1.2 Построение полинома Жегалкина

Гулянов

№1 Табл. истинности f.

X_1	X_2	X_3	X_4	f
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Решение

$f(0,0,0,0) = a_0 = 0$

$f(0,0,0,1) = a_0 \oplus a_4 = 0$

$f(0,0,1,0) = a_0 \oplus a_3 = 0$

$f(0,0,1,1) = a_0 \oplus a_3 \oplus a_4 + a_{34} = 0$

$f(0,1,0,0) = a_0 \oplus a_2 = 0$

$f(0,1,0,1) = a_0 \oplus a_2 \oplus a_4 \oplus a_{24} = 1$

$f(0,1,1,0) = a_0 \oplus a_2 \oplus a_3 + a_{23} = 0$

$f(0,1,1,1) = a_0 \oplus a_2 \oplus a_3 \oplus a_4 \oplus a_{23} \oplus a_{24} \oplus a_{24} \oplus a_{34} \oplus a_{234} = 1$

$f(1,0,0,0) = a_0 \oplus a_1 = 0$

$f(1,0,0,1) = a_0 + a_1 \oplus a_4 \oplus a_{14} = 0$

$f(1,0,1,0) = a_0 \oplus a_1 \oplus a_3 \oplus a_{13} = 1$

$f(1,0,1,1) = a_0 \oplus a_1 \oplus a_3 \oplus a_4 \oplus a_{13} \oplus a_{14} \oplus a_{134} = 1$

$f(1,1,0,0) = a_0 \oplus a_{12} \oplus a_1 \oplus a_2 = 0$

$f(1,1,0,1) = a_0 \oplus a_1 \oplus a_2 \oplus a_4 \oplus a_{12} \oplus a_{14} \oplus a_{24} \oplus a_{124} = 1$

$f(1,1,1,0) = a_0 \oplus a_1 \oplus a_2 \oplus a_{12} \oplus a_{13} + a_{23} \oplus a_{123} = 0$

$f(1,1,1,1) = a_0 \oplus a_1 \oplus a_2 \oplus a_3 \oplus a_4 \oplus a_{12} \oplus a_{13} \oplus a_{14} \oplus a_{23} \oplus a_{24} \oplus a_{34} \oplus a_{134} \oplus a_{123} \oplus a_{124} \oplus a_{234} + a_{1234} = 1$

$f - x_1 x_2 x_3 \oplus x_2 x_4 \oplus x_1 x_3$ — полином

№2 $f = \overline{x_1} \oplus x_2 \oplus x_3 \oplus \overline{x_4}$

X_1	X_2	X_3	X_4	$\overline{X_1}$	$\overline{X_1} \oplus X_2$	$\overline{X_1} \oplus X_2 \oplus X_3$	$\overline{X_4}$	f
0	0	0	0	1	1	1	1	0
0	0	0	1	1	1	1	0	1
0	0	1	0	1	1	0	1	1
0	0	1	1	1	1	0	0	0
0	1	0	0	1	0	0	1	1
0	1	0	1	1	0	0	0	0
0	1	1	0	1	0	1	1	0
0	1	1	1	1	0	1	0	1

x_1	x_2	x_3	x_4	$\overline{x_1}$	$\overline{x_1} \oplus x_2$	$\overline{x_1} \oplus x_2 \oplus x_3$	$\overline{x_4}$	f
0	1	1	1	1	0	1	1	0
1	0	0	0	0	0	0	1	1
1	0	0	1	0	0	0	0	0
1	0	1	0	0	0	1	1	0
1	0	1	1	0	0	1	0	1
1	1	0	0	0	1	1	1	0
1	1	0	1	0	1	1	0	1
1	1	1	0	0	1	0	1	1
1	1	1	1	0	1	0	0	0

метод треугольника:

f

$0 = a_0$

$1 = a_4$

$1 = a_3 = a_{34}$

$1 = a_2 = a_{24} = a_{23} = a_{234}$

$1 = a_1 = a_{14} = a_{13} = a_{134} = a_{12} = a_{124} = a_{123} = a_{1234}$

0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0
1	0	1	0	1	0	1	1	0	0	0	0	0	0	0	
1	1	0	0	1	0	1	0	0	0	0	0	0	0		
0	1	0	1	1	0	0	1	0	0	0	0	0			
1	1	0	1	0	1	1	1	0	0	0	0				
0	0	1	0	0	1	1	0	0	0	0					
0	1	1	0	0	0	1	0	0	0						
1	0	1	0	0	0	0	1	0							
1	1	1	0	0	0	0	0								
0	0	1	1	0	0	0									
0	1	0	1	0	0										
1	1	0	0	1	0										
0	1	1	1	0											
1	0	1	1	0											
1	1	1	0												
0															

$f = x_1 \oplus x_2 \oplus x_3 \oplus x_4$ – полином

№3 $f=(x_1 \vee x_2) \wedge (x_3 \vee x_4)$

x_1	x_2	x_3	x_4	$x_1 \vee x_2$	$x_3 \vee x_4$	f
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	0	1	0
0	1	0	0	1	0	0
0	1	0	1	1	1	1
0	1	1	0	1	1	1
0	1	1	1	1	1	1
1	0	0	0	1	0	0
1	0	0	1	1	1	1
1	0	1	0	1	1	1
1	0	1	1	1	1	1
1	1	0	0	1	0	0
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

$f(0,0,0,0) = a_0 = 0$

$f(0,0,0,1) = a_0 \oplus a_4 = 0$

$f(0,0,1,0) = a_0 \oplus a_3 = 0$

$f(0,0,1,1) = a_0 \oplus a_3 \oplus a_4 \oplus a_{34} = 0$

$f(0,1,0,0) = a_0 \oplus a_2 = 0$

$f(0,1,0,1) = a_0 \oplus a_2 \oplus a_4 \oplus a_{24} = 1$

$f(0,1,1,0) = a_0^0 \oplus a_2^0 \oplus a_3^0 \oplus a_{23}^1 = 1$

$f(0,1,1,1) = a_0^0 \oplus a_2^0 \oplus a_3^0 \oplus a_4^0 \oplus a_{23}^1 \oplus a_{34}^0 \oplus a_{24}^1 \oplus a_{234}^1 = 1$

$f(1,0,0,0) = a_0^0 \oplus a_1^0 = 1$

$f(1,0,0,1) = a_0^0 \oplus a_1^0 \oplus a_4^0 \oplus a_{14}^1 = 1$

$f(1,0,1,0) = a_0^0 \oplus a_1^0 \oplus a_3^0 \oplus a_{13}^1 = 1$

$f(1,0,1,1) = a_0^0 \oplus a_1^0 \oplus a_3^0 \oplus a_4^0 \oplus a_{13}^1 \oplus a_{14}^1 \oplus a_{34}^0 \oplus a_{134}^1 = 1$

$f(1,1,0,0) = a_0^0 \oplus a_1^0 \oplus a_2^0 \oplus a_{12}^0 = 0$

$f(1,1,0,1) = a_0^0 \oplus a_1^0 \oplus a_2^0 \oplus a_4^0 \oplus a_{12}^0 \oplus a_{24}^1 \oplus a_{14}^1 \oplus a_{124}^1 = 1$

$f(1,1,1,0) = a_0^0 \oplus a_1^0 \oplus a_2^0 \oplus a_3^0 \oplus a_{12}^0 \oplus a_{13}^1 \oplus a_{23}^1 \oplus a_{123}^1 = 1$

$f(1,1,1,1) = a_0^0 \oplus a_1^0 \oplus a_2^0 \oplus a_3^0 \oplus a_4^0 \oplus a_{12}^0 \oplus a_{13}^1 \oplus a_{14}^1 \oplus a_{24}^1 \oplus a_{23}^1 \oplus a_{34}^0 \oplus$
$\oplus a_{123}^1 \oplus a_{124}^1 \oplus a_{134}^1 \oplus a_{234}^1 \oplus a_{1234}^1 = 1$

$f = x_1 x_2 x_3 \oplus x_1 x_3 \oplus x_1 x_4 \oplus x_2 x_3 \oplus x_2 x_4 \oplus x_1 x_3 x_4 \oplus x_2 x_3 x_4 + x_1 x_2 x_4 + x_1 x_2 x_3 x_4 -$
– полином

№4 $f = (x_1 \wedge \bar{x}_3) \oplus (x_2 \vee x_4)$

x_1	x_2	x_3	x_4	$x_1 \wedge \bar{x}_3$	$x_2 \vee x_4$	f
0	0	0	0	0	0	0
0	0	0	1	0	1	1
0	0	1	0	0	0	0
0	0	1	1	0	1	1
0	1	0	0	0	1	1
0	1	0	1	0	1	1
0	1	1	0	0	1	1
0	1	1	1	0	1	1
1	0	0	0	1	0	1
1	0	0	1	1	1	0
1	0	1	0	0	0	0
1	0	1	1	0	1	1
1	1	0	0	1	0	1
1	1	0	1	1	1	0
1	1	1	0	0	0	0
1	1	1	1	0	1	1

1	1	0	1	0	1	1
1	1	1	0	1	1	0
1	1	1	1	1	1	0

f

$=a_0$	$=a_4$	$=a_3$	$=a_{34}$	$=a_2$	$=a_{24}$	$=a_{23}$	$=a_{234}$	$=a_1$	$=a_{14}$	$=a_{13}$	$=a_{134}$	$=a_{12}$	$=a_{124}$	$=a_{123}$	$=a_{1234}$
0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0
1	1	0	1	1	1	0	0	1	1	0	0	0	0	0	
0	1	1	1	1	1	0	0	0	1	0	0	0	0		
1	0	0	0	0	1	0	1	1	1	0	0	0			
1	0	0	0	1	1	1	0	0	1	0	0				
1	0	0	1	0	0	1	0	1	1	0					
1	0	1	1	0	1	1	0	0	1						
1	1	0	1	1	0	1	1	1							
0	1	1	0	1	1	0	0								
1	0	1	1	0	1	0									
1	1	0	1	1	1										
0	1	1	0	0											
1	0	1	0												
1	1	1													
0	0														
0															

$f = x_4 \oplus x_2 \oplus x_2 x_4 \oplus x_1 x_2$ – полином

№5 $f = x_1 \oplus (x_2 \wedge x_3) \oplus x_4$

x_1	x_2	x_3	x_4	$x_2 \wedge x_3$	$x_1 \oplus (x_2 \wedge x_3)$	f
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	0	0
0	0	1	1	0	0	1
0	1	0	0	0	0	0
0	1	0	1	0	0	1
0	1	1	0	1	1	1
0	1	1	1	1	1	0
1	0	0	0	0	1	1
1	0	0	1	0	1	0
1	0	1	0	0	1	1

1	0	1	1	0	1	0
1	1	0	0	0	1	1
1	1	0	1	0	1	0
1	1	1	0	1	0	0
1	1	1	1	1	0	1

f

a_4

$= a_{23}$

$= a_1$

$f = x_1 \oplus x_4 \oplus x_2 x_3$

№6 $f = (\bar{x}_1 \vee x_2) \wedge (\bar{x}_3 \vee x_4)$

x_1	x_2	x_3	x_4	$\bar{x}_1$	$\bar{x}_1 \vee x_2$	$\bar{x}_3$	$\bar{x}_3 \vee x_4$	f
0	0	0	0	1	1	1	1	1
0	0	0	1	1	1	1	1	1
0	0	1	0	1	1	0	0	0
0	0	1	1	1	1	0	1	1
0	1	0	0	1	1	1	0	0
0	1	0	1	1	1	1	1	1
0	1	1	0	1	1	0	0	0
0	1	1	1	1	1	0	1	1
1	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	1	0
1	0	1	0	0	0	0	0	0
1	0	1	1	0	0	0	1	0
1	1	0	0	0	1	1	0	0
1	1	0	1	0	1	1	1	1
1	1	1	0	0	1	0	0	0
1	1	1	1	0	1	0	1	1

f	a_0	a_4	a_3	a_{34}	a_2	a_{24}	a_{23}	a_{234}	a_1	a_{14}	a_{13}	a_{134}	a_{12}	a_{124}	a_{123}	a_{1234}
1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1
1	1	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0
0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0
1	0	0	1	0	0	1	0	0	1	1	0	0	1	1	0	0
1	0	1	0	0	1	0	0	0	1	0	1	0	1	0	1	0
1	0	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0
0	1	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0
1	1	0	1	1	0	0	0	0	1	1	0	1	1	0	1	0
0	0	1	0	1	0	1	1	0	0	0	1	1	0	0	0	0
0	0	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0
0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0
1	0	1	0	1	1	0	0	0	1	1	0	0	1	1	0	0
0	1	1	0	1	1	1	1	0	0	0	1	1	0	0	0	0
1	0	0	1	1	1	1	1	0	1	1	0	0	1	1	0	0
1	0	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0
1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	0	0
1	1	0	1	1	1	1	1	0	1	1	0	0	1	1	0	0
1	1	1	0	1	1	1	1	0	1	1	0	0	1	1	0	0
1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0

$f = x_3 \oplus x_3 x_4 \oplus x_1 \oplus x_1 x_3 \oplus x_1 x_3 x_4 \oplus x_1 x_2 \oplus x_1 x_2 x_3 \oplus x_1 x_2 x_3 x_4$ – полином

№7 $f = x_1 \wedge (x_2 \vee (x_3 \wedge x_4))$

x_1	x_2	x_3	x_4	$x_3 \wedge x_4$	$x_2 \vee (x_3 \wedge x_4)$	f
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	1	0	0	0	0
0	0	1	1	1	1	0
0	1	0	0	0	1	0
0	1	0	1	0	1	0
0	1	1	0	0	1	0
0	1	1	1	1	1	0
1	0	0	0	0	0	0
1	0	0	1	0	0	0
1	0	1	0	0	0	0
1	0	1	1	1	1	1
1	1	0	0	0	1	1
1	1	0	1	0	1	1
1	1	1	0	0	1	1
1	1	1	1	1	1	1

f

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 1 1 0 0 1 0
0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 1
0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1
0 0 0 0 0 0 0 0 0 1 1 0 0 1 0 0
0 0 0 0 0 0 0 0 0 1 1 0 0 1 0 1
0 0 0 0 0 0 0 0 0 1 1 0 0 1 1 0
0 0 0 0 0 0 0 0 0 1 1 0 0 1 1 1
0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0
0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 1
0 0 0 0 0 0 0 0 0 1 1 1 0 0 1 0
0 0 0 0 0 0 0 0 0 1 1 1 0 0 1 1
0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 1
0 0 0 0 0 0 0 0 0 1 1 1 0 1 1 0
0 0 0 0 0 0 0 0 0 1 1 1 0 1 1 1
0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0
0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 1
0 0 0 0 0 0 0 0 0 1 1 1 1 0 1 0
0 0 0 0 0 0 0 0 0 1 1 1 1 0 1 1
0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 0
0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1
0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 0
0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1

$= a_{1234}$
$= a_{12} \vee a_{124} \vee a_{123}$
$= a_{1234}$

$f = x_1 x_3 x_4 \oplus x_1 x_2 \oplus x_1 x_2 x_3 x_4$ - полином

№8 $f = ((x_1 \wedge x_2) \mid (x_3 \vee x_4)) \downarrow x_4$

x_1	x_2	x_3	x_4	$x_1 \wedge x_2$	$x_3 \vee x_4$	$(x_1 \wedge x_2) \mid (x_3 \vee x_4)$	f
0	0	0	0	0	0	1	0
0	0	0	1	0	1	1	0
0	0	1	0	0	1	1	0
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	0
0	1	1	0	0	1	1	0
0	1	1	1	0	1	1	0
1	0	0	0	0	0	1	0
1	0	0	1	0	1	1	0
1	0	1	0	0	1	1	0
1	0	1	1	0	1	1	0
1	1	0	0	1	0	0	0
1	1	0	1	1	1	0	1
1	1	1	0	1	1	0	0
1	1	1	1	1	1	0	1

f
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
1

a_{123}

a_{1234}

$f = x_1 x_2 x_3 \oplus x_1 x_2 x_3 x_4$ – полином

№9 $f = (x_1 / x_2) \wedge (x_3 / x_4)$

x_1	x_2	x_3	x_4	x_1 / x_2	x_3 / x_4	f
0	0	0	0	1	1	1
0	0	0	1	1	1	1
0	0	1	0	1	1	1
0	0	1	1	1	0	0
0	1	0	0	1	1	1
0	1	0	1	1	1	1
0	1	1	0	1	1	1
0	1	1	1	1	0	0
1	0	0	0	1	1	1
1	0	0	1	1	1	1
1	0	1	0	1	1	1
1	0	1	1	1	0	0
1	1	0	0	0	1	0
1	1	0	1	0	1	0
1	1	1	0	0	1	0
1	1	1	1	0	0	0

$1 = a_0$

$1\,0 = a_{34}$

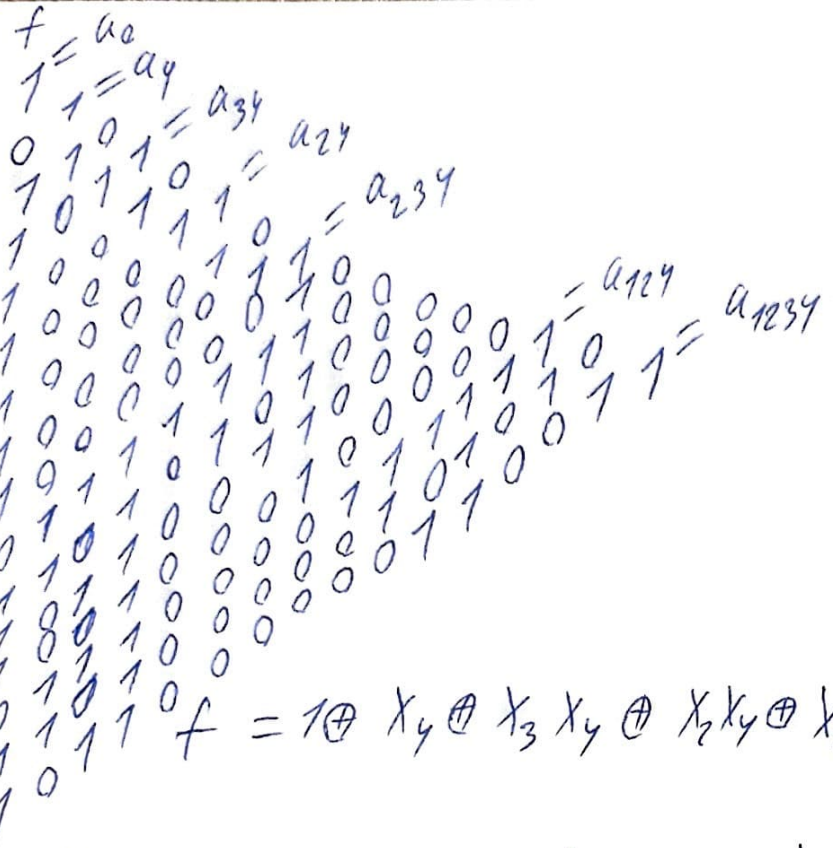
$1\,0\,1\,0\,0\,0\,0\,0 = a_{12}$

$1\,0\,1\,1\,0\,0\,0\,1 = a_{1234}$

$f = x_1 x_2 \oplus x_3 x_4 \oplus x_1 x_2 x_3 x_4 \oplus 1$

№10 $f = (x_1 \downarrow \bar{x}_2) \vee (\bar{x}_3 \mid x_4)$

x_1	x_2	x_3	x_4	$\bar{x}_2$	$\bar{x}_3$	$x_1 \downarrow x_2$	$\bar{x}_3 \mid x_4$	f
0	0	0	0	1	1	0	1	1
0	0	0	1	1	1	0	0	0
0	0	1	0	1	0	0	1	1
0	0	1	1	1	0	0	1	1
0	1	0	0	0	1	1	1	1
0	1	0	1	0	1	1	0	1
0	1	1	0	0	0	1	1	1
0	1	1	1	0	0	1	1	1
1	0	0	0	1	1	0	1	1
1	0	0	1	1	1	0	0	0
1	0	1	0	1	0	0	1	1
1	0	1	1	1	0	0	1	1
1	1	0	0	0	1	0	1	1
1	1	0	1	0	1	0	0	0
1	1	1	0	0	0	0	1	1
1	1	1	1	0	0	0	1	1



$f = 1 \oplus x_4 \oplus x_3 x_4 \oplus x_2 x_4 \oplus x_2 x_3 x_4 \oplus x_1 x_2 x_4 \oplus x_1 x_2 x_3 x_4$

№11 $f = (\bar{x}_1 \wedge (x_2 \downarrow x_3)) \uparrow (x_4 \oplus x_1)$

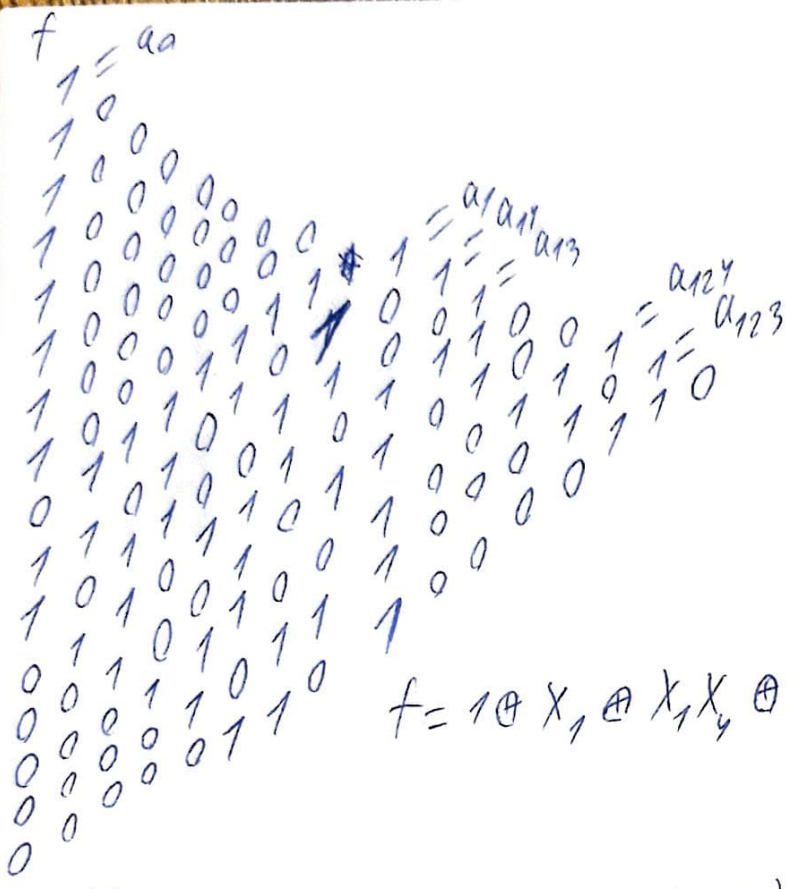
x_1	x_2	x_3	x_4	$x_2 \downarrow x_3$	$\bar{x}_1$	$\bar{x}_1 \wedge (x_2 \downarrow x_3)$	$x_4 \oplus x_1$	f
0	0	0	0	1	1	1	0	1
0	0	0	1	1	1	1	1	0
0	0	1	0	0	1	0	0	1
0	0	1	1	0	1	0	1	1
0	1	0	0	0	1	0	0	1
0	1	0	1	0	1	0	1	1
0	1	1	0	0	1	0	0	1
0	1	1	1	0	1	0	1	1
1	0	0	0	1	0	0	0	1
1	0	0	1	1	0	0	1	1
1	0	1	0	0	0	0	0	1
1	0	1	1	0	0	0	1	1
1	1	0	0	0	0	0	0	1
1	1	0	1	0	0	0	1	1
1	1	1	0	0	0	0	0	1
1	1	1	1	0	0	0	1	1

1	=	a_0													
1	=	a_4													
0	0	=	a_{34}												
1	1	0	=	a_{24}											
1	0	1	1	=	a_{234}										
1	0	0	1	0	=	a_{14}									
1	0	0	0	0	0	=	a_{134}								
1	0	0	0	0	0	0	=	a_{124}							
1	0	0	0	0	0	0	0	=	a_{1234}						
1	0	0	0	0	0	0	0	0							
1	0	0	0	0	0	0	0								
1	0	0	0	0	0	0									
1	0	0	0	0	0										
1	0	0	0	0											
1	0	0	0												
1	0	0													
1	0														
1															

$$f = 1 \oplus x_4 \oplus x_3 x_4 \oplus x_2 x_4 \oplus x_2 x_3 x_4 \oplus x_3 x_4 \oplus x_1 x_3 x_4 \oplus x_1 x_2 x_4 \oplus x_1 x_2 x_3 x_4$$

№12 $f = ((\bar{x}_1 \oplus x_2) \vee (\bar{x}_3 \oplus x_4)) \mid x_1$

x_1	x_2	x_3	x_4	$\bar{x}_1$	$\bar{x}_3$	$\bar{x}_1 \oplus x_2$	$\bar{x}_3 \oplus x_4$	$(\bar{x}_1 \oplus x_2) \vee (\bar{x}_3 \oplus x_4)$	f
0	0	0	0	1	1	1	1	1	1
0	0	0	1	1	1	1	0	1	1
0	0	1	0	1	0	1	1	1	1
0	0	1	1	1	0	1	1	1	1
0	1	0	0	1	1	0	0	0	1
0	1	0	1	1	1	0	0	0	1
0	1	1	0	1	0	0	1	1	1
0	1	1	1	1	0	0	1	1	0
1	0	0	0	0	1	0	0	0	1
1	0	0	1	0	1	0	0	0	1
1	0	1	0	0	0	0	1	1	0
1	0	1	1	0	0	0	1	1	0
1	1	0	0	0	1	1	0	1	0
1	1	0	1	0	1	1	0	1	0
1	1	1	0	0	0	1	0	1	0
1	1	1	1	0	0	1	1	1	0



$f = 1 \oplus x_1 \oplus x_1x_4 \oplus x_1x_3 \oplus x_1x_2x_4 \oplus x_1x_2x_3$

N13 $f = ((x_1 \wedge x_4) \downarrow (\overline{x_2} / x_3)) \vee (x_1 \wedge x_2)$

x_1	x_2	x_3	x_4	$x_1 \wedge x_4$	$\overline{x_2} / x_3$	$(x_1 \wedge x_4) \downarrow (\overline{x_2} / x_3)$	$x_1 \wedge x_2$	f
0	0	0	0	0	1	0	0	0
0	0	0	1	0	1	0	0	0
0	0	1	0	0	0	1	0	1
0	0	1	1	0	0	1	0	1
0	1	0	0	0	1	0	1	1
0	1	0	1	0	1	0	1	1
0	1	1	0	0	1	0	1	1
0	1	1	1	0	1	0	1	1
1	0	0	0	0	1	0	0	0
1	0	0	1	1	1	0	0	0
1	0	1	0	0	0	1	0	1
1	0	1	1	1	0	1	0	1
1	1	0	0	0	1	0	1	1
1	1	0	1	1	1	0	1	1
1	1	1	0	0	1	0	1	1
1	1	1	1	1	1	0	1	1

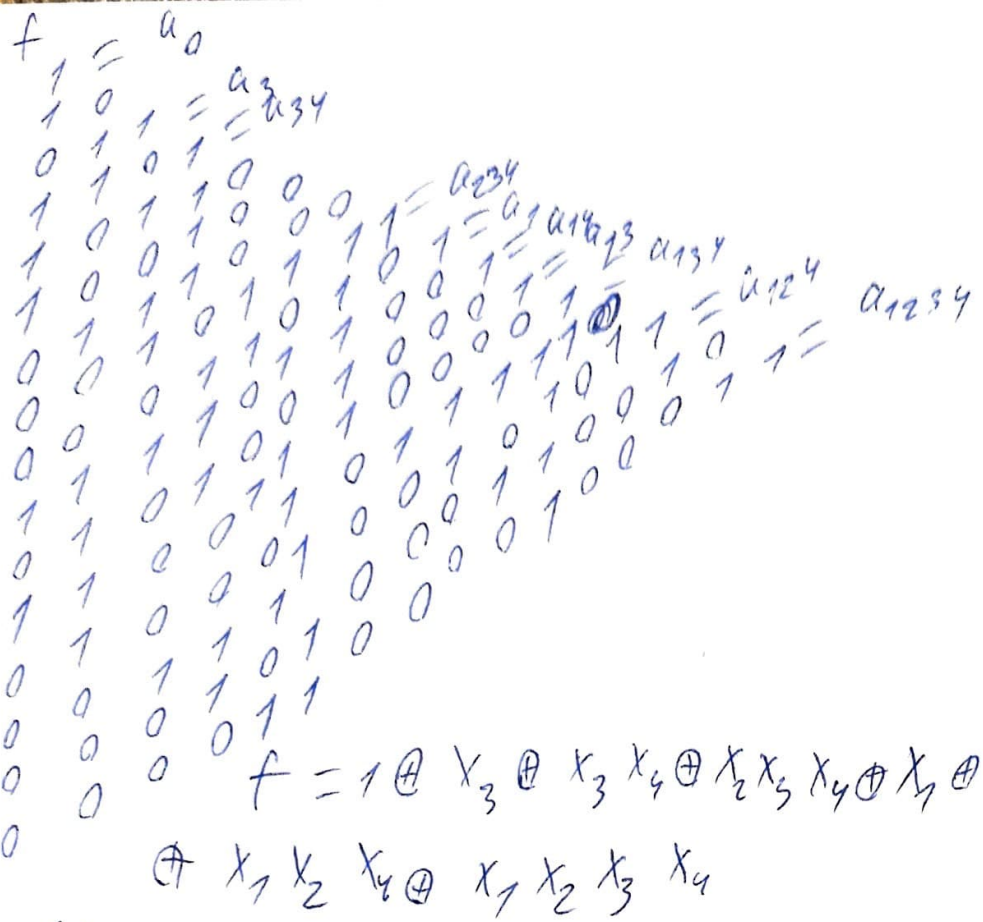
f

0 0 1 = a_3
0 1 0 = a_2
0 1 1 0 1 0 = a_{23}
1 0 0 1 1 0
1 0 0 0 0 1 0 0 0 = a_{134}
1 0 0 0 1 1 0 0 0 1 = a_{12}
1 0 0 1 0 1 1 0 1 1 0 0
1 0 1 1 1 1 0 0 1 1 0 1 1 = a_{1234}
1 1 1 0 0 1 0 0 0
0 0 1 1 0 1 1 0 0
0 1 0 1 1 0 1 1 0
1 0 1 0 1 0 1 1
0 1 1 0 1 0
0 0 1 1 0 1
0 0 0 0 1
0 0 0 0
0 0
0

$f = x_3 \oplus x_2 \oplus x_2x_3 \oplus x_1x_3x_4 \oplus x_1x_2 \oplus x_1x_2x_3x_4$

№14 $f = \overline{(x_1 \vee x_3)} \vee (\overline{x_2} \wedge x_4)$

x_1	x_2	x_3	x_4	$x_1 \vee x_3$	$\overline{x_1 \vee x_3}$	$\overline{x_2}$	$\overline{x_2} \wedge x_4$	f
0	0	0	0	0	1	1	0	1
0	0	0	1	0	1	1	1	1
0	0	1	0	1	0	1	0	0
0	0	1	1	1	0	1	1	1
0	1	0	0	0	1	0	0	1
0	1	0	1	0	1	0	1	1
0	1	1	0	1	0	0	0	0
0	1	1	1	1	0	0	0	0
1	0	0	0	1	0	1	0	0
1	0	0	1	1	0	1	1	1
1	0	1	0	1	0	1	0	0
1	0	1	1	1	0	1	1	1
1	1	0	0	1	0	0	0	0
1	1	0	1	1	0	0	0	0
1	1	1	0	1	0	0	0	0
1	1	1	1	1	0	0	0	0



$$f = 1 \oplus x_3 \oplus x_3 x_4 \oplus x_2 x_3 x_4 \oplus x_1 \oplus x_1 x_4 \oplus x_1 x_3 \oplus x_1 x_3 x_4 \oplus$$
$$\oplus x_1 x_2 x_4 \oplus x_1 x_2 x_3 x_4$$

№15 $f = (x_1 \oplus x_2) \wedge (\bar{x}_3 \oplus x_4)$

x_1	x_2	x_3	x_4	$\bar{x}_3$	$\bar{x}_3 \oplus x_4$	$x_3 \oplus x_2$	f
0	0	0	0	1	1	0	0
0	0	0	1	1	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	1	0	0
0	1	0	0	1	1	1	1
0	1	0	1	1	0	1	0
0	1	1	0	0	1	1	1
0	1	1	1	0	0	1	0
1	0	0	0	1	1	0	0
1	0	0	1	1	0	0	0
1	0	1	0	0	1	1	1
1	0	1	1	0	0	1	0
1	1	0	0	1	1	0	0
1	1	0	1	1	0	0	0
1	1	1	0	0	1	0	0
1	1	1	1	0	0	0	0

f

0	0	0	0	1	= a_2										
0	0	0	1	1	= a_{24}	a_{23}									
0	0	1	0	1	=	=	= a_1								
0	1	0	1	1	=	=	=	a_{14}	a_{13}						
1	1	1	1	0	=	=	=	=							
0	0	1	0	0	=	=	=	=	=	0	0				
0	1	1	0	0	=	=	=	=	=	0	0	0			
1	0	1	1	0	=	=	=	=	=	0	0	0			
1	1	0	0	0	=	=	=	=	=	0	0				
0	1	0	0	1	=	=	=	=	=						
0	1	0	1	0	=	=	=	=	=						
1	0	0	1	1	=	=	=	=	=						
1	1	0	1	0	=	=	=	=	=						
0	0	1	1	1	=	=	=	=	=						
0	1	1	1	1	=	=	=	=	=						
1	0	1	0	1	=	=	=	=	=						
1	1	0	1	1	=	=	=	=	=						
0	0	1	1	0	=	=	=	=	=						
0	1	1	0	1	=	=	=	=	=						
1	0	1	1	1	=	=	=	=	=						
1	1	0	0	1	=	=	=	=	=						
0	0	0	1	0	=	=	=	=	=						
0	0	0	0	0	=	=	=	=	=						

$$f = x_2 \oplus x_2 x_4 \oplus x_2 x_3 \oplus x_1 \oplus x_1 x_4 \oplus x_1 x_3$$