LaTeX Workshop

dr. ing. Jens Vankeirsbilck

25/10/2022
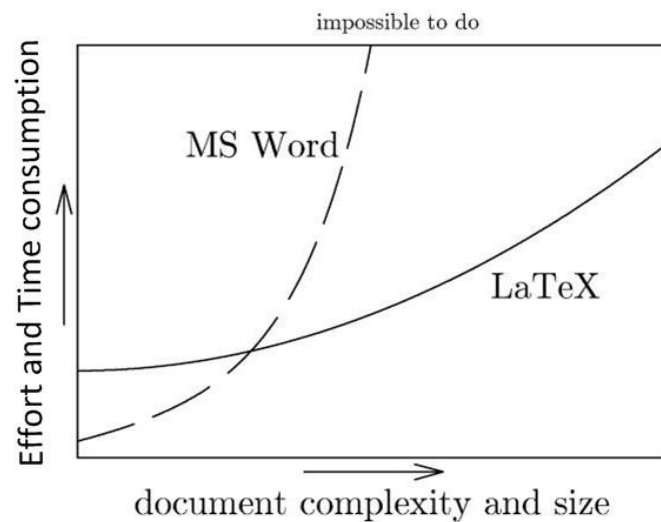
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Why LaTeX

Me: Moves one picture on word slightly

Microsoft Word:

Ladies and gentlemen, fasten your seatbelts.

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Sources:
- https://memebase.cheezburger.com/tag/microsoft-word
- https://modinst.lu.lv/en/using-overleaf-a-webinar/

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Starting a document

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LaTeX – Starting a document

Documentclass

\documentclass{article}

\begin{document}

Hello World!

\end{document}

› Documentclass tells LaTeX how to layout your document.
›› A.k.a.: template
› Standard classes:
›› article, report, book, letter
› Each major publisher typically has their own class
›› IEEEtran, acmart, etc.

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LaTeX – Starting a document

Preamble

\documentclass{article}

\begin{document}

Hello World!

\end{document}

› Called the *Preamble*

› You define which packages to use here

  ›› \usepackage[english]{babel}

  ›› \usepackage{graphicx}

› \usepackage[option1,option2]{package}

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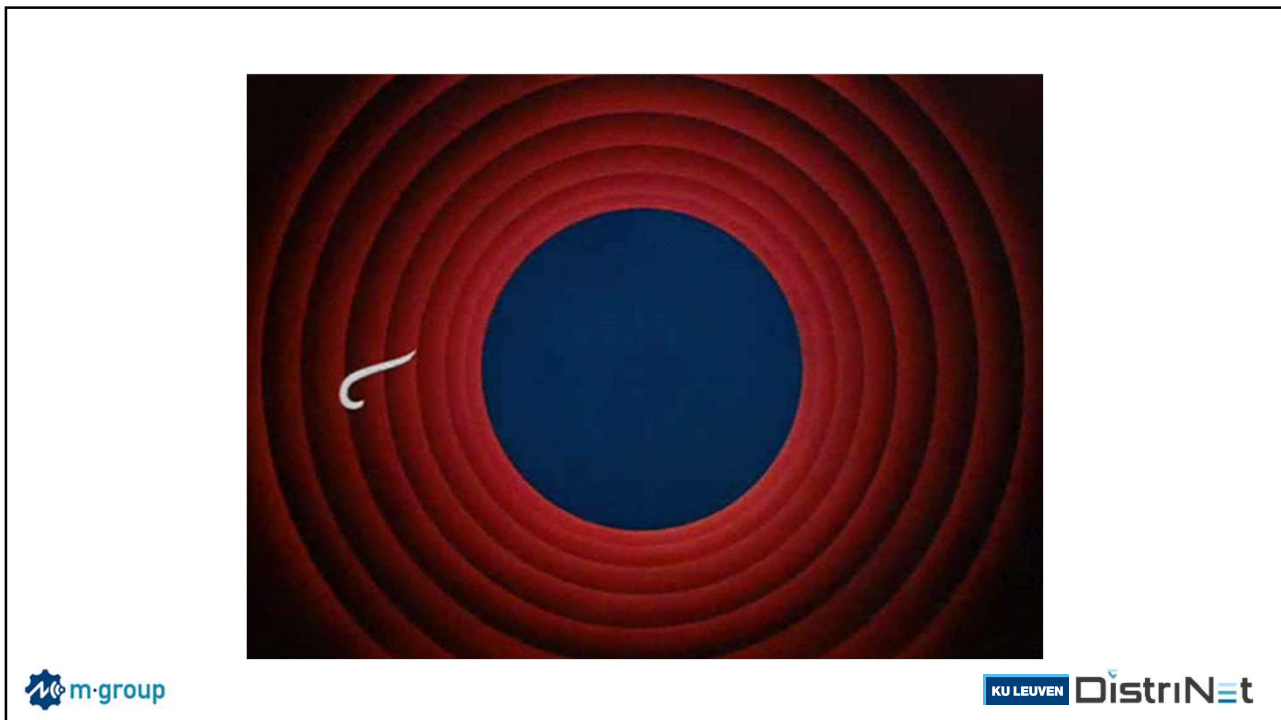
5

LaTeX – Starting a document

Document itself

\documentclass{article}

\begin{document}

Hello World!

\end{document}

› \begin{…} and \end{…} define the beginning and ending of an environment.

› \begin{document} and \end{document} identify the start and stop of your document

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Goal of Today

› **Show you the basics**

›› Starting a document

›› Text structuring

›› Figures, Tables, Equations and Algorithms

›› Bibliography

› What if you need more than the basics?

› Try it yourself

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Text structuring

Caveat:
Typesetting text is similar to coding: there are often many options to get to the same results. The following slides are flavored by my own LaTeX style.

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Including a Title and Author

```
\documentclass{article}
\title{My First Document}
\author{Jens Vkb}
\date{}
\begin{document}
\maketitle
Hello World!
\end{document}
```

› \title{…} and \author{…} are self-explanatory.

› \date{} is useful to suppress the showing of the current date

  ›› Typically suppressed by more advanced templates

› \maketitle <u>very important!</u> Without it, \title and \author are not executed!

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Including a Title and Author

Result

\documentclass{article}

\title{My First Document}

\author{Jens Vkb}

\date{}

\begin{document}

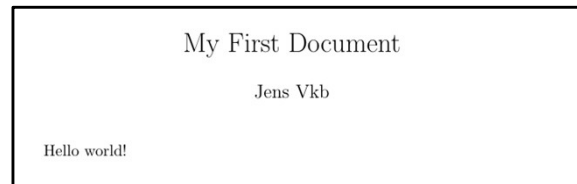\maketitle

Hello World!

\end{document}

My First Document

Jens Vkb

Hello world!

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Including structuring Elements

› Numbered elements:

›› \chapter{…}

›› \section{ …}

›› \subsection{ …}

›› \subsubsection{ …}

› Unnumbered elements
= same commands, but with *

›› \section*{}

› Depending on the template, certain elements might not be present:

›› \chapter{} only in books and reports

›› No structuring elements supported in letters (NL: brieven)
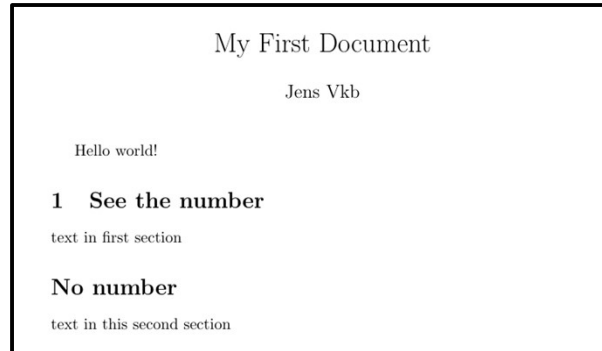
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Including structuring Elements

```
1 \documentclass{article}
2
3 \title{My First Document}
4 \author{Jens Vkb}
5 \date{}
6
7 \begin{document}
8
9 \maketitle
10
11 Hello world!
12
13 \section{See the number}
14 text in first section
15
16 \section*{No number}
17 text in this second section
18
19 \end{document}
```


My First Document

Jens Vkb

Hello world!

1 See the number

text in first section

No number

text in this second section

13

Figures, Tables, Equations and Algorithms

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Figures

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Including a Figure

› Need graphicx package

  ›› \usepackage{graphicx}

› Define a figure environment

  \begin{figure}[placing specifier]

     \centering

     \includegraphics[options]{pathToFigure}

     \caption{text explaining the figure}

  \end{figure}

› [placing specifier]

  ›› h = here

  ›› t = top of the page

  ›› b = bottom of the page

  ›› p = on a special page for *figures, tables, etc.*

  ›› ! = override LaTeX parameters that normally decide good positioning

› I never use a placing specifier and leave it up to the template and LaTeX

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Including a Figure

To get the best result, make sure the figure you include is in vector format! (.eps, .emf, .pdf, .svg)

› Need graphicx package

›› \usepackage{graphicx}

› Define a figure environment

\begin{figure}[placing specifier]
    \centering
    \includegraphics[options]{pathToFigure}
    \caption{text explaining the figure}
\end{figure}

› \centering makes sure the included figure is centered in the env.

› \includegraphics finds and inserts the actual figure file

›› Options typically refer to the width or height of the figure.

›› Most often related to \textwidth e.g. [width=0.5\textwidth]

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Including a figure

```
1  \documentclass{article}
2
3  \usepackage{graphicx}
4
5  \title{My First Document}
6  \author{Jens Vkb}
7  \date{}
8
9  \begin{document}
10
11 \maketitle
12
13 \section{Included Figures}
14 This figure is forced to be here
15
16 \begin{figure}[h]
17     \centering
18     \includegraphics[width=0.5\textwidth]{kyle.jpg}
19 \end{figure}
20
21 some other text here
22 \end{document}
```


My First Document

Jens Vkb

1   Included Figures

This figure is forced to be here

some other text here

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9
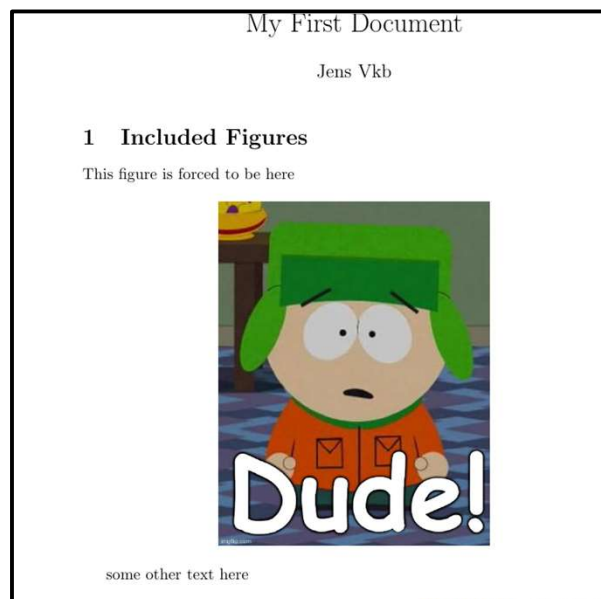
Tables

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Inserting a Table

\begin{table}[placing options]
    \caption{text explaining the Table}
    \centering
    \begin{tabular}{columnFormat}
        colTitle & <repeat for all columns> \\
        \hline
        data & data & <repeat> \\
        \hline
    \end{tabular}
\end{table}

› table environment
= makes sure table can be placed correctly

› tabular environment
= actual table

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Inserting a Table

\begin{table}[placing options]

    \caption{text explaining the Table}

    \centering

    \begin{tabular}{columnFormat}

        colTitle & <repeat for all columns> \\

        \hline

        data & data & <repeat> \\

        \hline

    \end{tabular}

\end{table}

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› {columnFormat } defines

  ›› How many columns in the table

  ›› The layout of the columns

    ›››c: centered text

    ›››l: left aligned text

    ›››r: right aligned text

  ›› When to draw vertical lines, defined by |

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Inserting a Table

\begin{table}[placing options]

    \caption{text explaining the Table}

    \centering

    \begin{tabular}{columnFormat}

        colTitle & <repeat for all columns> \\

        \hline

        data & data & <repeat> \\

        \hline

    \end{tabular}

\end{table}

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› & is a column separator. Used to show in which column the next *item* goes

› \hline inserts a horizontal line

› \\ is the standard LaTeX command for a line break

  ›› In a table: next row

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Inserting a Table

```
1  \documentclass{article}
2
3  \usepackage{graphicx}
4
5  \title{My First Document}
6  \author{Jens Vkb}
7  \date{}
8
9  \begin{document}
10
11 \maketitle
12
13 \section{Included Table}
14 This is a short Table
15
16 \begin{table}[h]
17     \caption{Look at my awesome result numbers.}
18     \centering
19     \begin{tabular}{l|c|r}
20         \hline
21         Exp. name & time [s] & Comment \\
22         \hline
23         walking & 180,15 & really fun \\
24         running & 59,23 & difficult \\
25         swimming & 00,0 & impossible on land \\
26         \hline
27     \end{tabular}
28 \end{table}
29
30 some other text here
31 \end{document}
```

My First Document

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1 Included Table

This is a short Table

Table 1: Look at my awesome result numbers.

Exp. name	time [s]	Comment
walking	180,15	really fun
running	59,23	difficult
swimming	00,0	impossible on land

some other text here

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Note on Figures and Tables

› In case your document is multicolumn, e.g. IEEE paper, but your figure needs to span more than 1 column: use * when defining the environment

›› \begin{figure*} … \end{figure*}

›› \begin{table*} … \end{table*}

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Equations

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Inserting an Equation
Free-standing Equation

› Need *amsmath* package

 ›› \usepackage{amsmath}

› Use equation environment

\begin{equation}

  <type equation here>

\end{equation}

› To type up your equation, you need to know the correct commands.

› A nice overview:

https://en.wikibooks.org/wiki/LaTeX/Mathematics
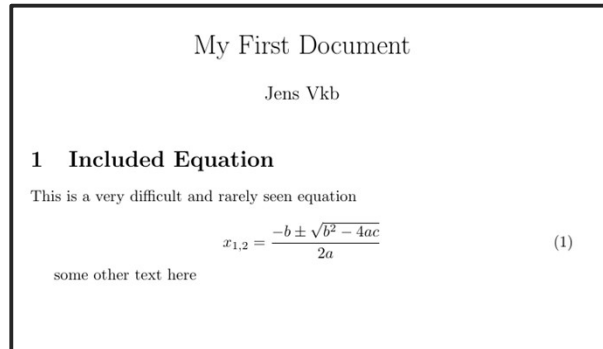
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Inserting an Equation

Free-standing equation

```
1  \documentclass{article}
2
3  \usepackage{graphicx}
4
5  \title{My First Document}
6  \author{Jens Vkb}
7  \date{}
8
9  \begin{document}
10
11 \maketitle
12
13 \section{Included Equation}
14 This is a very difficult and rarely seen equation
15
16 \begin{equation}
17 x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
18 \end{equation}
19
20 some other text here
21
22 \end{document}
```

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1 Included Equation

This is a very difficult and rarely seen equation

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1}$$

some other text here

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Insert an Equation

In-line Equation

› An equation can also be in-line

= inside the text

› This is enabled by using the math environment $...$

›› E.g: *variable D is calculated as $D = S \oplus d_i$ using the xor operation.*

variable D is calculated as $D = S \oplus d_i$ using the xor operation.

› Of course, can't refer to these equations as they don't have a number

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Algorithms

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Insert an Algorithm

› Many packages exist to typeset an algorithm

   ›› \usepackage{algorithmic}

   ›› \usepackage{algorithm2e}

   ›› \usepackage{algpseudocode}

> I typically use algpseudocode

› Algorithm typically embedded in an algorithm environment

   ›› \usepackage{algorithm}

   ›› \begin{algorithm}

     …

    \end{algorithm}

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Insert an Algorithm

```
14 \section{Included Table}
15 This is a show-off algorithm in pseudocode
16
17 \begin{algorithm}[h]
18    \caption{Pseudo-code describing the compile-time process to implement RASM.\label{alg:RASM}}
19    \begin{algorithmic}[1]
20       \ForAll{Basic Block~(BB) in CFG}
21          \Repeat $\:$ compileTimeSig $\gets$ random number
22          \Until{$compileTimeSig$ is unique}
23          \Repeat $\:$ subRanPrevVal $\gets$ random number
24          \Until{$(compileTimeSig\,+\,subRanPrevVal)$ is unique}
25       \EndFor
26       \algrenewcommand\algorithmicdo{\textbf{insert at beginning}}
27       \ForAll{BB in CFG}
28          \State signature $\gets \, signature\,-\,subRanPrevVal$
29          \State if $signature \; \neq \; compileTimeSig \;$ then \Call{error}{\null}
30       \EndFor
31       \algrenewcommand\algorithmicdo{\textbf{do}}
32       \ForAll{BB in CFG}
33          \If{Last Instr. is return instr. \textbf{and} $NrIntr_{BB}\,>\,1$}
34             \State \textbf{Calculate needed variables}
35                \State \hspace{\algorithmicindent} returnVal $\gets$ random number
36                \State \hspace{\algorithmicindent} adjustValue $\gets$ compileTimeSig_{BB} - returnVal$
37             \State \textbf{Insert signature update before return instr.}
38                \State \hspace{\algorithmicindent}$signature\gets signature\,+\,adjustValue$
39                \State \hspace{\algorithmicindent} if $signature \; \neq \; compileTimeSig \;$ then
\Call{error}{\null}
40             \Else
41                \ForAll{Successor of BB}
42                   \State expectedValue $\gets$ compileTimeSig_{succs} + subRanPrevVal_{succs}$
43                   \State adjustValue $\gets$ compileTimeSig_{BB} - expectedValue$
44                   \State \textbf{Insert signature update at BB end}
45                   \State \hspace{\algorithmicindent}$signature\gets signature\,+\,adjustValue$
46                \EndFor
47             \EndIf
48       \EndFor
49    \end{algorithmic}
50 \end{algorithm}
```

This is a show-off algorithm in pseudocode

Algorithm 1 Pseudo-code describing the compile-time process to implement RASM.

```
 1: for all Basic Block (BB) in CFG do
 2:    repeat compileTimeSig ← random number
 3:    until compileTimeSig is unique
 4:    repeat subRanPrevVal ← random number
 5:    until (compileTimeSig + subRanPrevVal) is unique
 6: end for
 7: for all BB in CFG insert at beginning
 8:    signature ← signature − subRanPrevVal
 9:    if signature ≠ compileTimeSig then ERROR()
10: end for
11: for all BB in CFG do
12:    if Last Instr. is return instr. and NrIntr_BB > 1 then
13:       Calculate needed variables
14:          returnVal ← random number
15:          adjustValue ← compileTimeSig_BB − returnVal
16:       Insert signature update before return instr.
17:          signature ← signature + adjustValue
18:          if signature ≠ compileTimeSig then ERROR()
19:    else
20:       for all Successor of BB do
21:          expectedValue ← compileTimeSig_succs + subRanPrevVal_succs
22:          adjustValue ← compileTimeSig_BB − expectedValue
23:          Insert signature update at BB end
24:             signature ← signature + adjustValue
25:       end for
26:    end if
27: end for
```

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Listings

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Insert a Listing

› Instead of pseudocode, you can also typeset actual code.
  This is called a listing

  ›› \usepackage{listings}

  ›› \begin{lstlisting}

     <code here>

     \end{lstlisting}

  ›› Or input code file directly, using

     \lstinputlisting[language=programmingLanguage]{PathToSourcefile}

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Insert a Listing

› The listings package supports many programming languages,
  but still enables you to customize everything you want

› Full explanation: https://en.wikibooks.org/wiki/LaTeX/Source_Code_Listings

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```
13 \lstdefinestyle{myStyle}{
14     backgroundcolor=\color{white},
15     commentstyle=\color{myGreen},
16     keywordstyle=\color{myPurple}\bfseries,
17     numberstyle=\tiny\color{gray},
18     stringstyle=\color{blue},
19     basicstyle=\ttfamily \small,
20     breaklines=true,
21     breakatwhitespace=false,
22     captionpos=b,
23     keepspaces=true,
24     numbers=left,
25     numbersep=5pt,
26     showspaces=false,
27     showstringspaces=false,
28     showtabs=false,
29     tabsize=4,
30     frame=lines,
31     xleftmargin=1em,
32     framexleftmargin=1em
33 }
34
35 \lstset{style=myStyle}
36
37 \begin{document}
38
39 \maketitle
40
41 \section{Included listing}
42 This is actual code
43
44 \begin{lstlisting}[language=C++, float=h, floatplacement=t, caption={Adjustment to be made to the source code
   to use our plugin}, label={lst:CFED-Handler}]
45 extern "C"{
46     void __attribute__((noProtection)) CFED_Handler(void){
47         while(1);
48     }
49 }
50 \end{lstlisting}
```

My First Document

Jens Vkb

1   Included listing

This is actual code

```
1 extern "C"{
2     void __attribute__((noProtection)) CFED_Handler(void){
3         while(1);
4     }
5 }
```

Listing 1: Adjustment to be made to the source code to use our plugin

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Referencing figures, tables, equations, algorithms and listings

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Labels and Referencing

› A Figure | Table | Equation | Algorithm | Listing has no place in a document, unless it is referenced!

› References, e.g. Fig. 1 shows…, are made through

  ›› \label{<label>} inside the environment to be referenced; and

  ›› \ref{<label>} in the text.

› Also works for numbered structuring elements.

  ›› \subsection{<title>}\label{<label>}

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Labels and Referencing

```
1  \documentclass{article}
2
3  \usepackage{graphicx}
4
5  \title{My First Document}
6  \author{Jens Vkb}
7  \date{}
8
9  \begin{document}
10
11 \maketitle
12
13 \section{Included listing}
14 As indicated in Fig.~\ref{fig:Kyle}, Kyle is not happy to be forced to be here.
15
16 \begin{figure}[h]
17     \centering
18     \includegraphics[width=0.6\textwidth]{kyle.jpg}
19     \caption{Picture showing Kyle's anxiety}
20     \label{fig:Kyle}
21 \end{figure}
22
23 \end{document}
```

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1   Included listing

As indicated in Fig. 1, Kyle is not happy to be forced to be here.

Figure 1: Picture showing Kyle's anxiety

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Bibliography

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Bibliography
Best Practice

› Resource you want to cite, must be provided to LaTeX in BibTex format.

› Although you could store your BibTex directly in your .tex document, it's much better to store it in a separate .bib file, and point LaTeX to this file

›› At the end of the document (but <u>before \end{document}</u>):

```
\bibliographystyle{style}
\bibliography{pathToBibFile}
```

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Bibliography

Creating the .bib file

› **Either manually**
  1. Create a myReferences.bib
  2. Fill it with the bibtex format of your references
  3. \bibliography{path/to/myReferences}

  > Without .bib file extension!

› **Or automatically**
  1. Put your references in a reference manager
     e.g. JabRef, Zotero, Mendeley…
  2. Export the database to .bib

  > Is what I use as ref. manager

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Bibliography

Citing a reference

› Optional, but to pretty-fy citations
  \usepackage{cite}

  > I always use this

› In text:

  "…using a reference~\cite{citekey}"

  > ~ is a fixed space. This prevents a line-break on this space. **ALWAYS INSERT THIS BEFORE \cite{} and \ref{}**

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Want to know more about Ref. Managers and BibTex

Or more general information about information retrieval?

› Contact colleague Eef Soete

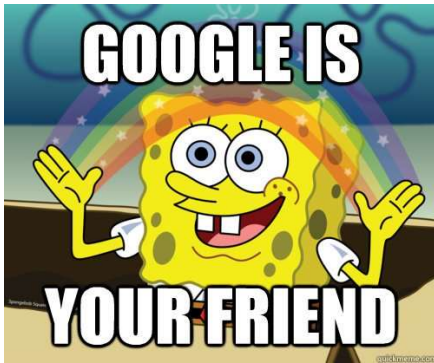 ›› Eef.Soete@kuleuven.be

› Or visit her in the Learning Centre (06.20)

  ›› Monday and Thursday

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Goal of Today

› Show you the basics

  ›› Starting a document

  ›› Text structuring

  ›› Figures, Tables, Equations, Algorithms

  ›› Bibliography

› **What if you need more than the basics?**

› Try it yourself

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What if you need more than the basics?

› https://en.wikibooks.org/wiki/LaTeX

› https://tex.stackexchange.com/

› https://www.overleaf.com/learn

› Don't be afraid to just google what you are trying to do!

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Goal of Today

› Show you the basics

›› Starting a document

›› Text structuring

›› Figures, Tables, Equations, Algorithms

›› Bibliography

› What if you need more than the basics?

› **Try it yourself**

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Yes, now you have to work

› *Exercise* 1:

Download and compile MSc. Thesis LaTeX template

›› https://iiw.kuleuven.be/studeren/masterproef/sjablonen

› Exercise 2: Recreate the document found at

https://filesender.belnet.be/?s=download&token=b2a6da81-738b-441d-bb0e-0ba28dec067d (link valid till 30/11)

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Some Interesting Packages

› siunitx: https://ctan.org/pkg/siunitx

›› To format units and numbers easily and uniformly

› xcolor: https://ctan.org/pkg/xcolor

›› To enable color text

› threeparttable: https://www.ctan.org/pkg/threeparttable

›› To enable dedicated notes section beneath a table (easily creatable through the package)

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