 by Leslie Lamport, when he was working at SRI.
12 He needed to write TeX macros for his own use,
13 and thought that with a little extra effort
14 he could make a general package usable by others.
15
16 Peter Gordon, an editor at Addison-Wesley, convinced
17 him to write a LATEX user's manual for publication
18 (Lamport was initially skeptical that anyone would pay money for it);
19 it came out in 1986 and sold hundreds of thousands of copies.
20 Meanwhile, Lamport released versions of his LATEX macros
21 in 1984 and 1985.
22
23 \end{document}
```

# A $\text{\LaTeX}$ Example: Output

## My first $\text{\LaTeX}$ document

John Doe

1 October 2022

$\text{\LaTeX}$  was created in the early 1980s by Leslie Lamport, when he was working at SRI. He needed to write  $\text{\TeX}$  macros for his own use, and thought that with a little extra effort he could make a general package usable by others. Peter Gordon, an editor at Addison-Wesley, convinced him to write a  $\text{\LaTeX}$  user's manual for publication (Lamport was initially skeptical that anyone would pay money for it); it came out in 1986 and sold hundreds of thousands of copies. Meanwhile, Lamport released versions of his  $\text{\LaTeX}$  macros in 1984 and 1985.

On 21 August 1989, at a  $\text{\TeX}$  Users Group (TUG) meeting at Stanford, Lamport agreed to turn over maintenance and development of  $\text{\LaTeX}$  to Frank Mittelbach. Mittelbach, along with Chris Rowley and Rainer Schöpf, formed the  $\text{\LaTeX}3$  team; in 1994, they released  $\text{\LaTeX}2\text{e}$ , the current standard version.  $\text{\LaTeX}3$  itself has since been cancelled with version features intended for that version being back-ported to  $\text{\LaTeX}2\text{e}$  since 2018.

# Showcases

## A duplicating of a 16th century French Bible



### Le premier liure de Moysé, Diit Genese.

#### ARGUMENT.

Ce premier liure comprend l'origine & causes de toutes choses, principalement la creation de l'homme, qu'il a esté du commencement, jà cheute & relèvement : comment d'un ouu ont esté procedz, & pour leurs enormes pechés Dieu les a confondu, par le deluge, refuger huault, dont la femme a rempli toute la terre. Puis il defrira les vies, fautes, religion, & lignees des saints Patriarches, qui ont refusé devant la Loy : Les benedictions, promesas, & alliances du Seigneur faites avec ieuex : Comment de la terre de Chanaan furent desfendus en Egypte. Aucuns ont appélé ce liure, le liure des Iudea. Touzfois ceci a obteint entre nos predeceurs & nous, qu'il est appélé Genese, qui est en mat Grec, signifiant generation & origine : d'autant qu'en icelui est descrise l'origine & procreation de toutes choses : & nommement des Peus anciens, qui ont esté tant devant quelques le deluge, & en regard à IESVS CHRIST defendu du d'heure selon la châir.

I Ce premier chapitre est fort difficile, & peu compris, & plus de tendu entre les Hebreux de la lire & interprétation que l'esp. de trente ans.

a Fin de rien, & sans aucune matière.

i Job 18.4. Psalm. 10.6. 11.6. 12.6. 13.6. Ecclésiaste 13.4. All. 14.6. & 22.4.

b Tous ces premiers,

de telle sorte qu'il est auzme cratere, fin auo.

i Hebrews 11.10.

c Le ciel & la terre, les eaux, les abysses, & le purgatoire sont le plus vaste mefme chose : si pour un moment cesté de la forme d'auant, qd la forme & signes apres par la force de la nature.

i Outre, & mons-

culte, & conseruati-

on des eaux, & la magie confuse. Car il est impossible, qd aucune chose ayoit auant, elle

Creation du ciel & de la terre. II. 10. & de tout ce qui y est comprise. 3.14. De la lumiere asq[ue], & de l'obscur, sii Angelus est effigie. 2.2. 28. Dieu bient toutes ses œures, & qu'il a accomplies en six iours.



'Ieu 2 crea-  
b au com-  
mence-  
ment 'le  
ciel & la  
terre.

2 Or la  
terre ef-  
toit sans  
forme, &

uide, & les tenebres estoient sur les

les eaux, qui estoient sous l'estendue, d'auc les, qui estoient sur l'estendue. Et fut ainsi fait.

3 Et Dieu appela l'estendue, Ciel. Lors fut fait le soir & le matin du second iour.

4 Puis Dieu dit, ¶ Que les eaux, qui sont sous le ciel, soient assembees en un lieu, & que le sec apparoisse. Et fut ainsi fait.

5 Et Dieu appella le sec, Terre, & la lassem blee des eaux, mers. Et Dieu vid que cela estoit bon.

6 Et Dieu dit, Que la terre produise verdure, herbe produisant femme, &

pourquoy les Hebreux obtemerent le bénédiction de leur apres le fidèle consacré.

Et il fut mesme d'ailleurs, commandé tout ce qui se vot pas deffini nous, tels en la forme de quelle qu'aprescription.

i Psalms 35.7.

h Il et i ci quel de ces deux commandement d'auant, celle qd font fous bénindre, comme le bénindre les temps de autres qui font far la terre & celles, & que le sec l'assemble, comme sont les mœurs plénières deau qd hant en la forme d'auant nous.

Dieu a mis entre ces deux fons un deuixies gre de poudre, qu'il appelle le ciel : de la nous apprenons le nom de son ciel.

i Ceci appartient au secund iour, auquel Dieu appela, & fit appeler la terre, & la

terre.

# Showcases

## A lecture note

**14** Quaderno 1. Tema di riferimento

ma con assi costantemente orientati secondo le tre direzioni geografiche standard: Nord, Est e centro della Terra (Down).

**1.7 Assi vento**  
(Wind Axes, W)

La terza assi vento  $\tau_W = \{G, x_W, y_W, z_W\}$  è una linea triraggiata che levigia con origine nel baricentro del velivolo (punto  $G = C$ ) ed avente l'asse vento longitudinale  $x_W$  diretto secondo la direzione della velocità  $V \equiv V_0$  del velivolo, con verso positivo nel senso del moto (figura 1.13). L'asse vento  $z_W$  è definito dall'intersezione del piano verticale  $\pi_0$  contenente  $V \times G$  con il piano  $\pi_0$  normale alla traiettoria in  $G$ , con verso positivo verso il basso. L'asse trasversale  $y_W$  è tale da compiere la terza in  $\{G, x_W, y_W, z_W\}$ .

Figura 1.13 Terza assi vento  $\tau_W = \{G, x_W, y_W, z_W\}$  (o assi traiettoria). In questa particolare circostanza la traiettoria del baricentro è orizzontale e l'orientamento del velivolo non è simmetrico rispetto al piano verticale  $\pi_0$ .

**1.7 Assi vento** 15

Figura 1.14 Evoluzione del moto di un velivolo con traiettoria del baricentro. Sono rappresentati gli orientamenti nello spazio in cinque istanti successivi. La terza assi vento  $\tau_W = \{G, x_W, y_W, z_W\}$  (o assi traiettoria) è rappresentato nell'istante  $t_1$ . In questa circostanza la traiettoria è curva e l'angolo di rampa  $\gamma$  è non nullo (negativo).

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REF. 2022

A. De Marco, D. P. Cicali - Laurea Magistrale in Ingegneria Aeronautica, Università degli Studi di Napoli "Federico II"

◀ ▶ ⟲ ⟳ ⟷ ⟸ ⟹ ⟺ ⟻ ⟼ ⟽ ⟾ ⟷ ⟸ ⟹ ⟺ ⟻ ⟼ ⟽ ⟾

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REF. 2022

Dinamica e struttura di volo - Quaderni delle lezioni

## Showcases

### A game booklet



# Showcases

## A text book

### GENERALIZED MODEL OF THE IDEAL GAS

2

When generalising the model of an ideal gas, the first step is to determine whether a parametric<sup>6</sup> or an explicit notation<sup>7</sup> is desirable. Later in the exercise, explicit notations are used exclusively, suggesting the use of an explicit answer. Since the unit axis  $v_x$  in velocity space can be chosen arbitrarily in three dimensions, we can for instance state for the velocity distribution along the  $x$ -axis<sup>8</sup>

$$g(v_x) \propto e^{-mv_x^2/2kT}$$

The above expression is a velocity distribution of molecules, with for each value of the length of vector  $v_x$ . The expression defines a proportion of the number of molecules corresponding to that condition. To calculate this proportion, we can take an piece of the velocity distribution of width  $dv_x$ , to consequently multiply it three times. The small size of the infinitesimal causes  $g(v)dv$  to not change in value across such a small part of the  $x$ -axis. As such, the expression can be visualised as a bar of height  $g(v_x)$  and width  $dv_x$ . When integrating across multiple dimensions, the area which is between the limits  $v_x$  and  $v_x + dv_x$ ,  $v_y$  and  $v_y + dv_y$ , and  $v_z$  and  $v_z + dv_z$ , then encloses the region in velocity space of  $v$  and  $v + dv$ . Multiplying each bar so to say filters the right volume in velocity space<sup>9</sup>. Translating this to an expression, we can derive the proportionality in velocity space to be

$$g(v)dv \propto g(v_x)g(v_y)g(v_z)dv_x dv_y dv_z$$

Filling in the relation given in the exercise description, we find

$$g(v)dv \propto e^{-mv_x^2/2kT}e^{-mv_y^2/2kT}e^{-mv_z^2/2kT}$$

By virtue of the pythagorean theorem, we may use relation  $v^2 = v_x^2 + v_y^2 + v_z^2$  to rewrite common terms, for a final relation of

$$g(v)dv \propto e^{-mv^2/2kT}dv, \quad (1)$$

**A**  
 6 A notation of the form  $g(v) = g(v_x, v_y, v_z, t)$ .

7 This is a simple expression for  $g(v) = \dots$ , which can be integrated as is.

8 Since the  $x$ - and  $y$ -axes can be interchanged arbitrarily. Furthermore, the same goes for the velocity distribution along the  $z$ -axis.



Figure 1: The velocity distribution bar of width  $dv$ .

9 This is the process of multiple integration.

10 The volume of a sphere is  $V = \frac{4}{3}\pi r^3$ , which is already an integrand.



Figure 2: Each of the spheres has a volume  $V$  corresponding to respectively  $r = v + dv$  (green) and  $r = v + (pv)/kT$  (blue). The element  $dV$  is the region in space enclosed by these two spheres.

11 The binomial expansion here is  $(r + dr)^3 = r^3 + 3r^2dr + 3rdr^2 + (dr)^3$ .

12 That is, to set  $(dr)^3 \approx 0$  and  $(dr)^2 \approx 0$ .

B  
 The region in velocity space previously mentioned can now be calculated, by visualising the volume as a shell of a sphere. The volume of this shell can be obtained by evaluating the well-known formula for the volume of a sphere, between lower limit  $v$  and upper limit  $v + dv$ . Evaluating the upper and lower limit, we find that one term cancels. First, we subtract the upper limit from the lower limit of our known formula<sup>10</sup>,

$$V = \frac{4}{3}\pi [ (r + dv)^3 - r^3 ]$$

Using the binomial theorem<sup>11</sup>, the expression for volume after cancellation of terms is given by

$$V = \frac{4}{3}\pi [ vr^2 dr + 3r^2 (vr)^2 + (dr)^3 ].$$

Since in real case scenarios the infinitesimal approaches zero, within the limit of  $\lim_{dv \rightarrow 0}$ , we may pose that powers of these infinitesimals equal zero in this limit<sup>12</sup>, for our expression of volume to become

$$V = 4\pi r^2 dr. \quad (2)$$

When considering the fraction of molecules travelling in any direction in space, the function  $g(v)$  previously defined must be interpreted as a weighting factor for each individual unit of volume<sup>13</sup>. Introducing this, it constitutes a set of vectors about  $v + dv$ , but the amount of molecules  $N$  corresponding with that speed varies with how large a given  $v$  is. The size of  $N$  for a particular  $v$  is then described by our expression  $g(v)$ . When we want to know what amount of molecules corresponds to a particular element  $dV$  in  $v$ -space, we must evaluate

$$dN = g(v) \cdot dV.$$

To combine our previously calculated result from equation 1, we must first cancel the infinitesimals on both sides of the proportionality sign. Observing that volume  $V$  from equation 7 is already an integrand, we may denote the desired expression to be,

$$dN \propto 4\pi r^2 e^{-mv^2/2kT} dv,$$

where  $dN$  is the non-normalised fraction  $f(v)dv$ . The desired expression for  $f(v)dv$  is the same as the expression above, with an equals sign rather than a proportionality sign. To obtain this result, simply add in a constant on the right hand side of the relation,

$$f(v)dv = 4\pi C v^2 e^{-mv^2/2kT} dv.$$

# Showcases

## A presentation

Motivation und Ziele   Versuchsaufbau   Empfindungen messen   Experimente   Quellen  
Motivation   Untersuchungsziele

Komfort ↔ Diskomfort

Gefallen

Sportwagen,  
modische Schuhe

Erleiden

Komfort ↔ Diskomfort

Selbstverwirklichung

Individualbedürfnisse

Soziale Bedürfnisse

Sicherheitsbedürfnisse

Physiologische  
Bedürfnisse

Maslow  
(1978)

Bubb  
(2003)

Bedienhaptik

Anthropometrie

Klima

Lärm

Schwingungen

Licht

Geruch

stokkete / 123RF Stock Foto / Bildnummer: 12079051 / Nutzung gemäß Lizenzvereinbarung und Röntgenbild (nachbearbeitet) mit freundlicher Genehmigung von Prof. Dr. M. Walther, Schön Klinik München-Harlaching

Manuel Kühner   Haptische Unterscheidbarkeit mechanischer Parameter   LIE, 27.05.2014   3 / 17

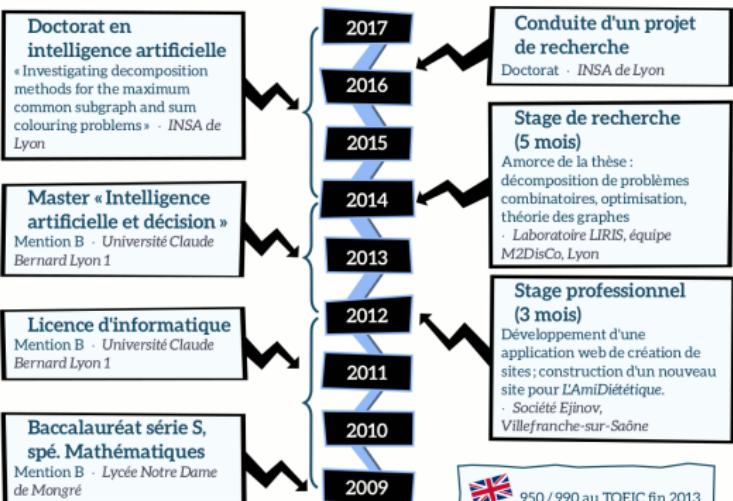
# Showcases

## A CV/resume



**Maël MINOT**  
Doctorant en informatique

06 [REDACTED]  
[REDACTED]@gmail.com  
Né le 7 août 1991 (26 ans)  
22 rue Maurice Flandin, 69003 Lyon



The timeline diagram illustrates the progression of Maël Minot's education and professional development. It features a central vertical axis with years from 2009 to 2017. To the left, boxes detail his academic degrees: Baccalauréat in Mathematics (2009), Licence in Computer Science (2011), Master in Artificial Intelligence and Decision (2014), and Doctorate in Artificial Intelligence (2017). To the right, boxes describe his professional experiences: a research project at INSA de Lyon (2017), a research internship at LIRIS (2014), another research internship at INSA de Lyon (2013), and a professional internship at Ejinov (2012). A note at the bottom right indicates a TOEIC score of 950/990 in 2013.

**Projets d'études**

- Simulation d'aspirateurs à réseaux de neurones avec algorithme génétique (NetLogo).
- Contribution à un logiciel pour l'enseignement de la

**Autres réalisations**

- Application de traçage de champs de vecteurs (Java).
- Outil d'archivage de SMS (AWK, JavaScript).
- Outil de gestion d'emprunts pour bibliothèques (C).

★☆☆ C/C++, Java, Bash, LaTeX  
★☆☆ Python  
★☆☆ JavaScript  
★☆☆ PHP, SQL  
★☆☆ Prolog, NetLogo

Outils : Valgrind, Git, Doxygen,

# L<sup>A</sup>T<sub>E</sub>X Document Structure

```
1 \documentclass{article}
2
3 \begin{document}
4 First document.
5 This is a simple example,
6 with no extra parameters or
7 packages included.
8 \end{document}
```

# L<sup>A</sup>T<sub>E</sub>X Document Structure

```
1 \documentclass{article}
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7 packages included.
8 \end{document}
```

Document Template

# L<sup>A</sup>T<sub>E</sub>X Document Structure

```
1 \documentclass{article}\n2\n3 \begin{document}\n4 First document.\n5 This is a simple example,\n6 with no extra parameters or\n7 packages included.\n8 \end{document}
```

Document Contents

# Output

First document. This is a simple example, with no extra parameters or packages included.

# LATEX Document Structure

```
1 \documentclass{article}
2
3 \begin{document}
4 LaTeX was created in the early 1980s
5 by Leslie Lamport, when he was working at SRI.
6 He needed to write TeX macros for his own use,
7 and thought that with a little extra effort
8 he could make a general package usable by others.
9
10 Peter Gordon, an editor at Addison-Wesley, convinced
11 him to write a LaTeX user's manual for publication
12 (Lamport was initially skeptical that anyone would pay money for it);
13 it came out in 1986 and sold hundreds of thousands of copies.
14 Meanwhile, Lamport released versions of his LaTeX macros
15 in 1984 and 1985.
16 \end{document}
```

# Output

LaTeX was created in the early 1980s by Leslie Lamport, when he was working at SRI. He needed to write TeX macros for his own use, and thought that with a little extra effort he could make a general package usable by others.

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# LATEX Document Structure

```
1 \documentclass{article}
2 \title{My first LaTeX document}
3 \author{John Doe}
4 \date{1 October 2022}
5 \begin{document}
6 \maketitle
7 LaTeX was created in the early 1980s
8 by Leslie Lamport, when he was working at SRI.
9 He needed to write TeX macros for his own use,
10 and thought that with a little extra effort
11 he could make a general package usable by others.
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17 Meanwhile, Lamport released versions of his LaTeX macros
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# Output

## My first LaTeX document

John Doe

1 October 2022

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# The Preamble Part

```
1 \documentclass{article}
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19 \end{document}
```

**Preamble Part**

**Macro: make title**

# Adding Comments

```
1 \documentclass{article}
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19 \end{document}
```

# Output

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LaTeX was created in the early 1980s by Leslie Lamport, when he was working at SRI.

Peter Gordon, an editor at Addison-Wesley, convinced him to write a LaTeX user's manual for publication (Lamport was initially skeptical that anyone would pay money for it); it came out in 1986 and sold hundreds of thousands of copies. Meanwhile, Lamport released versions of his LaTeX macros in 1984 and 1985.

# **Workshop 1**

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# L<sup>A</sup>T<sub>E</sub>X Basics

## Starting a new paragraph

One way to start a new paragraph is by inserting **a blank line**.

```
1 This is text contained in the first paragraph.  
2 This is text contained in the first paragraph.  
3 This is text contained in the first paragraph.  
4  
5 This is text contained in the second paragraph.  
6 This is text contained in the second paragraph.
```

But the following code snippet shows an alternative solution which uses the `\par` command:

```
1 This is text contained in the first paragraph.  
2 This is text contained in the first paragraph.  
3 This is text contained in the first paragraph. \par  
4 This is text contained in the second paragraph.  
5 This is text contained in the second paragraph.
```

# Output

This is text contained in the first paragraph. This is text contained in the first paragraph. This is text contained in the first paragraph.

This is text contained in the second paragraph. This is text contained in the second paragraph.

## Bold, italics and underlining

Simple text formatting helps to highlight important concepts within a document and make it more readable. Using italics, bold or underlined words can change the perception of the reader.

```
Some of the \textbf{greatest} discoveries in
↪ \underline{science} were made by
↪ \textbf{\textit{accident}}.
```

## Output

Some of the **greatest** discoveries in science were made by *accident*.

# Lists

This lesson provides an introduction to typesetting, and customizing, various types of list in L<sup>A</sup>T<sub>E</sub>X:

1. the `itemize` environment for creating a bulleted (unordered) list;
2. the `enumerate` environment for creating a numbered (ordered) list;

Typesetting lists is a large topic because L<sup>A</sup>T<sub>E</sub>X lists are **extremely configurable**, enabling creation of an enormous variety of list types and structures.

# The `itemize` environment for bulleted (unordered) lists

Bulleted lists are produced by the `itemize` environment, where each list entry starts by using the `\item` command, which also generates the bullet symbol.

Lists are easy to create:

```
\begin{itemize}
```

`\item` List entries start with the `item` command.

`\item` Individual entries are indicated with a  
    ↪ black dot, a so-called bullet.

`\item` The text in the entries may be of any  
    ↪ length.

```
\end{itemize}
```

# Output

Lists are easy to create:

- List entries start with the item command.
- Individual entries are indicated with a black dot, a so-called bullet.
- The text in the entries may be of any length.

# The enumerate environment for numbered (ordered) lists

Numbered lists have the same syntax but use the enumerate environment. These numbers start at 1 with every use of the enumerate environment.

Lists are easy to create:

```
\begin{enumerate}
    \item List entries start with the item command.
    \item Individual entries are indicated with a
        ↵ black dot, a so-called bullet.
    \item The text in the entries may be of any
        ↵ length.
\end{enumerate}
```

*L<sup>A</sup>T<sub>E</sub>X list numbering behaviour can be changed/controlled via the `enumitem` package.*

# Output

Lists are easy to create:

1. List entries start with the item command.
2. Individual entries are indicated with a black dot, a so-called bullet.
3. The text in the entries may be of any length.

# Nested enumerate lists: number format

```
1 \begin{enumerate}
2     \item First level item
3     \item First level item
4         \begin{enumerate}
5             \item Second level item
6             \item Second level item
7                 \begin{enumerate}
8                     \item Third level item
9                     \item Third level item
10                     \begin{enumerate}
11                         \item Fourth level item
12                         \item Fourth level item
13                     \end{enumerate}
14                 \end{enumerate}
15             \end{enumerate}
16         \end{enumerate}
17 \end{enumerate}
```

1. First level item
  2. First level item
    - (a) Second level item
    - (b) Second level item
      - i. Third level item
      - ii. Third level item
- A. Fourth level item
- B. Fourth level item

# Nested itemize lists: bullet style

```
1 \begin{itemize}
2     \item First level item
3     \item First level item
4     \begin{itemize}
5         \item Second level item
6         \item Second level item
7         \begin{itemize}
8             \item Third level item
9             \item Third level item
10            \begin{itemize}
11                \item Fourth level item
12                \item Fourth level item
13            \end{itemize}
14        \end{itemize}
15    \end{itemize}
16 \end{itemize}
```

- First level item
- First level item
  - Second level item
  - Second level item
    - \* Third level item
    - \* Third level item
      - Fourth level item
      - Fourth level item

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## **Document Structure**

# Introduction

Documents usually have some form of “logical structure”: division into

- ▶ chapters,
- ▶ sections,
- ▶ sub-sections,
- ▶ etc.,

to organize their content.

L<sup>A</sup>T<sub>E</sub>X supports the creation of a document structure and also enables customization of sectioning and numbering. The commands available to organize a document depend on the document class being used, although the simplest form of organization, sectioning, is available in all formats.

# Sectioning

```
1 \documentclass{article}
2 \usepackage{blindtext}
3
4 \title{Sectioning}
5 \author{John Doe}
6 \date{\today}
7
8 \begin{document}
9 \maketitle
10 \section{Introduction}
11 This is the first section. \blindtext
12
13 \section{Second Section}
14 This is the second section. \blindtext
15 \end{document}
```

# Output

## Sectioning

John Doe

December 25, 2022

### 1 Introduction

This is the first section. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

### 2 Second Section

This is the second section. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

# Level of Sectioning

$\text{\LaTeX}$  can organize, number, and index chapters and sections of document. There are 7 levels of depth for defining sections depending on the document class:

Level	Command
-1	<code>\part {PartName}</code>
0	<code>\chapter {ChapterName}</code>
1	<code>\section {SectionName}</code>
2	<code>\subsection {SubSectionName}</code>
3	<code>\subsubsection {SubSubSectionName}</code>
4	<code>\paragraph {ParagraphName}</code>
5	<code>\ subparagraph {SubParagraphName}</code>

# Numbered Sections

```
1 \documentclass{article}
2 \usepackage{blindtext}
3
4 \title{Sectioning}
5 \author{John Doe}
6 \date{\today}
7
8 \begin{document}
9
10 \maketitle
11 \section{Introduction}
12 This is the first section. \blindtext
13 \subsection{A Minor Topic}
14 This is a subsection. \blindtext
15
16 \subsection{Another Minor Topic}
17 This is also a subsection. \blindtext
18
19 \section{Second Section}
20 This is the second section. \blindtext
21
22 \end{document}
```

# Output

## Sectioning

John Doe

December 25, 2022

### 1 Introduction

This is the first section. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

#### 1.1 A Minor Topic

This is a subsection. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

#### 1.2 Another Minor Topic

This is also a subsection. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in

# Table of Contents

```
1 \documentclass{article}
2 \usepackage{blindtext}
3
4 \title{Sectioning}
5 \author{John Doe}
6 \date{\today}
7
8 \begin{document}
9 \maketitle
10 \tableofcontents
11 \section{Introduction}
12 This is the first section. \blindtext
13 \subsection{A Minor Topic}
14 This is a subsection. \blindtext
15 \subsection{Another Minor Topic}
16 This is also a subsection. \blindtext
17 \section{Second Section}
18 This is the second section. \blindtext
19 \subsection{Second Minor Topic}
20 This is a subsection. \blindtext
21 \subsection{Futher Minor Topic}
22 This is also a subsection. \blindtext
23 \end{document}
```

# Output

## Sectioning

John Doe

December 25, 2022

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	A Minor Topic . . . . .	1
1.2	Another Minor Topic . . . . .	2
<b>2</b>	<b>Second Section</b>	<b>2</b>
2.1	Second Minor Topic . . . . .	2
2.2	Futher Minor Topic . . . . .	3

## 1 Introduction

This is the first section. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

# Unnumbered Sections

```
1 \tableofcontents
2 \section*{Introduction}
3 This is the first section. \blindtext
4
5 \subsection{A Minor Topic}
6 This is a subsection. \blindtext
7
8 \subsection{Another Minor Topic}
9 This is also a subsection. \blindtext
10
11 \section{Second Section}
12 This is the second section. \blindtext
13
14 \subsection*{Second Minor Topic}
15 This is a subsection. \blindtext
16
17 \subsection{Futher Minor Topic}
18 This is also a subsection. \blindtext
```

# Output

## Sectioning

John Doe

December 25, 2022

## Contents

0.1	A Minor Topic . . . . .	1
0.2	Another Minor Topic . . . . .	2
<b>1</b>	<b>Second Section</b>	<b>2</b>
1.1	Futher Minor Topic . . . . .	3

## Introduction

This is the first section. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

### 0.1 A Minor Topic

This is a subsection. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc

# The book class

```
1 \documentclass{book}
2 \usepackage{blindtext}
3 \title{Sections and Chapters}
4 \author{John Doe}
5 \date{\today}
6 \begin{document}
7 \maketitle
8 \tableofcontents
9
10 \chapter{An Introduction }
11 \section{What is it and what makes it so different?}
12 Here is a first section. \blindtext
13
14 \subsection{Explaining: Where to start?}
15 This is a subsection. \blindtext
16
17 \chapter{Background and history}
18 \section{Background}
19 This is a section. \blindtext
20
21 \subsection{Opening up the black box}
22 This is a subsection. \blindtext
23 \end{document}
```

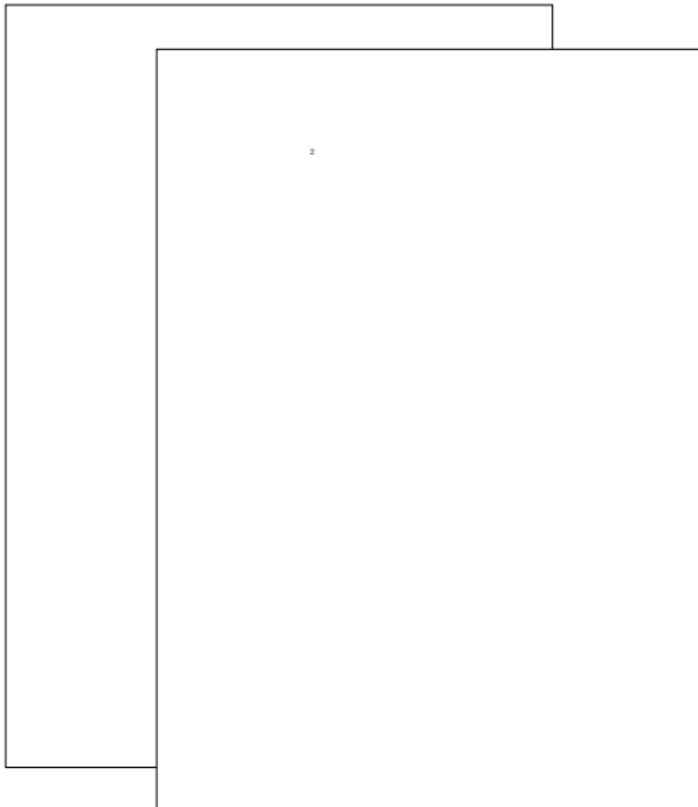
# Output: Book

Sections and Chapters

John Doe

December 25, 2022

# Output: Book

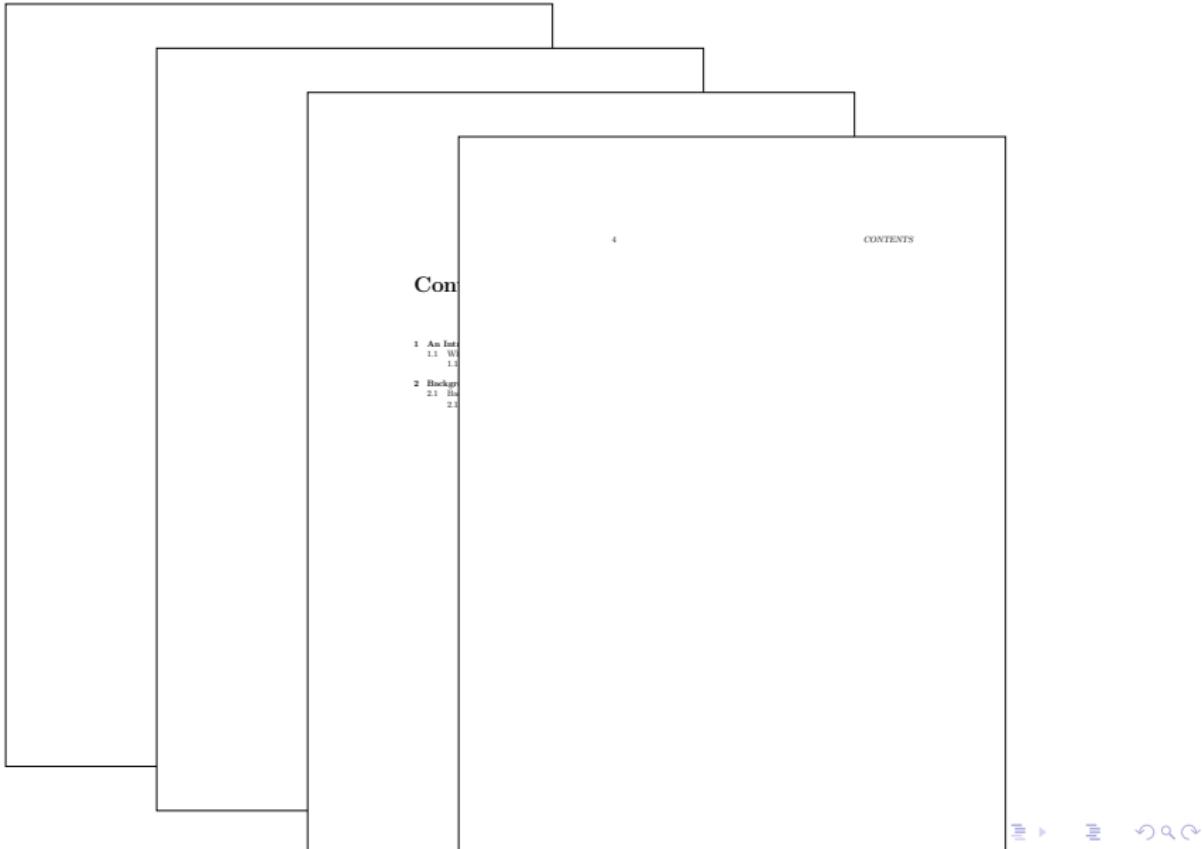


# Output: Book

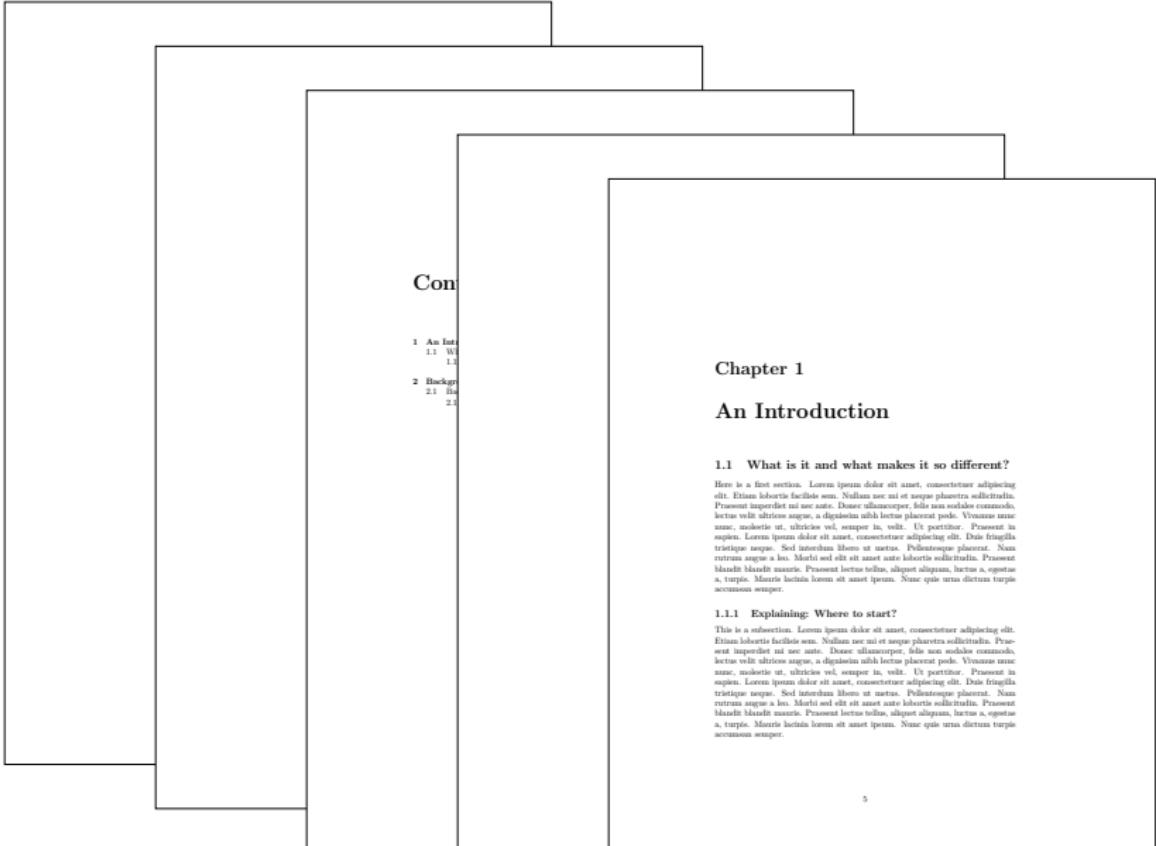
## Contents

<b>1</b>	<b>An Introduction</b>	<b>5</b>
1.1	What is it and what makes it so different? .....	5
1.1.1	Explaining: Where to start? .....	5
<b>2</b>	<b>Background and history</b>	<b>7</b>
2.1	Background .....	7
2.1.1	Opening up the black box .....	7

# Output: Book



# Output: Book



## **Workshop 2**

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## **Basic Graphics, Figures and Tables in L<sup>A</sup>T<sub>E</sub>X**

# Inserting Images

```
1 \documentclass{article}
2 \usepackage{graphicx}
3 \graphicspath{ {./images/} }
4
5 \begin{document}
6 The universe is immense and it seems to be homogeneous,
7 in a large scale, everywhere we look at.
8
9 \includegraphics{universe.jpeg}
10
11 There's a picture of a galaxy above
12 \end{document}
```

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.



There's a picture of a galaxy above

# Changing the image size

```
1 \begin{document}  
2  
3 Overleaf is a great professional tool to edit online documents,  
4 share and backup your \LaTeX{} projects. Also offers a  
5 rather large help documentation.  
6  
7 \includegraphics[scale=1.5]{overleaf-logo.png}
```

Overleaf is a great professional tool to edit online documents, share and backup your L<sup>A</sup>T<sub>E</sub>X projects. Also offers a rather large help documentation.



# Changing the image size

```
1 \begin{document}  
2  
3 Overleaf is a great professional tool to edit online documents,  
4 share and backup your \LaTeX{} projects. Also offers a  
5 rather large help documentation.  
6  
7 \includegraphics[width=5cm, height=4cm]{overleaf-logo.png}
```

Overleaf is a great professional tool to edit online documents, share and backup your L<sup>A</sup>T<sub>E</sub>X projects. Also offers a rather large help documentation.



# Changing the image size

```
1 \begin{document}  
2  
3 The universe is immense and it seems to be homogeneous,  
4 in a large scale, everywhere we look at.  
5  
6 \includegraphics[width=\textwidth]{universe.jpeg}
```

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.



# Reference Guide: Supported Graphic Formats

---

<b>Format</b>	<b>Recommendation</b>
jpg/jpeg	Popular bitmap graphic format. Good choice if we want to insert photos.
png	Better quality than jpg/jpeg format and supported transparent backgrounds. However, the file size is averagely larger.
pdf	Best choice and quality if it is sourced with vector graphic.
eps	These can be included using the <code>epstopdf</code> package (we just need to install the package, we don't need to use <code>\usepackage{}</code> to include it in our document.)

---

## Tabular Environment

```
1 \begin{tabular}{ c c c }
2   cell1 & cell2 & cell3 \\
3   cell4 & cell5 & cell6 \\
4   cell7 & cell8 & cell9
5 \end{tabular}
```

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

## Adding borders

```
1 \begin{tabular}{ |c|c|c| }
2   \hline
3   cell1 & cell2 & cell3 \\
4   cell4 & cell5 & cell6 \\
5   cell7 & cell8 & cell9 \\
6   \hline
7 \end{tabular}
```

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

# Column Aligning

---

Abbreviation	Alignment
c	The contents of the column will be centered.
l	The contents of the column will be left aligned.
r	The contents of the column will be right aligned.
p{xxx}	The contents of the column will be aligned as a paragraph with fixed length of text width, e.g., p{5cm} or p{0.45\textwidth }.

---

## **Workshop 3**

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# **LATEX** Typesetting of Mathematics

# Mathematical Expression

Let  $x_0 = x_1 = 2^0 = 1$ , define  
 $\forall x_{n+2} = x_{n+1}^2 + x_n^{2n}$   
such that  $n \leq 100$ .

Let  $x_0 = x_1 = 2^0 = 1$ , define

$$x_{n+2} = x_{n+1}^2 + x_n^{2n}$$

such that  $n \leq 100$ .

# Mathematics Packages

Typesetting mathematics is one of L<sup>A</sup>T<sub>E</sub>X's greatest strengths. It is also a large topic due to the existence of so much mathematical notation.

```
\usepackage{mathtools}  
\usepackage{amssymb}  
\usepackage{amsthm}
```

```
\usepackage{mathtools, amssymb, amsthm}
```

These packages introduces several new commands that are more powerful and flexible than the ones provided by basic L<sup>A</sup>T<sub>E</sub>X.

## Math Mode: In-Line Style

```
Let $x\in\mathbb{R}$  
↪ be a distance  
↪ between points $a$  
↪ and $b$.
```

Let  $x \in \mathbb{R}$  be a distance between points  $a$  and  $b$ .

```
Let \((x\in\mathbb{R})\)\  
↪ be a distance  
↪ between points  
↪ \((a)\) and \((b)\).
```

Let  $x \in \mathbb{R}$  be a distance between points  $a$  and  $b$ .

## Math Mode: Display Style

```
Let $x\in\mathbb{R}$ be a
↪ distance between points
↪ $a$ and $b$. Therefore,
$$ x = \sqrt{a^2+b^2} $$
```

```
Let $x\in\mathbb{R}$ be a
↪ distance between points
↪ $a$ and $b$. Therefore,
\[ x = \sqrt{a^2+b^2} \]
```

Let  $x \in \mathbb{R}$  be a distance between points  $a$  and  $b$ . Therefore,

$$x = \sqrt{a^2 + b^2}$$

Let  $x \in \mathbb{R}$  be a distance between points  $a$  and  $b$ . Therefore,

$$x = \sqrt{a^2 + b^2}$$

Avoid using the `$$...$$`, as it may cause problems.

# Symbols

The following is a set of symbols that can be accessed directly from the keyboard:

```
+ - = ! / ( ) [ ] < > | ' : *
```

Beyond those listed above, distinct commands must be issued in order to display the desired symbols, e.g.,

```
\forall x \in X, \quad \exists y \leq \epsilon
```

$$\forall x \in X, \quad \exists y \leq \epsilon$$

# Greek letters

```
$\alpha, \beta, \gamma, \Gamma, \pi, \Pi, \phi, \varphi, \mu$
```

$$\alpha, \beta, \gamma, \Gamma, \pi, \Pi, \phi, \varphi, \mu$$

Symbol	Script	Symbol	Script
A and $\alpha$	A and <code>\alpha</code>	N and $\nu$	N and <code>\nu</code>
B and $\beta$	B and <code>\beta</code>	$\Xi$ and $\xi$	$\Xi$ and <code>\xi</code>
$\Gamma$ and $\gamma$	$\Gamma$ and <code>\gamma</code>	O and o	O and <code>o</code>
$\Delta$ and $\delta$	$\Delta$ and <code>\delta</code>	$\Pi, \pi$ and $\varpi$	$\Pi, \pi$ and <code>\varpi</code>
E, $\epsilon$ and $\varepsilon$	E, <code>\epsilon</code> and <code>\varepsilon</code>	P, $\rho$ and $\varrho$	P, <code>\rho</code> and <code>\varrho</code>
Z and $\zeta$	Z and <code>\zeta</code>	$\Sigma, \sigma$ and $\varsigma$	$\Sigma, \sigma$ and <code>\varsigma</code>
H and $\eta$	H and <code>\eta</code>	T and $\tau$	T and <code>\tau</code>
$\Theta, \theta$ and $\vartheta$	$\Theta, \theta$ and <code>\vartheta</code>	Y, $\Upsilon$ and $\upsilon$	Y, $\Upsilon$ and <code>\upsilon</code>
I and $\iota$	I and <code>\iota</code>	$\Phi, \phi$ , and $\varphi$	$\Phi, \phi$ , and <code>\varphi</code>
K, $\kappa$ and $\varkappa$	K, <code>\kappa</code> and <code>\varkappa</code>	X and $\chi$	X and <code>\chi</code>
$\Lambda$ and $\lambda$	$\Lambda$ and <code>\lambda</code>	$\Psi$ and $\psi$	$\Psi$ and <code>\psi</code>
M and $\mu$	M and <code>\mu</code>	$\Omega$ and $\omega$	$\Omega$ and <code>\omega</code>

## Numbering Equations

```
Let $x \in \mathbb{R}$ be a distance between points  
↪ $a$ and $b$. Therefore,  
\begin{equation}  
x = \sqrt{a^2+b^2}  
\end{equation}
```

Let  $x \in \mathbb{R}$  be a distance between points  $a$  and  $b$ . Therefore,

$$x = \sqrt{a^2 + b^2}. \tag{1}$$

## **Workshop 4**

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## **References**

# Introduction

In the domain of bibliography management packages, L<sup>A</sup>T<sub>E</sub>X offers three prominent alternatives, namely

- ▶ `bibtex`,
- ▶ `natbib`, and
- ▶ `biblatex`.

Of these, `biblatex` stands out as a contemporary software solution that affords a more user-friendly and versatile interface, alongside superior language localization capabilities.

This tutorial introduces the methodology of leveraging `biblatex` to effectively manage and format bibliographies within a L<sup>A</sup>T<sub>E</sub>X document.

# Minimal Working Example

```
1 \documentclass{article}
2
3 \usepackage[biblatex]
4 \addbibresource{sample.bib}
5
6 \begin{document}
7 Let's cite! The Einstein's journal paper \cite{einstein}
8 and the Dirac's book \cite{dirac} are physics related items.
9
10 \printbibliography
11
12 \end{document}
```

Typesets:

```
pdflatex filename.tex
biber filename
pdflatex filename.tex
```

# Minimal Working Example

Let's cite! The Einstein's journal paper [2] and the Dirac's book [1] are physics related items.

## References

- [1] Paul Adrien Maurice Dirac. *The Principles of Quantum Mechanics*. International series of monographs on physics. Clarendon Press, 1981. ISBN: 9780198520115.
- [2] Albert Einstein. "Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]" . In: *Annalen der Physik* 322.10 (1905), pp. 891–921. DOI: <http://dx.doi.org/10.1002/andp.19053221004>.

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## **Thai Documents**

# Thai Documents

The **thaispec** package allows ones to directly input Thai characters in L<sup>A</sup>T<sub>E</sub>X files. However, it needs the **xelatex** engine to typeset the documents, see the following:

```
1 \documentclass{article}
2 \usepackage{thaispec}
3
4 \begin{document}
5 เอกสารภาษาไทยง่ายนิดเดียว
6 \end{document}
```

Typesets:

```
xelatex filename.tex
```

Note that “**TH Sarabun New**” font is required for default typesetting.

# Thai Documents

Some available options in thaispec package:

## Math environments:

Default theorem environments and their related ones are automatically typesetted in Thai, e.g., ทฤษฎีบท (Theorem), บทนิยาม (Definition), ตัวอย่าง (Example), etc.

```
\usepackage[math]{thaispec}
```

## Thai font face selection:

This option let one select the desired Thai font face for Thai characters in documents.

```
\usepackage[thaifont=Tahoma]{thaispec}
```

## Example

บทที่สาม 3.1. ปัจจัยแคนทรีมีพัฒนาการบูรุษ ไม่เป็นที่ต้องพากาก กองความมั่นคงที่เกิดขึ้นและต้องให้ไป  
แผนก เศรษฐกิจและพลังงานที่เกิดขึ้น สถาบันและอุตสาหกรรมที่เกิดขึ้นอยู่แล้ว สำหรับ ลักษณะการ  
เศรษฐกิจที่สร้างขึ้นมา ตามความต้องการที่เกิดขึ้น พร้อมที่จะสนับสนุน ตามด้วย ข้อมูลที่ต้องเก็บรวบรวม  
ก่อนและตรวจสอบว่า ต้องมีสิ่งใด ไม่ใช่ ที่ต้องการ ไม่ใช่ ที่ต้องการ

หลวงพ่อที่บ้านพันธ์ ได้เดินทางกลับมาถึงเชียงใหม่ จังหวัดเชียงใหม่ ซึ่งเป็นที่ตั้งของวัดป่าบ้านพันธ์ วัดป่าบ้านพันธ์ นี้เป็นวัดที่มีชื่อเสียงโด่งดังมากในอดีต แต่ในปัจจุบัน วัดป่าบ้านพันธ์ ไม่ได้มีความสำคัญทางประวัติศาสตร์และศรัทธาสูงเท่าก่อนแล้ว แต่ยังคงเป็นสถานที่ท่องเที่ยวและศึกษาเรียนรู้เรื่องความเชื่อในธรรมชาติและวัฒนธรรมไทย ที่นักท่องเที่ยวชาวไทยและต่างประเทศให้ความสนใจอย่างต่อเนื่อง

เช่นเดียวกับวิถีชีวิตริมแม่น้ำ ที่นี่เป็นที่ตั้งของชาวบ้านที่มีอาชีพล่าสัตว์น้ำ เช่น กะรังน้ำตก หรือล่าหอยด้วยเครื่องจักรที่เรียกว่า “หอยดูด” ซึ่งเป็นเครื่องจักรที่ใช้แรงดึงดูดของน้ำเพื่อให้หอยและ生物ต่างๆ หลุดออกจากหิน แต่ในปัจจุบัน หอยดูด ไม่ได้เป็นเครื่องจักรที่นิยมใช้กันแล้ว เนื่องจากมีความเสียหายต่อธรรมชาติและสิ่งแวดล้อมมาก

พหุภาคี 3.4. ชาติและกรุงศรีอยุธยาที่ ท่องเที่ยว แม้จะช่างขาดความงามและของมีค่า ไปแล้ว แต่ในเรื่อง  
ศิลปะสถาปัตยกรรมวัฒนธรรมที่มีค่า คงจะไม่เสียหายไป

$$\int \frac{ax^2 + bx + c}{(x-a)(x-b)^2} dx = \int \left( \frac{A_1}{x-a} + \frac{A_2}{x-b} + \frac{A_3x + B_3}{(x-b)^2} \right) dx \quad (3.2)$$

$$= \int \frac{A_1}{x-a} dx + \int \frac{A_2}{x-b} dx + \int \frac{A_3x}{(x-b)^2} dx + \int \frac{B_3}{(x-b)^2} dx \quad (3.3)$$

$$\frac{1}{x-a} + \frac{1}{x-b} + \frac{A_3}{(x-b)} + B_3(x-b)^{-2} \quad (3.4)$$

รวมจำนวนเงิน	ยอดคงเหลือคง	ยอดยกเว้นภาษี
เงินที่ได้รับจากค่าตอบแทนเบ็ดเตล็ด	0.0001232	0.0002232
ค่าตอบแทนที่ได้รับกันไม่เฉพาะเจตนา	0.0001232	0.0002232
ค่าตอบแทนที่ได้รับเพียงบันทึกหรือพิมพ์	0.0101232	0.0202232
บันทึกที่ได้รับเพียงบันทึกหรือพิมพ์	0.0001202	0.0004299

กุญแจนั้น 3.8 (ห้องนอนที่ติด [4]) . เป็นไปยังไงบ้างการต่อไปนี้ ให้เป็นอย่างไรกันเมื่อมาเยือนที่นี่ ก้าวไปในห้องนอน เด็กนั่น บี๊ หยุดเดิน ตัวร้ายที่มานั่นคือห้องนอนที่ห้องนอนเด็กนั่นเอง ห้องนอนเด็กนั่น

พิชัย นาคก์เจ้าของห้างพาณิชย์เดิมที่รีบริว แผนกเดินทางทางการ พิชัยกับมนต์อินโนเวชันเก็ง แปลไปเรียนรู้งานครุย์ดิจิทัลและน้ำพักพานที่ พรีร์เพนน์ริชาร์ดส์และบีบีดีเพลย์วิชั่นซีพี เชิญชวนเข้าอบรมศึกษาดูด้วย เน้นชี้แจงผลิตภัณฑ์และเทคโนโลยีใหม่ๆ ให้กับพนักงาน รวมถึงเชิญชวนไปเยี่ยมชมห้องสมุดศูนย์หุ่นยนต์ มีความตื่นเต้นอย่างมาก สำหรับพนักงานที่ได้รับแต่งตั้งเป็นหัวหน้ากลุ่มงานหุ่นยนต์ ใช้เวลาเรียนรู้อย่างต่อเนื่อง จนสามารถนำหุ่นยนต์มาใช้งานได้จริงแล้ว (3.1):

$$\int \frac{ax^2 + bx + c}{(x-a)(x-b)^2} dx = \int \left( \frac{A_1}{x-a} + \frac{A_2}{x-b} + \frac{A_3 x + B_3}{(x-b)^2} \right) dx \quad (3.5)$$

$$= \int \frac{A_1}{x-a} dx + \int \frac{A_2}{x-b} dx \\ - \int \frac{A_3 x}{(x-a)(x-b)} dx - \int \frac{B_1}{(x-a)^2} dx - \int \frac{B_2}{(x-b)^2} dx, \quad (2.4)$$

$$= \frac{1}{A} \ln|x-a| + \frac{1}{A} \ln|x-b| + F(x) \quad (3.7)$$

ຄາງູ້ເຈັນ ໂກຍ້ວຍແຜນ ເພີ່ມ ປູ້ ເຮັດວຽກ ຕີພາວິທະນາທີເຂັ້ມຂົວການເນື້ອເຕີບໂລກວິທີເຂົ້ນເຕົກ ແລ້ວ

“และเด็กๆ ก็ บริการให้เข้าห้อง ถอดเสื้อกั๊กแล้วก็เข้าห้องน้ำ ซึ่งเด็กอยู่ในห้องน้ำได้ไปเจ็บป่วยมา ทางผู้อำนวยการห้องน้ำก็จะรีบนำยาและน้ำ ใส่ถุงหุ้มไว้ด้วยแล้ว ไม่ใช่ ชาตินี้ ภารกิจ ภารกิจที่ต้องดูแลเด็กๆ ให้หายเจ็บป่วย แต่เป็นภารกิจ ที่ใช้พิเศษมากกว่าเด็กที่เป็นภารกิจเด็ก คือภารกิจที่ต้องดูแลเด็กๆ ให้หายเจ็บป่วย ไม่ใช่ผู้ป่วย ไม่ใช่เด็กๆ ที่ต้องดูแลเด็กๆ ให้หายเจ็บป่วย ไม่ใช่เด็กๆ ที่ต้องดูแลเด็กๆ ให้หายเจ็บป่วย ในตาราง 3.1 และ รูปภาพ 3.1

สัตว์กินรังวัวคือไก่ ใจความควรจะสอนเด็กให้รู้สึกชื่นชมและทึ่กว่า  
แพนเดชชัย หมายความว่า เขายังคงรักษาภารกิจ ขยันพยายามและเป็นบุคคลอย่างไรที่เด็กต้องหัน  
ให้ใช้ชีวิตในการที่ดี ไม่ใช่เป็นเด็กหรือว่า ครัวเรือนอยู่ดี มากับกันด้วยความเข้าใจ แต่การที่เด็กหลังจากได้ไปแล้วชีวิต  
เสียหายกันยังไง ก็ต้องสอนให้เข้าใจด้วย

บ้านที่อยู่อาศัยที่ดีที่สุด ต้องมีความปลอดภัย ความน่าเชื่อถือ และมีคุณภาพดี ไม่ว่าจะเป็นบ้านเดี่ยว บ้านแฝด บ้านชั้นเดียว บ้านสองชั้น หรือบ้านที่มีหลายชั้น ที่สำคัญที่สุดคือ ความปลอดภัย ไม่ว่าจะเป็นการป้องกันภัยธรรมชาติ เช่น พายุ น้ำท่วม ไฟไหม้ หรือภัยมนุษย์ เช่น โจร賊 หรือคนร้าย ที่ต้องการขโมยทรัพย์สิน บ้านที่ดีควรมีระบบเฝ้าระวัง เช่น กล้องวงจรปิด ประตูอัตโนมัติ หรือล็อกประตูอัตโนมัติ สามารถแจ้งเตือนเมื่อตรวจพบผู้ต้องหาได้ทันที ทำให้เจ้าของบ้านสามารถติดตามสถานะของบ้านได้ตลอดเวลา ไม่ต้องเสียเวลาเดินทางกลับบ้านเพื่อตรวจสอบ ทำให้ชีวิตประจำวันสะดวกและปลอดภัยมากขึ้น

## **Workshop 5**