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# ISGS L<sup>A</sup>T<sub>E</sub>X Beginner's Workshop 2016

## Session 1 – Basics

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# 1. Introduction

# Introduction – T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X

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Some facts about T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X (see [2]):

- T<sub>E</sub>Xa is markup and programming language by Donald Knuth
- Knuth started the development of T<sub>E</sub>X in 1977
- T<sub>E</sub>X is extremely stable
- L<sup>A</sup>T<sub>E</sub>X can be understood as popular macro of T<sub>E</sub>X
- 'pronounced either "Lah-tech" or "Lay-tech" [2]



Donald Knuth [1]

# What is L<sup>A</sup>T<sub>E</sub>X and what is it not?

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- L<sup>A</sup>T<sub>E</sub>X is different to programs as Microsoft Word or LibreOffice
- Document has to be “programed”
- Multiple tools and programs are required
  - Compiler
  - Editor

# Comparison to Office Programs

## Office

programs from Microsoft, LibreOffice, etc.

- allow quick writing
- What You See Is What You Get (WYSIWYG)
- easy to adjust appearance of every single letter

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<sup>1</sup><http://www.lyx.org/>

# Comparison to Office Programs

## Office

programs from Microsoft, LibreOffice, etc.

- allow quick writing
- What You See Is What You Get (WYSIWYG)
- easy to adjust appearance of every single letter

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

is not *one* program, but a set of tools.

- many text editors (from simple to powerful)
- document creation is done by a compiler (e.g. pdf<sub>l</sub>atex)
- rudimentary WYSIWYG (with LyX<sup>1</sup>)
- forces you to separate content from appearance

---

<sup>1</sup><http://www.lyx.org/>



# Comparison – Office

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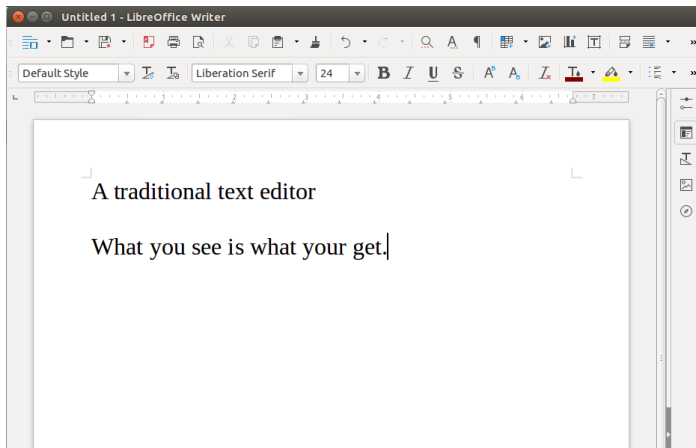
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# Advantages of L<sup>A</sup>T<sub>E</sub>X

- Documents always look good
- Automatic generation of table of contents, index of figures, index of keywords, bibliography, section numbers, . . .
- Easy typesetting of mathematical formulas, tables, footnotes, . . .
- Referencing of figures, sections, bibliography, . . .
- Easy definition of own commands and macros
- Separation of content and style
- Truly cross-platform
- Extensible!

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# Installation – Compiler

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A L<sup>A</sup>T<sub>E</sub>X compiler and editor must be installed:

## Compiler

Tex Live (Linux)  
MiKTeX (Windows)  
MacTeX (iOS)

package: texlive-full  
<http://www.miktex.org/>  
[http://www.tug.org/](http://www.tug.org/mactex/)  
mactex/

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# Installation – Editor

## Editor

Kile (Linux)

Texmaker (Linux)

Kile (Windows)

Texmaker (Windows)

Texmaker (iOS)

package: kile

package: texmaker

<https://windows.kde.org/>

<http://www.heise.de/download/texmaker.html>

<http://www.macupdate.com/app/mac/14641/texmaker>

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# 3. Basic Structure of Commands

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## Commands

are always specified using the same syntax:

```
\command[<optional args>]{<required args>}
```



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## Environments

are used to enclose parts of the text:

```
\begin{<environment type>}[...]{...}  
...  
\end{<environment type>}
```

- you can have environments for images, citations, formulas, definitions, lists, ...
- they can be nested

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## Blocks

consist of curly braces enclosing some text:

{ . . . }

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# 4. Structure of Documents

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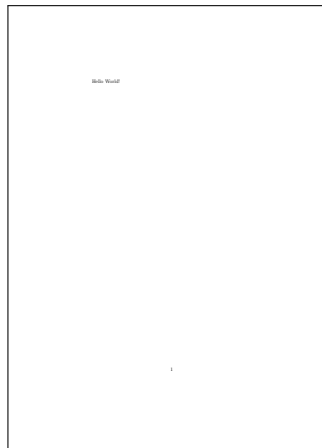
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# Basic Document

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



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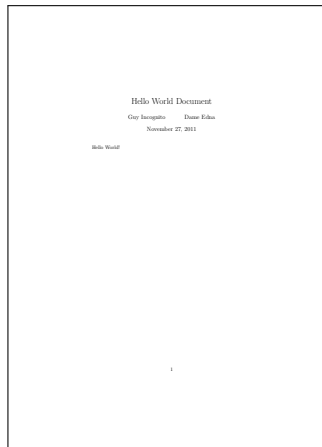
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# Document with Header

```
\documentclass{article}  
\title{Hello World Document}  
\author{Guy Incognito  
        \and Dame Edna}  
\begin{document}  
    \maketitle  
    Hello World!  
\end{document}
```



# Document with Some Text

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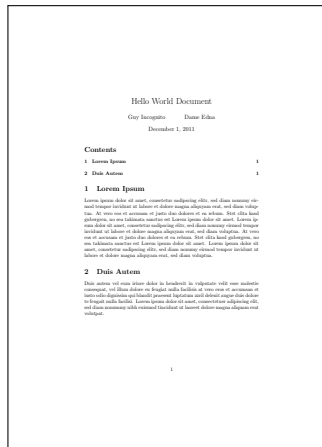
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```
\documentclass{article}
\title{Hello World Document}
\author{Guy Incognito
        \and Dame Edna}
\begin{document}
    \maketitle
    \tableofcontents
    \section{Lorem Ipsum} ...
    \section{Duis Autem} ...
\end{document}
```



# Document Classes

```
\documentclass[<options>]{<class name>}
```

## book

two-sided; title page; parts, chapters, sections, paragraphs

## report

one-sided; title page; chapters, sections, paragraphs

## article

one-sided; sections and paragraphs only

## letter

for letters

## beamer

for slides

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```
\documentclass[<options>]{<class name>}
```

- 10pt / 11pt / 12pt
- letterpaper / a4paper / a5paper
- twocolumn, twoside, landscape
- draft



# Basic Document Structure

```
\documentclass[<options>]{<style>}
```

*preamble:*      *meta information*  
                 *packages*  
                 *macros*

```
\begin{document}  
  \maketitle  
  \tableofcontents  
  \chapter{<name>} ...  
    \section{<name>} ...  
      \subsection{<name>} ...  
        \subsection{<name>} ...  
    \section{<name>} ...  
  \chapter{<name>} ...  
\end{document}
```

# Compile commands

## Files

- `rootfile.tex`
- `input1.tex`
- `bibliography.bib`

## Compile commands

```
pdflatex <rootfile.tex>
bibtex <rootfile.aux>
makeindex <rootfile.idx>
pdflatex <rootfile.tex>
pdflatex <rootfile.tex>
```

## Compile output

```
rootfile.pdf
```

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# 5. Basic Commands, Symbols and Fonts

# Special Symbols

comments %

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# Special Symbols

comments    %

%	\$	#	&	\%	\\$	\#	\&
_	^	~	~	\_	\^{ }	\~{ }	\$\sim\$

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# Special Symbols

comments `%`

<code>% \$ # &amp;</code>	<code>\% \ \$ \# \&amp;</code>
<code>_ ^ ~ ~</code>	<code>\_ \^{} \~{} \$ \sim\$</code>

<code>{ }</code>	<code>\{ \}</code>
<code>&lt; &gt;</code>	<code>\textless \textgreater</code>
<code>\</code>	<code>\textbackslash</code>

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# Special Symbols

comments `%`

`% $ # & \_ \^{} \sim{} \$\sim$`

`{ } \{ \} < > \textless \textgreater \textbackslash`

`“ ” \lq \lq \rq \rq`

unbreakable space `~`  
(soft) hyphenation hint `\-`

L<sup>A</sup>T<sub>E</sub>X `\LaTeX`

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L<sup>A</sup>T<sub>E</sub>X text was historically using ASCII characters

- writing international characters using special notation:  
 $\backslash" \{a\} = \ddot{a}$ ,  $\backslash' \{a\} = \acute{a}$ ,  $\backslash\sim \{a\} = \tilde{a}$ ,  $\backslash u \{a\} = \check{a}$
- this is good for portability

# International Characters

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- writing international characters using special notation:  
 $\backslash" \{a\} = \ddot{a}$ ,  $\backslash' \{a\} = \acute{a}$ ,  $\backslash\sim \{a\} = \tilde{a}$ ,  $\backslash u \{a\} = \ddot{a}$
- this is good for portability
- but cumbersome for users not writing in English:  
 $\backslash' \{E\} l \ se \backslash\sim \{n\} or \ est \backslash' \{a\} \ bien$   
Él señor está bien
- use  $\backslash usepackage [utf8] \{inputenc\}$  in the preamble for convenient text input (more on packages later)

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# Manual Breaks

new paragraph    \\

\\[<height>]

page break discouraged    \\\*

# Manual Breaks

new paragraph	<code>\\</code>
	<code>\\[&lt;height&gt;]</code>
page break discouraged	<code>\\*</code>
page breaks (without float handling)	<code>\newpage</code> (not stretching) <code>\pagebreak[]</code> (stretching)
page breaks (with float handling)	<code>\clearpage</code> <code>\cleardoublepage</code>

# Manual Breaks

new paragraph	<code>\\</code> <code>\\[&lt;height&gt;]</code>
page break discouraged	<code>\\*</code>
page breaks (without float handling)	<code>\newpage</code> (not stretching) <code>\pagebreak[]</code> (stretching)
page breaks (with float handling)	<code>\clearpage</code> <code>\cleardoublepage</code>
line breaks	<code>\newline</code> (not stretching) <code>\linebreak[]</code> (stretching)

# Manual Breaks

new paragraph	<code>\\</code> <code>\\[&lt;height&gt;]</code>
page break discouraged	<code>\\*</code>
page breaks (without float handling)	<code>\\newpage</code> (not stretching) <code>\\pagebreak[]</code> (stretching)
page breaks (with float handling)	<code>\\clearpage</code> <code>\\cleardoublepage</code>
line breaks	<code>\\newline</code> (not stretching) <code>\\linebreak[]</code> (stretching)

## Note

`\\` and `\\clearpage` are sufficient for most cases.

# Font Sizes

tiny	<code>\tiny</code>
scriptsize	<code>\scriptsize</code>
small	<code>\small</code>
normalsize	<code>\normalsize</code>
large	<code>\large</code>
Large	<code>\Large</code>
LARGE	<code>\LARGE</code>
huge	<code>\huge</code>
Huge	<code>\Huge</code>

## Note

Font size commands affect all of the following text, to return to the previous size automatically, use blocks:

```
{\small this is a small text}
```



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# Font Styles

## Families

Roman Family

```
\rmfamily
```

Sans Serif Family

```
\sffamily
```

Typewriter

```
\ttfamily \texttt{...}
```

Family

## Series

Medium Series

```
\mdseries
```

**Bold Face Series**

```
\bfseries \textbf{...}
```

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# Font Styles

## Shapes

**Upright Shape**

`\upshape`

***Italic Shape***

`\itshape`      `\textit{...}`

***Slanted Shape***

`\slshape`      `\textsl{...}`

**SMALL CAPS**

`\scshape`      `\textsc{...}`

## Remember

Use sparingly. Just because you *can* change the font size/style doesn't mean you *should*.

# Document Sections

## Levels

```
\part  
\chapter  
\section  
\subsection  
\subsubsection  
\paragraph  
\subparagraph
```

## Chapter 1

## Chapter

### 1.1 Section

#### 1.1.1 Subsection

#### Subsubsection

#### Paragraph

**Subparagraph** Text Here!

- you don't have to use every level of hierarchy
- appending an asterisk (\*) excludes the section from the table of contents

# Including of Files

## Files

```
document.tex
chapter_1.tex
chapter_2.tex
subfolder/chapter_3.tex
literature.bib
```

## Include in document.tex

```
\input{chapter_1}
\input{chapter_2}
\input{subfolder/chapter_3}

\bibliography{literature.bib}
```

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# Command

`\tableofcontents`

# Table of Contents

Contents	
<b>I Part</b>	<b>3</b>
<b>1 Chapter</b>	<b>5</b>
1.1 Section	5
1.1.1 Subsection	5
1	

# Basic Environments I

## Enumeration

```
\begin{enumerate}  
  \item One  
  \item Two  
  \item[] Three  
  \item Four  
\end{enumerate}
```

- 1 One
- 2 Two
- Three
- 3 Four

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# Basic Environments I

## Enumeration

```
\begin{enumerate}  
  \item One  
  \item Two  
  \item[] Three  
  \item Four  
\end{enumerate}
```

- 1 One
- 2 Two
- Three
- 3 Four

## Itemization

```
\begin{itemize}  
  \item One\linebreak  
    and a half  
  \item Two  
\end{itemize}
```

- One  
and a half
- Two

### Introduction

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# Basic Environments II

## Description

```
\begin{description}
  \item[First Item] Explanation of 1st item
  \item[Second Item] Explanation of 2nd item
  \item[Third Item] You get the idea\dots
\end{description}
```

**First Item** Explanation of 1st item

**Second Item** Explanation of 2nd item

**Third Item** You get the idea...

### Introduction

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# Basic Environments III

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## Verbatim

```
\begin{verbatim} ... \end{verbatim}
```

Using monospaced font for coding examples

Short (inline) version: `\verb|text| = text`

# Basic Environments III

## Introduction

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## Verbatim

```
\begin{verbatim} ... \end{verbatim}
```

Using monospaced font for coding examples

Short (inline) version: `\verb|text| = text`

## Verse / Quote / Quotation

```
\begin{quotation} ... \end{quotation}
```

*This is a quotation.*

*It looks a little bit different than the other text.*

# Useful Environments IV

## Introduction

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## Equation

`\begin{equation} ... \end{equation}`

$$\lim_{n \rightarrow \infty} \frac{1}{n} = 0 \quad (1)$$

# Basic Environments V

## Introduction

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## Tabular

```
\begin{tabular}{crl}
    centered row&right&left\\[2mm]
    another centered row&with more&content\\
    and & another & row\\
\end{tabular}
```

centered row	right	left
another centered row	with more	content
and	another	row

# Basic Environments VI

## Figure

```
\begin{figure}  
  \includegraphics{...}  
  \caption{Figure}  
\end{figure}
```



Figure: Figure

# Basic Environments VII

## Algorithm (package: algorithm2e)

```
\begin{algorithm}
\ForEach{Task $i$} {
    Calculate Cost($i$)\;
    \If{Cost($i$) $\le$ Cost($a$)} {
        $a$ = $i$;
    }
}
\end{algorithm}
```

```
foreach Task i do
    Calculate Cost(i);
    if Cost(i) ≤ Cost(a) then
        | a = i;
    end
end
```

# Labels & References

- `\footnote{...}` creates a footnote<sup>2</sup>

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---

<sup>2</sup>like this

# Labels & References

- `\footnote{...}` creates a footnote<sup>2</sup>
- Referring to other elements of your text

`\label{<labelname>}`

`\ref{<labelname>}`, e.g. 3.6 (section number)

`\pageref{<labelname>}`, e.g. 22 (page number)

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<sup>2</sup>like this



# Labels & References

- `\footnote{...}` creates a footnote<sup>2</sup>
- Referring to other elements of your text
  - `\label{<labelname>}`
  - `\ref{<labelname>}`, e.g. 3.6 (section number)
  - `\pageref{<labelname>}`, e.g. 22 (page number)
- Labels are counted separately for different environments (figures, tables, sections, ...)
- Recommended conventions for label name prefixes
  - sec: for sections, etc. ...
  - eq: for equations/formulas
  - fig: for images
  - ...

---

<sup>2</sup>like this

## Introduction

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## Bibliography

```
\bibliography{<filename>}
```

## BibTeX entry

in a file <filename>.bib

```
@Book {Lamport94,  
  author      = {Leslie Lamport},  
  title       = {LaTeX: A document preparation  
                system: User's guide and reference},  
  publisher   = {Addison-Wesley},  
  year        = {1994}  
}
```

## Introduction

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## Citation

```
\cite{Lamport94}
```

yields e.g. [Lamport 94] or [1] (depending on style)

```
\nocite{Lamport94}
```

```
\nocite{*}
```

## Bibliography style

```
\bibliographystyle{<style>}
```

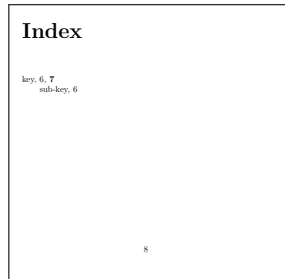
- ada
- plain
- ...

## Commands

```
% add in preamble
\usepackage{makeidx}
\makeindex

% add in body
This is a key\index{key}
and this is a
sub-key\index{key!sub-key}
\newpage
and a bold key number
\index{key|textbf}

\printindex
```



# Own Commands and Macros

- Defining a new command is very easy:

```
\newcommand{\face}{:o)}
```

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## Own Commands & Macros

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<sup>3</sup>[ftp://ftp.fu-berlin.de/tex/CTAN/macros/latex/  
contrib/todonotes/todonotes.pdf](ftp://ftp.fu-berlin.de/tex/CTAN/macros/latex/contrib/todonotes/todonotes.pdf)

# Own Commands and Macros

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## Own Commands & Macros

Micro Typography

- Defining a new command is very easy:

```
\newcommand{\face}{:o)}
```

- Now you can call `\face` to make a `:o` appear
- Very useful e.g. for defining a `\TODO` marker:

```
\newcommand{\TODO}[1]{  
  {\textbf{TODO --- #1 --- TODO}}  
}
```

# Own Commands and Macros

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## Own Commands & Macros

Micro Typography

- Defining a new command is very easy:

```
\newcommand{\face}{:o)}
```

- Now you can call `\face` to make a `:o)` appear
- Very useful e.g. for defining a `\TODO` marker:

```
\newcommand{\TODO}[1]
{\textbf{TODO --- #1 --- TODO}}
```

- `\TODO{find more examples}`

**TODO — find more examples! — TODO**

(Hint: for TODOs have a look at the package `todonotes`<sup>3</sup>)

---

<sup>3</sup><ftp://ftp.fu-berlin.de/tex/CTAN/macros/latex/contrib/todonotes/todonotes.pdf>

# Hints for Micro Typography

Items sorted in ascending order by subtlety...

- Set variables in math mode<sup>4</sup>

$\$a\$, \$b\$, \$c\$ \rightarrow a, b, c$

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## Micro Typography

---

<sup>4</sup>we will have much fun with math mode in session 2



# Hints for Micro Typography

Items sorted in ascending order by subtlety...

- Set variables in math mode<sup>4</sup>  
 $\$a$,  $\$b$ ,  $\$c \rightarrow a, b, c$$
- there are 4 types of dashes:  
– (-), -- (-), --- (—), \$- (—)

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<sup>4</sup>we will have much fun with math mode in session 2

# Hints for Micro Typography

Items sorted in ascending order by subtlety...

- Set variables in math mode<sup>4</sup>  
 $\$a$,  $\$b$,  $\$c \rightarrow a, b, c$$$
- there are 4 types of dashes:  
– (-), -- (-), --- (—), \$-\$ (-)
- Use non-breakable spaces between words and numbers

`Figure~\ref{...}`  $\rightarrow$  Figure 1

---

<sup>4</sup>we will have much fun with math mode in session 2

# Hints for Micro Typography

Items sorted in ascending order by subtlety...

- Set variables in math mode<sup>4</sup>  
 $\$a$,  $\$b$,  $\$c \rightarrow a, b, c$$$
- there are 4 types of dashes:  
 $- (-)$ ,  $-- (-)$ ,  $--- (—)$ ,  $\$-\$ (-)$
- Use non-breakable spaces between words and numbers  
 $\text{Figure}\sim\backslash\text{ref}\{\dots\} \rightarrow \text{Figure } 1$
- Half space between number and unit  
 $3\backslash, \text{cm} \rightarrow 3\text{ cm}$  instead of  $3\text{cm}$  or  $3\text{ cm}$   
 (even nicer:  $\backslash\text{unit}$  and  $\backslash\text{unitfrac}$ )

---

<sup>4</sup>we will have much fun with math mode in session 2

# Hints for Micro Typography

Items sorted in ascending order by subtlety...

- Set variables in math mode<sup>4</sup>  
 $\$a$,  $\$b$,  $\$c \rightarrow a, b, c$$$
- there are 4 types of dashes:  
 $- (-)$ ,  $-- (-)$ ,  $--- (—)$ ,  $\$-\$ (-)$
- Use non-breakable spaces between words and numbers  
 $\text{Figure}\sim\backslash\text{ref}\{\dots\} \rightarrow \text{Figure } 1$
- Half space between number and unit  
 $3\backslash, \text{cm} \rightarrow 3\text{ cm}$  instead of  $3\text{cm}$  or  $3\text{ cm}$   
 (even nicer:  $\backslash\text{unit}$  and  $\backslash\text{unitfrac}$ )
- “Normal” space after abbreviations  
 (when a period does not end a sentence)  
 $\text{e.}\backslash, \text{g.}\backslash \text{ a duck} \rightarrow \text{e.g. a duck}$

---

<sup>4</sup>we will have much fun with math mode in session 2

## Introduction

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## Micro Typography

# Thank you for your attention!

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