*TikZ*ische Erlebnisse

Dante Frühjahrstagung 2025

Uwe Ziegenhagen

3. April 2025

Inhalt

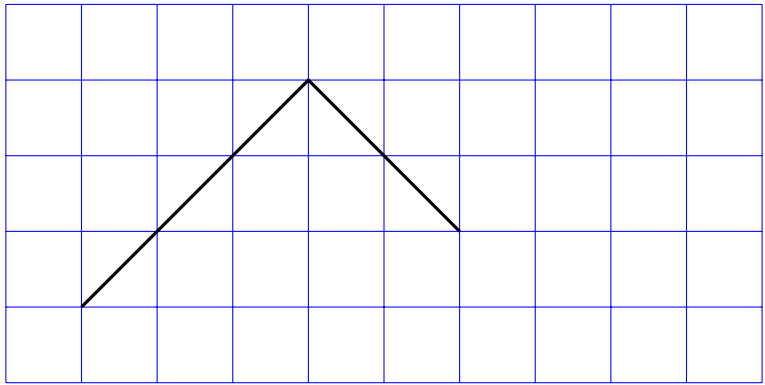
- Kurze – nicht vollständige – Vorstellung von TikZ-Grundlagen
- Beispiele, Beispiele, Beispiele. . .
- Siehe auch `https://github.com/UweZiegenhagen/TikZ_Tutorial`

Geschichte

- TikZ = „TikZ ist kein Zeichenprogramm“
- TikZ = „Frontend“ für PGF („portable graphics format“)
- Entwickler Till Tantau, Christian Feuersänger
- Erscheinungsjahr 2005

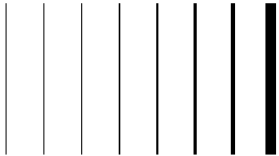
Einfache Linien

```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,5);
\draw[very thick] (1,1) -- (4,4) -- (6,2);
\end{tikzpicture}
```



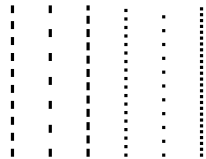
Liniendicken

```
\begin{tikzpicture}
\draw[ultra thin] (2,1) -- (2,3);
\draw[very thin] (2.5,1) -- (2.5,3);
\draw[thin] (3,1) -- (3,3);
\draw[semithick] (3.5,1) -- (3.5,3);
\draw[thick] (4,1) -- (4,3);
\draw[very thick] (4.5,1) -- (4.5,3);
\draw[ultra thick] (5,1) -- (5,3);
\draw[line width=4pt] (5.5,1) -- (5.5,3);
\end{tikzpicture}
```



Linienstile

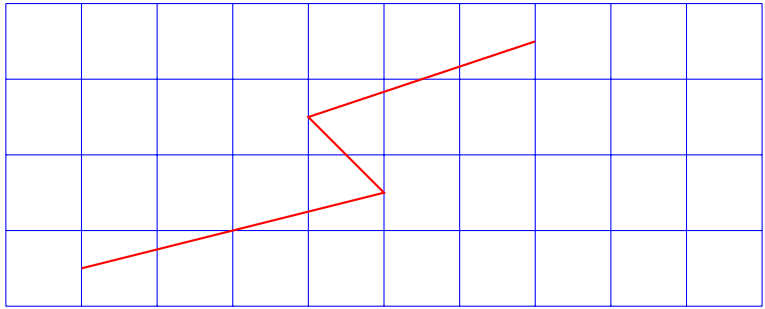
```
\begin{tikzpicture}
\draw[very thick, dashed] (2,1) -- (2,3);
\draw[very thick, loosely dashed] (2.5,1) -- (2.5,3);
\draw[very thick, densely dashed] (3,1) -- (3,3);
\draw[very thick, dotted] (3.5,1) -- (3.5,3);
\draw[very thick, loosely dotted] (4,1) -- (4,3);
\draw[very thick, densely dotted] (4.5,1) -- (4.5,3);
\end{tikzpicture}
```



Rel. Koordinaten I

mit Update der Koordinaten

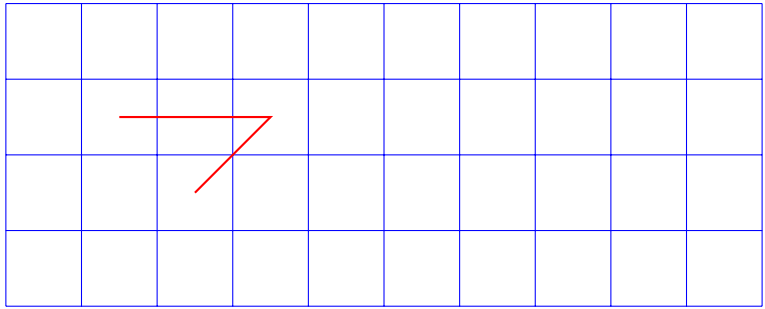
```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,4);

\draw[thick, red] (1,0.5) -- ++(4,1) -- ++(-1,1) -- ++(3,1);
\end{tikzpicture}
```



Rel. Koordinaten II

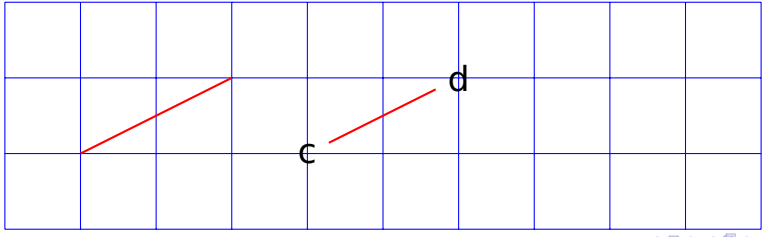
ohne Update der Koordinaten

```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,4);

\draw[thick, red] (2.5,1.5) -- +(1,1) -- +(-1,1);
\end{tikzpicture}
```



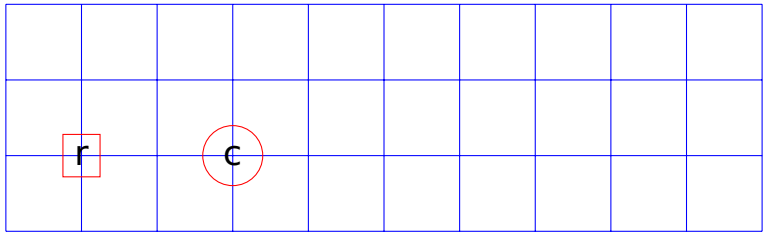
Nodes und Coordinates

```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,3);

\coordinate (a) at (1,1);
\coordinate (b) at (3,2);
\draw[red, thick] (a) -- (b);

\node (c) at (4,1){c};
\node (d) at (6,2){d};
\draw[red, thick] (c) -- (d);
\end{tikzpicture}
```



Node Shapes

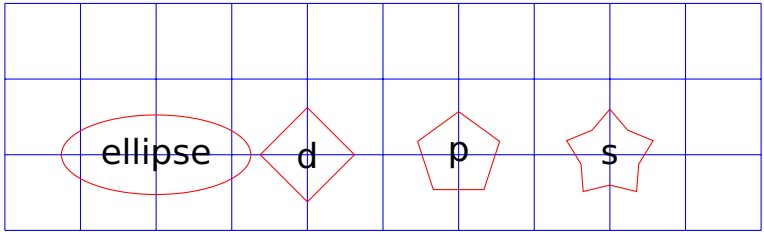
```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,3);

\node[rectangle,draw = red] (r) at (1,1){r};
\node[circle,draw = red] (c) at (3,1){c};
\end{tikzpicture}
```



- mehr mit `\usetikzlibrary{shapes}`

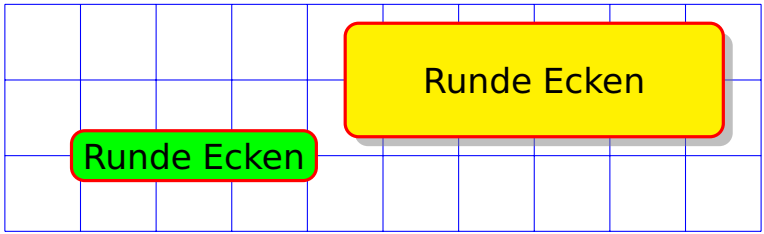
Die shapes Bibliothek

```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,3);

\node[ellipse,draw = red] (e) at (2,1){ellipse};
\node[diamond,draw = red] (d) at (4,1){d};
\node[regular polygon,regular polygon sides=5,draw=red](p) at (6,1){p};
\node[star,star points=5,draw = red] (s) at (8,1){s};
\end{tikzpicture}
```



Shapes formatieren

```
\begin{tikzpicture}
\draw[step=1cm,blue,thin] (0,0) grid (10,3);

\node[rectangle,draw = red,very thick,rounded corners=5pt,fill=green] (r) at (2.5,1){Runde
    Ecken};

\node[rectangle,drop shadow,draw = red,very thick,rounded corners=5pt,minimum width=5cm,
    minimum height=15mm, fill=yellow] (r) at (7,2){Runde Ecken};
\end{tikzpicture}
```



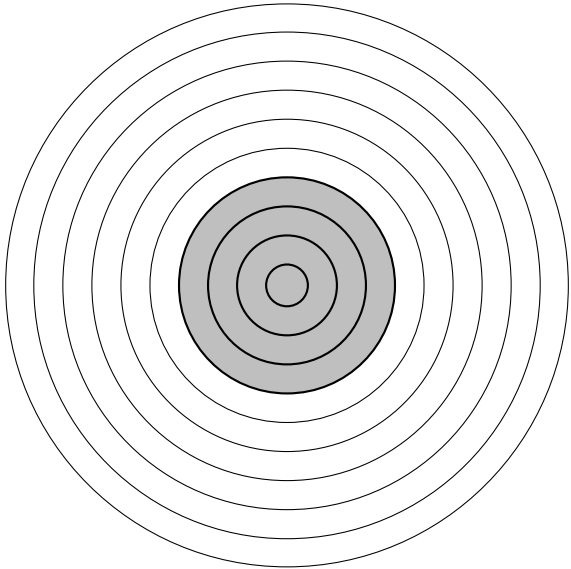
Anwendungen

- Zielscheibe 10m Luftpistole
- Weihnachtszahlen
- Kalender
- Synthesizer-Aufbau

Zielscheibe Luftpistole I

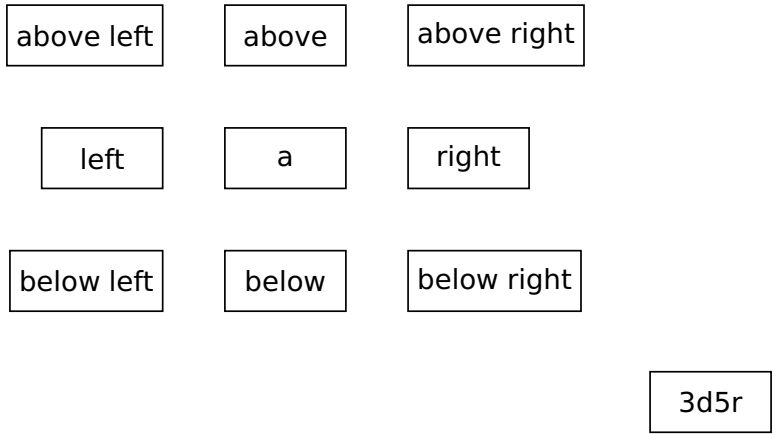
```
\begin{tikzpicture}
\coordinate (o) at (8,8);
\draw[black] (o) circle (77.5mm);
\draw[black] (o) circle (69.75mm);
\draw[black] (o) circle (61.75mm);
\draw[black] (o) circle (53.75mm);
\draw[black] (o) circle (45.75mm);
\draw[black] (o) circle (37.75mm);
\draw[black,thick,fill=lightgray] (o) circle (29.75mm);
\draw[black,thick] (o) circle (21.75mm);
\draw[black,thick] (o) circle (13.75mm);
\draw[black,thick] (o) circle (5.75mm);
\end{tikzpicture}
```

Zielscheibe Luftpistole II



Exkurs Positioning Library I

- Relative Koordinaten mit der `positioning` Library



Exkurs Positioning Library II

```
\node at (0,0) [box] (a) {a};
\node [below = of a,box] (b) {below};
\node [above = of a,box] (c) {above};
\node [left = of a,box] (d) {left};
\node [right = of a,box] (e) {right};
\node [below left = of a,box] (f) {below left};
\node [below right= of a,box] (g) {below right};
\node [above left = of a,box] (h) {above left};
\node [above right= of a,box] (i) {above right};
\node [below right = 3cm and 5cm of a,box] {3d5r};
```

Zielscheibe Luftpistole III

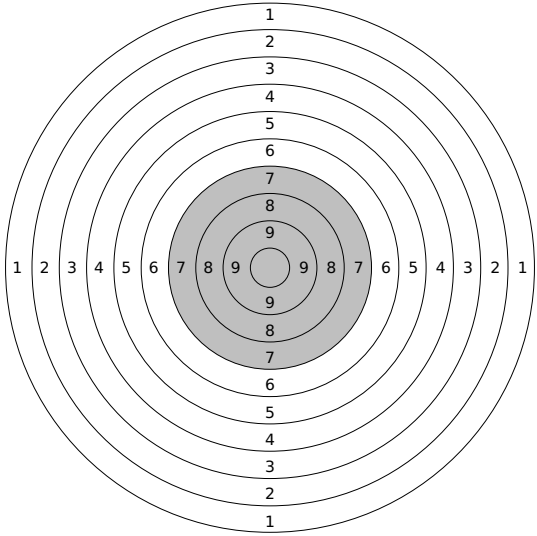
- Positioning-Bibliothek laden

```
\usetikzlibrary{positioning}
```

```
\begin{tikzpicture}
\node[right=0.7cm of o] {9};
\node[right=1.5cm of o] {8};
\node[right=2.3cm of o] {7};
\node[right=3.1cm of o] {6};
\node[right=3.9cm of o] {5};
\node[right=4.7cm of o] {4};
\node[right=5.5cm of o] {3};
\node[right=6.3cm of o] {2};
\node[right=7.1cm of o] {1};
\end{tikzpicture}
```

- wiederholen für left, above, below

Zielscheibe Luftpistole IV

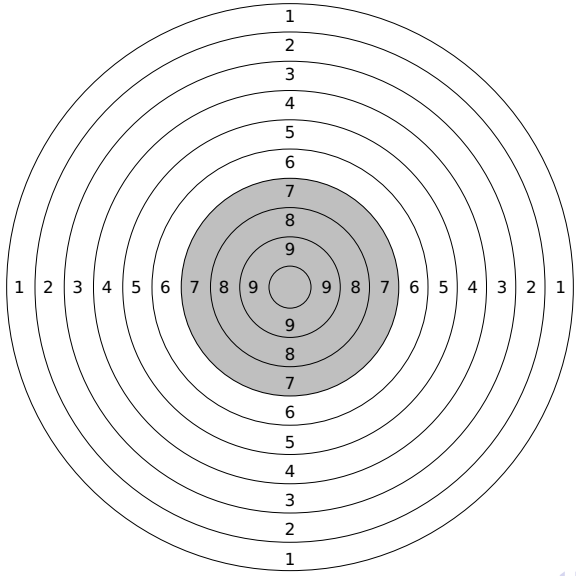


Zielscheibe Luftpistole V

- Code vereinfachen mit `listofitems` Paket

```
\usepackage{listofitems}
\setsepchar{;}
\coordinate (o) at (8,8);
\draw[black,thick,fill=lightgray] (o) circle (29.75mm);
\readlist\kreise{77.5;69.75;61.75;53.75;45.75;37.75;21.75;13.75;5.75}
\foreachitem\kreis\in\kreise{
  \draw[black] (o) circle (\kreis mm);
}
\readlist\labels{7.1;6.3;5.5;4.7;3.9;3.1;2.3;1.5;0.7}
\readlist\directions{right;above;left;below}
\foreachitem\direction\in\directions{
  \foreachitem\label\in\labels{
    \node[\direction=\label cm of o] {\labelcnt};
   }}
```

Zielscheibe Luftpistole VI



Weihnachtszahlen I

- Zahlen 1–24 für Weihnachten
- DIN A4 Blatt gut ausfüllen
- (Manuelle) Matrix von Nodes

```
\node at (0,0) {1};
\node at (1,0) {2};
\node at (2,0) {3};
\node at (3,0) {4};

\node at (0,-1) {5};
\node at (1,-1) {6};
\node at (2,-1) {7};
\node at (3,-1) {8};
```

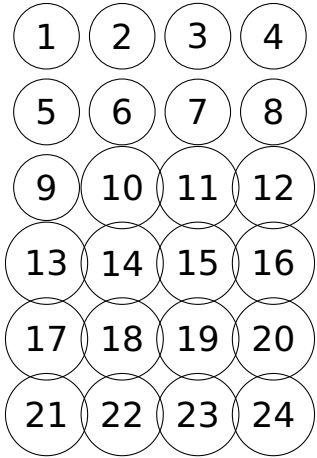
Weihnachtszahlen II

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24

Weihnachtszahlen III

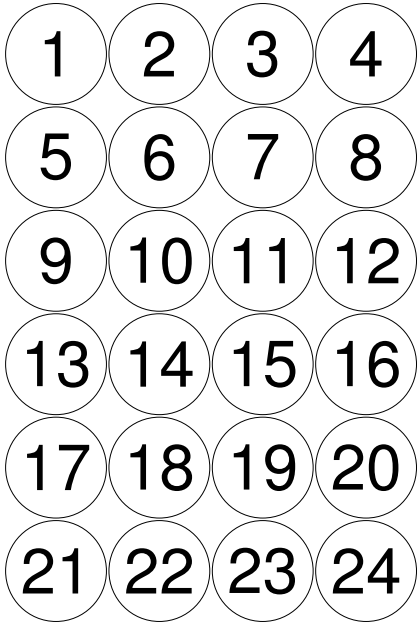
```
\tikzstyle{every node}=[circle,draw=black]

\node at (0,0) {1};
\node at (1,0) {2};
\node at (2,0) {3};
\node at (3,0) {4};

\node at (0,-1) {5};
\node at (1,-1) {6};
\node at (2,-1) {7};
\node at (3,-1) {8};
```

Weihnachtszahlen IV

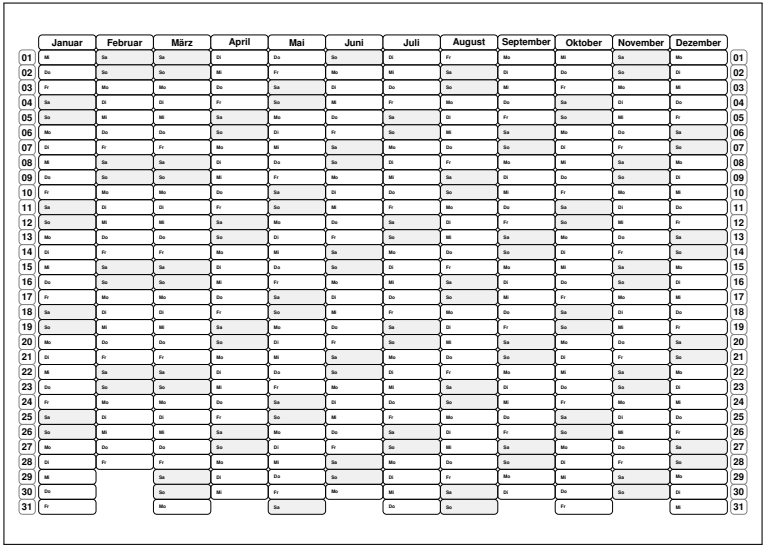


Weihnachtszahlen V

```
\tikzstyle{every node}=[circle,draw=black,font=\fontsize{80}{80}\
    selectfont,x=41mm,y=41mm,minimum width=40mm,thick]

\node at (0,0) {1};
\node at (1,0) {2};
\node at (2,0) {3};
\node at (3,0) {4};

\node at (0,-1) {5};
\node at (1,-1) {6};
\node at (2,-1) {7};
\node at (3,-1) {8};
```


1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20
21 22 23 24

Kalender I



	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
01	Mi	Sa	Sa	Di	Do	So	Di	Fr	Mo	Mi	Sa	Mo	01
02	Do	So	So	Mi	Fr	Mo	Mi	Sa	Di	Do	So	Di	02
03	Fr	Mo	Mo	Do	Sa	Di	Do	So	Mi	Fr	Mo	Mi	03
04	Sa	Di	Di	Fr	So	Mi	Fr	Mo	Do	Sa	Di	Do	04
05	So	Mi	Mi	Sa	Mo	Do	Sa	Di	Fr	So	Mi	Fr	05
06	Mo	Do	Do	So	Di	Fr	So	Mi	Sa	Mo	Do	Sa	06
07	Di	Fr	Fr	Mo	Mi	Sa	Mo	Do	So	Di	Fr	So	07
08	Mi	Sa	Sa	Di	Do	So	Di	Fr	Mo	Mi	Sa	Mo	08
09	Do	So	So	Mi	Fr	Mo	Mi	Sa	Di	Do	So	Di	09
10	Fr	Mo	Mo	Do	Sa	Di	Do	So	Mi	Fr	Mo	Mi	10
11	Sa	Di	Di	Fr	So	Mi	Fr	Mo	Do	Sa	Di	Do	11
12	So	Mi	Mi	Sa	Mo	Do	Sa	Di	Fr	So	Mi	Fr	12
13	Mo	Do	Do	So	Di	Fr	So	Mi	Sa	Mo	Do	Sa	13
14	Di	Fr	Fr	Mo	Mi	Sa	Mo	Do	So	Di	Fr	So	14
15	Mi	Sa	Sa	Di	Do	So	Di	Fr	Mo	Mi	Sa	Mo	15
16	Do	So	So	Mi	Fr	Mo	Mi	Sa	Di	Do	So	Di	16
17	Fr	Mo	Mo	Do	Sa	Di	Do	So	Mi	Fr	Mo	Mi	17
18	Sa	Di	Di	Fr	So	Mi	Fr	Mo	Do	Sa	Di	Do	18
19	So	Mi	Mi	Sa	Mo	Do	Sa	Di	Fr	So	Mi	Fr	19
20	Mo	Do	Do	So	Di	Fr	So	Mi	Sa	Mo	Do	Sa	20
21	Di	Fr	Fr	Mo	Mi	Sa	Mo	Do	So	Di	Fr	So	21
22	Mi	Sa	Sa	Di	Do	So	Di	Fr	Mo	Mi	Sa	Mo	22
23	Do	So	So	Mi	Fr	Mo	Mi	Sa	Di	Do	So	Di	23
24	Fr	Mo	Mo	Do	Sa	Di	Do	So	Mi	Fr	Mo	Mi	24
25	Sa	Di	Di	Fr	So	Mi	Fr	Mo	Do	Sa	Di	Do	25
26	So	Mi	Mi	Sa	Mo	Do	Sa	Di	Fr	So	Mi	Fr	26
27	Mo	Do	Do	So	Di	Fr	So	Mi	Sa	Mo	Do	Sa	27
28	Di	Fr	Fr	Mo	Mi	Sa	Mo	Do	So	Di	Fr	So	28
29	Mi		Sa	Di	Do	So	Di	Fr	Mo	Mi	Sa	Mo	29
30	Do		So	Mi	Fr	Mo	Mi	Sa	Di	Do	So	Di	30
31	Fr		Mo		Sa		Do	So		Fr		Mi	31

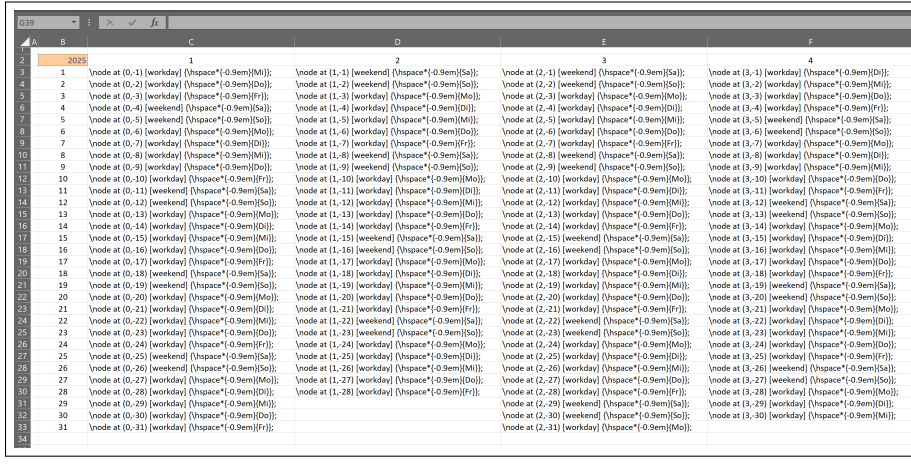
Kalender II

- Excel = Lebensnotwendigkeit für BWLer
- Excel nutzen, um Kalender zu „bauen“
- Gleiches Konzept wie bei den Weihnachtszahlen: viele Nodes
- Excel-Formel

```
=WENNFEHLER("\node at (" & C$2-1 &"," & -1* $B3 & ") [" & WENN(LINKS(TEXT
    (DATWERT($B3&"."&C$2&"."&$B$2);"TTT");1)="S";"weekend";"workday") &
    "] {\hspace*{-0.9em}{" & TEXT(DATWERT($B3&"."&C$2&"."&$B$2);"TTT") &
    "}};";"")
```

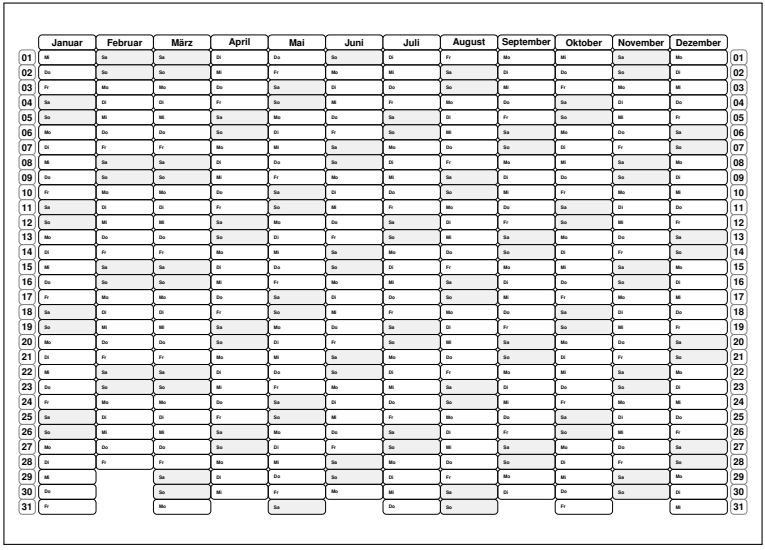
Kalender III

- `\node at (0,-1)[workday] {\hspace*{-0.9em}{Mi}};`



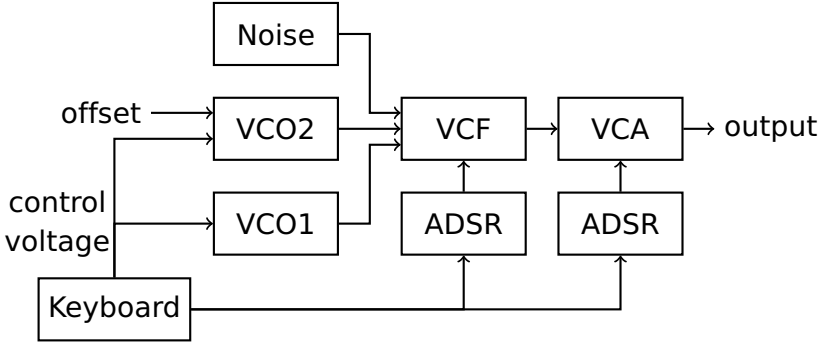
	B	C	D	E	F
2	2025	1	2	3	4
3	1	\node at (0,-1) [workday] {\hspace*{-0.9em}{Mi}};	\node at (1,-1) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (2,-1) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (3,-1) [workday] {\hspace*{-0.9em}{Di}};
4	2	\node at (0,-2) [workday] {\hspace*{-0.9em}{Do}};	\node at (1,-2) [weekend] {\hspace*{-0.9em}{So}};	\node at (2,-2) [weekend] {\hspace*{-0.9em}{So}};	\node at (3,-2) [workday] {\hspace*{-0.9em}{Mi}};
5	3	\node at (0,-3) [workday] {\hspace*{-0.9em}{Fr}};	\node at (1,-3) [workday] {\hspace*{-0.9em}{Mo}};	\node at (2,-3) [workday] {\hspace*{-0.9em}{Mo}};	\node at (3,-3) [workday] {\hspace*{-0.9em}{Do}};
6	4	\node at (0,-4) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (1,-4) [workday] {\hspace*{-0.9em}{Di}};	\node at (2,-4) [workday] {\hspace*{-0.9em}{Di}};	\node at (3,-4) [workday] {\hspace*{-0.9em}{Fr}};
7	5	\node at (0,-5) [weekend] {\hspace*{-0.9em}{So}};	\node at (1,-5) [workday] {\hspace*{-0.9em}{Mi}};	\node at (2,-5) [workday] {\hspace*{-0.9em}{Mi}};	\node at (3,-5) [weekend] {\hspace*{-0.9em}{Sa}};
8	6	\node at (0,-6) [workday] {\hspace*{-0.9em}{Mo}};	\node at (1,-6) [workday] {\hspace*{-0.9em}{Do}};	\node at (2,-6) [workday] {\hspace*{-0.9em}{Do}};	\node at (3,-6) [weekend] {\hspace*{-0.9em}{So}};
9	7	\node at (0,-7) [workday] {\hspace*{-0.9em}{Di}};	\node at (1,-7) [workday] {\hspace*{-0.9em}{Fr}};	\node at (2,-7) [workday] {\hspace*{-0.9em}{Fr}};	\node at (3,-7) [workday] {\hspace*{-0.9em}{Mo}};
10	8	\node at (0,-8) [workday] {\hspace*{-0.9em}{Mi}};	\node at (1,-8) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (2,-8) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (3,-8) [workday] {\hspace*{-0.9em}{Di}};
11	9	\node at (0,-9) [workday] {\hspace*{-0.9em}{Do}};	\node at (1,-9) [weekend] {\hspace*{-0.9em}{So}};	\node at (2,-9) [weekend] {\hspace*{-0.9em}{So}};	\node at (3,-9) [workday] {\hspace*{-0.9em}{Mi}};
12	10	\node at (0,-10) [workday] {\hspace*{-0.9em}{Fr}};	\node at (1,-10) [workday] {\hspace*{-0.9em}{Mo}};	\node at (2,-10) [workday] {\hspace*{-0.9em}{Mo}};	\node at (3,-10) [workday] {\hspace*{-0.9em}{Do}};
13	11	\node at (0,-11) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (1,-11) [workday] {\hspace*{-0.9em}{Di}};	\node at (2,-11) [workday] {\hspace*{-0.9em}{Di}};	\node at (3,-11) [workday] {\hspace*{-0.9em}{Fr}};
14	12	\node at (0,-12) [weekend] {\hspace*{-0.9em}{So}};	\node at (1,-12) [workday] {\hspace*{-0.9em}{Mi}};	\node at (2,-12) [workday] {\hspace*{-0.9em}{Mi}};	\node at (3,-12) [weekend] {\hspace*{-0.9em}{Sa}};
15	13	\node at (0,-13) [workday] {\hspace*{-0.9em}{Mo}};	\node at (1,-13) [workday] {\hspace*{-0.9em}{Do}};	\node at (2,-13) [workday] {\hspace*{-0.9em}{Do}};	\node at (3,-13) [weekend] {\hspace*{-0.9em}{So}};
16	14	\node at (0,-14) [workday] {\hspace*{-0.9em}{Di}};	\node at (1,-14) [workday] {\hspace*{-0.9em}{Fr}};	\node at (2,-14) [workday] {\hspace*{-0.9em}{Fr}};	\node at (3,-14) [workday] {\hspace*{-0.9em}{Mo}};
17	15	\node at (0,-15) [workday] {\hspace*{-0.9em}{Mi}};	\node at (1,-15) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (2,-15) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (3,-15) [workday] {\hspace*{-0.9em}{Di}};
18	16	\node at (0,-16) [workday] {\hspace*{-0.9em}{Do}};	\node at (1,-16) [weekend] {\hspace*{-0.9em}{So}};	\node at (2,-16) [weekend] {\hspace*{-0.9em}{So}};	\node at (3,-16) [workday] {\hspace*{-0.9em}{Mi}};
19	17	\node at (0,-17) [workday] {\hspace*{-0.9em}{Fr}};	\node at (1,-17) [workday] {\hspace*{-0.9em}{Mo}};	\node at (2,-17) [workday] {\hspace*{-0.9em}{Mo}};	\node at (3,-17) [workday] {\hspace*{-0.9em}{Do}};
20	18	\node at (0,-18) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (1,-18) [workday] {\hspace*{-0.9em}{Di}};	\node at (2,-18) [workday] {\hspace*{-0.9em}{Di}};	\node at (3,-18) [workday] {\hspace*{-0.9em}{Fr}};
21	19	\node at (0,-19) [weekend] {\hspace*{-0.9em}{So}};	\node at (1,-19) [workday] {\hspace*{-0.9em}{Mi}};	\node at (2,-19) [workday] {\hspace*{-0.9em}{Mi}};	\node at (3,-19) [weekend] {\hspace*{-0.9em}{Sa}};
22	20	\node at (0,-20) [workday] {\hspace*{-0.9em}{Mo}};	\node at (1,-20) [workday] {\hspace*{-0.9em}{Do}};	\node at (2,-20) [workday] {\hspace*{-0.9em}{Do}};	\node at (3,-20) [weekend] {\hspace*{-0.9em}{So}};
23	21	\node at (0,-21) [workday] {\hspace*{-0.9em}{Di}};	\node at (1,-21) [workday] {\hspace*{-0.9em}{Fr}};	\node at (2,-21) [workday] {\hspace*{-0.9em}{Fr}};	\node at (3,-21) [workday] {\hspace*{-0.9em}{Mo}};
24	22	\node at (0,-22) [workday] {\hspace*{-0.9em}{Mi}};	\node at (1,-22) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (2,-22) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (3,-22) [workday] {\hspace*{-0.9em}{Di}};
25	23	\node at (0,-23) [workday] {\hspace*{-0.9em}{Do}};	\node at (1,-23) [weekend] {\hspace*{-0.9em}{So}};	\node at (2,-23) [weekend] {\hspace*{-0.9em}{So}};	\node at (3,-23) [workday] {\hspace*{-0.9em}{Mi}};
26	24	\node at (0,-24) [workday] {\hspace*{-0.9em}{Fr}};	\node at (1,-24) [workday] {\hspace*{-0.9em}{Mo}};	\node at (2,-24) [workday] {\hspace*{-0.9em}{Mo}};	\node at (3,-24) [workday] {\hspace*{-0.9em}{Do}};
27	25	\node at (0,-25) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (1,-25) [workday] {\hspace*{-0.9em}{Di}};	\node at (2,-25) [workday] {\hspace*{-0.9em}{Di}};	\node at (3,-25) [workday] {\hspace*{-0.9em}{Fr}};
28	26	\node at (0,-26) [weekend] {\hspace*{-0.9em}{So}};	\node at (1,-26) [workday] {\hspace*{-0.9em}{Mi}};	\node at (2,-26) [workday] {\hspace*{-0.9em}{Mi}};	\node at (3,-26) [weekend] {\hspace*{-0.9em}{Sa}};
29	27	\node at (0,-27) [workday] {\hspace*{-0.9em}{Mo}};	\node at (1,-27) [workday] {\hspace*{-0.9em}{Do}};	\node at (2,-27) [workday] {\hspace*{-0.9em}{Do}};	\node at (3,-27) [weekend] {\hspace*{-0.9em}{So}};
30	28	\node at (0,-28) [workday] {\hspace*{-0.9em}{Di}};	\node at (1,-28) [workday] {\hspace*{-0.9em}{Fr}};	\node at (2,-28) [workday] {\hspace*{-0.9em}{Fr}};	\node at (3,-28) [workday] {\hspace*{-0.9em}{Mo}};
31	29	\node at (0,-29) [workday] {\hspace*{-0.9em}{Mi}};		\node at (2,-29) [weekend] {\hspace*{-0.9em}{Sa}};	\node at (3,-29) [workday] {\hspace*{-0.9em}{Di}};
32	30	\node at (0,-30) [workday] {\hspace*{-0.9em}{Do}};		\node at (2,-30) [weekend] {\hspace*{-0.9em}{So}};	\node at (3,-30) [workday] {\hspace*{-0.9em}{Mi}};
33	31	\node at (0,-31) [workday] {\hspace*{-0.9em}{Fr}};		\node at (2,-31) [workday] {\hspace*{-0.9em}{Mo}};	
34					

Kalender IV


Januar Februar März April Mai Juni Juli August September Oktober November Dezember
01 Mi Sa Sa Di Do So Di Fr Mo Mi Sa Mo 01
02 Do So So Mi Fr Mo Mi Sa Di Do So Di 02
03 Fr Mo Mo Do Sa Di Do So Mi Fr Mo Mi 03
04 Sa Di Di Fr So Mi Fr Mo Do Sa Di Do 04
05 So Mi Mi Sa Mo Do Sa Di Fr So Mi Fr 05
06 Mo Do Do So Di Fr So Mi Sa Mo Do Sa 06
07 Di Fr Fr Mo Mi Sa Mo Do So Di Fr So 07
08 Mi Sa Sa Di Do So Di Fr Mo Mi Sa Mo 08
09 Do So So Mi Fr Mo Mi Sa Di Do So Di 09
10 Fr Mo Mo Do Sa Di Do So Mi Fr Mo Mi 10
11 Sa Di Di Fr So Mi Fr Mo Do Sa Di Do 11
12 So Mi Mi Sa Mo Do Sa Di Fr So Mi Fr 12
13 Mo Do Do So Di Fr So Mi Sa Mo Do Sa 13
14 Di Fr Fr Mo Mi Sa Mo Do So Di Fr So 14
15 Mi Sa Sa Di Do So Di Fr Mo Mi Sa Mo 15
16 Do So So Mi Fr Mo Mi Sa Di Do So Di 16
17 Fr Mo Mo Do Sa Di Do So Mi Fr Mo Mi 17
18 Sa Di Di Fr So Mi Fr Mo Do Sa Di Do 18
19 So Mi Mi Sa Mo Do Sa Di Fr So Mi Fr 19
20 Mo Do Do So Di Fr So Mi Sa Mo Do Sa 20
21 Di Fr Fr Mo Mi Sa Mo Do So Di Fr So 21
22 Mi Sa Sa Di Do So Di Fr Mo Mi Sa Mo 22
23 Do So So Mi Fr Mo Mi Sa Di Do So Di 23
24 Fr Mo Mo Do Sa Di Do So Mi Fr Mo Mi 24
25 Sa Di Di Fr So Mi Fr Mo Do Sa Di Do 25
26 So Mi Mi Sa Mo Do Sa Di Fr So Mi Fr 26
27 Mo Do Do So Di Fr So Mi Sa Mo Do Sa 27
28 Di Fr Fr Mo Mi Sa Mo Do So Di Fr So 28
29 Mi Sa Di Do So Di Fr Mo Mi Sa Mo 29
30 Do So Mi Fr Mo Mi Sa Di Do So Di 30
31 Fr Mo Sa Do So Fr Mi 31

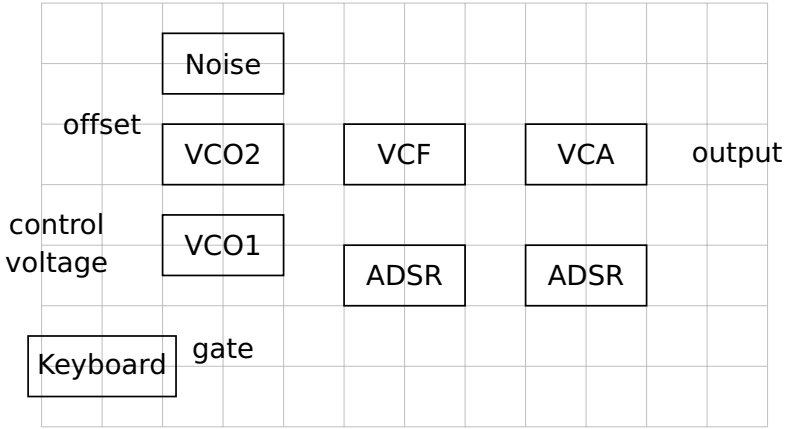
Synthesizer-Diagramm I

- Bisher mein komplexestes TikZ-Diagramm
- Beschreibt den Signalweg in Synthesizer
- Steile Lernkurve!



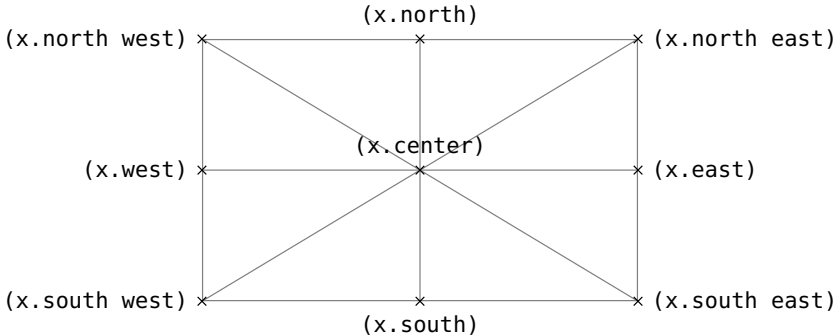
Synthesizer-Diagramm II

- Nodes mit absoluten Koordinaten
- Besser mit relativen Koordinaten arbeiten!



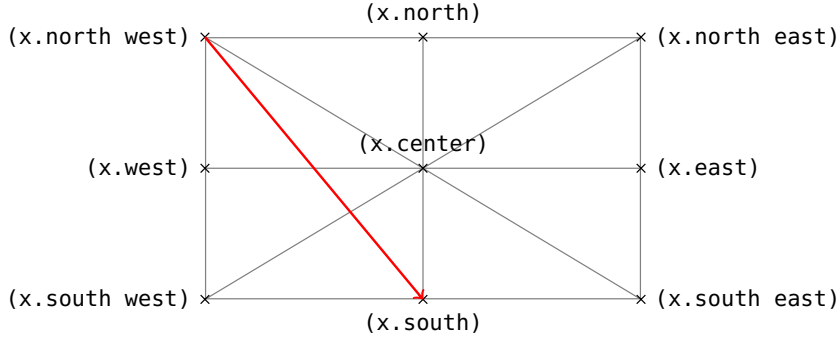
Synthesizer-Diagramm III

- Jeder Node hat vordefinierte Ankerpunkte



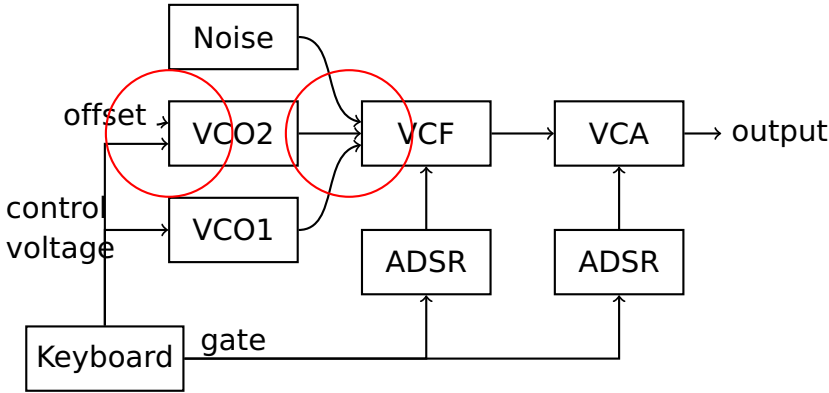
Synthesizer-Diagramm IV

- Pfeil von `x.north west` nach `x.south`



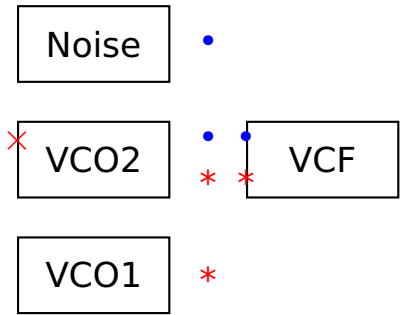
Synthesizer-Diagramm V

- So weit, so gut, aber. . .
- Wir brauchen mehr Anker!



Synthesizer-Diagramm VI

- Zu berechnende Punkte



Synthesizer-Diagramm VII

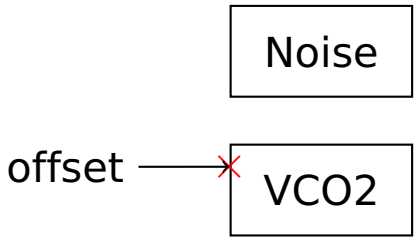
- Koordinatenberechnungen mit der `calc` Library

```
1 ($<coordinate>!<number>!<coordinate>$)
```

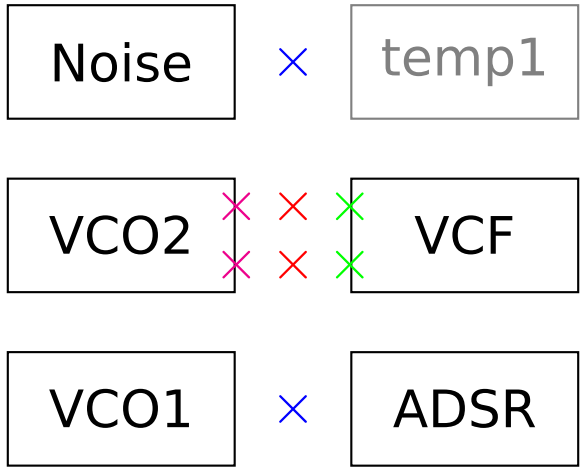
- `<coordinate>` steht dabei für eine Koordinate, ein Node ohne Text
- `<number>` ist Zahl zwischen 0 und 1 und gibt die Prozente an, um den wir uns von Koordinate 1 zu Koordinate 2 bewegen.
- `0.25` steht also für ein Viertel des Weges

Synthesizer-Diagramm VIII

```
\node at (0,0) [box] (noise) {Noise};
\node [box, below = of noise] (vco2) {VCO2};
\coordinate (coordoffset) at ($(vco2.west)!0.5!(vco2.north west)$);
\node at (coordoffset){\textcolor{red}{$\times$}};

\node [left = of coordoffset](offset) {offset};
\draw [thick,->] (offset) -- (coordoffset);
```

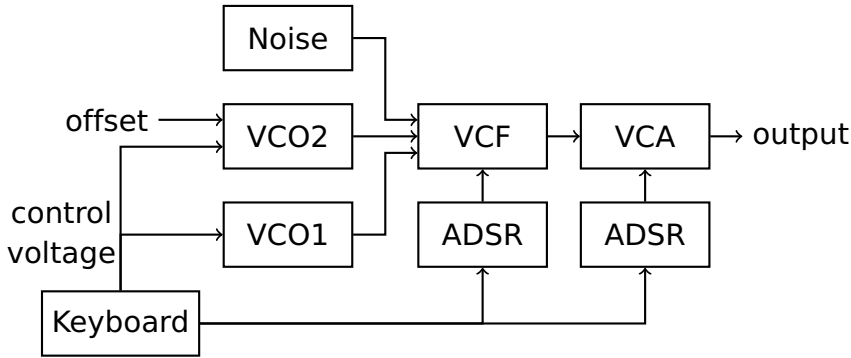


Synthesizer-Diagramm IX



Synthesizer-Diagramm X

- Finales Diagramm



Fazit

- Wow. . .
- Riesige Bandbreite der Möglichkeiten
- Steile Lernkurve $\rightarrow$ ChatGPT & Co können diese abflachen
- Tolle Ergebnisse