Versuch V6

C405 Hardwarepraktikum II

Abnahme: 20. Januar 2025
Stand: 20. Januar 2025

Tom Mohr
Martin Ohmeyer

Inhaltsverzeichnis

1 Allgemeines

1.1 Zähler

Variablen, die zu einem Zähler gehören, tragen die Bezeichnung z_n.

1.2 Würfel

Variablen, die zum Würfel gehören, tragen die Bezeichnung w_n. Sie sind wie in Abbildung 1.1 dargestellt auf die Augen des Würfels verteilt.

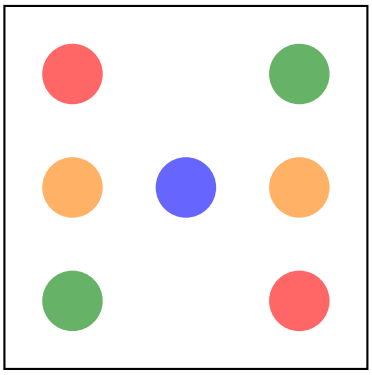


Abb. 1.1: Der Würfel

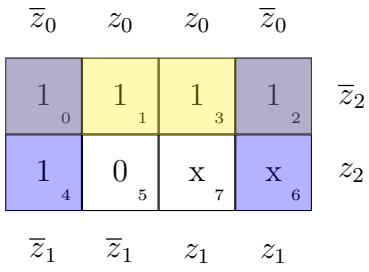
2 Logikgatter

2.1 Wahrheitswerttabelle

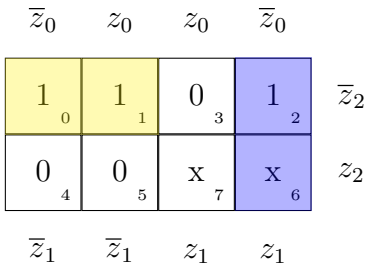
Zähler	Würfel	z_2	z_1	z_0	w_3	w_2	w_1	w_0
0	1	0	0	0	1	1	1	0
1	2	0	0	1	1	1	0	1
2	3	0	1	0	1	1	0	0
3	4	0	1	1	1	0	0	1
4	5	1	0	0	1	0	0	0
5	6	1	0	1	0	0	0	1

Tabelle 2.1: Mapping: Zähler auf Würfel

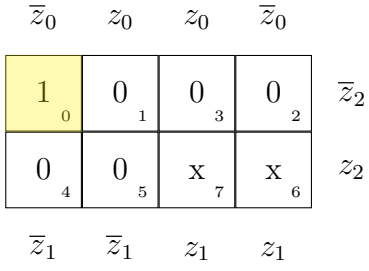
2.2 KV-Diagramme und vereinfachte Formeln



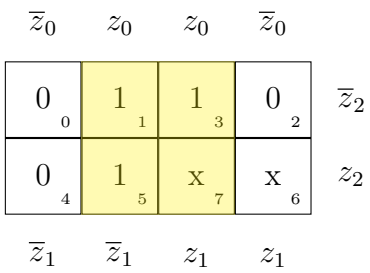
$w_3 = \overline{z}_2 \ \vee \ \overline{z}_0$



$w_2 = \overline{z}_2\overline{z}_1 \ \vee \ z_1\overline{z}_0$



$w_1 = \overline{z}_2\overline{z}_1\overline{z}_0$



$w_0 = z_0$

2.3 Aufbau

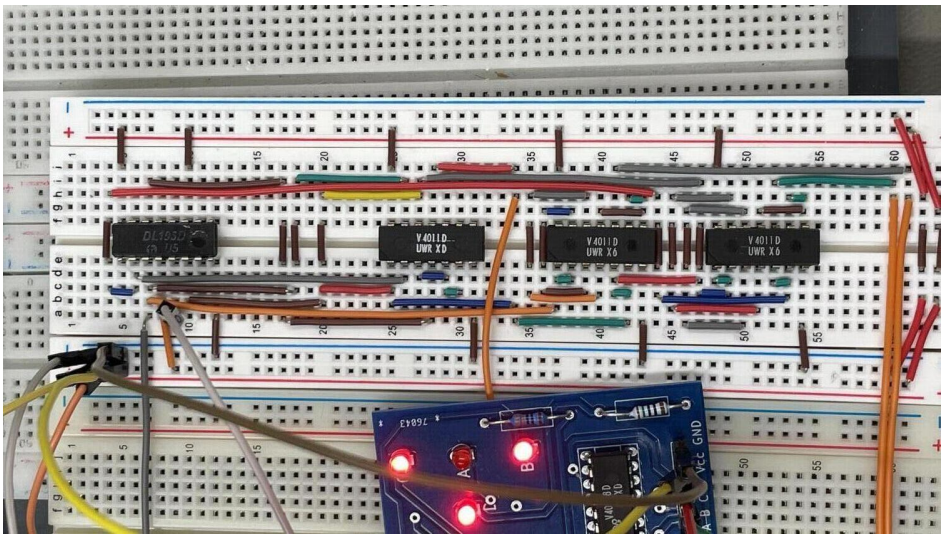
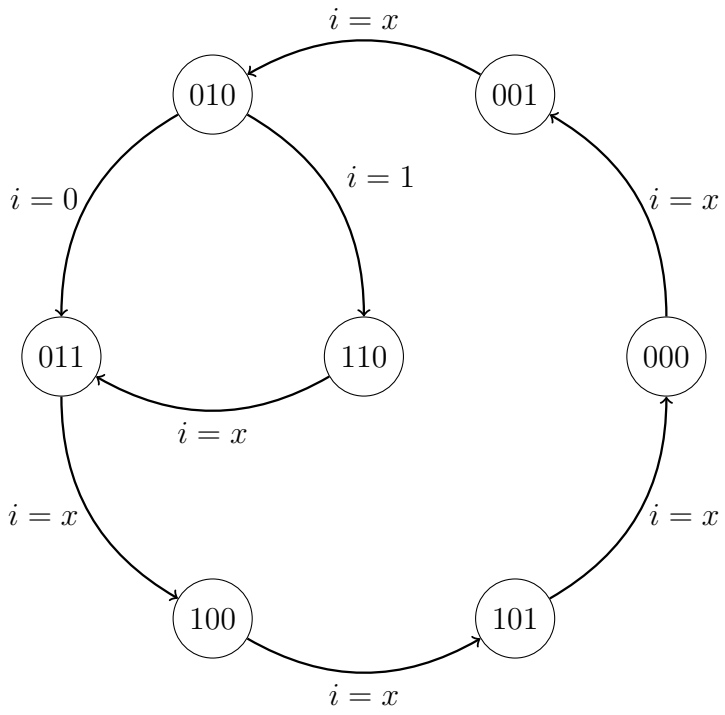


Abb. 2.1: Aufbau der Schaltung mit 3 NAND-Gattern

3 Gal

3.1 Zähler

3.1.1 Mealy-Automat

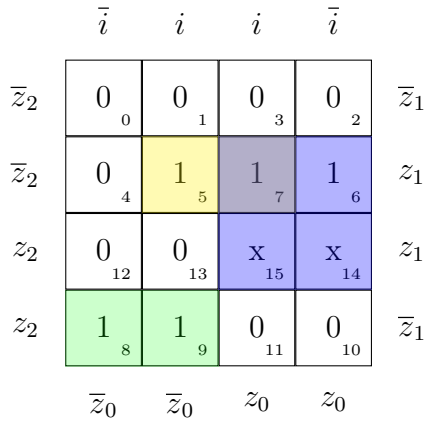


3.1.2 Wahrheitswerttabelle

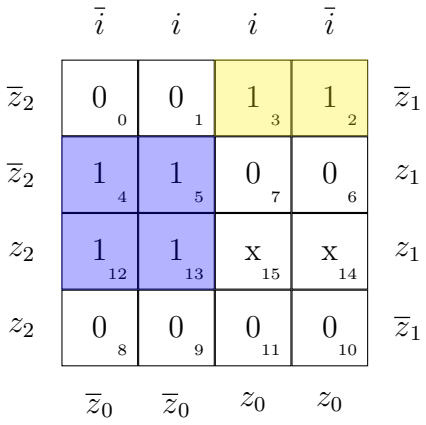
Dez.	z_2	z_1	z_0	i	z_2^+	z_1^+	z_0^+
0	0	0	0	0	0	0	1
1	0	0	0	1	0	0	1
2	0	0	1	0	0	1	0
3	0	0	1	1	0	1	0
4	0	1	0	0	0	1	1
5	0	1	0	1	1	1	0
6	0	1	1	0	1	0	0
7	0	1	1	1	1	0	0
8	1	0	0	0	1	0	1
9	1	0	0	1	1	0	1
10	1	0	1	0	0	0	0
11	1	0	1	1	0	0	0
12	1	1	0	0	0	1	1
13	1	1	0	1	0	1	1
14	1	1	1	0	x	x	x
15	1	1	1	1	x	x	x

Tabelle 3.1: Wahrheitstabelle

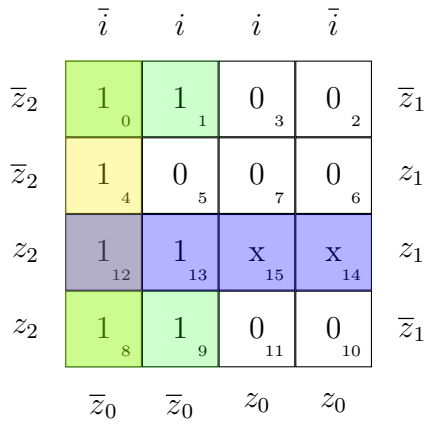
3.1.3 KV-Diagramme und vereinfachte Formeln



$$z_2^+ = \overline{z}_2 z_1 i \ \vee \ z_2 \overline{z}_1 \overline{z}_0 \ \vee \ z_1 z_0$$



$$z_1^+ = z_1 \overline{z}_0 \ \vee \ \overline{z}_2 \overline{z}_1 z_0$$



$$z_0^+ = \overline{z}_0 \overline{i} \ \vee \ \overline{z}_1 \overline{z}_0 \ \vee \ z_2 z_1$$

3.2 Mapping Zähler auf Würfel

3.2.1 Wahrheitswerttabelle

Dez.	WZ.	z_2	z_1	z_0	w_3	w_2	w_1	w_0
0	1	0	0	0	1	1	1	0
1	2	0	0	1	1	1	0	1
2	3	0	1	0	1	1	0	0
3	4	0	1	1	1	0	0	1
4	5	1	0	0	1	0	0	0
5	6	1	0	1	0	0	0	1
6	6	1	1	0	0	0	0	1

Tabelle 3.2: Wahrheitstabelle

3.2.2 KV-Diagramme und vereinfachte Formeln

$\overline{z}_0$	z_0	z_0	$\overline{z}_0$	
1 $_0$	1 $_1$	1 $_3$	1 $_2$	$\overline{z}_2$
1 $_4$	0 $_5$	x $_7$	0 $_6$	z_2
$\overline{z}_1$	$\overline{z}_1$	z_1	z_1	

$w_3 = \overline{z}_2 \ \vee \ \overline{z}_1\overline{z}_0$

$\overline{z}_0$	z_0	z_0	$\overline{z}_0$	
1 $_0$	1 $_1$	0 $_3$	1 $_2$	$\overline{z}_2$
0 $_4$	0 $_5$	x $_7$	0 $_6$	z_2
$\overline{z}_1$	$\overline{z}_1$	z_1	z_1	

$w_2 = \overline{z}_2\overline{z}_0 \ \vee \ \overline{z}_2\overline{z}_1$

$\overline{z}_0$	z_0	z_0	$\overline{z}_0$	
1 $_0$	0 $_1$	0 $_3$	0 $_2$	$\overline{z}_2$
0 $_4$	0 $_5$	x $_7$	0 $_6$	z_2
$\overline{z}_1$	$\overline{z}_1$	z_1	z_1	

$w_1 = \overline{z}_2\overline{z}_1\overline{z}_0$

$\overline{z}_0$	z_0	z_0	$\overline{z}_0$	
0 $_0$	1 $_1$	1 $_3$	0 $_2$	$\overline{z}_2$
0 $_4$	1 $_5$	x $_7$	1 $_6$	z_2
$\overline{z}_1$	$\overline{z}_1$	z_1	z_1	

$w_0 = z_0 \ \vee \ z_2z_1$

3.3 Code

```
PIN 1 = clock ;
PIN 2 = i ;

PIN 16 = z0 ; /* Pin nicht angeschlossen, fuer int. Funktion notwendig */
PIN 17 = z1 ; /* Pin nicht angeschlossen, fuer int. Funktion notwendig */
PIN 18 = z2 ; /* Pin nicht angeschlossen, fuer int. Funktion notwendig */

PIN 16 = w0 ;
PIN 17 = w1 ;
PIN 18 = w2 ;
PIN 19 = w3 ;

z2.d = !z2 & z1 & i # z2 & !z1 & !z0 # z1 & z0;
z1.d = z1 & !z0 # !z2 & !z1 & z0;
z0.d = !z0 & !i # !z1 & !z0 # z2 & z1;

w3.d = !z2 # !z1 & !z0;
w2.d = !z2 & !z0 # !z2 & !z1;
w1.d = !z2 & !z1 & !z0;
w0.d = z0 # z2 & z1;
```

3.4 Aufbau

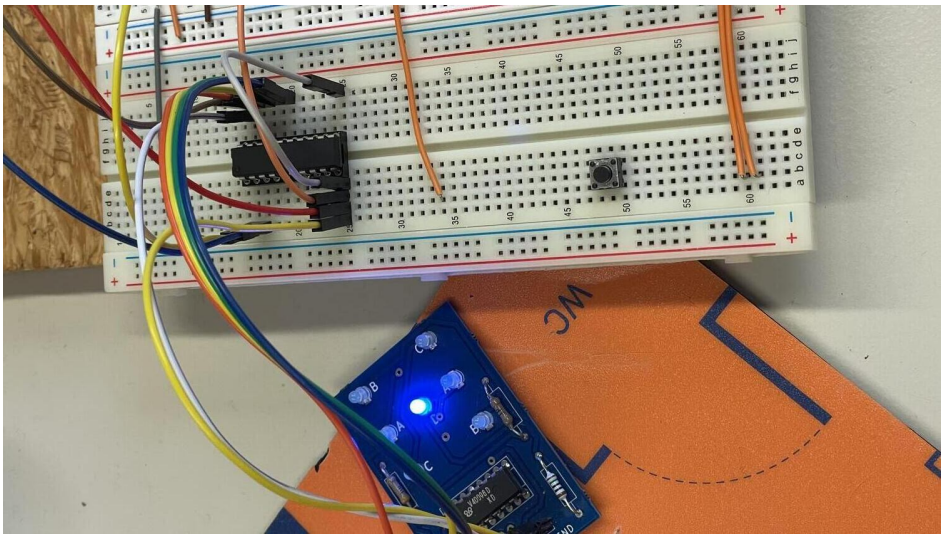


Abb. 3.1: Aufbau der Schaltung mit Gal