

1. kolokvij (6.12.2023)

1.) Podano funkcijo zapiši v eksplicitni PDNO in eksplicitni PKNO obliki!

$$f(x_1, x_2, x_3) = ((x_1 \rightarrow x_2) \downarrow x_3) \nabla x_2$$

$$f(x_1, x_2, x_3) = ((x_1 \rightarrow x_2) \downarrow x_3) \nabla x_2 =$$

$$= ((\bar{x}_1 \vee x_2) \vee x_3) \cdot \bar{x}_2 =$$

Absorbojca: $x \cdot (x \vee y) = x$

$$= x_2 \vee x_1 \bar{x}_2 \bar{x}_3$$

x_1	x_2	x_3	$((x_1 \rightarrow x_2) \downarrow x_3) \nabla x_2$	$f(x_1, x_2, x_3)$
0	0	0	1 0 0	0
0	0	1	1 0 0	0
0	1	0	1 0 1	1
0	1	1	1 0 1	1
1	0	0	0 1 1	1
1	0	1	0 0 0	0
1	1	0	1 0 1	1
1	1	1	1 0 1	1

$$f_{PDNO}(x_1, x_2, x_3) = \bigvee^3(2, 3, 4, 6, 7) =$$

$$= \bar{x}_1 \bar{x}_2 \bar{x}_3 \vee \bar{x}_1 x_2 x_3 \vee$$

$$x_1 \bar{x}_2 \bar{x}_3 \vee x_1 x_2 \bar{x}_3 \vee$$

$$x_1 x_2 x_3$$

$$f_{PKNO}(x_1, x_2, x_3) = \bigwedge^3(0, 1, 5) =$$

$$= (x_1 \vee x_2 \vee x_3) \cdot$$

$$(x_1 \vee x_2 \vee \bar{x}_3) \cdot$$

$$(\bar{x}_1 \vee x_2 \vee \bar{x}_3)$$

2.) Določite MDNO in MKNO obliko podane funkcije. Pri obeh oblikah ovrednotite število operatorjev (vrat) in operandov (vhodov) in na podlagi tega določite MNO obliko

$$f(x_1, x_2, x_3, x_4) = \bigvee^4(1, 2, 3, 5, 8, 9, 11, 15)$$

MDNO:

	$x_3 x_4$			
	00	01	11	10
00		1	1	1
01		1		
11			1	
10	1	1	1	

(1) $\bar{x}_1 \bar{x}_2 \bar{x}_3 x_4$

(9, 3) $\bar{x}_1 \bar{x}_2 x_4$

((1, 3), (9, 11)) $\bar{x}_2 x_4$

(2) $\bar{x}_1 \bar{x}_2 x_3 \bar{x}_4$

(1, 5) $\bar{x}_1 \bar{x}_3 x_4$

((1, 3), (3, 11))

(3) $\bar{x}_1 \bar{x}_2 x_3 x_4$

(1, 3) $\bar{x}_2 \bar{x}_3 x_4$

(5) $\bar{x}_1 x_2 \bar{x}_3 x_4$

(2, 3) $\bar{x}_1 \bar{x}_2 \bar{x}_3$

(8) $x_1 \bar{x}_2 \bar{x}_3 \bar{x}_4$

(3, 11) $\bar{x}_2 x_3 x_4$

(9) $x_1 \bar{x}_2 \bar{x}_3 x_4$

(3, 9) $x_1 \bar{x}_2 \bar{x}_3$

(11) $x_1 \bar{x}_2 x_3 x_4$

(9, 11) $x_1 \bar{x}_2 x_4$

(15) $x_1 x_2 x_3 x_4$

(11, 15) $x_1 x_2 x_4$

$$f_{MDNO} = x_1 x_2 x_4 \vee \bar{x}_1 \bar{x}_3 x_4$$

$$\vee x_1 \bar{x}_2 \bar{x}_3 \vee \bar{x}_1 \bar{x}_2 x_3$$

	m_1	m_2	m_3	m_5	m_8	m_9	m_{11}	m_{15}
$\bar{x}_1 \bar{x}_3 x_4$	✓			✓				
$\bar{x}_1 \bar{x}_2 x_3$		✓	✓					
$x_1 \bar{x}_2 \bar{x}_3$					✓	✓		
$x_1 x_2 x_4$							✓	✓
$\bar{x}_2 x_4$	✓		✓				✓	✓

MKN0:

$$f^0 = V^0(0, 4, 6, 7, 10, 12, 13, 14)$$

		x_3, x_4				4	3	2	1
		00	01	11	10				
x_1, x_2	00	1				(0) $\bar{x}_1 \bar{x}_2 \bar{x}_3 \bar{x}_4$	(0,4) $\bar{x}_1 \bar{x}_3 \bar{x}_4$	((4,6), (12,14)) $x_2 \bar{x}_4$	
	01	1		1	1	(4) $\bar{x}_1 x_2 \bar{x}_3 \bar{x}_4$	(4,6) $\bar{x}_1 x_2 \bar{x}_4$	((4,12), (6,14))	
	11	1	1		1	(6) $\bar{x}_1 x_2 x_3 \bar{x}_4$	(4,12) $x_2 \bar{x}_3 \bar{x}_4$		
	10				1	(7) $\bar{x}_1 x_2 x_3 x_4$	(6,7) $\bar{x}_1 x_2 x_3$		
						(10) $x_1 \bar{x}_2 x_3 \bar{x}_4$	(6,14) $x_2 x_3 \bar{x}_4$		
						(12) $x_1 x_2 \bar{x}_3 \bar{x}_4$	(10,14) $x_1 x_3 \bar{x}_4$		
						(13) $x_1 x_2 \bar{x}_3 x_4$	(12,13) $x_1 x_2 \bar{x}_3$		
						(14) $x_1 x_2 x_3 \bar{x}_4$	(12,14) $x_1 x_2 \bar{x}_4$		

$$f_{\text{MDNS}} = \bar{x}_1 \bar{x}_3 \bar{x}_4 \vee x_1 x_2 \bar{x}_3 \vee \bar{x}_1 x_2 x_3 \vee x_1 x_3 \bar{x}_4$$

$f_{\text{MDNS}} = \bar{x}_1 \bar{x}_3 \bar{x}_4 \vee x_1 x_2 \bar{x}_3 \vee \bar{x}_1 x_2 x_3 \vee x_1 x_3 \bar{x}_4$	m_0	m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8	m_9	m_{10}	m_{11}	m_{12}	m_{13}	m_{14}
$\bar{x}_1 \bar{x}_3 \bar{x}_4$	✓														
$x_1 x_2 \bar{x}_3$				✓	✓										
$\bar{x}_1 x_2 x_3$						✓	✓								
$x_1 x_3 \bar{x}_4$									✓						✓
$x_2 \bar{x}_4$		✓	✓							✓	✓				✓

3. Za obe funkciji iz nabora $\{ \nabla, 0 \}$ preveri pripadnost osnovnim zaprtim razredom (zapiši tabelo pripadnosti). Po potrebi nabor razširi do funkcijske polnosti!

x_1	x_2	∇	T_0	T_1	S	L	M
0	0	0 $\rightarrow \nabla \in T_0$	✓	✗	✗	✗	✗
0	1	1 $\rightarrow \nabla \in T_1$	✗	✓	✗	✗	✗
1	0	1 $\rightarrow \nabla \notin T_0$; $0 \nabla 1 = 1 \nabla 0$; $\nabla \notin S$					
1	1	0 $\rightarrow \nabla \notin T_1$					

$$(1,0) < (1,1); f(1,0) \neq f(1,1); \nabla \notin M$$

x	0
0	0 $\rightarrow 0 \in T_0$
1	0 $\rightarrow 0 \notin T_1$ $0 = 0; 0 \notin S$

L: ∇ :

	x_2	
	0	1
x_1	0	1
	1	0

$\bar{x}_1 \bar{x}_2, \bar{x}_1 x_2$ popolnoma različna
 $x_1 x_2$ popolnoma različna

$$f(x_1, x_2) = a_0 \nabla a_1 x_1 \nabla a_2 x_2 = x_1 \nabla x_2$$

$$f(0, 0) = a_0 \nabla 0 \nabla 0 = a_0 = 0 \quad a_0 = 0$$

$$f(0, 1) = 0 \nabla a_1 0 \nabla a_2 \cdot 1 = a_2 = 1 \quad a_2 = 1$$

$$f(1, 0) = 0 \nabla a_1 1 \nabla a_2 \cdot 0 = a_1 = 1 \quad a_1 = 1$$

$$f(x_1, x_2) = x_1 \nabla x_2 = x_1 \bar{x}_2$$

0:

	x	
	0	1

\bar{x}

$$f(x) = 0 = a_0$$

Nabor $\{0, \nabla\}$ ni funkcijsko poln saj ne odpira razredov T_0 in L . Naborn lahko s pomočjo ∇ → ali ↑ dopolnimo do funkcijske polnosti.

4. Določa šumne meje za visoko in nizko stanje, če je najmanjša dovoljena napetost visokega izhoda enaka 4,3V, visokega vhoda pa 3,4V. Največja dovoljena napetost nizkega izhoda je 0,2V, nizkega vhoda pa 1,1V.

$$V_{OH(min)} = 4,3V$$

$$V_{IH(min)} = 3,4V$$

$$V_{OL(max)} = 0,2V$$

$$V_{IL(max)} = 1,1V$$

Šumne meje - visoko stanje (H): $V_{OH(min)} - V_{IH(min)} = 4,3V - 3,4V = 0,9V$
 - nizko stanje (L): $V_{IL(max)} - V_{OL(max)} = 1,1V - 0,2V = 0,9V$

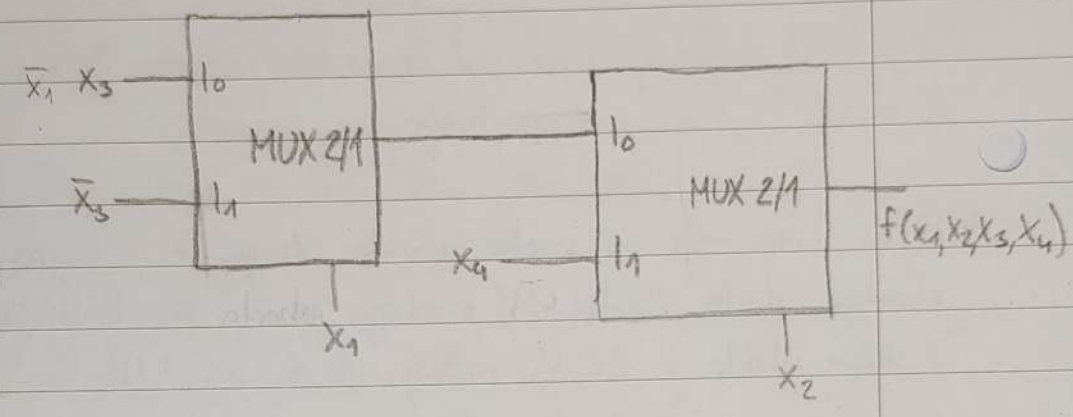
2. kolokvij (10.1.2023)

1. Z uporabo multipleksorjev MUX 2/1 realiziraj funkcijo $f(x_1, x_2, x_3, x_4) = \sum(2, 3, 5, 7, 8, 9, 13, 15)$

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

$A_0 = x_2$
 $l_0 = \bar{x}_1 x_3 \vee x_1 \bar{x}_3 \rightarrow A_0 = x_1$
 $l_1 = x_4$
 $A_0 = x_3$
 $l_0 = x_1$
 $l_1 = \bar{x}_1$

x_1	x_2	x_3	x_4	f^4
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1



x_1
 \bar{x}_3
 \bar{x}_1