Introduction to Scientific Working

Aart Middeldorp

Outline

1. **Evaluation**
2. **LaTeX**
3. **Generative AI**
4. **TikZ**
5. **Scheduling and Grading**

Outline

Online Evaluation in Presence

https://lv-analyse.uibk.ac.at/evasys/public/online/index

Outline

Boxes

- `\makebox[`*width*`][`*alignment*`]{`*text*`}`

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```
\makebox[5cm]{Name: ~ \hrulefill}
\makebox[5cm]{Matriculation Number: ~ \hrulefill}
```

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Name: _____

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\makebox[5cm]{Name: ~ \hrulefill} \quad Code: ~ \framebox[1cm]{\strut}
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Name: _____

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Name: _____ Code: ☐

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  width: (optional) width of box

  alignment: `c` (default) `l` `r` `s`

- `\framebox[`*width*`][`*alignment*`]{`*text*`}`
- `\raisebox[`*displacement*`]{`*text*`}`

```
\makebox[5cm]{Name: ~ \hrulefill} \quad Code: ~ \framebox[1cm]{\strut}
\makebox[5cm]{Matriculation Number: ~ \hrulefill}
```

src

Name: _____ Code: ☐

Matriculation Number: _____

Handout

- printed version of slides

Handout

- printed version of slides

```
\documentclass[handout]{beamer}
\usepackage{pgfmorepages}
\pgfpagesuselayout{4 on 1}[a4paper, border shrink = 5mm, landscape]
```

src

Handout

- printed version of slides

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\documentclass[handout]{beamer}
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\pgfpagesuselayout{4 on 1}[a4paper, border shrink = 5mm, landscape]
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src

- `\documentclass[draft]{beamer}`
- `\includeonlyframes{`*frame label list*`}`

  to speed up compilation

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- printed version of slides

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\documentclass[handout]{beamer}
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```

src

- `\documentclass[draft]{beamer}`
- `\includeonlyframes{`*frame label list*`}`

  to speed up compilation
- `\begin{frame}[fragile]`

  for frames that include `verbatim` text

Commands

- `\newcommand{`*name*`}[`*number*`]{`*code*`}`

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\newcommand{\wfo}{well-founded order\xspace}
\newcommand{\CTAN}[1]{\href{https://ctan.org/pkg{#1}{#1}}
```

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```
\newcommand{\wfo}{well-founded order\xspace}
\newcommand{\CTAN}[1]{\href{https://ctan.org/pkg{#1}{#1}}
\newcommand{\TIKZ}[2][library]{\href{https://tikz.dev/#1-#2}{#2}}
\newcommand{\seq}[2][n]{{#2_1},...,{#2_{#1}}}
```

src

Outline

Guidelines

- Springer Nature

Guidelines

- Springer Nature
- COPE (discussion)

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- IIS Academic GenAI Policy

Guidelines

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- guidelines for students at MIP faculty (in progress)

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Der Einsatz von KI-Werkzeugen im Studium erfordert ein hohes Maß an Eigenverantwortung und Reflexion. Wir appellieren ausdrücklich an alle Studierenden, die folgenden Grundsätze zu beachten und ernst zu nehmen:

Ein Studium dient in erster Linie dem Erwerb von Kompetenzen – nicht nur dem Aneignen von Inhalten. KI kann dabei unterstützen, birgt jedoch die erhebliche Gefahr, dass genau diese Kompetenzen nicht ausreichend entwickelt werden, wenn Lernprozesse ausgelagert oder verkürzt werden. Insbesondere in einer Fakultät, in der „learning by doing“ eine zentrale Rolle spielt, ist das eigenständige Bearbeiten von Aufgaben, das Programmieren, das Experimentieren und das Durchdringen von Problemstellungen unverzichtbar.

Gerade zu Beginn des Studiums ist dieser aktive Lernprozess nicht ersetzbar. Auch wenn dabei manchmal Frustration entstehen kann, ist es entscheidend, sich Herausforderungen selbst zu stellen. Nicht das bloße Ergebnis – etwa die korrekte Lösung einer Übungsaufgabe – ist wichtig, sondern der Weg dorthin. Der Lernprozess entsteht durch das eigene Nachdenken, Ausprobieren und auch durch Fehler. Fehler sind ein integraler und wertvoller Bestandteil des Lernens.

KI-Systeme können zudem fehlerhafte oder irreführende Ergebnisse liefern, oft in einer Weise, die nicht unmittelbar erkennbar ist. Für die Nutzung und Weiterverwendung solcher Ergebnisse tragen Sie die Verantwortung. Um Fehler überhaupt erkennen zu können, benötigen Sie genau die Kompetenzen, die im Studium vermittelt werden sollen. Erst auf dieser Grundlage kann KI sinnvoll und unterstützend eingesetzt werden.

Ein weiterer wichtiger Aspekt betrifft die Zusammenarbeit: Wissenschaft lebt vom Austausch und von gemeinsamer Problemlösung – „Science is teamwork". Eine übermäßige Nutzung von KI kann dazu führen, dass dieser Austausch reduziert wird und damit auch wichtige soziale und fachliche Kompetenzen weniger entwickelt werden.

Letztlich kann eine unreflektierte oder zu intensive Nutzung von KI Ihrem eigenen Lernfortschritt schaden. Daher ist es wichtig, dass Sie Ihren eigenen Lernprozess bewusst beobachten und kritisch hinterfragen: Wann unterstützt KI sinnvoll? Und wann ersetzt sie notwendige eigene Denkleistung?

Sie tragen die Verantwortung für Ihren Lernprozess!

Dazu gehört auch ein sensibler Umgang mit rechtlichen Rahmenbedingungen. Bei der Nutzung von KI können Fragen des Urheberrechts und des Datenschutzes entstehen, etwa wenn Inhalte hochgeladen oder KI-generierte Ergebnisse weiterverwendet werden.

Outline

Transparency

```
\usetikzlibrary{decorations.pathmorphing}

\usepackage{tikzducks}

\duck [laughing]
\fill [top color = white, bottom color = blue]
    (-1,-0.2) -- (-1,0.5)
    decorate [decoration={snake}]{-- (3,0.5)} -- (3,-0.2);
```

Transparency

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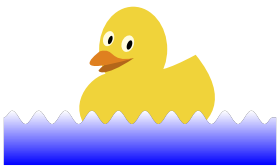

Transparency

```
\usetikzlibrary{decorations.pathmorphing}

\usepackage{tikzducks}

\duck [laughing, crazyhair = red]
\fill [top color = white, bottom color = blue, opacity = 0.5]
    (-1,-0.2) -- (-1,0.5)
    decorate [decoration={snake}]{-- (3,0.5)} -- (3,-0.2);
```

src

```
\begin{tikzpicture}[very thick, opacity = 0.4]
  \filldraw [red!50!white]  ( 90:1.3) circle (2.3);
  \filldraw [green]         (210:1.3) circle (2.3);
  \filldraw [blue!50!white] (330:1.3) circle (2.3);
  \node at (90:2.2) {$A$}; \node at (210:2.2) {$B$}; \node at (330:2.2) {$C$};
  \node [font = \large] {$A \cap B \cap C$};
\end{tikzpicture}
```

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\begin{tikzpicture}[very thick, opacity = 0.4]
  \filldraw [red!50!white]  ( 90:1.3) circle (2.3);
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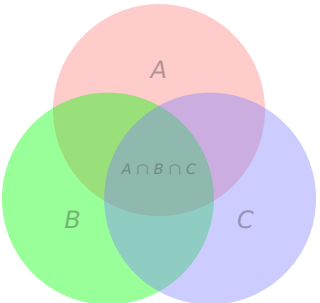

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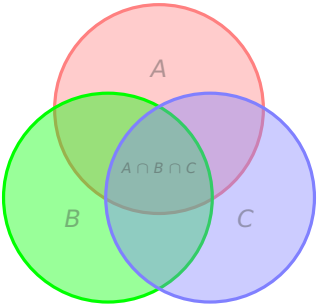

```
\begin{tikzpicture}[very thick, fill opacity = 0.4, text opacity = 1]
  \filldraw [red!50!white]  ( 90:1.3) circle (2.3);
  \filldraw [green]         (210:1.3) circle (2.3);
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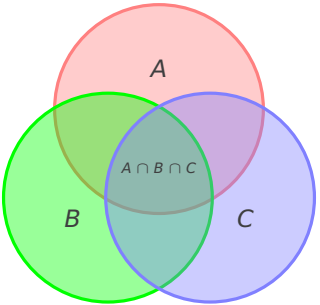

```
\begin{scope}[opacity = 0.6]
  \draw [line width = 4mm, red] circle(1);
  \fill [rounded corners, fill = red, rotate = 15]
     (-1.3,-0.2) rectangle (1.3,0.2);
\end{scope}

\node [rotate = 15] {TOP SECRET};
```

```
\begin{scope}[opacity = 0.6]
  \draw [line width = 4mm, red] circle(1);
  \fill [rounded corners, fill = red, rotate = 15]
     (-1.3,-0.2) rectangle (1.3,0.2);
\end{scope}
\node [rotate = 15] {TOP SECRET};
```

```
\begin{scope}[opacity = 0.6, transparency group]
  \draw [line width = 4mm, red] circle(1);
  \fill [rounded corners, fill = red, rotate = 15]
     (-1.3,-0.2) rectangle (1.3,0.2);
\end{scope}
\node [rotate = 15] {TOP SECRET};
```

src

```
\usetikzlibrary{matrix, positioning, quotes}

\tikzset{standard/.style = {matrix of nodes, inner sep = 0pt,
  nodes = {inner sep = 1mm}, left delimiter = {(}, right delimiter = {)}}}
\tikzset{every node/.append style = {font = \sffamily}}

\matrix[standard] (m) {
   1 & 2 & 3 \\
   4 & 5 & 6 \\
   7 & 8 & 9 \\ };
\matrix[standard, right = 3cm of m] (n) {
   1 & 4 & 7 \\
   2 & 5 & 8 \\
   3 & 6 & 9 \\ };

\draw[->, shorten <=5m, shorten >=5m, thick] (m.east) to["transpose"] (n);
```

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```
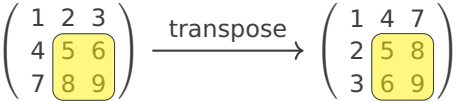
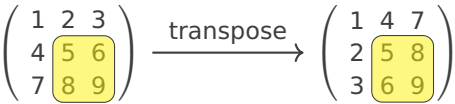
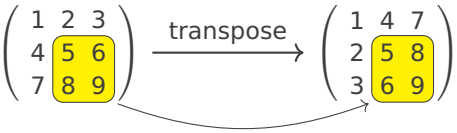

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \xrightarrow{\text{transpose}} \begin{pmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{pmatrix}$$


1 2 3
4 5 6
7 8 9
transpose
1 4 7
2 5 8
3 6 9




```
\tikzset{submatrix/.style = {rectangle, rounded corners, fill = yellow,
  fill opacity = 0.5}}
\draw[submatrix] (m-2-2.north west) rectangle (m-3-3.south east);
\draw[submatrix] (n-2-2.north west) rectangle (n-3-3.south east);
```

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\tikzset{submatrix/.style = {rectangle, rounded corners, fill = yellow,
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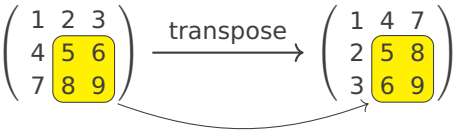
\draw[submatrix] (m-2-2.north west) rectangle (m-3-3.south east);
\draw[submatrix] (n-2-2.north west) rectangle (n-3-3.south east);
```




```
\usetikzlibrary{fit, backgrounds}
\tikzset{submatrix/.style = {rectangle, rounded corners, fill = yellow,  draw,
  inner sep = 0pt}}
\begin{scope}[on background layer]
  \node (m1) [submatrix, fit = (m-2-2) (m-3-3)] {};
  \node (n1) [submatrix, fit = (n-2-2) (n-3-3)] {};
\end{scope}
\draw [->] (m1.south east) to[bend right = 20] (n1.south west);
```

src

- `\foreach` *variable* `in {`*list of values*`} {`*commands*`};`

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```
\draw \foreach \i in {10,20,...,360} {(\i:1) circle (1)};
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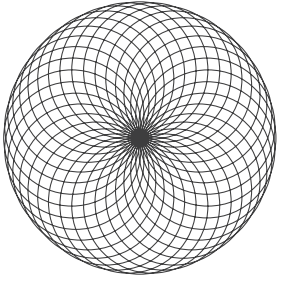
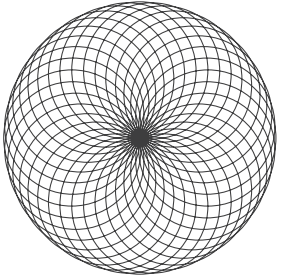


- `\foreach` *variable* `in {`*list of values*`} {`*commands*`};`

```
\draw \foreach \i in {10,20,...,360} {(\i:1) circle (1)};
\filldraw [even odd rule, orange] \foreach \i in {10,20,...,360}
  {(\i:1) circle (1)};
```



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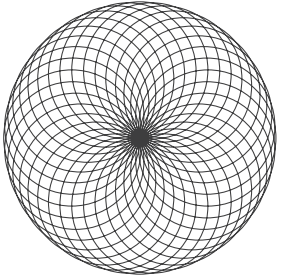
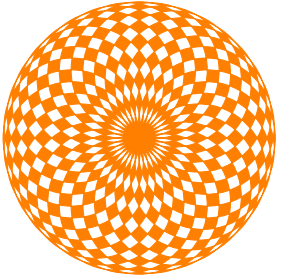
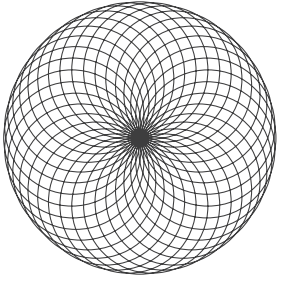


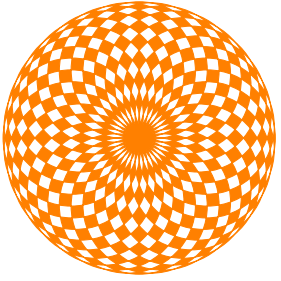


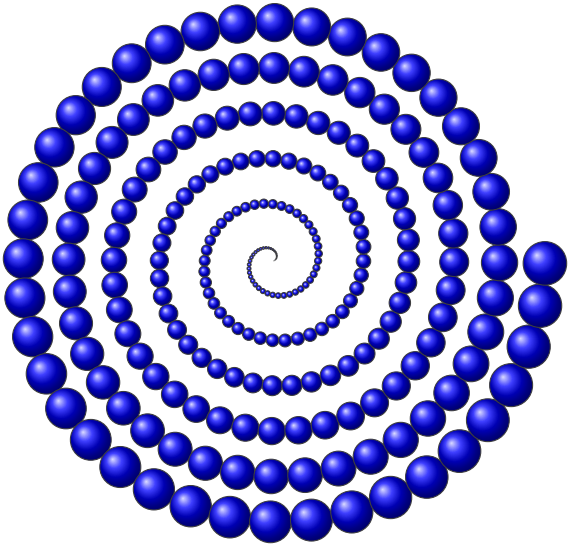
▶ `\foreach` *variable* `in {`*list of values*`} {`*commands*`};`

```
\draw \foreach \i in {10,20,...,360} {(\i:1) circle (1)};
\filldraw [even odd rule, orange] \foreach \i in {10,20,...,360}
  {(\i:1) circle (1)};
\foreach \i in {0,0.025,...,6}
   \draw [shading=ball] ($(0,0)!\i!\i*360:(1,0)$) circle (0.08*\i);
```

src







Outline

Topics

1 chemmacros
2 chessboard
3 cleveref
4 enumitem
5 listings
6 mathtools
8 MusiXTeX
9 pgf–go
10 pgfplots
11 postit
12 qrcodetikz
13 TangramTikz
14 tikzmark
15 tikzpeople
16 tkz-berge
17 todonotes

Assignment

1 Bacher Martin
2 Weilbacher Jannick
3 Darsel Esma
3 Fitz Julia
4 Bekhtari Salma
4 Ristova Kirjana
5 Krumholz Maya
5 Sagerer Marie
6 Oppermann Linda
8 Beier Tom Simon
8 Küllmar Jan Peter
9 Albrecht Odin
10 Kerber Thomas Martin
11 Ilic Ilija
11 Khakhlou Pavel
12 Ciech Dominique Manuel
13 Paganini Adriano
14 Hölzl Sebastian
15 Krause Jakob Moritz
16 Musch Eric Edgar Friedrich
17 Freiermuth Marie
17 Leinfelder Matthias Christian

Scheduling

- June 11 — 5 | 4 | 11 | 8 | 17 | 9
- June 18 — 10 | 16 | 13 | 14 | 15 | 6
- June 25 — 3 | 12 | 1 | 2 | |

Instructions

- 15 minute presentation using slides with beamer package

  upload both sources and PDF in OLAT (deadline: 8 am on presentation day)

Scheduling

▸ June 11	5	4	11	8	17	9
▸ June 18	10	16	13	14	15	6
▸ June 25	3	12	1	2		

Instructions

- 15 minute presentation using slides with beamer package

  upload both sources and PDF in OLAT (deadline: 8 am on presentation day)
- 5 to 10 page report in LIPIcs format (deadline: 10 am on July 3)

  upload both sources and PDF in OLAT

Grading

$$\text{score} = E + P_1 + P_2 + R$$

- E : points for solved exercises (at most 25)
- P_1 : points for presentation of solutions (at most 10)
- P_2 : points for presentation of assigned topic (at most 25)
- R : points for report on assigned topic (at most 40)

$$\text{grade} = \text{score} \in (-50) \to 5 \quad [50-63) \to 4 \quad [63-75) \to 3 \quad [75-88) \to 2 \quad [88-) \to 1$$