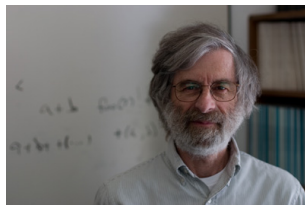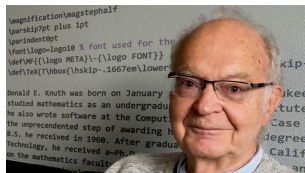# LaTeX workshop

Arjan Wildhagen

February 27, 2020

What is LaTeX

- TeX invented by Donald Knuth in 1977
  - /ˈtɛx/ or /ˈtɛk/, from the word τέχνη meaning *art* or *craft*, root of *technical*

- Extended to LaTeX by Leslie Lamport in 1984
  - /laˈtɛx/ or /leiˈtɛk/

LATEX> Word

LATEX uses dynamic programming to minimize spacing.

Microsoft Word   **LATEX**

```
hey hey hey                        hey hey
hey                                hey hey
stupidbitch                        stupidbitch
```

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☹

☺

Pros and Cons

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Cons

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- Sometimes very hard to get specific layout

How to LaTeX

5 Levels of LaTeX understanding

CognAC

How to LaTeX

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- Beginner

CognAC

How to LATEX

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- Beginner
- Intermediate

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Where to LATEX?

UI's

Linux
- TeXLive
- Gummi
- Kile
- Latexila

Windows
- MikTex
- TexnicCenter
- WinEdt
- TexStudio (works on all platforms)

MacOS
- MacTex
- TexShop
- Texnicle
- Archimedes

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Files

Filename extensions

- .tex   standard TeX file
- .bib   bibliography file
- .bst   bibliography formatting file
- .cls   class file
- .sty   style file
- And more...
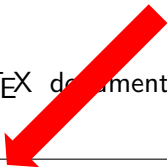
CognAC

Hello world!

Our first LaTeX document!

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

```
Hello World!
```

CognAC

Hello world!

Many different options! (proc, book, report, slides, beamer, etc.)
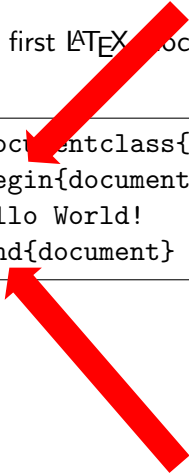
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```
Hello World!
```

Everything in front of \begin{document} is called the preamble and will not show up in the document.

Reserved characters

LATEX has some characters reserved where typing them evokes a functionality

These chars are: # $ % ^ & _ { } ~ \

Packages

Packages can be treated as libraries in other programming
languages (e.g. Java or Python). They can be invoked by typing
the usepackage command, and possible parameters:

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\usepackage[parameters]{package_name}
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```
\usepackage[parameters]{package_name}
```

Hint: You can concatenate multiple packages if they do not need a parameter. E.g.:

```
\usepackage{package_name1, package_name2, ...}
```

Packages

Useful packages:

- amsmath, amssymb, amsthm, mathtools, xfrac
- caption, float, graphicx, tikz
- comment, enumerate, geometry, hyperref, verbatim
- array, babel, hyperref, listings, xcolor
- many many more (to be found at the CTAN website)

Some more basics

Chapters/sections have a level of appereance. Parts and chapters are usually only used in books

Command	Level
\part	-1
\chapter	0
\section	1
\subsection	2
\subsubsection	3
\paragraph	4
\subparagraph	5

If the number in front of the section/paragraph is unwanted, a * can be added after the command to remove this enumeration.

\section{example}→**1 Example**

\section*{example}→**Example**

Spacing

(Horizontal) spacing is defined with multiple commands, and a generic one. Basic lengths are points (pt), millimeter (mm), centimeter (cm), inch (in), height of an x in current font (ex) and width of an M in current font (em). From small to large:

Command	space
\!	-³⁄₁₈ em
\,	³⁄₁₈ em
\> or \:	⁴⁄₁₈ em
\;	⁵⁄₁₈ em
\enspace	½ em
\quad	1 em
\qquad	2 em
\hspace{...}	...

The command \linespread{...} changes the whitespace between lines in the document.
\linespread{1} is standard,
\linespread{1.6} is doubled whitespace.

Font sizes

Font sizes of the whole document can be changed as a parameter of the documentclass command, e.g.
\documentclass[12pt]{article}. Different fonts are possible, search for the correct package on Google. Sizing fonts from small to large (assuming the original fontsize is 11pt):

Command	size
\tiny	6 pt
\scriptsize	8 pt
\footnotesize	9 pt
\small	10 pt
\normalsize	10.95 pt

Command	size
\large	12 pt
\Large	14.4 pt
\LARGE	17.28 pt
\huge	20.74
\Huge	24.88

Important distinction

Groups/Switches   vs   **Environment**

Defines something until the group is ended, or for the whole document

Only applies to the code written in between the \begin{} and \end{}

\centering is a switch {\centering} creates a local scope/group, or with \bgroup \centering \egroup

\begin{centering}...
\end{centering} is an environment

Not every switch can be transformed into an environment, and vice versa!

CognAC

Almost there

So, now lets dive into some examples

Tables

Tables are one of the most frustrating things most users experience, but you are not alone!

Use https://www.tablesgenerator.com/ to help you out a lot.

There are many environments that help with tables:

- tabular, tabular*, tabularx, tabulary, array, ...

In essence a table is easily defined with:

```
\begin{tabular}{nr of columns and specs}
Cell1.1 & Cell1.2 & ... \\ ← New row!
Cell2.1 & Cell2.2 & ... \\ ← New row!
\end{tabular}
```

At *nr of coumns and specs* you can define columns and their text alignment. {l c r} means 3 columns, the first is left aligned, the second is centered, the third one is right aligned.

Tables

We can also specify borders and merge cells.

```
\begin{tabular}{c||l|r}
\hline
\multirow{2}{*}{Merged cell!} & Well & hello\\
 & there & \multicolumn{1}{c|}{General} \\
\cline{2-3}
\multicolumn{2}{c|}{Merged cell!} & Kenobi
\end{tabular}
```

↓ produces ↓

Merged cell!	Well	hello
	there	General
Merged cell!		Kenobi

Lists

To simply list a couple of items, the following should be good (you can also change the symbol):

```
\begin{itemize}
 \item Nr.1
 \item[\textendash] Nr.2
 \item[$\lambda$] Nr.3
\end{itemize}
```

- Nr.1

– Nr.2

λ Nr.3

Lists

Or use the enumerate package to help you with ordering lists:

```
\begin{enumerate}[a)]
 \item Nr.1
 \item Nr.2
 \item[$\eta$] Nr.3
\end{enumerate}
```

a) Nr.1

b) Nr.2

η Nr.3

Figures

Using figures is best with the graphicx package. The standard creation of a figure is as follows:

```
\begin{figure}[floats]
 \centering
 \includegraphics →
→[parameters]{filepath}
 \caption{Caption}
 \label{fig:my_fig}
\end{figure}
```


Figure: Baby Camel

Floats

Determine where you want your figure (or rather floating object) to be, if the compiler is not doing a good job at it (LaTeX automatically determines the best position). There are multiple floats available:

- h   Place the object (*approximately*) at this point
- t   Place the object at the top of the page
- b   Place the object at the bottom of the page
- p   Place the object on a special page for floating objects only
- !   Override internal parameters
- H   Place the object precisely at this point (same as !ht)

Labeling

Create easy references to everything with a label. These references are dynamic, meaning that it will always refer to that specific label. This works for any floating object (*Note: The label command appears after the caption command!*)

```
Creating a label:
 \label{fig:my_label}

Creating a reference:
 \ref{fig:my_label)
```

Hint: Use the hyperref package to be able to click on the references and jump to the right object.

Math mode

Math mode allows multiple symbols, and all text is always in italics. Enter and leave math mode with \$, and create highlighted equations with \$\$, or with \[... \]. Example:

```
\[\sum_{n=0}^{\infty}\dfrac{1}{n^2}
    = \dfrac{\pi^2}{6}\]
```

Produces

$$\sum_{n=0}^{\infty}\frac{1}{n^2} = \frac{\pi^2}{6}$$

Math mode

The equation or align environment also allow highlighted equations, and the align environment also supports vertical alignment of specific characters (e.g. $=$):

```
\begin{align}
 f(x) &= x\cdot y\\
&= y\cdot x
\end{align}
```

Which produces:

$$f(x) = x \cdot y \tag{1}$$
$$= y \cdot x \tag{2}$$

Error handeling

Some basic errors and what they mean:

Undefined control sequence	Used a command that does not exist
Underfull hbox	LaTeX can't fill the whole line, usually to be ignored
Overfull hbox	LaTeX tries to fit too much on 1 line, can also be ignored usually
Too many }'s	There are too many }'s in the document
Runaway argument	There are too little }'s in the document
Missing $ inserted	Either you used a command that should be in math mode, or math mode is never closed.

Useful commands

Here are some useful commands!

- \\[length] → new line (no given length gives default height)

- \newpage → Creates a new page

- % → Comments one line of code

- \newcommand{\comment}[2]{#2} → with the comment package this allows to easily comment multiple lines (add this before the start of the document)

- \usepackage[a4paper, margin=3cm]{geometry} → Creating a bigger space on a page to work with

What now?

Use `http://detexify.kirelabs.org/classify.html` to help finding symbols

Practise! As is with programming, 80% is knowing how to search Google and extract information from Stack Overflow

These slides, as the workshop file, can be found on my Github account where also (in the very near future) tutorials can be found for each level of understanding LᴬTEX (link: `https://arjan-w.github.io/LaTeXHelp/`)