Introduction to Scientific Working

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Summary of last lecture

Paragraphs

- `\usepackage[ngerman]{babel}`: For german
- `sudo apt install texlive-lang-german`

Lists (itemize, enumerate, description)

Inclusion of graphics

- `graphicx` package
- `\includegraphics{File}` makes a box

Homework

- Repeat chapters 1–3 of "Not so short introduction to LaTeX" focusing on the typesetting of mathematics

Lecture Content

Research and Understanding

Understanding and summarizing of scientific text, Literature research,
Internet search, Citing, Practical scientific work

Structuring Scientific Works

Kinds: Seminar, Bachelor and Master theses,
Topic analysis and paper structuring

LaTeX

Interaction, Typesetting of text, Images, Diagrams, Lists, Tables,
Mathematics, Fonts, Special cases

Evaluation, Checking and Presentation

Evaluation of work of others, Review system in computer science,
Introduction to presentation

Definitions

Define a command

- Using \def
- Using \newcommand

Define/change a variable

- Length
- Page/Item number

Typesetting Mathematics

Definition

Specifics of mathematics

- mathematical formulae
- variables and references to formulae
- Greek letters and special symbols

Example

```
Let $a$, $b$ sides
and $c$ the hypotenuse.
Then $c^2 = a^2+b^2$.

The pronounciation of \TeX\ is
\(\tau\epsilon\chi\).
```

Let a, b sides and c the hypotenuse. Then $c^2 = a^2 + b^2$.

The pronounciation of TeX is $\tau\epsilon\chi$.

Example

```
Mark the correct answer with
\begin{math}
  \star
\end{math}.
```

Mark the correct answer with $\star$.

Definition

- Mathematics can be given in the flow of text or in an environment:

  Text $\cdot$ \$ \($\cdot$ \)   \begin{math} $\cdot$ \end{math}

  Environment   equation   multline   gather   align

         array   split   eqnarray

- No spaces are allowed in mathematics

Example

```latex
\begin{displaymath}
  y=x^2 \qquad
  y' = 2x \qquad
  y'' = q
\end{displaymath}
```

$$y = x^2 \qquad y' = 2x \qquad y'' = q$$

```latex
$$
  \lim_{x \to 0}
  \frac{\sin x}{x} = 1
$$
```

$$\lim_{x \to 0} \frac{\sin x}{x} = 1$$

```latex
\begin{equation*}
  \frac{x^2}{x+1} \qquad
  x^{\frac{2}{k+1}} \qquad
  {n \choose k}
\end{equation*}
```

$$\frac{x^2}{x+1} \qquad x^{\frac{2}{k+1}} \qquad \binom{n}{k}$$

Single equation environment

- Single equation in `equation` is numbered
- Using `\label` and `\eqref` one can refer to it
- `equation*` omits the label

Example

```latex
\begin{equation}
  \label{eq:1}
  \sum_{k=0}^\infty q^k =
  1 + q + q^2 + \cdots =
  \frac{1}{1-q}
\end{equation}
```

$$\sum_{k=0}^{\infty} q^k = 1 + q + q^2 + \cdots = \frac{1}{1-q}$$

$$(1)$$

Example (cont.)

```
The equation~\eqref{eq:1}
is correct only when
$\lvert q \rvert < 1$.
```

The equation (1) is correct only when $\lvert q \rvert < 1$.

Equations spanning multiple lines

- `multline`, `multline*`
- `equation` with `split` or `array`
- `gather`, `gather*`
- The environments `multline`, `split`, `gather` require the `amsmath` package

Aligning equations

- align, align*
- requires amsmath

Example

```
\begin{align*}
 y_1 & = x^2
   \\
 y_2 &= 2x
   \\
 y_3 &= q
 \end{align*}
```

$$y_1 = x^2$$
$$y_2 = 2x$$
$$y_3 = q$$

Page layout

- Depends on the document class
- Can be changed using `\textheight` and `\textwidth`

Example

article uses narrow text (360pt), as opposed to srcartcl (418,25pt)

Headers and footers

- `\pagestyle{plain}`: central page numbering, default
- `\pagestyle{empty}`
- `\pagestyle{heading}`: chapter title in header

Large objects

Definition

- Objects that do not fit well in pages
- Automatically placed

Figures

- `figure` environment
- `\caption{...}` necessary!
- `\label{<label>}` after caption allows references `\ref{<label>}`
- `\pageref{<label>}` references the page rather than label

Placement

- `figure` can be optionally given a placement argument which reduces the options

h	"here"
t	"top"
b	"bottom"
p	"page"

- by default `tbp`

Example

```
\begin{figure}[h]
  \centering
  ...
  \caption{Example figure}
  \label{fig:here}
\end{figure}
```

Example

```
\begin{figure}[ht]
  ...
  \caption{Result of the placement parameter}
\end{figure}
```

Example

```
Figure~\ref{bild} on
page~\pageref{bild} shows
some art.
\begin{figure}[tb]
\vspace{6cm}
\caption{In the fog}
\label{bild}
\end{figure}
```

Figure 1 on page 15 shows some art.

Figure: In the fog

Example (Table)

bound	MPO	LMPO	POP*	sPOP*
$O(1)$				$9_{\backslash \textbf{0.06}}$
$O(n^1)$				$32_{\backslash \textbf{0.07}}$
$O(n^2)$				$38_{\backslash \textbf{0.09}}$
$O(n^3)$				$39_{\backslash \textbf{0.20}}$
$O(n^k)$			$43_{\backslash \textbf{0.05}}$	$39_{\backslash \textbf{0.20}}$
yes	$76_{\backslash \textbf{0.09}}$	$57_{\backslash \textbf{0.05}}$	$43_{\backslash \textbf{0.05}}$	$39_{\backslash \textbf{0.07}}$
maybe	$681_{\backslash \textbf{0.16}}$	$700_{\backslash \textbf{0.11}}$	$714_{\backslash \textbf{0.11}}$	$718_{\backslash \textbf{0.11}}$

Figure: Number of Oriented Problems and Average Execution Time in Seconds

Homework: Recreate (Numbers/Text do not matter)

Cost Category			Total in Euro
Direct Costs	**Personnel**	Postdocs	410,568
		Students	234,924
	i. Total Direct Costs for Personnel (in Euro)		**1,021,610**
	Travel		88,845
	Equipment		23,000
	Other goods and services	Consumables	2,000
		Publications	10,000
		Other (Audit)	13,745
	ii. Total Other Direct Costs (in Euro)		**137,590**
A – Total Direct Costs (i + ii) (in Euro)			**1,159,200**
B – Indirect Costs (overheads) 25% of Direct Costs (in Euro)			**289,800**
Total Requested EU Contribution (in Euro)			**1,449,000**