1. vaja

Boolova algebra

$\mathcal{X}$ … operandi $\{0,1\}$

O … operatorji $\{\vee, \wedge, \neg\}$

P … postulati

↳ **zaprtost**

P1: $x, y \in \mathcal{X};\ x \vee y \in \mathcal{X}$

P1*: $x, y \in \mathcal{X};\ x \wedge y \in \mathcal{X}$

↳ **nevtralni element**

P2: $x, 0 \in \mathcal{X};\ x \vee 0 = x$

P2*: $x, 1 \in \mathcal{X};\ x \wedge 1 = x$

↳ **komutativnost**

P3: $x, y \in \mathcal{X};\ x \vee y = y \vee x$

P3*: $x, y \in \mathcal{X};\ x \wedge y = y \wedge x$

↳ **distributivnost**

P4: $x, y, z \in \mathcal{X};\ x \vee (y \wedge z) = (x \vee y) \wedge (x \vee z)$

P4*: $x, y, z \in \mathcal{X};\ x \wedge (y \vee z) = (x \wedge y) \vee (x \wedge z)$

↳ **inverzni element**

P5: $\forall x \in \mathcal{X}, \exists \overline{x} \in \mathcal{X};\ x \vee \overline{x} = 1$

P5*: $\forall x \in \mathcal{X}, \exists \overline{x} \in \mathcal{X};\ x \cdot \overline{x} = 0$

↳ **število elementov**

P6: $\exists x, y \in \mathcal{X};\ x \neq y$

LASTNOSTI

↳ **asociativnost**

$x \vee (y \vee z) = (x \vee y) \vee z = x \vee y \vee z$

$x (y z) = (x y) z = x y z$

↳ **de Morganov izrek**

$\overline{(x_1 \vee x_2 \vee \ldots \vee x_n)} = \overline{x}_1 \cdot \overline{x}_2 \cdot \ldots \cdot \overline{x}_n$

$\overline{(x_1 \cdot x_2 \cdot \ldots \cdot x_n)} = \overline{x}_1 \vee \overline{x}_2 \vee \ldots \vee \overline{x}_n$

↳ **idempotenca**

$x \vee x \vee x \ldots \vee x = x$

$x \cdot x \cdot x \ldots \cdot x = x$

↳ **absorbcija**

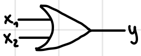
$x \vee x \cdot y = x$

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

LOGIČNI OPERATORJI

↳ **disjunkcija (or)**

$y = x_1 \vee x_2$



x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	1

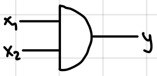
↳ **negacija (not)**

$y = \neg x = \overline{x}$

x	y
0	1
1	0

↳ **konjunkcija (and)**

$y = x_1 \wedge x_2$

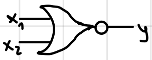


x_1	x_2	y
0	0	0
0	1	0
1	0	0
1	1	1

↳ **Peirceov operator (nor)**

$y = \overline{x_1 \vee x_2} = x_1 \downarrow x_2$

x_1	x_2	y
0	0	1
0	1	0
1	0	0
1	1	0

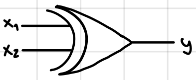


$x_1 \downarrow (x_2 \downarrow x_3) \neq (x_1 \downarrow x_2) \downarrow x_3 \neq$

$\neq x_1 \downarrow x_2 \downarrow x_3$

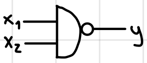
↳ **Ekskluzivni ali (xor)** $\oplus$

$y = x_1 \nabla x_2 = \overline{x}_1 x_2 \vee x_1 \overline{x}_2$



↳ **Shefferjev operator (nand)**

$y = \overline{x_1 \cdot x_2} = x_1 \uparrow x_2$



x_1	x_2	y
0	0	1
0	1	1
1	0	1
1	1	0

S postulati dokaži $x \vee x = x$

$x \vee x = (x \vee x) 1$ (P2*)

$= (x \vee x) \cdot (x \vee \overline{x})$ (P5)

$= x \vee (x \cdot \overline{x})$ (P4)

$= x \vee 0$ (P5*)

$= x$

Poenostavi izraz $x_2 \rightarrow \overline{((x_1 \vee \overline{x}_3)(\overline{x}_1 \vee \overline{x}_3))}$

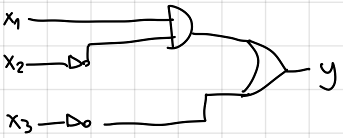
$= \overline{x}_2 \vee \overline{((x_1 \vee \overline{x}_3)(\overline{x}_1 \vee \overline{x}_3))}$

$= \overline{x}_2 \vee (\overline{(x_1 \vee \overline{x}_3)} \vee \overline{(\overline{x}_1 \vee \overline{x}_3)})$

$= \overline{x}_2 \vee ((\overline{x}_1 \cdot x_3) \vee (x_1 \cdot x_3))$

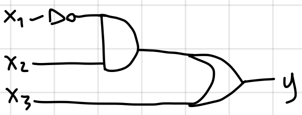
$= \overline{x}_2 \vee x_3 \cdot (\overline{x}_1 \vee x_1)$

$= \overline{x}_2 \vee x_3$



Naloga

$f(x_1, x_2, x_3) = \overline{x}_1 x_2 \vee x_3$



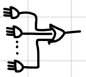
x_1	x_2	x_3	$\overline{x}_1 \wedge x_2 \vee x_3$	
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	1
1	0	0	0	0
1	0	1	0	1
1	1	0	0	0
1	1	1	0	1

2. vaja

Oblike zapisa preklopnih funk.

- POPOLNE
- NORMALNE
- MINIMALNA

PDNO PKNO



PDNO

$$f(x_1,x_2,\dots,x_n) = \bigvee_{i=0}^{2^n-1} m_i f(\vec{\omega}_i)$$

$$m_i = x_1^{w_{1,i}} \cdot x_2^{w_{2,i}} \cdot \ldots \cdot x_n^{w_{n,i}} \; ; \; i = 0,1,2,\dots,2^n-1$$

$$x^w = \begin{cases} x, w=1 \\ \overline{x}, w=0 \end{cases}$$

x_1	x_2	x_3	f(x_1,x_2,x_3)	minterm	f
0	0	0	$f(\vec{w}_0)$	m_0	1
0	0	1	$f(\vec{w}_1)$	m_1	0
0	1	0	$f(\vec{w}_2)$	m_2	0
0	1	1	$f(\vec{w}_3)$	m_3	0
1	0	0	$f(\vec{w}_4)$	m_4	1
1	0	1	$f(\vec{w}_5)$	m_5	1
1	1	0	$f(\vec{w}_6)$	m_6	1
1	1	1	$f(\vec{w}_7)$	m_7	1

Zgled:

$n=4$

$i = 9_{[10]} = 1001_{[2]}$

$m_9 = x_1^1 x_2^0 x_3^0 x_4^1 = x_1 \overline{x}_2 \overline{x}_3 x_4$

Krajši način zapisa PDNO: $f(x_1,x_2,\dots,x_n) = \vee^n \underbrace{(i_1, i_2, \dots, i_k)}_{\text{indeksi midtermov}}$

⇓

↘ Primer za to tabelo:

$f(x_1,x_2,x_3) = \overline{x}_1\overline{x}_2\overline{x}_3 \vee x_1\overline{x}_2\overline{x}_3 \vee x_1\overline{x}_2x_3 \vee x_1x_2\overline{x}_3 \vee x_1x_2x_3 = \vee^3(0,4,5,6,7)$

ANALITIČNO:

$$\begin{aligned}
& x_1 \vee x_1\overline{x}_2 \vee \overline{x}_2\overline{x}_3 \\
&= x_1(x_2 \vee \overline{x}_2)(x_3 \vee \overline{x}_3) \vee x_1\overline{x}_2(x_3 \vee \overline{x}_3) \vee (x_1 \vee \overline{x}_1)\overline{x}_2\overline{x}_3 \\
&= x_1x_2x_3 \vee x_1x_2\overline{x}_3 \vee x_1\overline{x}_2x_3 \vee x_1\overline{x}_2\overline{x}_3 \vee \cancel{x_1\overline{x}_2x_3} \vee \cancel{x_1\overline{x}_2\overline{x}_3} \vee \cancel{x_1\overline{x}_2\overline{x}_3} \vee \overline{x}_1\overline{x}_2\overline{x}_3 \\
&= x_1x_2x_3 \vee x_1x_2\overline{x}_3 \vee x_1\overline{x}_2x_3 \vee x_1\overline{x}_2\overline{x}_3 \vee \overline{x}_1\overline{x}_2\overline{x}_3 \\
&= \vee^3\,(7,6,5,4,0) \\
&= \vee^3\,(0,4,5,6,7)
\end{aligned}$$

PKNO

$$f(x_1,x_2,\dots,x_n) = \&_{i=0}^{2^n-1} (M_{2^n-1-i} \vee f(\vec{w}_i))$$

$$M_i = x_1^{\overline{w}_{1,i}} \vee x_2^{\overline{w}_{2,i}} \vee \ldots \vee x_n^{\overline{w}_{n,i}} \; ; \; i = 0,1,\dots,2^n-1$$

x_1	x_2	x_3	f(x_1,x_2,x_3)	maksterm	f
0	0	0	$f(\vec{w}_0)$	M_7	1
0	0	1	$f(\vec{w}_1)$	M_6	0
0	1	0	$f(\vec{w}_2)$	M_5	0
0	1	1	$f(\vec{w}_3)$	M_4	0
1	0	0	$f(\vec{w}_4)$	M_3	1
1	0	1	$f(\vec{w}_5)$	M_2	1
1	1	0	$f(\vec{w}_6)$	M_1	1
1	1	1	$f(\vec{w}_7)$	M_0	1

KRAJŠI NAČIN ZAPISA

$f(x_1,x_2,\dots,x_n) = \&^n(i_k, i_{k-1}, \dots, i_1)$

Zgled:

$n=4$

$2^n-1-i = 15 - \overset{i}{9} = 6$

$2^n-1-i = 6_{[10]} = 0110_{[2]}$

$M_9 = x_1^{\overline{0}} \vee x_2^{\overline{1}} \vee x_3^{\overline{1}} \vee x_4^{\overline{0}} = x_1 \vee \overline{x}_2 \vee \overline{x}_3 \vee x_4$

Pretvorba PDNO ⟺ PKNO

① Izpišemo manjkajoče terme

$f(x_1,x_2,x_3) = \vee^3(0,4,5,6,7)$

manjkajo: m_1, m_2, m_3

$f(x_1,x_2,x_3) = \vee^3(1,2,3)$

② Funkcijo drugič negiramo

pretvorimo v terme

$[7-1, 7-2, 7-3]$

$f_{PKNO}(x_1,x_2,x_3) = \&^3(6,5,4)$

---

2. NALOGA: Podana je preklopna funkcija:

PKNO

$f(x_1,x_2,x_3,x_4) = \&^4(14,13,10,9,6,5,2,1)$

ZAPIŠI

a) PKNO v eksplicitni obliki

b) PDNO v eksplicitni in skrajšani obliki

c) pravilnostno tabelo

x_1	x_2	x_3	x_4	m	M	f
0	0	0	0	m_0	M_{15}	1
0	0	0	1	m_1	M_{14}	0
0	0	1	0	m_2	M_{13}	0
0	0	1	1	m_3	M_{12}	1
0	1	0	0	m_4	M_{11}	1
0	1	0	1	m_5	M_{10}	0
0	1	1	0	m_6	M_9	0
0	1	1	1	m_7	M_8	1
1	0	0	0	m_8	M_7	1
1	0	0	1	m_9	M_6	0
1	0	1	0	m_{10}	M_5	0
1	0	1	1	m_{11}	M_4	1
1	1	0	0	m_{12}	M_3	1
1	1	0	1	m_{13}	M_2	0
1	1	1	0	m_{14}	M_1	0
1	1	1	1	m_{15}	M_0	1

① izpišemo manjkajoče terme

manjkajo: $M_{15}, M_{12}, M_{11}, M_8, M_7, M_4, M_3, M_0$

② Funkcijo drugič negiramo

$f_{PDNO}(x_1,x_2,x_3,x_4) = \vee^4(0,3,4,7,8,11,12,15)$

$$\begin{aligned}
f(x_1,x_2,x_3,x_4) &= \overset{0}{\overline{x}_1\overline{x}_2\overline{x}_3\overline{x}_4} \vee \overset{3}{\overline{x}_1\overline{x}_2x_3x_4} \vee \overset{4}{\overline{x}_1x_2\overline{x}_3\overline{x}_4} \vee \overset{7}{\overline{x}_1x_2x_3x_4} \vee \overset{8}{x_1\overline{x}_2\overline{x}_3\overline{x}_4} \vee \\
&\vee \overset{11}{x_1\overline{x}_2x_3x_4} \vee \overset{12}{x_1x_2\overline{x}_3\overline{x}_4} \vee \overset{15}{x_1x_2x_3x_4} = \\
&= \overline{x}_1(\overline{x}_2\overline{x}_3\overline{x}_4 \vee \overline{x}_2x_3x_4 \vee x_2\overline{x}_3\overline{x}_4 \vee x_2x_3x_4) \vee x_1(\overline{x}_2\overline{x}_3\overline{x}_4 \vee \overline{x}_2x_3x_4 \vee x_2\overline{x}_3\overline{x}_4 \vee x_2x_3x_4) = \\
&= \underbrace{(\overline{x}_1 \vee x_1)}_{=1}(\overline{x}_2\overline{x}_3\overline{x}_4 \vee \overline{x}_2x_3x_4 \vee x_2\overline{x}_3\overline{x}_4 \vee x_2x_3x_4) = \\
&= \overline{x}_2\overline{x}_3\overline{x}_4 \vee \overline{x}_2x_3x_4 \vee x_2\overline{x}_3\overline{x}_4 \vee x_2x_3x_4 = \\
&= \underbrace{(\overline{x}_2 \vee x_2)}_{=1}(\overline{x}_3\overline{x}_4 \vee x_3x_4) = \\
&= \overline{x}_3\overline{x}_4 \vee x_3x_4 = x_3 \Leftrightarrow x_4
\end{aligned}$$

DN01 - 4.11.

①. $(x\vee\bar{y})\cdot y = x\cdot y$ ∀ P3*

$(x\cdot y)\vee(\bar{y}\cdot y)\sim$ P4* ∀ P3*

$(x\cdot y)\vee 0\sim$ P5*

$\sim x\cdot y$ P2

②. $f(x,y,z)=\overline{(\bar{x}\bar{y}\vee yz)\vee(x\vee z)}\sim$

$\overline{(\bar{x}\bar{y}\vee yz)}\cdot\overline{(x\vee z)}\sim$ DeMorgan

$\overline{(\bar{x}\bar{y})}\cdot(\overline{yz})\cdot(\bar{x}\cdot\bar{z})\sim$ De Morgan

$\sim(x\vee y)\cdot(\bar{y}\vee\bar{z})\cdot(\bar{x}\bar{z})$ De Morgan

$\sim(x\bar{y}\vee x\bar{z}\vee\boxed{y\bar{y}}\vee y\bar{z})\cdot(\bar{x}\bar{z})$ P4*

$\sim(x\bar{y}\vee x\bar{z}\vee y\bar{z})\cdot\bar{x}\bar{z}\sim$ P5*

$\sim\underbrace{x\bar{y}\cdot\bar{x}\bar{z}}_{0}\vee\underbrace{x\bar{z}\cdot\bar{x}\bar{z}}_{0}\vee y\bar{z}\cdot\bar{x}\bar{z}\sim$

P5*

$\sim y\bar{z}\bar{x}\bar{z}\sim\bar{x}y\bar{z}$

③. $f(x_1,x_2,x_3,x_4)=\&^4(14,12,11,8,7,3,2,0)$

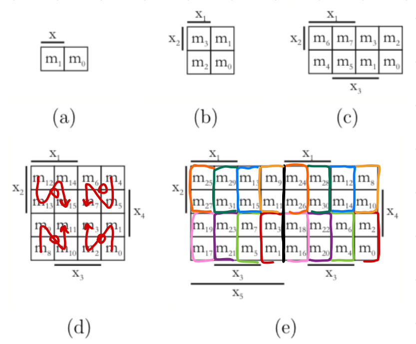
manjkajoči termi: $M_{15}, M_{13}, M_{10}, M_9, M_6, M_5, M_4, M_1$

pretvoriš: $\overline{M_i}=m_{2^n-1-i}$

$f(x_1,x_2,x_3,x_4)=\vee^4(0,2,5,6,9,10,11,14)$

3. vaja

Veitchevi diagrami



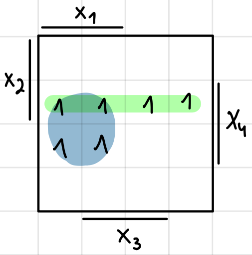
(a) (b) (c)

(d) (e)

d) $m_{13} = x_1 x_2 \overline{x_3} x_4$

PRIMER:

$f = V^4(5,7,9,11,13,15)$



$x_2 x_4 \vee x_1 x_4$

FUNKCIJSKO POLN SISTEM

- $\{\vee, \wedge, \neg\}$
- $\{\vee, \neg\}$
- $\{\wedge, \neg\}$

- $\{\uparrow\}$??

↳ $\neg: \overline{x} = \overline{x \cdot x} = x \uparrow x$

$\wedge: x_1 \wedge x_2 = \overline{\overline{x_1 \wedge x_2}} = \overline{x_1 \uparrow x_2} = (x_1 \uparrow x_2) \uparrow (x_1 \uparrow x_2)$

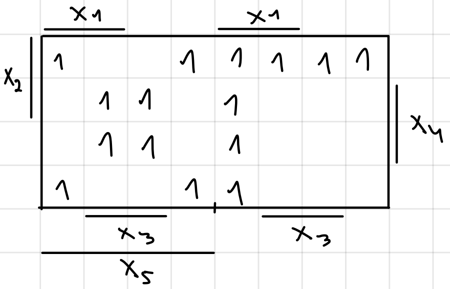
$\vee: x_1 \vee x_2 = \overline{\overline{x_1 \vee x_2}} = \overline{\overline{x_1} \cdot \overline{x_2}} = \overline{x_1} \uparrow \overline{x_2} = (x_1 \uparrow x_1) \uparrow (x_2 \uparrow x_2)$

Naloga

manjkajoči: 30, 24, 23, 22, 19, 16, 15, 14, 13, 8, 7, 6, 5, 3, 0

① $f(x_1,x_2,x_3,x_4,x_5) = \&^5(31,29,28,27,26,25,21,20,18,17,12,11,10,9,4,2,1)$

$f(x_1,x_2,x_3,x_4,x_5) = V^5(1,7,8,9,12,15,16,17,18,23,24,25,26,28,31)$



②

$\{\downarrow\}$

x_1	x_2	$x_1 \downarrow x_2$
0	0	1
0	1	0
1	0	0
1	1	0

$\neg: \overline{x} = x \downarrow x$

$\vee: x_1 \vee x_2 = \overline{\overline{x_1 \vee x_2}} = \overline{x_1 \downarrow x_2} = (x_1 \downarrow x_2) \downarrow (x_1 \downarrow x_2)$

$\wedge: x_1 \wedge x_2 = \overline{\overline{x_1 \wedge x_2}} = \overline{x_1} \downarrow \overline{x_2} = (x_1 \downarrow x_1) \downarrow (x_2 \downarrow x_2)$

4. vaja

Zaprti razredi (Postov teorem)

T_0... $f(0,0,\dots,0)=0$

T_1... $f(1,1,\dots,1)=1$

S... $\overline{f}(\overline{x_1},\overline{x_2},\dots,\overline{x_n})=f(x_1,x_2,\dots,x_n)$

L... $f(x_1,x_2,\dots,x_n)=a_0\nabla a_1x_1\nabla\dots\nabla a_nx_n),\ f\in L$

M... $f\in M,\ \forall ij;\ \vec{w}_i<\vec{w}_j\rightarrow f(\vec{w}_i)\leq f(\vec{w}_j)$

Primer:

Ali je $\{\vee,\rightarrow,1\}$ poln?

T_0:

$\vee$: $0\vee 0=0;\ \vee\in T_0$

$\rightarrow$: $0\rightarrow 0=1;\ \rightarrow\notin T_0$

T_1:

$\vee$: $1\vee 1=1;\ \vee\in T_1$

$\rightarrow$: $1\rightarrow 1=1;\ \rightarrow\in T_1$

1: $1=1;\ 1\in T_1$

ni poln, ker ohranja vred. 1

.... tukaj se že lahko ustaviš

S:

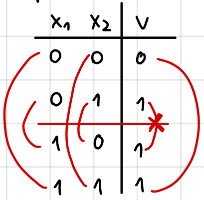
$\vee$: analitično

$\overline{\overline{x_1}\vee\overline{x_2}}=x_1\vee x_2$

$x_1x_2\neq x_1\vee x_2;\ \vee\notin S$

$\vee^2(3)\neq\vee^2(1,2,3)$

prav. tabela



x_1	x_2	$\vee$
0	0	0
0	1	1
1	0	1
1	1	1

vse prezrcaljene morajo biti različne

L:

$\vee$: analitično

$f(x_1,x_2)=f_L(x_1,x_2)=a_0\nabla a_1x_1\nabla a_2x_2$

$f_L(0,0)=a_0\nabla a_10\nabla a_20=a_0=0$

$f_L(0,1)=a_0\nabla a_1\cdot 0\nabla a_2\cdot 1=a_2=1$

$f_L(1,0)=a_0\nabla a_11\nabla a_2\cdot 0=a_1=1$

$f_L(x_1,x_2)=0\nabla 1x_1\nabla 1\cdot x_2=x_1\nabla x_2$

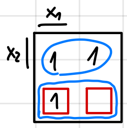
Preverimo $f=f_L$ pri ostalih vhodih

$f_L(1,1)=1\nabla 1=0$

$f(1,1)=1\vee 1=1$

$f_L(1,1)\neq f(1,1);\ \vee\notin L$

Veitchev diagram



$\overline{x_1}\,\overline{x_2}:x_1\overline{x_2}$

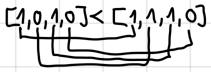
$\overline{x_2}:x_2$

$f\notin L$

M:

$\rightarrow$:

$\vec{w}_i<\vec{w}_j:\ w_{k_i}\leq w_{k_j}$



$[1,0,1,0]<[1,1,1,0]$

Dovolj, da preverimo sosede, ki se razlik. po enem bitu

x_1	x_2	$\rightarrow$
0	0	1
0	1	1
1	0	0
1	1	1

$\vec{w}_0<\vec{w}_1,\ f(\vec{w}_0)\leq f(\vec{w}_1)$

$\vec{w}_0<\vec{w}_2,\ f(\vec{w}_0)\nleq f(\vec{w}_2);\ \rightarrow\notin M$

Primer: Preveri pripadnost $f=\&^4(0,1,6,8,9,14)$ razreda L

$x_1x_2x_3x_4$	f	f_L
0000	1	1
0001	0	0
0010	1	1
0011	1	0
0100	1	1
0101	1	0
0110	0	1
0111	0	0
1000	1	1
1001	0	0
1010	1	1
1011	1	0
1100	1	1
1101	1	0
1110	0	1
1111	0	0

ZRCALI

$f_L(0,0,0,0)=a_0\nabla a_10\nabla a_20\nabla a_30\nabla a_40=a_0=1$ $\qquad a_0=1$

tistega ko iščeš daš na 1

$f_L(0,0,0,1)=a_0\nabla a_10\nabla a_20\nabla a_30\nabla a_41=1\nabla a_4=0$ $\qquad a_4=1$

rezultat je iz tabele

$f_L(0,0,1,0)=1\nabla a_3=1$ $\qquad a_3=0$

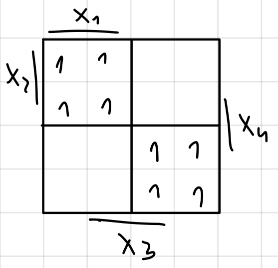
$f_L(0,1,0,0)=1\nabla a_2=1$ $\qquad a_2=0$

$f_L(1,0,0,0)=1\nabla a_1=1$ $\qquad a_1=0$

$f_L(x_1,x_2,x_3,x_4)=1\nabla 0x_1\nabla 0x_2\nabla 0x_3\nabla 1\cdot x_4=\underline{1\nabla x_4}=\overline{x_4}$

povsod kjer je $x_4=0$ je funkcija $f_L=1$

$f\neq f_L;\ f\notin L$



$f(x_1,x_2,x_3,x_4)=(x_1\rightarrow x_2)\nabla(x_3\equiv x_4)=V^4(1,2,5,6,8,11,13,14)$

- preveri pripadnost zaprtim razredom, L na oba načina
- po potrebi dopolni do funk. polnosti

	$x_1x_2x_3x_4$	f	f_L	
	0000	0		
$\vec{w}_1$	0001	1		
	0010	1		
$\vec{w}_3$	0011	0	0	S
	0100	0		
	0101	1		
	0110	1	1	
	0111	0		
	1000	1		
	1001	0		
	1010	0		
	1011	1		
	1100	0	1	L
	1101	1		
	1110	1		
	1111	0		T_1

$L \cdot\ f_L(0,0,0,0)=a_0\nabla a_1 0\nabla a_2 0\nabla a_3 0\nabla a_4 0=a_0=0 \qquad a_0=0$

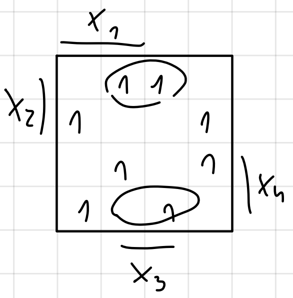
$f_L(0,0,0,1)=0\nabla a_1 0\nabla a_2 0\nabla a_3 0\nabla a_4 1=0\nabla a_4=1 \qquad a_4=1$

$f_L(0,0,1,0)=0\nabla a_3=1 \qquad a_3=1$

$f_L(0,1,0,0)=0\nabla a_2=0 \qquad a_2=0$

$f_L(1,0,0,0)=0\nabla a_1=1 \qquad a_1=1$

$f_L(x_1,x_2,x_3,x_4)=0\nabla 1\cdot x_1\nabla 0\cdot x_2\nabla 1\cdot x_3\nabla 1\cdot x_4=x_1\nabla x_3\nabla x_4$



$x_1\bar{x}_2x_3\bar{x}_4 : \overline{x_1}\,\overline{x_2}\,x_1\,\overline{x_4}$

$\bar{x}_2x_3\bar{x}_4 : x_2x_3\bar{x}_4$

	T_0	T_1	S	L	M
f	$\in$	$\notin$	$\notin$	$\notin$	$\notin$

Protiprimer:

$f_L(0,1,1,0)=0\nabla 0\nabla 0\nabla 1\nabla 0=1$

$f_L(0,1,1,1)=0\nabla 0\nabla 0\nabla 1\nabla 1=0$

$f_L(0,0,1,1)=0\nabla 0\nabla 0\nabla 1\nabla 1=0$

$f_L(1,1,0,0)=0\nabla 1\nabla 0\nabla 0\nabla 0=1$ Protiprimer

$S:$

$f(x_1,x_2,x_3,x_4)=\bar{f}(\overline{x_1},\overline{x_2},\overline{x_3},\overline{x_4})$

$f(0,0,1,1)\neq\bar{f}(\bar{0},\bar{0},\bar{1},\bar{1})$

$M:\ \overset{\vec{w}_1}{[0,0,0,1]}<\overset{\vec{w}_3}{[0,0,1,1]};\quad \underset{1}{\underset{\shortparallel}{f(0,0,0,1)}}\nleq \underset{0}{\underset{\shortparallel}{f(0,0,1,1)}}$

$f\notin M$

$T_0:$

$$\left.\begin{array}{l}0\rightarrow 0=1\\ 0\equiv 0=1\end{array}\right\}\rightarrow 1\veebar 1=0$$

$T_1:$

$$\left.\begin{array}{l}1\rightarrow 1=1\\ 1\equiv 1=1\end{array}\right\}\rightarrow 1\veebar 1=0$$

Funkcija je polna pri $\{f,1\}$, da je $f\in T_0$