



Introduction to Scientific Working

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Summary of last lecture

Definition

Specifics of mathematics

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

Definition

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

Text `$ · $` `\(· \)` `\begin{math} · \end{math}`

Environment `equation` `multline` `gather` `align`

`array` `split` `eqnarray`

- No spaces are allowed in 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

L^AT_EX

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

Font sizes

- **Sometimes** it is useful to manually change the font size

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

Row spacing

- Adjustment of row spacing
- Only when the end of paragraph is in the scope of the command

Example

```
{\Large Improper\  
Distance}\par
```

Improper
Distance

```
{\Large Proper\  
Distance}\par}
```

Proper
Distance

Font style

Three properties of font style:

- 1 **Family**: roman, sans serif, typewriter
- 2 **Series**: medium, boldface extended
- 3 **Form**: upright, slanted, italic, caps and small caps

<code>\textrm{text}</code>	<code>\rmfamily</code>	test
<code>\textsf{text}</code>	<code>\sffamily</code>	test
<code>\texttt{text}</code>	<code>\ttfamily</code>	test
<code>\textmd{text}</code>	<code>\mdseries</code>	test
<code>\textbf{text}</code>	<code>\bfseries</code>	test
<code>\textup{text}</code>	<code>\upshape</code>	test
<code>\textsl{text}</code>	<code>\slshape</code>	<i>test</i>
<code>\textit{text}</code>	<code>\itshape</code>	<i>test</i>
<code>\textsc{text}</code>	<code>\scshape</code>	Test

Distances

Line spacing

Use `\linespread{factor}` in preamble

Specific horizontal space

Use `\hspace{length}`

mm mm

cm cm = 10 mm

in inch = 25.4 mm

pt point = $\frac{1}{72.27}$ in = 0.351 mm

bp big point = $\frac{1}{72}$ in 0.353 mm

em Quad (Geviert) = double width of a digit in current font

ex Height of the letter x

Horizontal distance

<code>\,</code>	very little
<code>\enspace</code>	a digit
<code>\quad</code>	x
<code>\qqquad</code>	double <code>\quad</code>
<code>\hfill</code>	extensible from 0 to ∞

Specific vertical distance

Use `\vspace{länge}`

Vertical distances

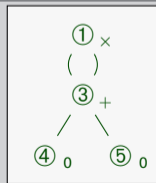
<code>\smallskip</code>	1/4 row
<code>\medskip</code>	1/2 row
<code>\bigskip</code>	1 row
<code>\vfill</code>	extensible from 0 to ∞

T_EX is not too useful for drawing

Drawing in $\text{L}^A\text{T}_E\text{X}$

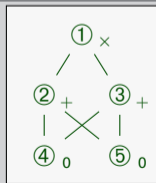
- T_EX and $\text{L}^A\text{T}_E\text{X}$ are not useful for drawing
- focus on text processing
- graphics can be included with `\includegraphics`
- The `tikz` package allows drawing in $\text{L}^A\text{T}_E\text{X}$

Example



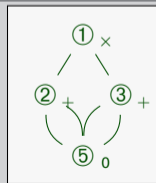
T_1

\sqsupset_3^2



T_2

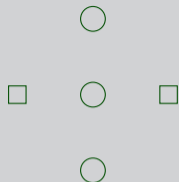
\sqsupset_5^4



T_3

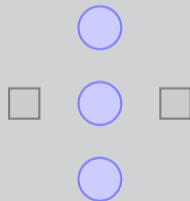
Example (Using Nodes)

```
\begin{tikzpicture}
  \node at ( 0,2) [circle,draw] {};
  \node at ( 0,1) [circle,draw] {};
  \node at ( 0,0) [circle,draw] {};
  \node at ( 1,1) [rectangle,draw] {};
  \node at (-1,1) [rectangle,draw] {};
\end{tikzpicture}
```



Example (Using Styles)

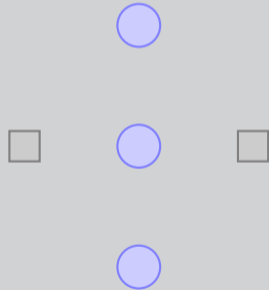
```
\begin{tikzpicture}
  [inner sep=2mm, place/.style={circle,draw=blue!50,
    fill=blue!20,thick},transition/.style={rectangle,
    draw=black!50, fill=black!20,thick}]
  \node at ( 0,2) [place] {};
  \node at ( 0,1) [place] {};
  \node at ( 0,0) [place] {};
  \node at ( 1,1) [transition] {};
  \node at (-1,1) [transition] {};
\end{tikzpicture}
```



Example (Relative Placement)

```
\begin{tikzpicture}
  [inner sep=2mm,
  place/.style={circle,draw=blue!50,
  fill=blue!20,thick},
  transition/.style={rectangle,
  draw=black!50,fill=black!20,thick},

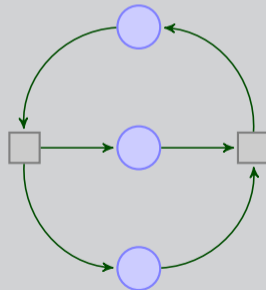
  \node[place] (waiting) {};
  \node[place] (critical)
    [below=of waiting] {};
  \node[place] (semaphore)
    [below=of critical] {};
  \node[transition] (leave critical)
    [right=of critical] {};
  \node[transition] (enter critical)
    [left=of critical] {};
\end{tikzpicture}
```



Example (Adding Connections)

```
\begin{tikzpicture}
  \node[place] (waiting) {};
  \node[place] (critical)
    [below=of waiting] {};
  \node[place] (semaphore)
    [below=of critical] {};

  \node[transition] (leave critical)
    [right=of critical] {}
    edge [pre]          (critical)
    edge [post,bend right] (waiting)
    edge [pre, bend left] (semaphore);
  \node[transition] (enter critical)
    [left=of critical] {}
    edge [post]          (critical)
    edge [pre, bend left] (waiting)
    edge [post,bend right] (semaphore);
\end{tikzpicture}
```



L^AT_EX is also not a presentation program

L^AT_EX presentations

- easy to reuse parts of paper in a presentation
- beamer document class

Example

```
\documentclass [%  
%handout,  
%draft  
{beamer}  
  
...
```

Example

```
\begin{beamerboxesrounded}[shadow=true]{\large Mini seminar papers}
\begin{tabular}{@{}c@{\hspace{.5cm}}c}
\begin{minipage}[b]{53ex}%
  \begin{enumerate}%
    \item T. Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl\\
      The Not So Short Introduction to LaTeX\\
      \url{https://tobi.oetiker.ch/lshort/lshort.pdf}
    \item \emph{Communication of the ACM}, Volume 59, Number 1 \& 2, 2016
  \end{enumerate}
\end{minipage}
&
\begin{minipage}[b]{20ex}
\vspace{.7cm}
\includegraphics[height=2.3cm,width=2.1cm]{ewa.jpg}
\end{minipage}
\end{tabular}
\end{beamerboxesrounded}}
```

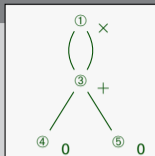
Example

Mini seminar papers

- 1 T. Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl
The Not So Short Introduction to LaTeX
<https://tobi.oetiker.ch/lshort/lshort.pdf>
- 2 *Communication of the ACM*, Volume 59, Number 1 & 2, 2016

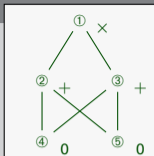


Example



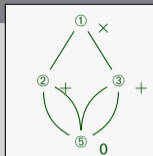
T_1

\sqsubset_3^2



T_2

\sqsupset_5^4



T_3

Example

```
\begin{tikzpicture}[node distance=8mm, bg/.style = {fill=black!3,draw=black,minimum width=2.cm}]
  \begin{scope}[xshift=-3.4cm]
    \tnode[] {A1}{\cOne}{\mTimes}
    \tnode[below of=A1] {A2}{\cThree}{\mPlus}
    \tnode[below of=A2, xshift=-5mm] {A3}{\cFour}{\mZ}
    \tnode[below of=A2, xshift=5mm] {A4}{\cFive}{\mZ}
    \path (A1) edge [bend left] (A2);
    \path (A1) edge [bend right] (A2);
    \path (A2) edge [] (A3);
    \path (A2) edge [] (A4);
    \node[] (L) at (0,-2.3) {$T_{1}$};
    \begin{pgfonlayer}{background}
      \node [bg, fit=(A1) (A2) (A3) (A4) ] {};
    \end{pgfonlayer}
  \end{scope}
  [...]
\end{tikzpicture}
```


Example (cont'd)

```
\uncover<2,6->{\node at (-1.7,-0.8) {\alert<6>{\fldtwothree$}};}

\uncover<2,4->{
\begin{scope}
  \tnode[] {A1}{\cOne$}{\mTimes$}
  \tnode[below of=A1, xshift=-5mm] {A2}{\cTwo$}{\mPlus$}
  \tnode[below of=A1, xshift=5mm] {A3}{\cThree$}{\mPlus$}
  \tnode[below of=A2] {A4}{\cFour$}{\mZ$}
  \tnode[below of=A3] {A5}{\cFive$}{\mZ$}
  \path (A1) edge (A2);
  \path (A1) edge (A3);
  \path (A2) edge (A4);
  \path (A2) edge (A5);
  \path (A3) edge (A4);
  \path (A3) edge (A5);
  \node[] (L) at (0,-2.3)   {\T_{2}$};
  \begin{pgfonlayer}{background}
    \node [bg, fit=(A1) (A2) (A3) (A4) (A5)] {};
  \end{pgfonlayer}
\end{scope}
}

\uncover<2,7->{\node at (1.7,-0.8) {\alert<7>{\fldfourfive$}};}

\uncover<2,5->{
\begin{scope}[xshift=3.4cm]
  [...]
\end{scope}
}
```

User defined commands

Macros

- Some formatting expressions are used repeatedly
- It is recommended to introduce **abbreviations**, in the form of **Macros**
`\newcommand{\POPSTARS}{\ensuremath{\text{sPOP}^{\ast}}}`
- Can be parametrized
`\newcommand{\todo}[1]{\textcolor{red}{(TODO: \textbf{\#1})}}`
- `amsmath` gives special macro definitions command for big operators
`\DeclareMathOperator{\bigO}{\mathsf{O}}`
- Maximum of 9 parameters in user-defined macros in \LaTeX ☺

Macros (cont'd)

- Alternative definitions
 - `\newcommand*`
 - `\renewcommand`
 - `\DeclareMathOperator` (with `amsmath`)
 - `\def` (T_EX)
- `\newcommand*` allows no paragraphs in arguments `\newcommand` does

Program code

- `listings` package
- Which languages are supported?
- What is `\lstset`?

Example (cont'd)

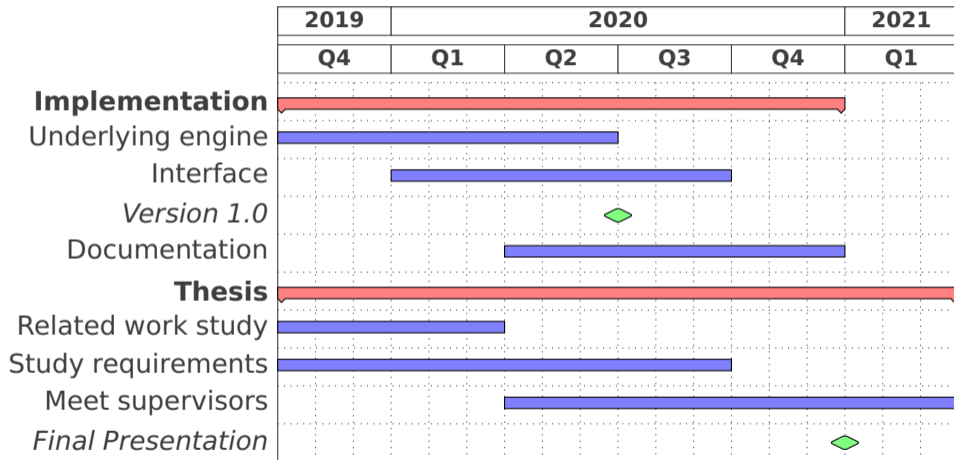
```
\begin{scope}
  \tnode[] {A1}{\cOne$}{\mTimes$}
  \tnode[below of=A1, xshift=-5mm] {A2}{\cTwo$}{\mPlus$}
  \tnode[below of=A1, xshift=5mm] {A3}{\cThree$}{\mPlus$}
  \tnode[below of=A2] {A4}{\cFour$}{\mZ$}
  \tnode[below of=A3] {A5}{\cFive$}{\mZ$}

  [...]
\end{scope}
```

Example

```
\newcommand*\cOne{\text{\ding{192}}}
\newcommand*\m[1]{\mathsf{#1}}
\newcommand*\fldtwothree{\uflda{\text{\tiny{2}}}{\text{\tiny{3}}}}
\newcommand*\fldfourfive{\flda{\text{\tiny{4}}}{\text{\tiny{5}}}}
\tikzstyle{nid}=[xshift=3mm,yshift=-1mm]
\newcommand*\tnode[4][]{%
  \node[#1] (#2) {#3};
  \node[nid] at (#2) {\tiny{\textbf{#4}}};
}
\newcommand*\mPlus{\mathrel{\m{+}}}
\newcommand*\mTimes{\mathrel{\m{\times}}}
```

Use Tikz(?) to create a BSc timeline



Homework

- 1 Imitate the derivation and diagram of PDF2 and the certificate on PDF8 from:
`cl-informatik.uibk.ac.at/teaching/ws23/ewa/imit.tgz`
- 2 Skim the documentation of the `beamer` and `tikz` packages
- 3 Read “A Guide for New Referees in Theoretical Computer Science” by Ian Parberry
or “The task of the referee” by Alan J. Smith
- 4 Read “How NOT to review a paper: The tools and techniques of the adversarial reviewer” by Graham Cormode.