Курсовая работа
Часть 2
Вариант 18

Студентка
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Р3118

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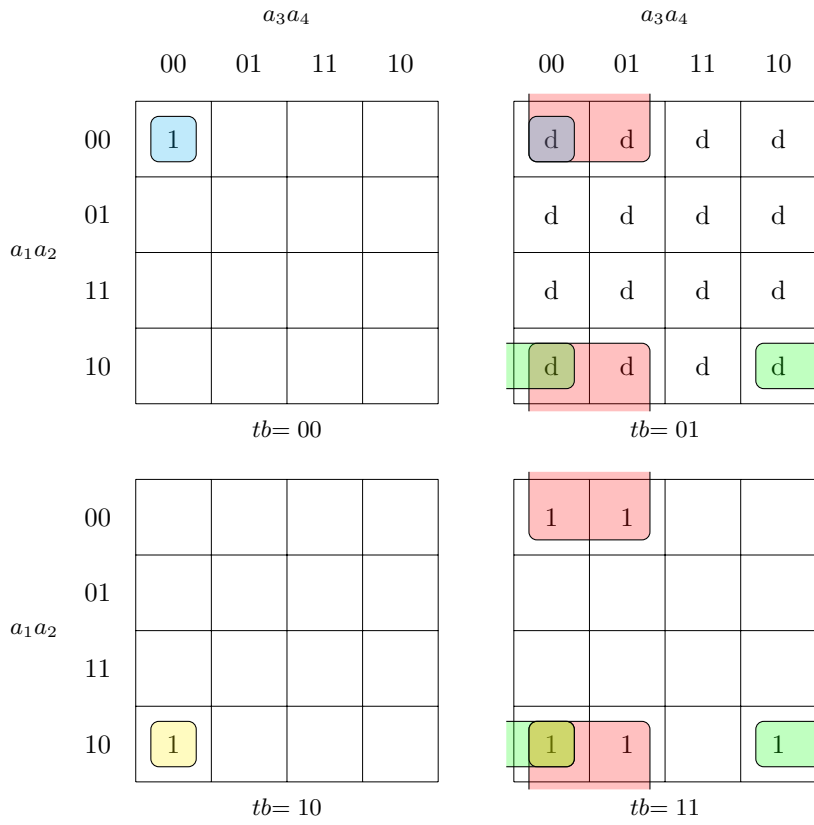
Санкт-Петербург, 2022 г.

Задание

Построить комбинационную схему, реализующую функцию $C = A - 1$ при $t = 0$ ($A = a_1a_2a_3a_4$ и $C = c_1c_2c_3c_4$), $C = A - B$ при $t = 1$. ($A = a_2a_3a_4$, $B = ba_1$, $C = c_1c_2c_3c_4$) При переносе, $e = 1$.
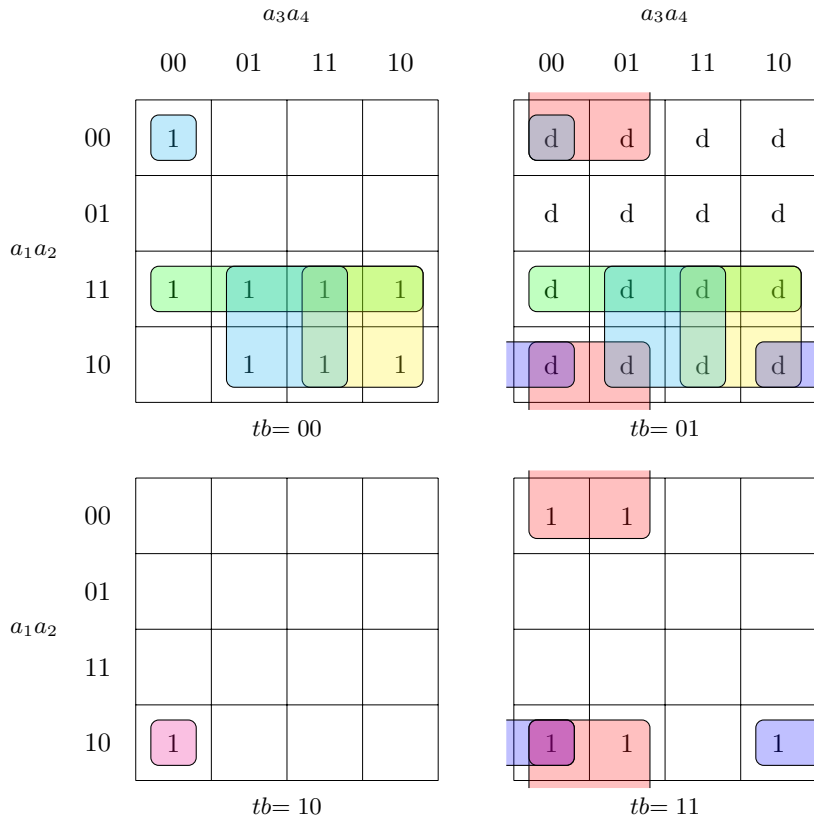
Таблица истинности

№	t	b	a_1	a_2	a_3	a_4	e	c_1	c_2	c_3	c_4
0	0	0	0	0	0	0	1	1	1	1	1
1	0	0	0	0	0	1	0	0	0	0	0
2	0	0	0	0	1	0	0	0	0	0	1
3	0	0	0	0	1	1	0	0	0	1	0
4	0	0	0	1	0	0	0	0	0	1	1
5	0	0	0	1	0	1	0	0	1	0	0
6	0	0	0	1	1	0	0	0	1	0	1
7	0	0	0	1	1	1	0	0	1	1	0
8	0	0	1	0	0	0	0	0	1	1	1
9	0	0	1	0	0	1	0	1	0	0	0
10	0	0	1	0	1	0	0	1	0	0	1
11	0	0	1	0	1	1	0	1	0	1	0
12	0	0	1	1	0	0	0	1	0	1	1
13	0	0	1	1	0	1	0	1	1	0	0
14	0	0	1	1	1	0	0	1	1	0	1
15	0	0	1	1	1	1	0	1	1	1	0
16	0	1	0	0	0	0	d	d	d	d	d
17	0	1	0	0	0	1	d	d	d	d	d
18	0	1	0	0	1	0	d	d	d	d	d
19	0	1	0	0	1	1	d	d	d	d	d
20	0	1	0	1	0	0	d	d	d	d	d
21	0	1	0	1	0	1	d	d	d	d	d
22	0	1	0	1	1	0	d	d	d	d	d
23	0	1	0	1	1	1	d	d	d	d	d
24	0	1	1	0	0	0	d	d	d	d	d
25	0	1	1	0	0	1	d	d	d	d	d
26	0	1	1	0	1	0	d	d	d	d	d
27	0	1	1	0	1	1	d	d	d	d	d
28	0	1	1	1	0	0	d	d	d	d	d
29	0	1	1	1	0	1	d	d	d	d	d
30	0	1	1	1	1	0	d	d	d	d	d
31	0	1	1	1	1	1	d	d	d	d	d
32	1	0	0	0	0	0	0	0	0	0	0
33	1	0	0	0	0	1	0	0	0	0	1
34	1	0	0	0	1	0	0	0	0	1	0
35	1	0	0	0	1	1	0	0	0	1	1
36	1	0	0	1	0	0	0	0	1	0	0
37	1	0	0	1	0	1	0	0	1	0	1
38	1	0	0	1	1	0	0	0	1	1	0
39	1	0	0	1	1	1	0	0	1	1	1
40	1	0	1	0	0	0	1	1	1	1	1
41	1	0	1	0	0	1	0	0	0	0	0
42	1	0	1	0	1	0	0	0	0	0	1
43	1	0	1	0	1	1	0	0	0	1	0
44	1	0	1	1	0	0	0	0	0	1	1
45	1	0	1	1	0	1	0	0	1	0	0
46	1	0	1	1	1	0	0	0	1	0	1
47	1	0	1	1	1	1	0	0	1	1	0
48	1	1	0	0	0	0	1	1	1	1	0
49	1	1	0	0	0	1	1	1	1	1	1

50	1	1	0	0	1	0	0	0	0	0	0
51	1	1	0	0	1	1	0	0	0	0	1
52	1	1	0	1	0	0	0	0	0	1	0
53	1	1	0	1	0	1	0	0	0	1	1
54	1	1	0	1	1	0	0	0	1	0	0
55	1	1	0	1	1	1	0	0	1	0	1
56	1	1	1	0	0	0	1	1	1	0	1
57	1	1	1	0	0	1	1	1	1	1	0
58	1	1	1	0	1	0	1	1	1	1	1
59	1	1	1	0	1	1	0	0	0	0	0
60	1	1	1	1	0	0	0	0	0	0	1
61	1	1	1	1	0	1	0	0	0	1	0
62	1	1	1	1	1	0	0	0	0	1	1
63	1	1	1	1	1	1	0	0	1	0	0

Минимизация булевых функций на картах Карно

a_3a_4 a_3a_4

	00	01	11	10
00	1			
01				
11				
10				

a_1a_2 $tb= 00$

	00	01	11	10
00	d	d	d	d
01	d	d	d	d
11	d	d	d	d
10	d	d	d	d

$tb= 01$

	00	01	11	10
00				
01				
11				
10	1			

a_1a_2 $tb= 10$

	00	01	11	10
00	1	1		
01				
11				
10	1	1		1

$tb= 11$

$$e = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} \quad (S_Q = 21)$$

a_3a_4 a_3a_4

	00	01	11	10
00	1			
01				
11	1	1	1	1
10		1	1	1

a_1a_2 $tb= 00$

	00	01	11	10
00	d	d	d	d
01	d	d	d	d
11	d	d	d	d
10	d	d	d	d

$tb= 01$

	00	01	11	10
00				
01				
11				
10	1			

a_1a_2 $tb= 10$

	00	01	11	10
00	1	1		
01				
11				
10	1	1		1

$tb= 11$

$$c_1 = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,a_2\,\overline{t} \vee a_1\,a_3\,\overline{t} \vee a_1\,a_4\,\overline{t} \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} \quad (S_Q = 33)$$

a_3a_4 a_3a_4

tb= 00   tb= 01

tb= 10   tb= 11

$$c_2 = a_2\,a_3\,a_4 \vee \overline{a_2}\,\overline{a_3}\,b \vee \overline{a_1}\,a_2\,a_3 \vee a_2\,a_3\,\overline{b} \vee a_2\,a_4\,\overline{b} \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4} \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee \overline{a_1}\,a_2\,\overline{b}\,t \vee \overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \quad (S_Q = 40)$$

a_3a_4 a_3a_4

tb= 00   tb= 01

tb= 10   tb= 11
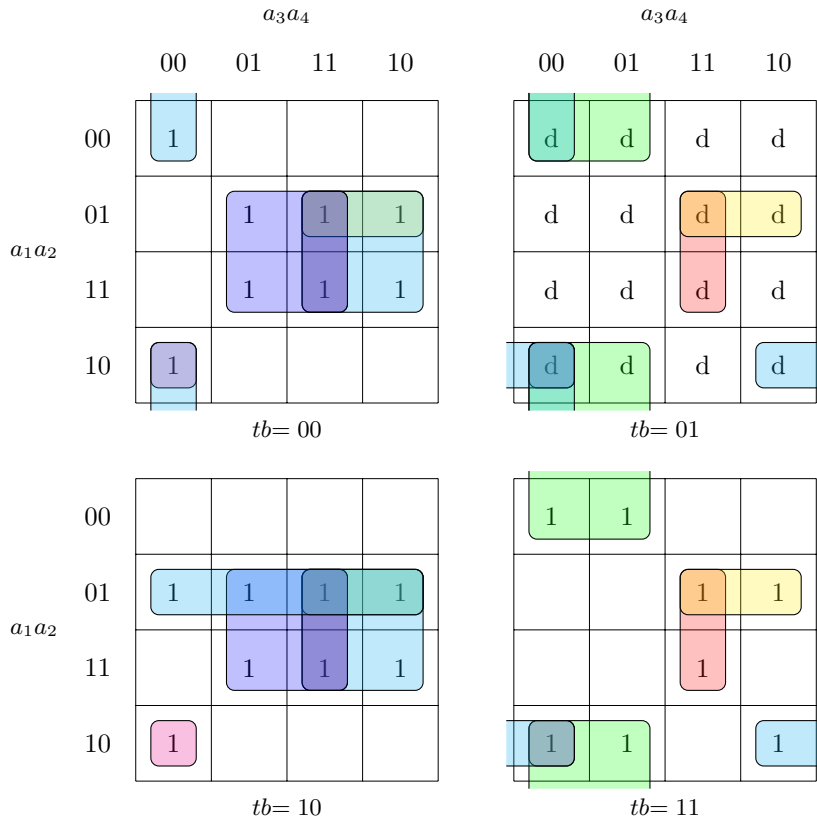
$$c_3 = \overline{a_1}\,\overline{a_3}\,b \vee \overline{a_3}\,a_4\,b \vee a_3\,a_4\,\overline{b} \vee \overline{a_3}\,\overline{a_4}\,\overline{t} \vee a_1\,a_3\,\overline{a_4}\,b \vee \overline{a_1}\,a_3\,\overline{b}\,t \vee a_1\,\overline{a_3}\,\overline{a_4}\,\overline{b} \quad (S_Q = 31)$$

a_3a_4 maps with rows a_1a_2.

tb= 00

	00	01	11	10
00	1			1
01	1			1
11	1			1
10	1			1

tb= 01

	00	01	11	10
00	d	d	d	d
01	d	d	d	d
11	d	d	d	d
10	d	d	d	d

tb= 10

	00	01	11	10
00		1	1	
01		1	1	
11	1			1
10	1			1

tb= 11

	00	01	11	10
00		1	1	
01		1	1	
11	1			1
10	1			1

$$c_4 = a_1\,\overline{a_4} \vee \overline{a_4}\,\overline{t} \vee \overline{a_1}\,a_4\,t \quad (S_Q = 10)$$

Преобразование системы булевых функций

$$
\begin{cases}
e = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^e = 21) \\
c_1 = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,a_2\,\overline{t} \vee a_1\,a_3\,\overline{t} \vee a_1\,a_4\,\overline{t} \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \\
\qquad \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^{c_1} = 33) \\
c_2 = a_2\,a_3\,a_4 \vee \overline{a_2}\,\overline{a_3}\,b \vee \overline{a_1}\,a_2\,a_3 \vee a_2\,a_3\,\overline{b} \vee a_2\,a_4\,\overline{b} \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4} \vee a_1\,\overline{a_2}\,\overline{a_4}\,b \vee \\
\qquad \vee \overline{a_1}\,a_2\,\overline{b}\,t \vee \overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^{c_2} = 40) \\
c_3 = \overline{a_1}\,\overline{a_3}\,b \vee \overline{a_3}\,a_4\,b \vee a_3\,a_4\,\overline{b} \vee \overline{a_3}\,\overline{a_4}\,\overline{t} \vee a_1\,a_3\,\overline{a_4}\,b \vee \overline{a_1}\,a_3\,\overline{b}\,t \vee \\
\qquad \vee a_1\,\overline{a_3}\,\overline{a_4}\,\overline{b} & (S_Q^{c_3} = 31) \\
c_4 = a_1\,\overline{a_4} \vee \overline{a_4}\,\overline{t} \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 10)
\end{cases}
$$
$$(S_Q = 135)$$

Проведем совместную декомпозицию системы.

$$\varphi_0 = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,\overline{a_2}\,\overline{a_4}\,b$$

$$
\begin{cases}
\varphi_0 = \overline{a_2}\,\overline{a_3}\,b \vee a_1\,\overline{a_2}\,\overline{a_4}\,b & (S_Q^{\varphi_0} = 9) \\
e = \varphi_0 \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^e = 13) \\
c_1 = \varphi_0 \vee a_1\,a_2\,\overline{t} \vee a_1\,a_3\,\overline{t} \vee a_1\,a_4\,\overline{t} \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,t \vee \overline{a_1}\,\overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^{c_1} = 25) \\
c_2 = \varphi_0 \vee a_2\,a_3\,a_4 \vee a_2\,a_3\,\overline{b} \vee a_2\,a_4\,\overline{b} \vee \overline{a_1}\,a_2\,a_3 \vee a_1\,\overline{a_2}\,\overline{a_3}\,\overline{a_4} \vee \overline{a_1}\,a_2\,\overline{b}\,t \vee \\
\qquad \vee \overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\overline{t} & (S_Q^{c_2} = 32) \\
c_3 = a_3\,a_4\,\overline{b} \vee \overline{a_1}\,\overline{a_3}\,b \vee \overline{a_3}\,a_4\,b \vee \overline{a_3}\,\overline{a_4}\,\overline{t} \vee a_1\,a_3\,\overline{a_4}\,b \vee a_1\,\overline{a_3}\,\overline{a_4}\,\overline{b} \vee \\
\qquad \vee \overline{a_1}\,a_3\,\overline{b}\,t & (S_Q^{c_3} = 31) \\
c_4 = a_1\,\overline{a_4} \vee \overline{a_4}\,\overline{t} \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 10)
\end{cases}
$$
$$(S_Q = 120)$$

Проведем раздельную факторизацию системы.

$$
\begin{cases}
\varphi_0 = \overline{a_2}\, b\, \left(\overline{a_3} \vee a_1\, \overline{a_4}\right) & (S_Q^{\varphi_0} = 7) \\
e = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right) & (S_Q^e = 12) \\
c_1 = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right) \vee a_1\, \overline{t}\, \left(a_2 \vee a_3 \vee a_4\right) & (S_Q^{c_1} = 19) \\
c_2 = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1 \vee \overline{t}\right) \vee a_2\, a_3\, \left(\overline{a_1} \vee a_4 \vee \overline{b}\right) \vee a_2\, a_4\, \overline{b} \vee \overline{a_1}\, a_2\, \overline{b}\, t & (S_Q^{c_2} = 24) \\
c_3 = \overline{a_3}\, b\, \left(a_4 \vee \overline{a_1}\right) \vee a_3\, \overline{b}\, \left(a_4 \vee \overline{a_1}\, t\right) \vee \overline{a_3}\, \overline{a_4}\, \overline{t} \vee a_1\, a_3\, \overline{a_4}\, b \vee a_1\, \overline{a_3}\, \overline{a_4}\, \overline{b} & (S_Q^{c_3} = 28) \\
c_4 = \overline{a_4}\, \left(a_1 \vee \overline{t}\right) \vee \overline{a_1}\, a_4\, t & (S_Q^{c_4} = 9)
\end{cases}
$$
$$(S_Q = 99)$$

Проведем совместную декомпозицию системы.

$$
e = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right)
$$

$$
\begin{cases}
\varphi_0 = \overline{a_2}\, b\, \left(\overline{a_3} \vee a_1\, \overline{a_4}\right) & (S_Q^{\varphi_0} = 7) \\
c_2 = \varphi_0 \vee a_2\, a_3\, \left(\overline{a_1} \vee a_4 \vee \overline{b}\right) \vee a_2\, a_4\, \overline{b} \vee \overline{a_1}\, a_2\, \overline{b}\, t \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1 \vee \overline{t}\right) & (S_Q^{c_2} = 24) \\
c_3 = a_3\, \overline{b}\, \left(a_4 \vee \overline{a_1}\, t\right) \vee \overline{a_3}\, b\, \left(\overline{a_1} \vee a_4\right) \vee \overline{a_3}\, \overline{a_4}\, \overline{t} \vee a_1\, a_3\, \overline{a_4}\, b \vee a_1\, \overline{a_3}\, \overline{a_4}\, \overline{b} & (S_Q^{c_3} = 28) \\
c_4 = \overline{a_4}\, \left(a_1 \vee \overline{t}\right) \vee \overline{a_1}\, a_4\, t & (S_Q^{c_4} = 9) \\
e = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right) & (S_Q^e = 12) \\
c_1 = e \vee a_1\, \overline{t}\, \left(a_2 \vee a_3 \vee a_4\right) & (S_Q^{c_1} = 8)
\end{cases}
$$
$$(S_Q = 88)$$

Проведем раздельную факторизацию системы.

$$
\begin{cases}
\varphi_0 = \overline{a_2}\, b\, \left(\overline{a_3} \vee a_1\, \overline{a_4}\right) & (S_Q^{\varphi_0} = 7) \\
c_2 = \varphi_0 \vee a_2\, \overline{b}\, \left(a_4 \vee \overline{a_1}\, t\right) \vee a_2\, a_3\, \left(\overline{a_1} \vee a_4 \vee \overline{b}\right) \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1 \vee \overline{t}\right) & (S_Q^{c_2} = 23) \\
c_3 = \overline{a_3}\, \overline{a_4}\, \left(\overline{t} \vee a_1\, \overline{b}\right) \vee a_3\, \overline{b}\, \left(a_4 \vee \overline{a_1}\, t\right) \vee \overline{a_3}\, b\, \left(\overline{a_1} \vee a_4\right) \vee a_1\, a_3\, \overline{a_4}\, b & (S_Q^{c_3} = 27) \\
c_4 = \overline{a_4}\, \left(a_1 \vee \overline{t}\right) \vee \overline{a_1}\, a_4\, t & (S_Q^{c_4} = 9) \\
e = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right) & (S_Q^e = 12) \\
c_1 = e \vee a_1\, \overline{t}\, \left(a_2 \vee a_3 \vee a_4\right) & (S_Q^{c_1} = 8)
\end{cases}
$$
$$(S_Q = 86)$$

Проведем совместную декомпозицию системы.

$$
\varphi_1 = \overline{a_4}\, \left(a_1 \vee \overline{t}\right), \quad \overline{\varphi_1} = a_4 \vee \overline{a_1}\, t
$$

$$
\begin{cases}
\varphi_1 = \overline{a_4}\, \left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\, b\, \left(\overline{a_3} \vee a_1\, \overline{a_4}\right) & (S_Q^{\varphi_0} = 7) \\
c_2 = \varphi_0 \vee \varphi_1\, \overline{a_2}\, \overline{a_3} \vee a_2\, a_3\, \left(\overline{a_1} \vee a_4 \vee \overline{b}\right) \vee \overline{\varphi_1}\, a_2\, \overline{b} & (S_Q^{c_2} = 16) \\
c_3 = \overline{\varphi_1}\, a_3\, \overline{b} \vee \overline{a_3}\, b\, \left(\overline{a_1} \vee a_4\right) \vee \overline{a_3}\, \overline{a_4}\, \left(\overline{t} \vee a_1\, \overline{b}\right) \vee a_1\, a_3\, \overline{a_4}\, b & (S_Q^{c_3} = 23) \\
c_4 = \varphi_1 \vee \overline{a_1}\, a_4\, t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \overline{a_2}\, \overline{a_3}\, \overline{a_4}\, \left(a_1\, t \vee \overline{a_1}\, \overline{t}\right) & (S_Q^e = 12) \\
c_1 = e \vee a_1\, \overline{t}\, \left(a_2 \vee a_3 \vee a_4\right) & (S_Q^{c_1} = 8)
\end{cases}
$$
$$(S_Q = 76)$$

Проведем совместную декомпозицию системы.

$$\varphi_2 = a_1\,\overline{a_4}, \quad \overline{\varphi_2} = \overline{a_1} \vee a_4$$

$$
\begin{cases}
\varphi_2 = a_1\,\overline{a_4} & (S_Q^{\varphi_2} = 2) \\
\varphi_1 = \overline{a_4}\,\left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\,b\,(\varphi_2 \vee \overline{a_3}) & (S_Q^{\varphi_0} = 5) \\
c_2 = \varphi_0 \vee \varphi_1\,\overline{a_2}\,\overline{a_3} \vee a_2\,a_3\,\left(\overline{\varphi_2} \vee \overline{b}\right) \vee \overline{\varphi_1}\,a_2\,\overline{b} & (S_Q^{c_2} = 15) \\
c_3 = \varphi_2\,a_3\,b \vee \overline{\varphi_1}\,a_3\,\overline{b} \vee \overline{\varphi_2}\,\overline{a_3}\,b \vee \overline{a_3}\,\overline{a_4}\,\left(\overline{t} \vee a_1\,\overline{b}\right) & (S_Q^{c_3} = 20) \\
c_4 = \varphi_1 \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \overline{a_2}\,\overline{a_3}\,\overline{a_4}\,\left(a_1\,t \vee \overline{a_1}\,\overline{t}\right) & (S_Q^{e} = 12) \\
c_1 = e \vee a_1\,\overline{t}\,(a_2 \vee a_3 \vee a_4) & (S_Q^{c_1} = 8)
\end{cases}
$$
$$(S_Q = 73)$$

Проведем совместную декомпозицию системы.

$$\varphi_3 = \overline{a_2}\,\overline{a_3}\,\overline{a_4}, \quad \overline{\varphi_3} = a_2 \vee a_3 \vee a_4$$

$$
\begin{cases}
\varphi_3 = \overline{a_2}\,\overline{a_3}\,\overline{a_4} & (S_Q^{\varphi_3} = 3) \\
\varphi_2 = a_1\,\overline{a_4} & (S_Q^{\varphi_2} = 2) \\
\varphi_1 = \overline{a_4}\,\left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\,b\,(\varphi_2 \vee \overline{a_3}) & (S_Q^{\varphi_0} = 5) \\
c_2 = \varphi_0 \vee \varphi_1\,\overline{a_2}\,\overline{a_3} \vee a_2\,a_3\,\left(\overline{\varphi_2} \vee \overline{b}\right) \vee \overline{\varphi_1}\,a_2\,\overline{b} & (S_Q^{c_2} = 15) \\
c_3 = \varphi_2\,a_3\,b \vee \overline{\varphi_1}\,a_3\,\overline{b} \vee \overline{\varphi_2}\,\overline{a_3}\,b \vee \overline{a_3}\,\overline{a_4}\,\left(\overline{t} \vee a_1\,\overline{b}\right) & (S_Q^{c_3} = 20) \\
c_4 = \varphi_1 \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \varphi_3\,\left(a_1\,t \vee \overline{a_1}\,\overline{t}\right) & (S_Q^{e} = 10) \\
c_1 = e \vee \overline{\varphi_3}\,a_1\,\overline{t} & (S_Q^{c_1} = 5)
\end{cases}
$$
$$(S_Q = 72)$$

Проведем совместную декомпозицию системы.

$$\varphi_4 = \varphi_2\,b, \quad \overline{\varphi_4} = \overline{\varphi_2} \vee \overline{b}$$

$$
\begin{cases}
\varphi_3 = \overline{a_2}\,\overline{a_3}\,\overline{a_4} & (S_Q^{\varphi_3} = 3) \\
\varphi_2 = a_1\,\overline{a_4} & (S_Q^{\varphi_2} = 2) \\
\varphi_1 = \overline{a_4}\,\left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\,b\,(\varphi_2 \vee \overline{a_3}) & (S_Q^{\varphi_0} = 5) \\
c_4 = \varphi_1 \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \varphi_3\,\left(a_1\,t \vee \overline{a_1}\,\overline{t}\right) & (S_Q^{e} = 10) \\
c_1 = e \vee \overline{\varphi_3}\,a_1\,\overline{t} & (S_Q^{c_1} = 5) \\
\varphi_4 = \varphi_2\,b & (S_Q^{\varphi_4} = 2) \\
c_2 = \varphi_0 \vee \varphi_1\,\overline{a_2}\,\overline{a_3} \vee \overline{\varphi_4}\,a_2\,a_3 \vee \overline{\varphi_1}\,a_2\,\overline{b} & (S_Q^{c_2} = 13) \\
c_3 = \varphi_4\,a_3 \vee \overline{\varphi_1}\,a_3\,\overline{b} \vee \overline{\varphi_2}\,\overline{a_3}\,b \vee \overline{a_3}\,\overline{a_4}\,\left(\overline{t} \vee a_1\,\overline{b}\right) & (S_Q^{c_3} = 19)
\end{cases}
$$
$$(S_Q = 72)$$

Проведем совместную декомпозицию системы.

$$\varphi_5 = \overline{\varphi_1}\,\overline{b}$$

$$
\begin{cases}
\varphi_3 = \overline{a_2}\,\overline{a_3}\,\overline{a_4} & (S_Q^{\varphi_3} = 3) \\
\varphi_2 = a_1\,\overline{a_4} & (S_Q^{\varphi_2} = 2) \\
\varphi_1 = \overline{a_4}\,\left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\,b\,\left(\varphi_2 \vee \overline{a_3}\right) & (S_Q^{\varphi_0} = 5) \\
c_4 = \varphi_1 \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \varphi_3\,\left(a_1\,t \vee \overline{a_1}\,\overline{t}\right) & (S_Q^{e} = 10) \\
c_1 = e \vee \overline{\varphi_3}\,a_1\,\overline{t} & (S_Q^{c_1} = 5) \\
\varphi_4 = \varphi_2\,b & (S_Q^{\varphi_4} = 2) \\
\varphi_5 = \overline{\varphi_1}\,\overline{b} & (S_Q^{\varphi_5} = 2) \\
c_2 = \varphi_0 \vee \varphi_5\,a_2 \vee \varphi_1\,\overline{a_2}\,\overline{a_3} \vee \overline{\varphi_4}\,a_2\,a_3 & (S_Q^{c_2} = 12) \\
c_3 = \varphi_4\,a_3 \vee \varphi_5\,a_3 \vee \overline{\varphi_2}\,\overline{a_3}\,b \vee \overline{a_3}\,\overline{a_4}\,\left(\overline{t} \vee a_1\,\overline{b}\right) & (S_Q^{c_3} = 18) \\
\end{cases}
$$
$$(S_Q = 72)$$

Проведем раздельную факторизацию системы.

$$
\begin{cases}
\varphi_3 = \overline{a_2}\,\overline{a_3}\,\overline{a_4} & (S_Q^{\varphi_3} = 3) \\
\varphi_2 = a_1\,\overline{a_4} & (S_Q^{\varphi_2} = 2) \\
\varphi_1 = \overline{a_4}\,\left(a_1 \vee \overline{t}\right) & (S_Q^{\varphi_1} = 4) \\
\varphi_0 = \overline{a_2}\,b\,\left(\varphi_2 \vee \overline{a_3}\right) & (S_Q^{\varphi_0} = 5) \\
c_4 = \varphi_1 \vee \overline{a_1}\,a_4\,t & (S_Q^{c_4} = 5) \\
e = \varphi_0 \vee \varphi_3\,\left(a_1\,t \vee \overline{a_1}\,\overline{t}\right) & (S_Q^{e} = 10) \\
c_1 = e \vee \overline{\varphi_3}\,a_1\,\overline{t} & (S_Q^{c_1} = 5) \\
\varphi_4 = \varphi_2\,b & (S_Q^{\varphi_4} = 2) \\
\varphi_5 = \overline{\varphi_1}\,\overline{b} & (S_Q^{\varphi_5} = 2) \\
c_2 = \varphi_0 \vee a_2\,\left(\varphi_5 \vee \overline{\varphi_4}\,a_3\right) \vee \varphi_1\,\overline{a_2}\,\overline{a_3} & (S_Q^{c_2} = 12) \\
c_3 = a_3\,\left(\varphi_4 \vee \varphi_5\right) \vee \overline{\varphi_2}\,\overline{a_3}\,b \vee \overline{a_3}\,\overline{a_4}\,\left(\overline{t} \vee a_1\,\overline{b}\right) & (S_Q^{c_3} = 17) \\
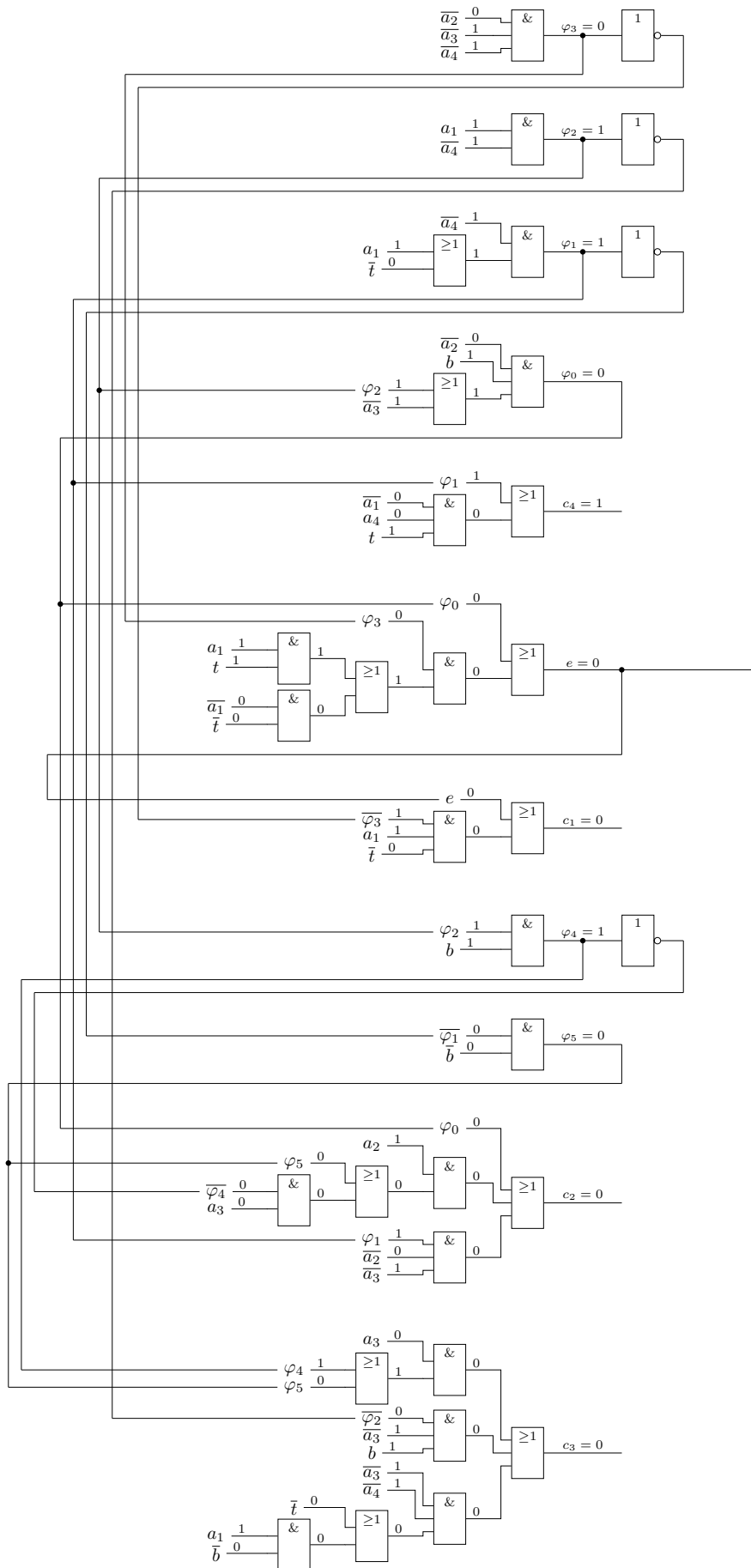\end{cases}
$$
$$(S_Q = 71)$$

Синтез комбинационной схемы в булевом базисе

Будем анализировать схему на следующем наборе аргументов:

$$a_1 = 1,\ a_2 = 1,\ a_3 = 0,\ a_4 = 0,\ b = 1,\ t = 1$$

Выходы схемы из таблицы истинности:

$$e = 0,\ c_1 = 0,\ c_2 = 0,\ c_3 = 0,\ c_4 = 1$$

Цена схемы: $S_Q = 71$. Задержка схемы: $T = 7\tau$.