САНКТ-ПЕТЕРГБУРГСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ
ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ, МЕХАНИКИ И ОПТИКИ

Курсовая работа по дискретной математике

Вариант 40

Выполнил: Назирджанов Некруз Фарходович

Группа: P3110

Санкт-Петербург

2021 г.

f = 1	f = d
$9 \leq 1X_4X_5 + X_1X_2X_3 < 12$	$\lvert X_5X_1X_2 - X_4X_3 \rvert = 0$

N	X_1	X_2	X_3	X_4	X_5	$1X_4X_5$	$(1X_4X_5)_{10}$	$X_1X_2X_3$	$(X_1X_2X_3)_{10}$	(+)	$X_5X_1X_2$	$(X_5X_1X_2)_{10}$	X_4X_3	$(X_4X_3)_{10}$	|-|	f
0	**0**	**0**	**0**	**0**	**0**	**100**	**4**	**000**	**0**	**4**	000	**0**	00	**0**	0	**d**
1	**0**	**0**	**0**	**0**	**1**	**101**	**5**	**000**	**0**	**5**	100	**4**	00	**0**	4	**0**
2	**0**	**0**	**0**	**1**	**0**	**110**	**6**	**000**	**0**	**6**	000	**0**	10	**2**	2	**0**
3	**0**	**0**	**0**	**1**	**1**	**111**	**7**	**000**	**0**	**7**	100	**4**	10	**2**	2	**0**
4	**0**	**0**	**1**	**0**	**0**	**100**	**4**	**001**	**1**	**5**	000	**0**	01	**1**	1	**0**
5	**0**	**0**	**1**	**0**	**1**	**101**	**5**	**001**	**1**	**6**	100	**4**	01	**1**	3	**0**
6	**0**	**0**	**1**	**1**	**0**	**110**	**6**	**001**	**1**	**7**	000	**0**	11	**3**	3	**0**
7	**0**	**0**	**1**	**1**	**1**	**111**	**7**	**001**	**1**	**8**	100	**4**	11	**3**	1	**0**
8	**0**	**1**	**0**	**0**	**0**	**100**	**4**	**010**	**2**	**6**	001	**1**	00	**0**	1	**0**
9	**0**	**1**	**0**	**0**	**1**	**101**	**5**	**010**	**2**	**7**	101	**5**	00	**0**	5	**0**
10	**0**	**1**	**0**	**1**	**0**	**110**	**6**	**010**	**2**	**8**	001	**1**	10	**2**	1	**0**
11	**0**	**1**	**0**	**1**	**1**	**111**	**7**	**010**	**2**	**9**	101	**5**	10	**2**	3	**1**
12	**0**	**1**	**1**	**0**	**0**	**100**	**4**	**011**	**3**	**7**	001	**1**	01	**1**	0	**d**
13	**0**	**1**	**1**	**0**	**1**	**101**	**5**	**011**	**3**	**8**	101	**5**	01	**1**	4	**0**
14	**0**	**1**	**1**	**1**	**0**	**110**	**6**	**011**	**3**	**9**	001	**1**	11	**3**	2	**1**
15	**0**	**1**	**1**	**1**	**1**	**111**	**7**	**011**	**3**	**10**	101	**5**	11	**3**	2	**1**
16	**1**	**0**	**0**	**0**	**0**	**100**	**4**	**100**	**4**	**8**	010	**2**	00	**0**	2	**0**
17	**1**	**0**	**0**	**0**	**1**	**101**	**5**	**100**	**4**	**9**	110	**6**	00	**0**	6	**1**
18	**1**	**0**	**0**	**1**	**0**	**110**	**6**	**100**	**4**	**10**	010	**2**	10	**2**	0	**d**
19	**1**	**0**	**0**	**1**	**1**	**111**	**7**	**100**	**4**	**11**	110	**6**	10	**2**	4	**1**
20	**1**	**0**	**1**	**0**	**0**	**100**	**4**	**101**	**5**	**9**	010	**2**	01	**1**	1	**1**
21	**1**	**0**	**1**	**0**	**1**	**101**	**5**	**101**	**5**	**10**	110	**6**	01	**1**	5	**1**
22	**1**	**0**	**1**	**1**	**0**	**110**	**6**	**101**	**5**	**11**	010	**2**	11	**3**	1	**1**
23	**1**	**0**	**1**	**1**	**1**	**111**	**7**	**101**	**5**	**12**	110	**6**	11	**3**	3	**0**
24	**1**	**1**	**0**	**0**	**0**	**100**	**4**	**110**	**6**	**10**	011	**3**	00	**0**	3	**1**
25	**1**	**1**	**0**	**0**	**1**	**101**	**5**	**110**	**6**	**11**	111	**7**	00	**0**	7	**1**
26	**1**	**1**	**0**	**1**	**0**	**110**	**6**	**110**	**6**	**12**	011	**3**	10	**2**	1	**0**
27	**1**	**1**	**0**	**1**	**1**	**111**	**7**	**110**	**6**	**13**	111	**7**	10	**2**	5	**0**
28	**1**	**1**	**1**	**0**	**0**	**100**	**4**	**111**	**7**	**11**	011	**3**	01	**1**	2	**1**
29	**1**	**1**	**1**	**0**	**1**	**101**	**5**	**111**	**7**	**12**	111	**7**	01	**1**	6	**0**
30	**1**	**1**	**1**	**1**	**0**	**110**	**6**	**111**	**7**	**13**	011	**3**	11	**3**	0	**d**
31	**1**	**1**	**1**	**1**	**1**	**111**	**7**	**111**	**7**	**14**	111	**7**	11	**3**	4	**0**

КДНФ: $f = \bar{x}_1x_2\bar{x}_3x_4x_5 \vee \bar{x}_1x_2x_3x_4\bar{x}_5 \vee \bar{x}_1x_2x_3x_4x_5 \vee x_1\bar{x}_2\bar{x}_3\bar{x}_4x_5 \vee x_1\bar{x}_2\bar{x}_3x_4x_5 \vee x_1\bar{x}_2x_3\bar{x}_4\bar{x}_5 \vee x_1\bar{x}_2x_3\bar{x}_4x_5 \vee x_1\bar{x}_2x_3x_4\bar{x}_5 \vee x_1x_2\bar{x}_3\bar{x}_4\bar{x}_5 \vee x_1x_2\bar{x}_3\bar{x}_4x_5 \vee x_1x_2x_3\bar{x}_4\bar{x}_5$

ККНФ: $f = (x_1 \vee x_2 \vee x_3 \vee x_4 \vee \bar{x}_5)(x_1 \vee x_2 \vee x_3 \vee \bar{x}_4 \vee x_5)(x_1 \vee x_2 \vee x_3 \vee \bar{x}_4 \vee \bar{x}_5)(x_1 \vee x_2 \vee \bar{x}_3 \vee x_4 \vee x_5)(x_1 \vee x_2 \vee \bar{x}_3 \vee x_4 \vee \bar{x}_5)(x_1 \vee x_2 \vee \bar{x}_3 \vee \bar{x}_4 \vee x_5)(x_1 \vee x_2 \vee \bar{x}_3 \vee \bar{x}_4 \vee \bar{x}_5)(x_1 \vee \bar{x}_2 \vee x_3 \vee x_4 \vee x_5)(x_1 \vee \bar{x}_2 \vee x_3 \vee x_4 \vee \bar{x}_5)(x_1 \vee \bar{x}_2 \vee x_3 \vee \bar{x}_4 \vee x_5)(x_1 \vee \bar{x}_2 \vee \bar{x}_3 \vee x_4 \vee \bar{x}_5)(\bar{x}_1 \vee x_2 \vee x_3 \vee x_4 \vee$

x_5) ($\bar{x}_1 \vee x_2 \vee \bar{x}_3 \vee \bar{x}_4 \vee \bar{x}_5$) ($\bar{x}_1 \vee \bar{x}_2 \vee x_3 \vee \bar{x}_4 \vee x_5$) ($\bar{x}_1 \vee \bar{x}_2 \vee x_3 \vee \bar{x}_4 \vee \bar{x}_5$) ($\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_3 \vee x_4 \vee \bar{x}_5$) ($\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_3 \vee \bar{x}_4 \vee \bar{x}_5$)

№	K0 U N	*	№	K1		*	№	K2	*		№	Z(f)
1	00000		1	01x11	2-5		1	x11x0	2-17		1	00000
2	01011	*	2	011x0	3-4	*	2	1x1x0	12-17		2	01x11
3	01100	*	3	x1100	3-14	*					3	0111x
4	01110	*	4	0111x	4-5						4	100x1
5	01111	*	5	x1110	4-15	*					5	10x01
6	10001	*	6	100x1	6-8						6	1x001
7	10010	*	7	10x01	6-10						7	1001x
8	10011	*	8	1x001	6-13						8	10x10
9	10100	*	9	1001x	7-8						9	1010x
10	10101	*	10	10x10	7-11						10	1100x
11	10110	*	11	1010x	9-10						11	11x00
12	11000	*	12	101x0	9-11	*					12	x11x0
13	11001	*	13	1x100	9-14	*					13	1x1x0
14	11100	*	14	1x110	11-15	*						
15	11111	*	15	1100x	12-13							
			16	11x00	12-14							
			17	111x0	14-15	*						

	01011	01110	01111	10001	10011	10100	10101	10110	11000	11001	11100
00000											
01x11	(*)		*								
0111x		*	*								
100x1				*	*						
10x01				*			*				
1x001				*						*	
1001x					*						
10x10								*			
1010x						*	*				
1100x									*	*	
11x00									*		*
x11x0		*									*
1x1x0						*		*			*

		01110	10001	10011	10100	10101	10110	11000	11001	11100
0111x	A	*								
100x1	B		*	*						
10x01	C		*			*				
1x001	D		*						*	
1001x	E			*						
10x10	F						*			
1010x	G				*	*				
1100x	H							*	*	
11x00	I							*		*
x11x0	J	*								*
1x1x0	K				*		*			*

$T = \{01x11\}$

Y = (A ∨ J) (B ∨ C ∨ D) (B ∨ E) (G ∨ K) (C ∨ G) (F ∨ K) (H ∨ I) (D ∨ H)(I ∨ J ∨ K) = (B ∨ CE ∨ DE) (GF ∨ K) (C ∨ G) (H ∨ ID)(AI ∨ J ∨ AK) = BCHJK ∨ BGHJK ∨ CEHJK

$C_1 = \begin{Bmatrix} T \\ B \\ C \\ H \\ J \\ K \end{Bmatrix}$ $S^a=22$ $S^b=28$

$C_3 = \begin{Bmatrix} T \\ C \\ E \\ H \\ J \\ K \end{Bmatrix}$ $S^a=22$ $S^b=28$

$C_2 = \begin{Bmatrix} T \\ B \\ G \\ H \\ J \\ K \end{Bmatrix}$ $S^a=22$ $S^b=28$

$C_{min} = \begin{Bmatrix} 01x11 \\ 100x1 \\ 1010x \\ 1100x \\ x11x0 \\ 1x1x0 \end{Bmatrix}$

МДНФ: $f = \bar{x}_1x_2x_4x_5 \vee x_1\bar{x}_2\bar{x}_3x_5 \vee x_1\bar{x}_2x_3\bar{x}_4 \vee x_1x_2\bar{x}_3\bar{x}_4 \vee x_2x_3\bar{x}_5 \vee x_1x_3\bar{x}_5$

$x_1=0$	x_2x_3				
		00	01	11	10
	00	d		d	
	01				
x_4x_5	11			1	1
	10			1	

$x_1=1$	x_2x_3				
		00	01	11	10
	00		1	1	1
	01	1	1		1
x_4x_5	11	1			
	10	d	1	d	

$x_1=0$	x_2x_3				
		00	01	11	10
	00	d	0	d	0
	01	0	0	0	0
x_4x_5	11	0	0		
	10	0	0		0

$x_1=1$	x_2x_3				
		00	01	11	10
	00	0			
	01			0	
x_4x_5	11		0	0	0
	10	d		d	0

МДНФ: $f = \bar{x}_1x_2x_4x_5 \vee x_1\bar{x}_2\bar{x}_3x_5 \vee x_1\bar{x}_2x_3\bar{x}_4 \vee x_1x_2\bar{x}_3\bar{x}_4 \vee x_2x_3\bar{x}_5 \vee x_1x_3\bar{x}_5$

МКНФ: $f = (x_1 \vee x_2)(x_1 \vee x_4)(x_2 \vee x_3 \vee x_5)(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_4)(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_3 \vee \bar{x}_5)(x_1 \vee x_3 \vee x_5)(\bar{x}_1 \vee \bar{x}_3 \vee \bar{x}_4 \vee \bar{x}_5)$

Факторное преобразование для МДНФ:

$\bar{x}_1x_2x_4x_5 \vee x_1\bar{x}_2\bar{x}_3x_5 \vee x_1\bar{x}_2x_3\bar{x}_4 \vee x_1x_2\bar{x}_3\bar{x}_4 \vee x_2x_3\bar{x}_5 \vee x_1x_3\bar{x}_5 =$ $S_Q = 28$

$= \bar{x}_1x_2x_4x_5 \vee x_1\bar{x}_2(\bar{x}_3x_5 \vee x_3\bar{x}_4) \vee x_1x_2\bar{x}_3\bar{x}_4 \vee x_3\bar{x}_5(x_2 \vee x_1)$ $S_Q = 27$

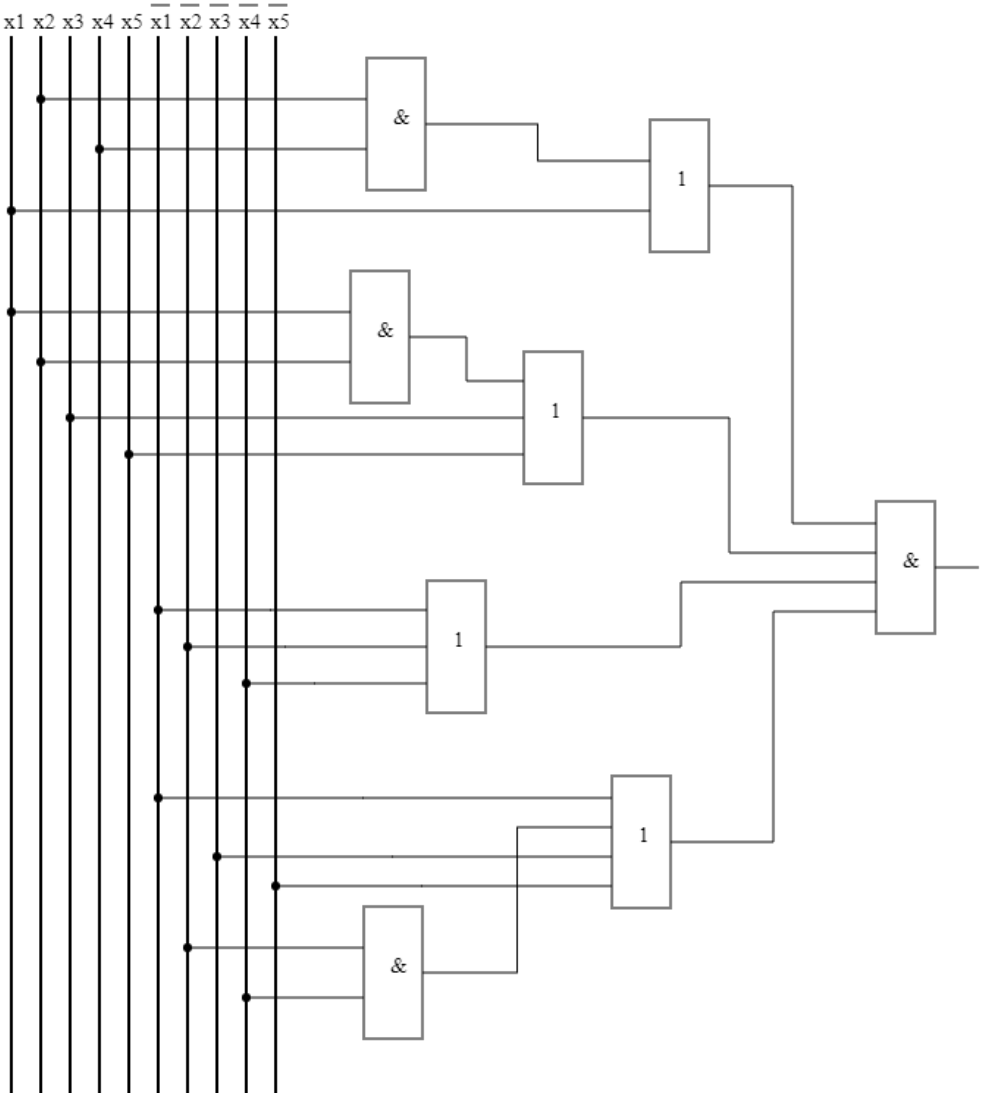
Факторное преобразование для МКНФ:

$(x_1 \vee x_2)(x_1 \vee x_4)(x_2 \vee x_3 \vee x_5)(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_4)(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_3 \vee \bar{x}_5)(x_1 \vee x_3 \vee x_5)(\bar{x}_1 \vee \bar{x}_3 \vee \bar{x}_4 \vee \bar{x}_5) =$ $S_Q = 28$

$=(x_1 \vee x_4x_2)(x_1x_2 \vee x_3 \vee x_5)(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_4)(\bar{x}_1 \vee \bar{x}_4\bar{x}_2 \vee \bar{x}_3 \vee \bar{x}_5)$

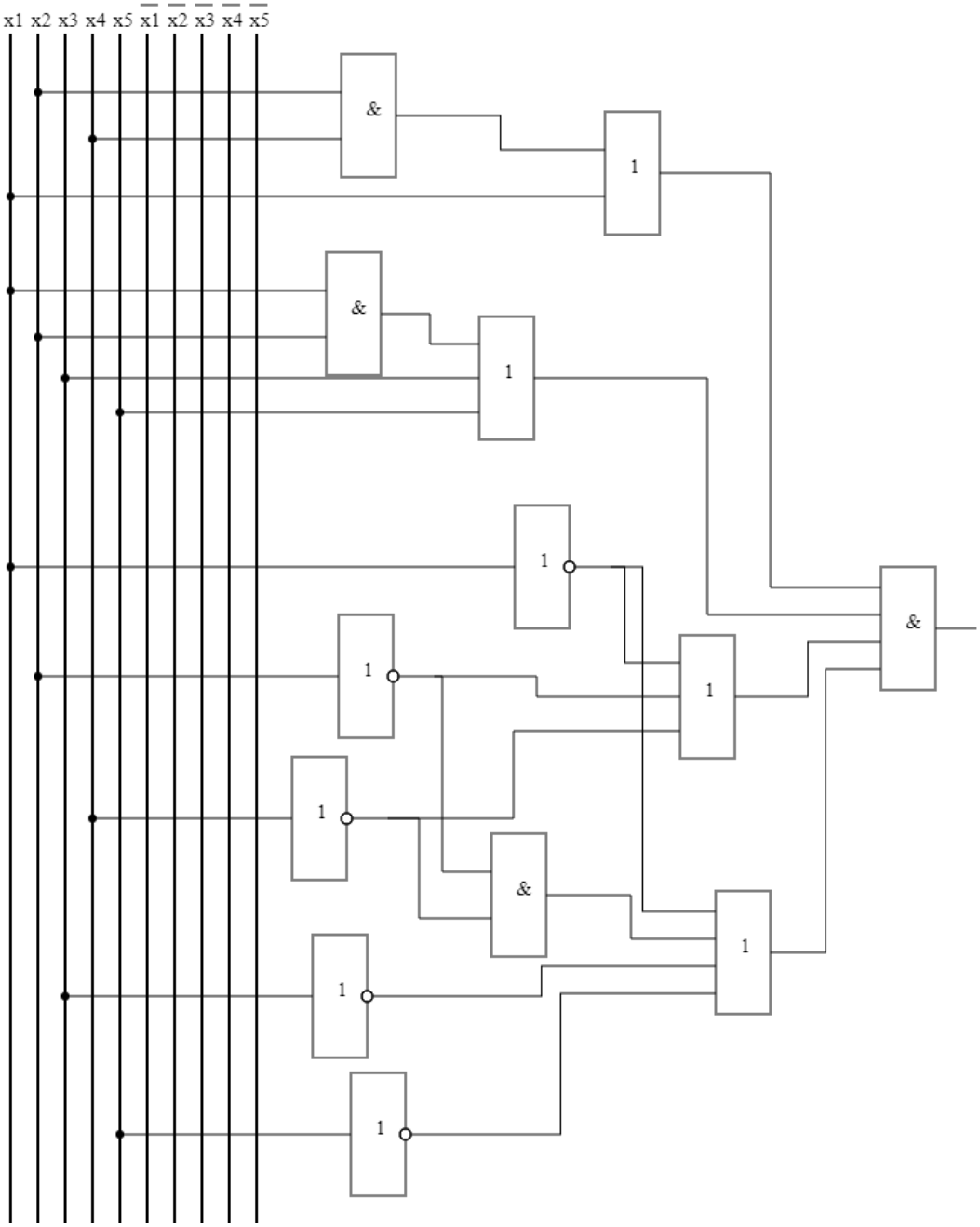
$S_Q = 22$

Булев базис



$S_Q = 22\ \tau = 3t$

Однофазные входы



$S_Q = 27\ \tau = 4t$

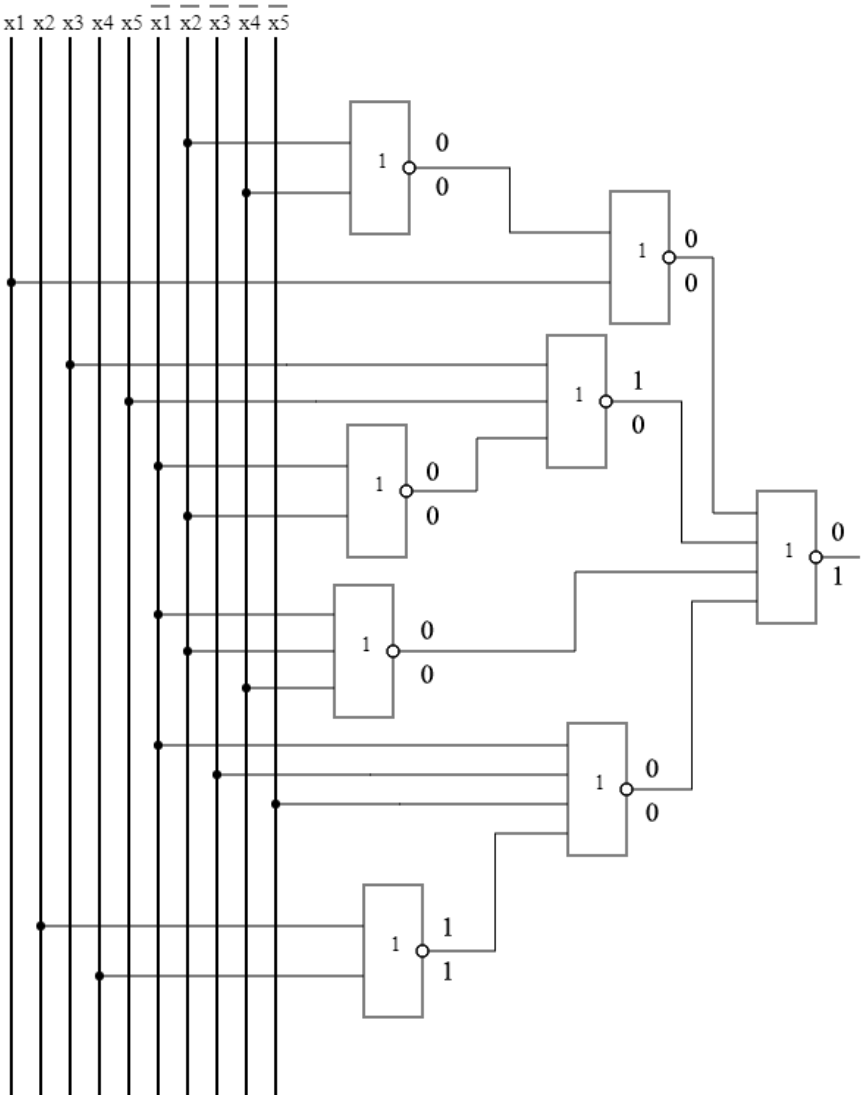
Базис ИЛИ-НЕ

$(x_1 \vee x_4x_2)\ (x_1x_2 \vee x_3 \vee x_5)\ (\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_4)\ (\bar{x}_1 \vee \bar{x}_4\bar{x}_2 \vee \bar{x}_3 \vee \bar{x}_5) =$

$=(x_1 \downarrow (\bar{x}_4 \downarrow \bar{x}_2)) \downarrow ((\bar{x}_1 \downarrow \bar{x}_2) \downarrow x_3 \downarrow x_5) \downarrow (\bar{x}_1 \downarrow \bar{x}_2 \downarrow \bar{x}_4) \downarrow (\bar{x}_1 \downarrow (x_2 \downarrow x_4) \downarrow \bar{x}_3 \downarrow \bar{x}_5)$

Проверка на наборах:

$f(10000) = 0$
$f(10001) = 1$



$S_Q = 22\ \tau = 3t$