Hacktopia University

Institute for Open Source Shenanigans
and Kernel Comedy (IOSSKC)

Faculty 0101 - Faculty of Recursive Computing Delights

GNU/Emacs: The Unconventional Operating System Saga Where GNU/Linux is Just a Kernel with Commitment Issues

Navigating the Bizarre Landscape of Command-Line Love Affairs and Kernel Drama

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stuff ...

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Abstract

this is the section where i will put my english abstract ...

Zusammenfassung

Hier die deutsche zusammenfassung ...

1 nix shell (env)

```
cat shell.nix
```

Listing 1: `nix-shell` config for generating a build environment

```
{ pkgs ? import <nixpkgs> {} }:

pkgs.mkShell {
  buildInputs = with pkgs; [
    (python310.withPackages(ps: with ps; [ numpy latexify-py scipy pygments ]))
    graphviz
  ];

  shellHook = ''
    echo "entering dev environment"
  '';
}
```

2 emacs config

2.1 packages

```
(package! evil-tutor)
(package! pdf-tools)
(package! org-special-block-extras) ;; (use-package org-special-block-extras :ensure t)
```

2.2 emacs config

```
;;; $DOOMDIR/config.el -*- lexical-binding: t; -*-

;; Place your private configuration here! Remember, you do not need to run 'doom
;; sync' after modifying this file!

;; ...

;; add latex classes for org-mocde export to latex (pdf)
(add-to-list 'org-latex-classes
             '("koma-book"
               "\\documentclass{scrbook}"
               ("\\chapter{%s}" . "\\chapter*{%s}")
               ("\\section{%s}" . "\\section*{%s}")
               ("\\subsection{%s}" . "\\subsection*{%s}")
               ("\\subsubsection{%s}" . "\\subsubsection*{%s}")
               ("\\paragraph{%s}" . "\\paragraph*{%s}")
               ("\\subparagraph{%s}" . "\\subparagraph*{%s}")))

(add-to-list 'org-latex-classes
             '("koma-article"
               "\\documentclass{scrartcl}"
               ("\\section{%s}" . "\\section*{%s}")
               ("\\subsection{%s}" . "\\subsection*{%s}")
               ("\\subsubsection{%s}" . "\\subsubsection*{%s}")
               ("\\paragraph{%s}" . "\\paragraph*{%s}")
               ("\\subparagraph{%s}" . "\\subparagraph*{%s}")))

;; syntax highlighting for org-mode code block
(setq org-latex-listings 'minted
      org-latex-packages-alist '(("" "minted"))
```

```
      org-latex-pdf-process
      '("pdflatex -shell-escape -interaction nonstopmode -output-directory %o %f"
        "pdflatex -shell-escape -interaction nonstopmode -output-directory %o %f"
        "pdflatex -shell-escape -interaction nonstopmode -output-directory %o %f"))

;; ...
```

3 convert python 2 latex

```
import math
import numpy as np
import scipy
import latexify
```

Table 3.1: table of libararys with coresponding version

latexify.__version__	'0.0.0a0'
np.__version__	'1.24.2'
scipy.__version__	'1.10.1'

With the imported libs, we can now convert a `python` function to `latex`

```
1  def recHelper(x: int, d: int = 3) -> int:
2      # forall x in [3, infty)
3      if x % 2 == 0:
4          return 0
5      elif d > math.floor(math.sqrt(x)):
6          return 1
7      elif x % d == 0:
8          return 0
9      else:
10         return recHelper(x, d + 2)
11
12 def isPrime(x: int) -> int:
13     if x <= 1:  # forall x in (infty, 1] : 1
14         return 0
15     elif x == 2:
16         return 1
17     else:  # forall x in (2, infty)
18         return recHelper(x, 3)
```

Listing 2: code block containing prime checking functions

In line 12 we remember the current position. Line 1 jumps to point-min.

$$\text{isPrime}(x) = \begin{cases} 0, & \text{if } x \leq 1 \\ 1, & \text{if } x = 2 \\ \text{recHelper}\left(x, 3\right), & \text{otherwise} \end{cases}$$

$$\text{recHelper}(x, d) = \begin{cases} 0, & \text{if } x \,\%\, 2 = 0 \\ 1, & \text{if } d > \lfloor \sqrt{x} \rfloor \\ 0, & \text{if } x \,\%\, d = 0 \\ \text{recHelper}\left(x, d + 2\right), & \text{otherwise} \end{cases}$$

Now we can call the `isPrime` function with the parameter `5` and `6`:

- is `5` a prime number? result of `isPrime` func: `True`
- is `6` a prime number? result of `isPrime` func: `False`

4 Funktionskomposition

Graph using the `dot` language

```
digraph G {
    node [shape=circle, fontname="Courier", fontsize=16]
    edge [fontname="Courier", fontsize=16]
    A:nw -> A [label="id"]
    A -> B [label="f"]
    B -> C [label="g"]
    A -> C [xlabel="g . f "]
    {rank=same; A B}
}
```

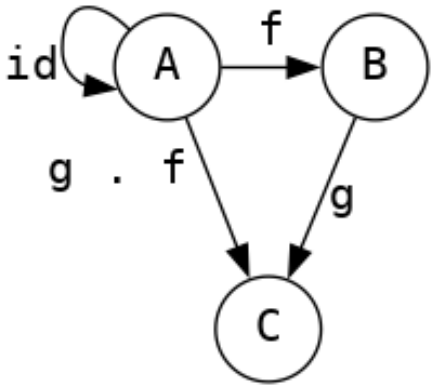

Figure 4.1: function composition and identity

Graph using latex `tikz picture`

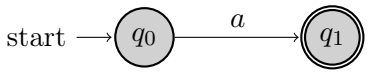

Figure 4.2: Graph des Büchi-Automaten $\hat{A}$. Der Zustand q_1 hat dabei keine ausgehende Kante. Der Zustand ist trotzdem akzeptierend, da beide enthaltenen Zustände von $\acute{A}$ akzeptierend sind. Die naive Anwendung des Leerheitstests auf alternierenden Büchi-Automaten liefert in diesem Fall also zu viele akzeptierende Zustände.

5 Some random Proof

Sei

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \in \mathbb{R}^{3\times 3}.$$

Zeigen Sie, dass für alle $\beta \in \mathbb{N}_{>0}$ gilt:

$$A^{\beta} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta & 0 & 1 \end{pmatrix}.$$

'Matrix multiplication as composition | Chapter 4, Essence of linear algebra' footnote `https://youtu.be/XkY2DOUCWMU` Die Matrix A auch als Lineare Transformation in $\mathbb{R}^3$ interpretiert werden.

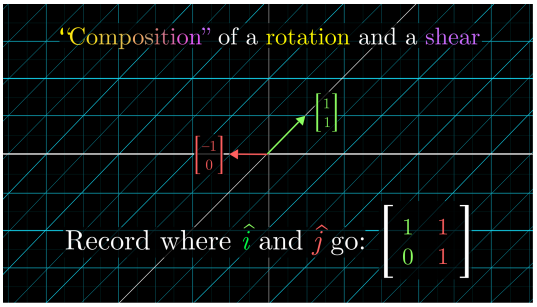

Figure 5.1: Composition of Transformations
Quelle: `https://www.3blue1brown.com/lessons/matrix-multiplication`

Diese Interpretation erleichtert das nachvollziehen dieses zu beweisenden Satzes, und lässt ihn fast schon trivial erscheinen.

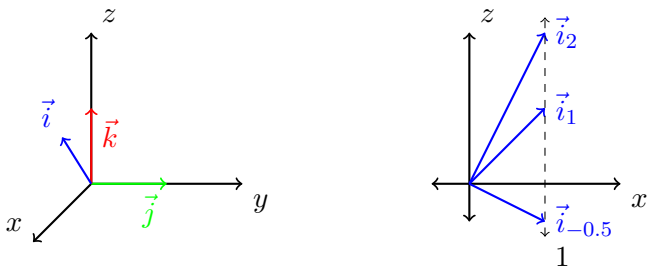

Figure 5.2: $\mathbb{R}^3$ mit linearer Transformation A^1

$$\text{Mit } \vec{i} = (1,0,\beta)^T \text{ und } \vec{j} = (0,1,0)^T \text{ und } \vec{k} = (0,0,1)^T.$$

Somit wird lediglich die x Koordinate Transformiert. Egal wie oft man diese Transformation potenziert, die y und z Achsen werden sich nicht verändern, hingegen wird sich die x Achse zunehmend der y Achse annähern.

$\mathbb{Z}$

$$\forall \beta \in \mathbb{N}^* \mid \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}^{\beta} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta & 0 & 1 \end{pmatrix}$$

Proof of important theorem. **Beweis** (durch vollständige Induktion nach β):

Induktionsvoraussetzung ($\star$):

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}^{\beta} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta & 0 & 1 \end{pmatrix}$$

Bemerkung 1.
Induktionsbeginn ($\beta = 0$):
man könnte auch bei 0 anfangen ...

Induktionsbeginn ($\beta = 1$):

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}^{1} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$$

Induktionsschritt ($\beta \rightsquigarrow \beta + 1$):

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}^{\beta+1} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ (\beta+1) & 0 & 1 \end{pmatrix} \tag{5.1}$$

$$\Leftrightarrow \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}^{\beta} \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ (\beta+1) & 0 & 1 \end{pmatrix} \tag{5.2}$$

$$\overset{\star}{\Leftrightarrow} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ (\beta+1) & 0 & 1 \end{pmatrix} \tag{5.3}$$

$$\Leftrightarrow \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta+1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta+1 & 0 & 1 \end{pmatrix} \tag{5.4}$$

□

6 TODO drawing functions and their root function / derivation

some `python` and `plotlib` code ...

```
print("hello world")
```

7 logic and stuff ...

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

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7.1 forward direction ($\rightarrow$)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{[A]^3 \qquad [A \to B]^1}{B}[\text{mp}] \qquad [\neg B]^2}{\bot}[\neg E]}{\neg A}[\neg I^3]}{\neg B \to \neg A}[\to I^2]}{(A \to B) \to (\neg B \to \neg A)}[\to I^1]$$

7.2 back direction ($\leftarrow$)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{[A]^5 \qquad \dfrac{[\neg B]^6 \qquad [\neg B \to \neg A]^4}{\neg A}[\text{mp}]}{\bot}[\neg E]}{B}[\text{raa}^6]}{A \to B}[\to I^5]}{(\neg B \to \neg A) \to (A \to B)}[\to I^4]$$

7.3 both directions ($\leftrightarrow$)

$$\dfrac{(A \to B) \to (\neg B \to \neg A) \qquad (\neg B \to \neg A) \to (A \to B)}{\vdash (A \to B) \leftrightarrow (\neg B \to \neg A)}[\leftrightarrow \text{I}]$$