Rubik's Clock

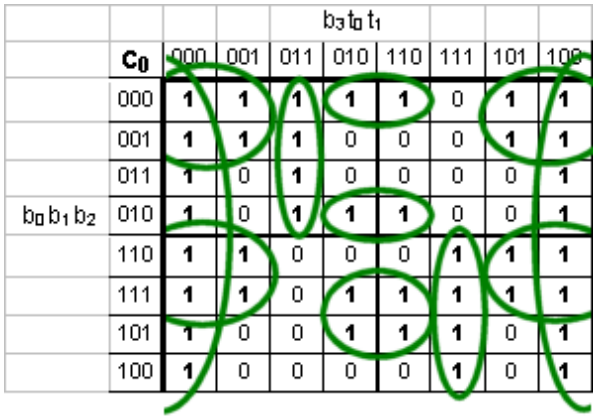
Wertetabelle:

c_0	c_1	c_2	c_3	c_4	c_5	c_6	c_7	c_8	c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}	c_{15}	c_{16}	c_{17}	b_0	b_1	b_2	b_3	t_0	t_1
1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1
1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0
1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1
1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0
1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1
1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0
0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1
1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	1	0	0	1
0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0
1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	1	0	1	1
1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0
1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1
0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	0
0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1
1	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0
0	1	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	1	0
1	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	1	1
1	0	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	1	0	1	0	0
0	1	1	0	1	1	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1
1	0	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	1	0	1	1	0
0	1	1	0	1	1	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	1
1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0	0	0
0	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1
0	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	1	0	1	0
1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1
1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	1	1	0	0
0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	1	1	0	1
0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	1	1	1	0
0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	1	1	1	1
1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	1	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1
0	0	1	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0
0	0	1	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1
1	1	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0
0	0	1	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1
0	0	1	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	0	1	1	0
1	1	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1
1	1	0	1	1	0	1	1	0	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0
0	0	1	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	1	0	1	0	0	1
1	1	0	1	1	0	1	1	0	1	0	0	0	0	0	1	0	0	1	0	1	0	1	0
0	0	1	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	1	0	1	0	1	1
1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	0	0
0	0	1	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	1	1	0	1
1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	1	0
1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	1	1
1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0
1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	1
0	0	0	0	0	0	1	0	1	0	0	0	1	1	1	1	1	1	1	1	0	0	1	0
0	0	0	0	0	0	1	0	1	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1
1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	0
1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	1	0
1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	1	1	1
1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	1	0	0	1	1	1	0	0	0
1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1
1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	1	0	0	1	1	1	0	1	0
0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0
1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1
1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	0
1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	1

c: 0 – don't turn b: 0 – down t: 0 – ccw
1 – turn 1 – up 1 – cw

Karnaugh-Diagramme:

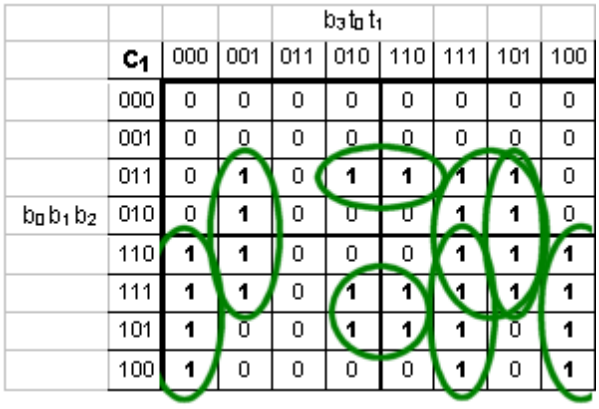
$b_0 b_1 b_2$ \ $b_3 t_0 t_1$	000	001	011	010	110	111	101	100
c_0								
000	**1**	**1**	**1**	**1**	**1**	0	**1**	**1**
001	**1**	**1**	**1**	0	0	0	**1**	**1**
011	**1**	0	**1**	0	0	0	0	**1**
010	**1**	0	**1**	**1**	**1**	0	0	**1**
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	**1**	0	0	**1**	**1**	**1**	0	**1**
100	**1**	0	0	0	0	**1**	0	**1**



c0 = (!t0 && !t1) || (b0 && b1 && !t0) || (!b0 && !b1 && !t0) || (b0 && b2 && t0 && !t1) || (!b0 && !b2 && t0 && !t1)
|| (b0 && b3 && t0 && t1) || (!b0 && !b3 && t0 && t1);

c0 = (!t0 && !t1) || ((b0==b1) && !t0) || ((b0==b2) && t0 && !t1) || ((b0==b3) && t0 && t1);

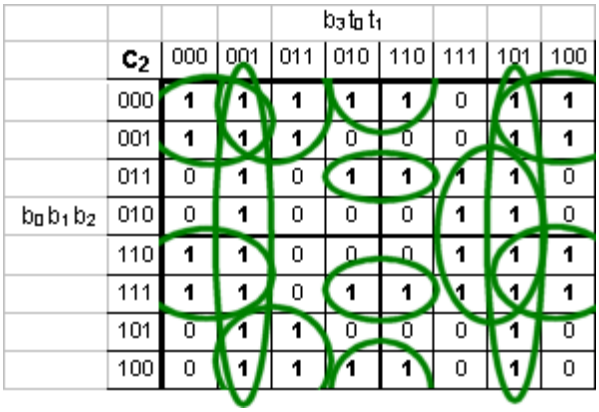
$b_0 b_1 b_2$ \ $b_3 t_0 t_1$	000	001	011	010	110	111	101	100
c_1								
000	0	0	0	0	0	0	0	0
001	0	0	0	0	0	0	0	0
011	0	**1**	0	**1**	**1**	**1**	**1**	0
010	0	**1**	0	0	0	**1**	**1**	0
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	**1**	0	0	**1**	**1**	**1**	0	**1**
100	**1**	0	0	0	0	**1**	0	**1**



c1 = (b0 && !t0 && !t1) || (b0 && b3 && t0 & t1) || (b1 && b3 && t1) || (b1 && !t0 & t1) || (!b0 && b1 && b2 && t0 && !t1)
|| (b0 && b2 && t0 && !t1)

c1 = (((!t0 && !t1) || (b3 && t0 && t1)) && b0) || ((b3 || !t0) && b1 && t1) || (((!b0 && b1) || b0) && b2 && t0 && !t1)

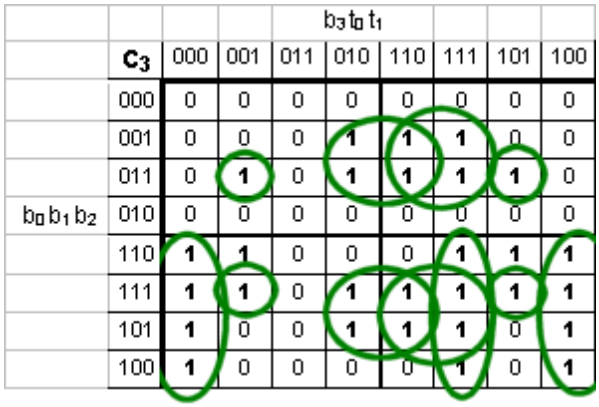
$B_0 b_1 b_2$ \ $b_3 t_0 t_1$	000	001	011	010	110	111	101	100
c_2								
000	**1**	**1**	**1**	**1**	**1**	0	**1**	**1**
001	**1**	**1**	**1**	0	0	0	**1**	**1**
011	0	**1**	0	**1**	**1**	**1**	**1**	0
010	0	**1**	0	0	0	**1**	**1**	0
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	0	**1**	**1**	0	0	0	**1**	0
100	0	**1**	**1**	**1**	**1**	0	**1**	0



c2 = (!t0 && t1) || (b0 && b1 && !t0) || (!b0 && !b1 & !t0) || (b1 && b3 && t1) || (!b1 && !b3 && t1) || (b1 && b2 && t0 && !t1)
|| (!b1 && !b2 && t0 && !t1)

c2 = (!t0 && t1) || ((b1==b0) && !t0) || ((b1==b2) && t0 && !t1) || ((b1==b3) && t1)

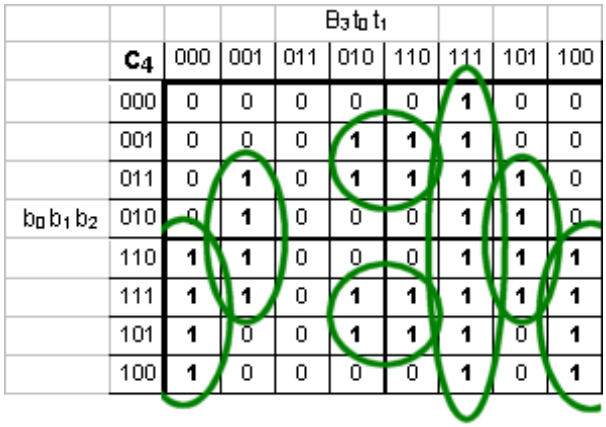
	$B_3\,t_0\,t_1$							
C_3	000	001	011	010	110	111	101	100
000	0	0	0	0	0	0	0	0
001	0	0	0	**1**	**1**	**1**	0	0
011	0	**1**	0	**1**	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$ 010	0	0	0	0	0	0	0	0
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	**1**	0	0	**1**	**1**	**1**	0	**1**
100	**1**	0	0	0	0	**1**	0	**1**



c3 = (b0 && !t0 && !t1) || (b0 && b1 && !t0) || (b2 && t0 && !t1) || (b2 && b3 && t0) || (b1 && b2 && !t0 && t1)
|| (b0 && b3 && t0 && t1)

c3 = ((!t1 || b1) && b0 && !t0) || ((!t1 || b3) && b2 && t0) || (((b1 && b2 && !t0) || (b0 && b3 && t0)) && t1)

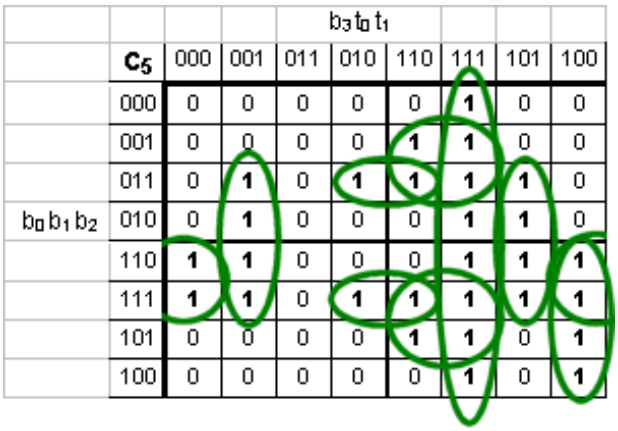
	$B_3\,t_0\,t_1$							
C_4	000	001	011	010	110	111	101	100
000	0	0	0	0	0	**1**	0	0
001	0	0	0	**1**	**1**	**1**	0	0
011	0	**1**	0	**1**	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$ 010	0	**1**	0	0	0	**1**	**1**	0
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	**1**	0	0	**1**	**1**	**1**	0	**1**
100	**1**	0	0	0	0	**1**	0	**1**



c4 = (b3 && t0 && t1) || (b2 && t0 && !t1) || (b1 && !t0 && t1) || (b0 && !t0 && !t1)

c4 = (((b3 && t1) || (b2 && !t1)) && t0) || (((b1 && t1) ||(b0 && !t1)) && !t0)

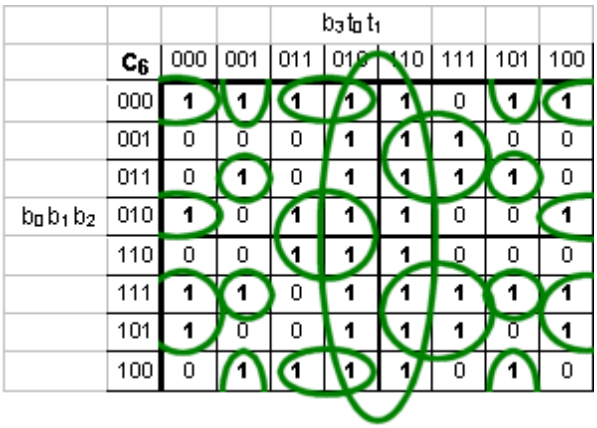
	$b_3\,t_0\,t_1$							
C_5	000	001	011	010	110	111	101	100
000	0	0	0	0	0	**1**	0	0
001	0	0	0	0	**1**	**1**	0	0
011	0	**1**	0	**1**	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$ 010	0	**1**	0	0	0	**1**	**1**	0
110	**1**	**1**	0	0	0	**1**	**1**	**1**
111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
101	0	0	0	0	**1**	**1**	0	**1**
100	0	0	0	0	0	**1**	0	**1**



c5 = (b3 && t0 && t1) || (b1 && !t0 && t1) || (b0 && b1 && !t0) || (b0 && b3 && !t0 && !t1) || (b1 && b2 && t0 && !t1)
|| (b2 && b3 && t0);

c5 = (((b3 && t0) || (b1 && !t0)) && t1) || (((b3 && !t1) || b1) && b0 && !t0) || (((b1 && !t1) || b3) && b2 && t0)

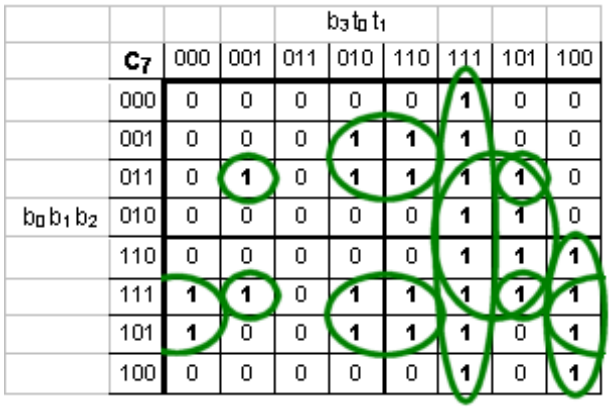
		$b_3\,t_0\,t_1$							
	C_6	000	001	011	010	110	111	101	100
	000	**1**	**1**	**1**	**1**	**1**	0	**1**	**1**
	001	0	0	0	**1**	**1**	**1**	0	0
	011	0	**1**	0	**1**	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$	010	**1**	0	**1**	**1**	**1**	0	0	**1**
	110	0	0	**1**	**1**	**1**	0	0	0
	111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
	101	**1**	0	0	**1**	**1**	**1**	0	**1**
	100	0	**1**	**1**	**1**	**1**	0	**1**	0



c6 = (t0 && !t1) || (b1 && b2 && !t0 && t1) || (b0 && b2 && !t0 && !t1) || (!b0 && !b2 && !t0 && !t1) || (b2 && b3 && t0)
|| (!b2 && !b3 && t0) || (b1 && b2 && !t0 && t1) || (!b1 && !b2 && !t0 && t1);

c6 = (t0 && !t1) || ((b2==b0) && !t0 && !t1) || ((b2==b1) && !t0 && t1) || ((b2==b3) && t0)

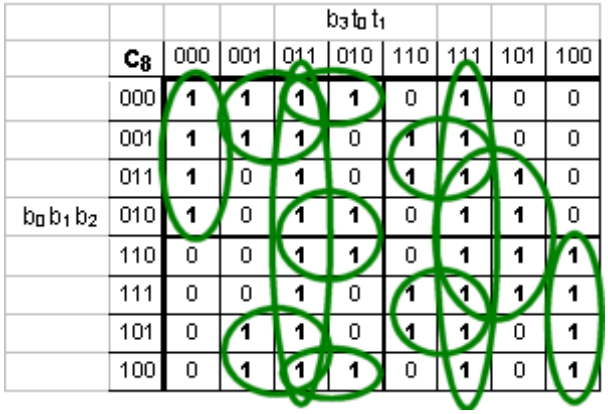
		$b_3\,t_0\,t_1$							
	C_7	000	001	011	010	110	111	101	100
	000	0	0	0	0	0	**1**	0	0
	001	0	0	0	**1**	**1**	**1**	0	0
	011	0	**1**	0	**1**	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$	010	0	0	0	0	0	**1**	**1**	0
	110	0	0	0	0	0	**1**	**1**	**1**
	111	**1**	**1**	0	**1**	**1**	**1**	**1**	**1**
	101	**1**	0	0	**1**	**1**	**1**	0	**1**
	100	0	0	0	0	0	**1**	0	**1**



c7 = (b3 && t0 && t1) || (b1 && b3 && t1) || (b1 && b2 && !t0 && t1) || (b2 && t0 && !t1) || (b0 && b2 && !t0 && !t1)
|| (b0 && b3 && !t0 && !t1)

c7 = ((b1 || t0) && b3 && t1) || (((b1 && !t0 && t1) || (t0 && !t1)) && b2) || ((b2 || b3) && b0 && !t0 && !t1)

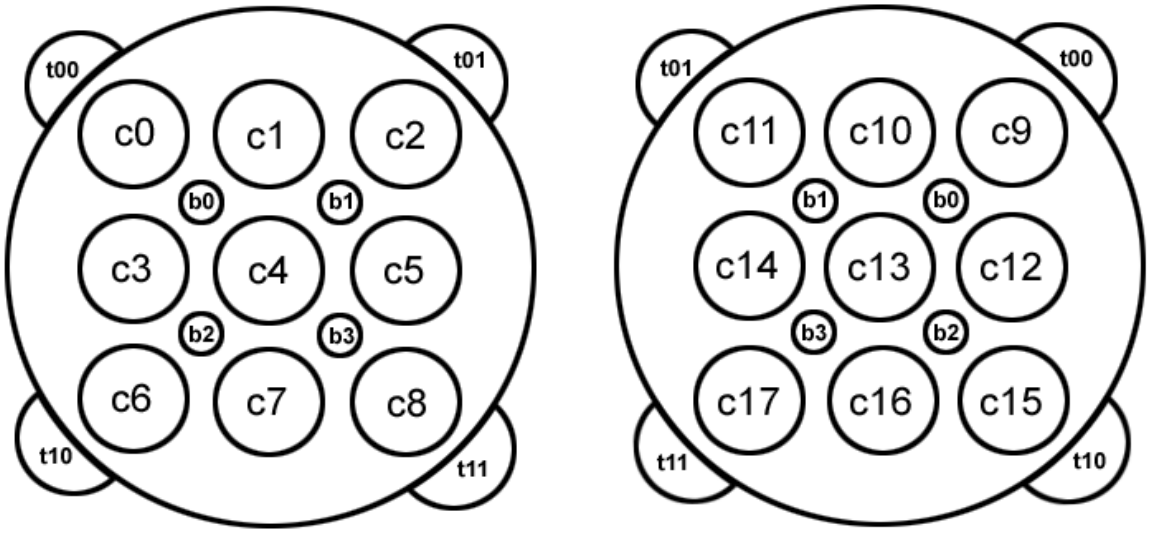
		$b_3\,t_0\,t_1$							
	C_8	000	001	011	010	110	111	101	100
	000	**1**	**1**	**1**	**1**	0	**1**	0	0
	001	**1**	**1**	**1**	0	**1**	**1**	0	0
	011	**1**	0	**1**	0	**1**	**1**	**1**	0
$b_0\,b_1\,b_2$	010	**1**	0	**1**	**1**	0	**1**	**1**	0
	110	0	0	**1**	**1**	0	**1**	**1**	**1**
	111	0	0	**1**	0	**1**	**1**	**1**	**1**
	101	0	**1**	**1**	0	**1**	**1**	0	**1**
	100	0	**1**	**1**	**1**	0	**1**	0	**1**



c8 = (t0 && t1) || (b0 && b3 && !t0 && !t1) || (!b0 && !b3 && !t0 && !t1) || (b1 && b3 && t1) || (!b1 && !b3 && t1)
|| (b2 && b3 && t0) || (!b2 && !b3 && t0)

c8 = (t0 && t1) || ((b3==b0) && !t0 && !t1) || ((b3==b1) && t1) || ((b3==b2) && t0)

1 er Block – 6 Bedingungen
2 er Block – 5 Bedingungen
4 er Block – 4 Bedingungen
8 er Block – 3 Bedingungen
16 er Block – 2 Bedingungen



Java- Programm:

```
class clock
{
	int	[] c = new int [18];
	boolean [] b = new boolean [4];

	public boolean invert (boolean bool)
	{
	  return (bool ? false : true);
	}

	public void push (int button)
	{
	  if (button >=0 && button <=3)		b[button] = b[button] ? false : true;
	}

	public void push (int button, boolean state)
	{
	  if (button >=0 && button <=3)		b[button] = state;
	}

	public void turn (int wheel, int num)
	{
	  boolean t0, t1, b0 = b[0], b1 = b[1], b2 = b[2], b3 = b[3];
	  boolean [] d = new boolean [9];
	  switch (wheel)
	  {
			case 0: t0 = false; t1 = false; break;
			case 1: t0 = false; t1 = true; break;
			case 2: t0 = true; t1 = false; break;
			case 3: t0 = true; t1 = true; break;
			default: return;
	  }
	  for (int i=0; i<2; i++)
	  {
			d[0] = (!t0 && !t1) || ((b0==b1) && !t0) || ((b0==b2) && t0 && !t1) || ((b0==b3) && t0 && t1);
			d[1] = (((!t0 && !t1) || (b3 && t0 && t1)) && b0) || ((b3 || !t0) && b1 && t1) || (((!b0 && b1) || b0) && b2 && t0 && !t1);
			d[2] = (!t0 && t1) || ((b1==b0) && !t0) || ((b1==b2) && t0 && !t1) || ((b1==b3) && t1);
			d[3] = ((!t1 || b1) && b0 && !t0) || ((!t1 || b3) && b2 && t0) || (((b1 && b2 && !t0) || (b0 && b3 && t0)) && t1);
			d[4] = (((b3 && t1) || (b2 && !t1)) && t0) || (((b1 && t1) ||(b0 && !t1)) && !t0);
			d[5] = (((b3 && t0) || (b1 && !t0)) && t1) || (((b3 && !t1) || b1) && b0 && !t0) || (((b1 && !t1) || b3) && b2 && t0);
			d[6] = (t0 && !t1) || ((b2==b0) && !t0 && !t1) || ((b2==b1) && !t0 && t1) || ((b2==b3) && t0);
			d[7] = ((b1 || t0) && b3 && t1) || (((b1 && !t0 && t1) || (t0 && !t1)) && b2) || ((b2 || b3) && b0 && !t0 && !t1);
			d[8] = (t0 && t1) || ((b3==b0) && !t0 && !t1) || ((b3==b1) && t1) || ((b3==b2) && t0);
			for (int j=0; j<9; j++)
				if (d[j]) c[j+9*i] = (c[j+9*i]+=num)%12 < 0 ? c[j+9*i]%12+12 : c[j+9*i]%12;
			num=-num; b0 = invert(b0); b1 = invert(b1);  b2 = invert(b2); b3 = invert(b3);
	  }
	}
}
```