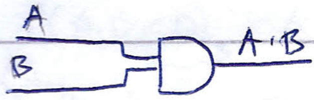
ZADACI SE MOGU NAĆI NA: morgoth.zemris.fer.hr/diglog !!

MASOVNE



$A \oplus B = A\bar{B} + \bar{B}A$

A	B	I	ILI	XOR
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0

$A \cdot A = A$ $\quad A + A = A$

$A \cdot 1 = A$ $\quad A + 0 = A$

$A \cdot 0 = 0$ $\quad A + 1 = 1$

pr. Zadatak

α - 001100110

β - 101010101

γ = 010101010

$\alpha : \beta$ $d = 5$

$\beta : \gamma$ $d = 9$

$\alpha : \gamma$ $d = 4$

minimalna distanca – broj bitova u kojima se dva broja razlikuju

otkrivanje grešaka $d_{min} \geq t + 1$ (broj grešaka)

ispravljanje pogrešaka $d_{min} \geq 2t + 1$ (broj grešaka koje možemo ispraviti)

$d_{min} = 4$

$4 \geq 2t + 1$

$t = 1,5$ → zaokružujemo na prvi manji cijeli broj (logično, jer ne možemo npr. pola greške ispraviti)

$t = 1$

Hammingov koder

↳ neparni paritet → samo se broji koliko je jedinica 0 1010111 pa samo stavi ispred (parni isti princip) → (može se i staviti iza, ali ispred je češće)

zad.

E7 → zaštititi neparnim paritetom Hammingovog koda

E - 1110 → 11100111 (p = 1 2 3 4 5 6 7 8)

7 - 0111

C_0	C_1	P_1	C_2	P_2	P_3	P_4	C_3	P_5	P_6	P_7	P_8
0	1	1	0	1	1	0	0	0	1	1	1

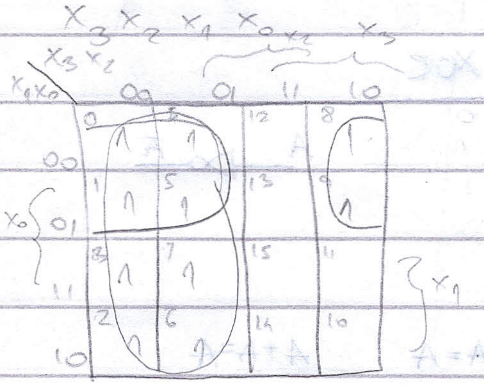
Hammingov kod – zaštitni bitovi su na potenciji broja 2 (po toliko ih štite i preskaču npr. 2^1 → štiti sebe i svog pokraj, pa preskoči 2 pa štiti dva itd., 2^3 - sebe i 7 pokraj pa 8 preskoči ....)

Rj - 011011000111

2006-2007 I MI 2. zad

BCD kod

$\sum m(0,1,2,3,4,5,6,7,8,9)$



$\bar{x}_3 + \bar{x}_1 x_2$

BCD

0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
~~1010~~	
~~1011~~	
~~1100~~	
~~1101~~	
~~1110~~	
~~1111~~	

ne koriste se!

XS3

	~~0000~~
	~~0001~~
	~~0010~~
0	0011
1	0100
2	0101
3	0110
4	0111
5	1000
6	1001
7	1010
8	1011
9	1100
	~~1101~~
	~~1110~~
	~~1111~~

Aiken (2421)

0000	0
0001	1
0010	2
0011	3
0100	4
~~0101~~	
~~0110~~	
~~0111~~	
~~1000~~	
~~1001~~	
~~1010~~	
1011	5
1100	6
1101	7
1110	8
1111	9

→ ne smije se u tim kodovima zbrajati → pretvori se u dekadski, pa zbroji pa opet pretvori u taj kod

npr. BCD

10001000 → 88
01000100 → 44
132 → 000100110010

K tablice - služe za minimizaciju funkcije

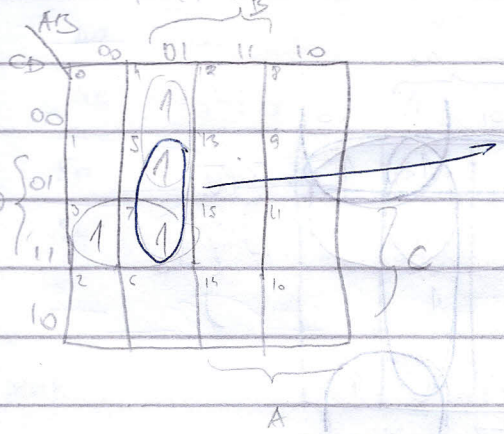
mintermi - međusobno se zbrajaju, a unutar sebe se množe

makstermi - obrnuto

x y z
0 0 0 $\bar{x} \cdot \bar{y} \cdot \bar{z}$
(kad je f=1)

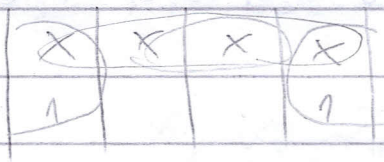
x y z
0 0 0 x+y+z
(kad je f=0)

$f(A,B,C,D) = \bar{A}B\bar{C} + \bar{A}CD$



$\bar{A}BD$ (hazard)

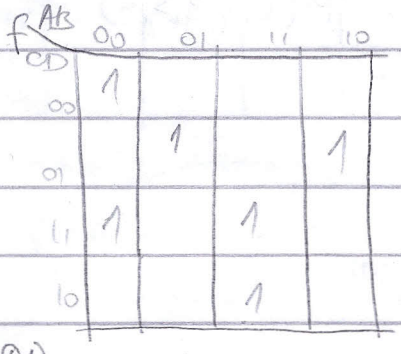
ZAD

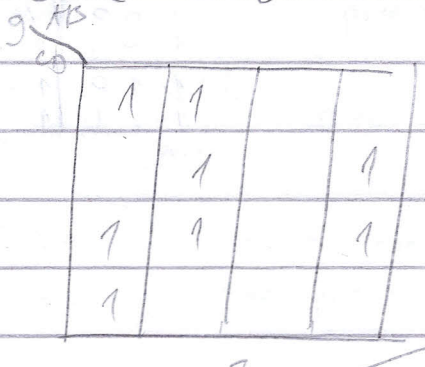


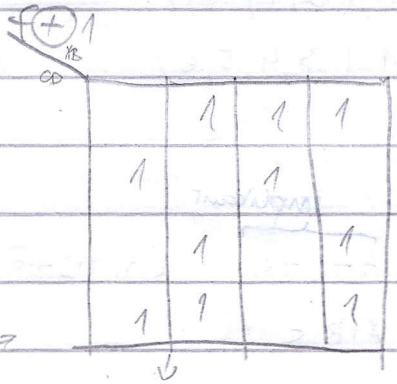
ZADATAK 1. (1.MI. (2006/2007.) grupa A)

(ovdje su g i f zadani)

$Z: (A,B,C,D) = \overline{(f \oplus 1) \cdot g}$

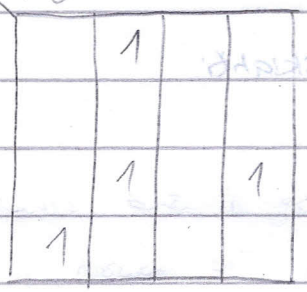






xorano f

$(f \oplus 1) \cdot g$



tamo gdje se preklapaju 1 stavljamo ih u tablicu

$\overline{(f \oplus 1) \cdot g}$

→ sad invertiramo

→ ovo su mintermi (pazimo su makstermi)

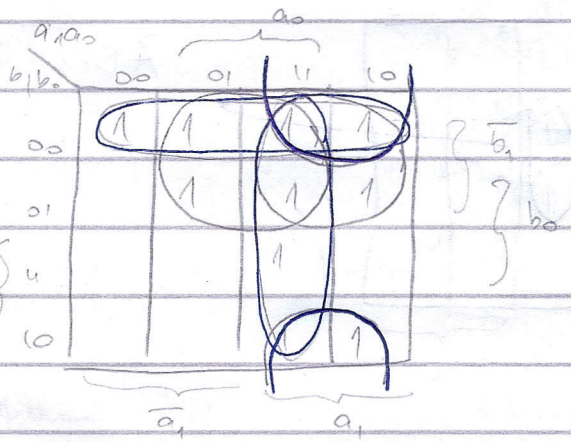
rješenje je: $Z = \prod M(2,4,7,11)$

14. Potrebno je projektirati komparator dvobitnih brojeva a_1a_0 i b_1b_0, rezultat treba postaviti 1 samo onda kad je $a \geq b$. Minimalni oblik te $f(a_1, a_0, b_1, b_0)$: glavni

01 10 = 2

1 a b

a_1	a_0	b_1	b_0	c	
0	0	0	0	1	0
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	1	4
0	1	0	1	1	5
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	1	8
1	0	0	1	1	9
1	0	1	0	1	10
1	0	1	1	0	
1	1	0	0	1	11
1	1	0	1	1	12
1	1	1	0	1	13
1	1	1	1	1	14



fj: $\overline{b_1}\overline{b_0} + a_1a_0 + a_0\overline{b_1} + a_1\overline{b_1} + a_1\overline{b_0}$

Prekrivas ($f(A,B,C)$)

$\Sigma m(0,1,2,7)$

$\Pi M(3,4,5,6)$

*

A	B	C	
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	1
1	1	0	1
1	1	1	1

$AB + CA$ ... ATAKTAS

$m(5,6,7)$

$M(0,1,2,3,4)$

implikant

$(\overline{A}+B+C) \cdot (A+\overline{B}+\overline{C})$

$A \cdot B \cdot C$

primarni implikanti - implikanti koji se više ne mogu skraćivati

bitni primarni implikant

ZAD. $m(38, 42, 46, 50, 54)$ → odzdrma potencije → broj 38 i sad uzmeš npr. 64, to ne možeš od 38 oduzeti, pa uzmeš 32 → možeš oduzeti i staviš 1, pa sljedeći 16 (ostalo ti je 6) ne možeš, 8 ne, 4 možeš, ostane 2, pa 2 možeš i 1 ne možeš.

38 - 100110 (32 16 8 4 2 1)

↓

fj: 16 8 4 2 1 → potencije

→ broj 1-ca jedinica

38	100110	-3
42	101010	-3
46	101110	-4
50	110010	-3
54	110110	-4

	A B C D E F	
√38	1 0 0 1 1 0	grupa od 3 jedinice
√42	1 0 1 0 1 0	
√50	1 1 0 0 1 0	
√46	1 0 1 1 1 0	grupa od 4 jedinice
√54	1 1 0 1 1 0	

$x=4$

$x =$ primarni implikanti

38,46	1 0 - 1 1 0
38,54	1 - 0 1 1 0
42,46	1 0 1 - 1 0
50,54	1 1 0 - 1 0

	38 ✓	42 ✓	46 ✓	50 ✓	54 ✓
38,46	+	+			
38,54	+				+
42,46		+	+		
50,54				+	+

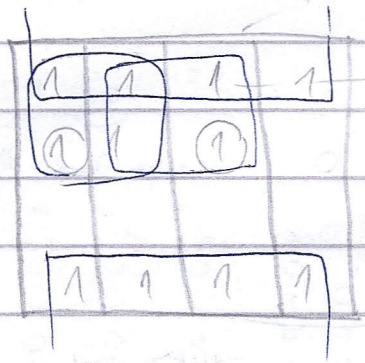
→ ovdje nema i gdje je samo jedan + ovi će biti u konačnoj tabeli i ovi su bitni primarni implikanti

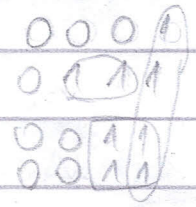
$y=2$

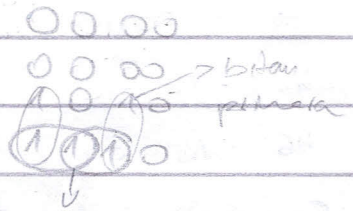
$z=2$

$f = \bar{A}BC\bar{E}\bar{F} + A\bar{B}\bar{C}\bar{E}\bar{F} + A\bar{B}DE\bar{F}$ ili $+ A\bar{C}DE\bar{F}$ ²

to tamo gore ovde; tako pisano



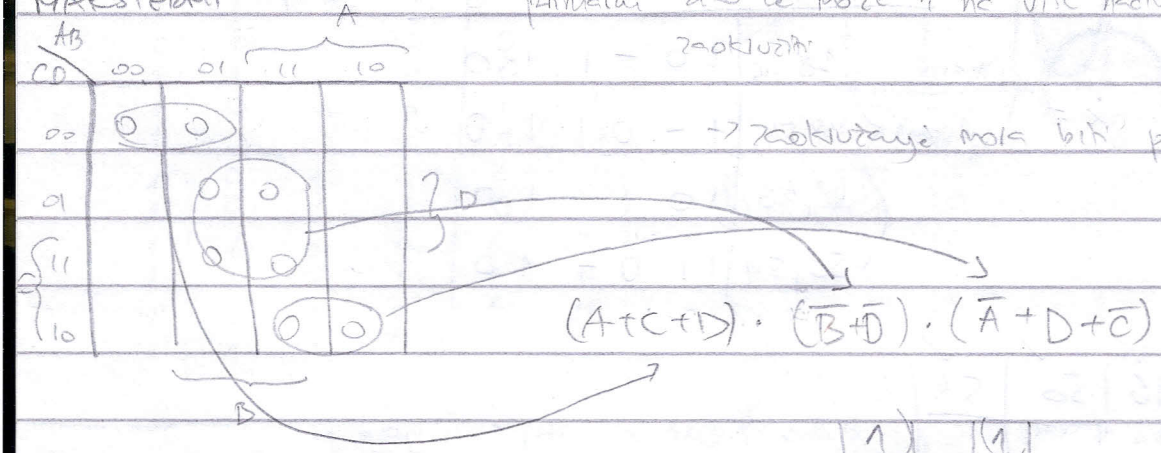




bitan primalac - ako se jedinica može na samo jedan način zaokružiti

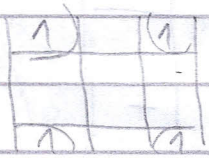
obični primalac - ako se može 1 na više načina zaokružiti

MAKSTERMI

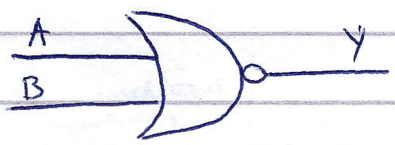


→ zaokružuje male bit potencije broja 2

$$(A+C+D)\cdot(\overline{B}+\overline{D})\cdot(\overline{A}+D+\overline{C})$$



NOR / NILI



$$y=\overline{A+B}$$

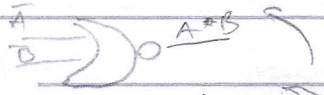
NAND / NI

$$y=\overline{A\cdot B}$$

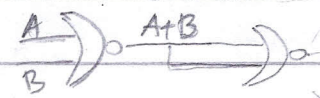
SVE POMOĆU NOR

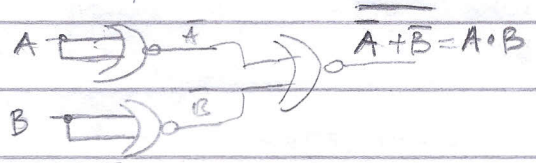
$\overline{A}$

$A\cdot B=\overline{\overline{A}+\overline{B}}$



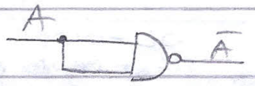
$A+B=\overline{\overline{A+B}}$ NOT





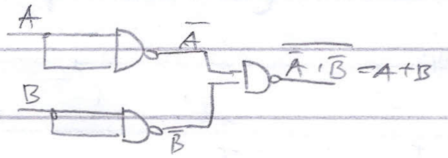
NAND

$\bar{A} \to$

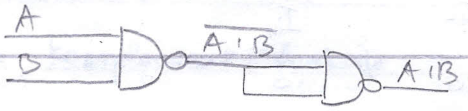


$B+\bar{B}=1$

$A+B = \overline{\bar{A}\cdot\bar{B}}$



$A\cdot B = \overline{\overline{A\cdot B}}$



! $\overline{AC} \neq \bar{A}\bar{C}$ NE!!!

ZAD. Samo NOR

$f = B\cdot(\bar{C}\cdot B) + (\bar{B}\cdot(\overline{AC}))$

$\overline{AC} = \overline{\overline{\bar{A}+\bar{C}}} = \bar{A}+\bar{C}$

$f = BB\bar{C} + (\bar{B}\cdot(\bar{A}+\bar{C}))$

$f = B\bar{C} + \bar{B}\bar{A} + \bar{B}\bar{C}$

$f = \bar{C}(B+\bar{B}) + \bar{B}\bar{A}$

$f = \bar{C} + \bar{B}\bar{A}$

$f = \bar{C} + \overline{A+B}$

$f = \overline{\overline{\bar{C} + \overline{A+B}}}$

samo sam si označila koji što obuhvaća. TO SE NE CRTA!!!

! NOR(C) = NOR(C,C)

NOR(NOR(NOR(C) NOR(A,B)))

ilgi. (NOR(NOR(NOR(C), NOR(A,B)))

ZAD. samo NAND

$\bar{A}(BC + B\bar{C}) + AC\bar{D} + C\bar{D}$

$\bar{A}BC + \bar{A}B\bar{C} + AC\bar{D} + C\bar{D}$

$\bar{A}B\underbrace{(C+\bar{C})}_{1} + C\bar{D}\underbrace{(A+1)}_{1}$

Da pita broj sklopova, samo prebrojiš norove/nandove

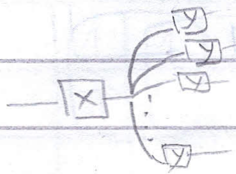
$\bar{A}B + C\bar{D}$

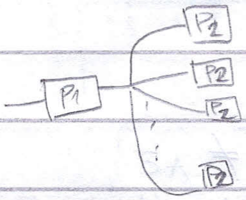
$\overline{\overline{\bar{A}B}\;\overline{C\bar{D}}}$

NAND(NAND(NAND(A), B), NAND(C, NAND(D)))

ZADATAK 3. (2.MI. (2006./2007./grupa A) Za dvije porodice integriranih logičkih sklopova poznati su podaci prikazani u tablici. Ako se u nekom složenom sustavu sklopovi porodice P_1 pobuđuju sklopove porodice P_2, koliko se najviše sklopova porodice P_2 može spojiti na izlaz iz jednog sklopa P_1?

OL - output low (h-high)
IL - input low





! pazi na mjerne jedinice

	n_1		n_2	
	"L"	"H"		
	$\frac{I_{OL}}{I_{IL}}$	$\frac{I_{OH}}{I_{IH}}$		
	10	10	20	20

n_{21}

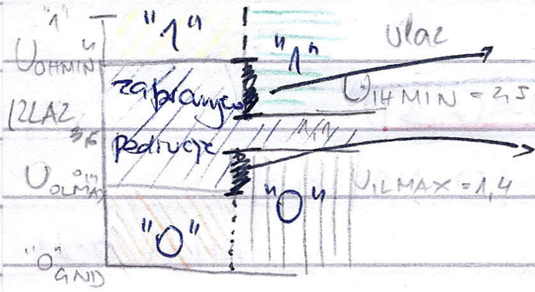
$\frac{I_{OL_1}}{I_{IL_2}} = 10$, $\frac{I_{OH_1}}{I_{IH_2}}$ → uzima se minimum od ta dva broja

40 (10) e) 10

(Ustvari gledamo koliko sklopova možemo spojiti a da prvi sklop ne pregori!!)

ZADATAK 4. (2.MI (2006/2007) grupa A)

O-OUTPUT! I-INPUT!



$U_{OHMIN} - U_{IHMIN} = U_{GSV}$ 1,5

$U_{OLMAX} - U_{ILMAX} = U_{GSN}$ -1

$U_{OLMAX} = 0,4V$ $U_{IHMIN} = 2,5\ V$

$U_{OHMIN} = 4V$ $U_{ILMAX} = 1,4\ V$

ZADATAK 5. (2.MI. (2006/2007) grupa A)

$U_1 = 5V$

$f_1 = 100\ MHz$

$U_2 = 4V$

$f_2 = ?$

$p_2 = 1,1 p_1$ (+10%)

$P = fCU^2$ ← samo se uvrsti u formulu!

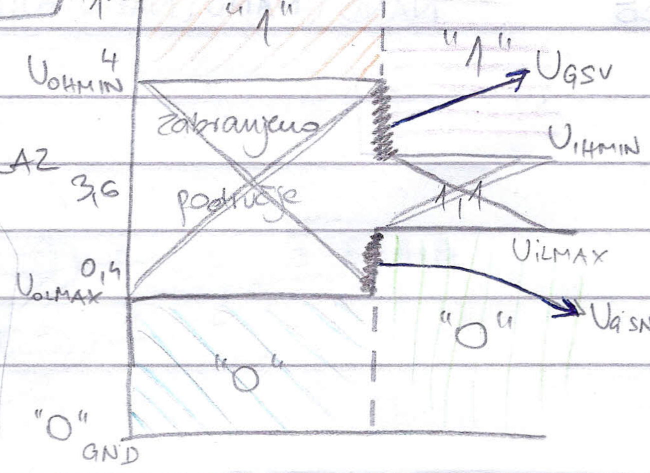
$p_1 = f_1 C U_1^2$

$p_2 = f_2 C U_2^2$

ZADATAK 4.: UVEĆANJ

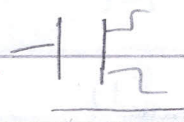
Za neku porodicu logičkih sklopova poznato je sljedeće: $U_{OHMIN}=4V$, širina zab. područja na izlazu iznosi 3,6V, $U_{IHMIN}=2,5V$, širina zabranjenog područja na ulazu iznosi 1,1V. Koje su granice istosmjerne smetnje tog sustava?

e) $|U_{GSV}|=1,5V$, $|U_{GSN}|=1V$, $|U_{GS}|=1V$



CMOS

PUN → pull up network → crta se komplement varijabli



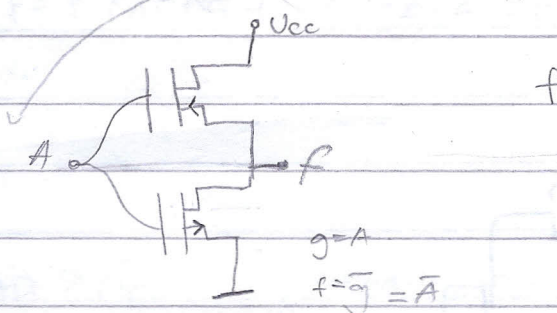
→ crta se komplement funkcije

Serija ·
paralela +

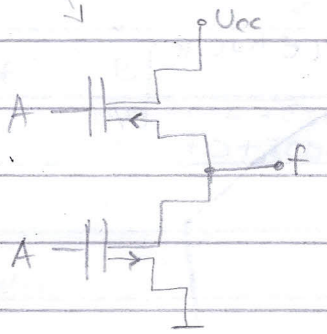
PDN → pull down network

INVERTOR

$A \rightarrow \bar{A}$ (isto je ako i dva A stavis)

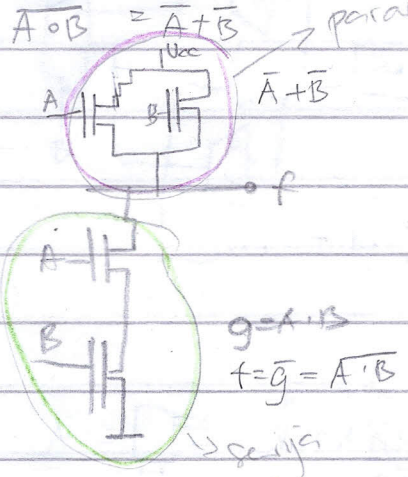


$f = \bar{A}$ =

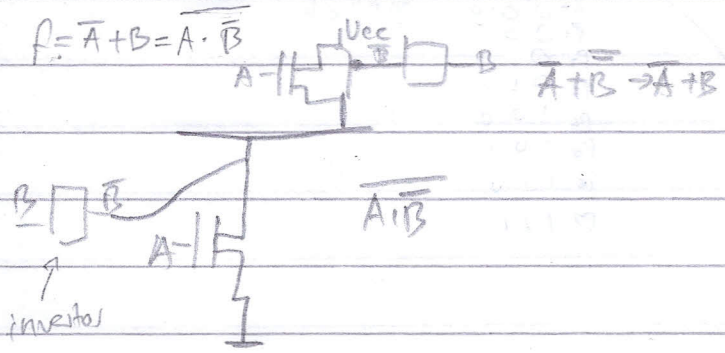


NI

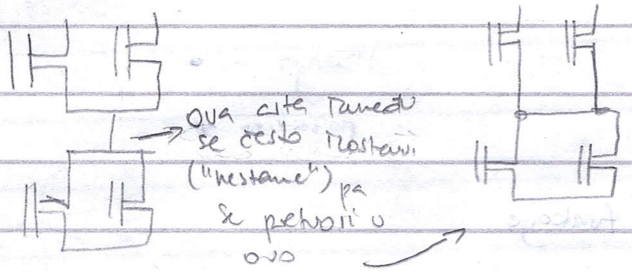
$\overline{A \cdot B} = \bar{A} + \bar{B}$ → paralela



$f = \bar{A} + B = \overline{A \cdot \bar{B}}$



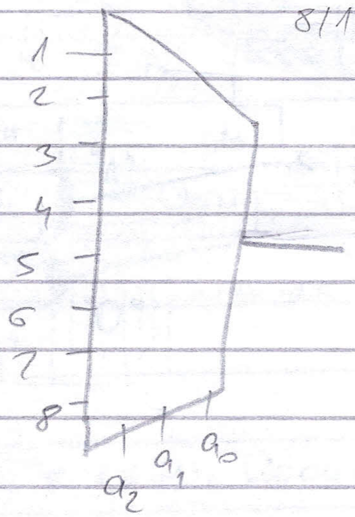
ZADATAK → lakše ti je čitati odozgore kada nema invertora na kraju funkcije, ako ima, čitaj odozdolje

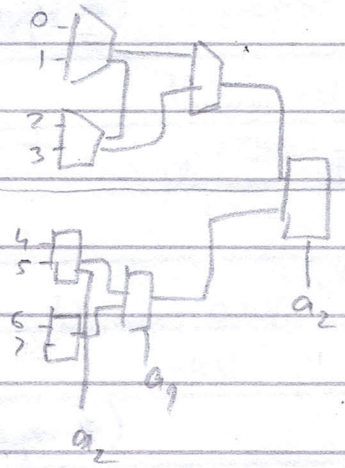


! (ta dva sklopa su identična!)

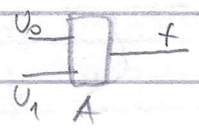
→ broj tranzistora → zbrojiš varijable i pomnožiš s 2 (jer čitaš i s jedne i druge strane)

MULTIPLEKSOR ?





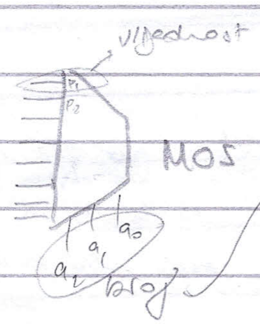
$f = \bar{a}_2 \bar{a}_1 \bar{a}_0 \cdot 1 + \ldots$



A	
0	U_0
1	U_1

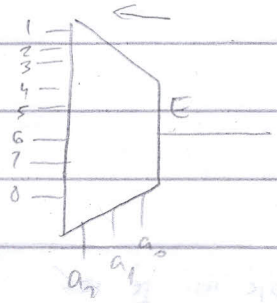
$f = \bar{A} U_0 + A U_1$

$f = \bar{a}_2$



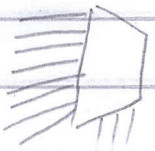
	a_2	a_1	a_0
p_0	0	0	0
p_1	0	0	1
p_2	0	1	0
p_3	0	1	1
p_4	1	0	0
p_5	1	0	1
p_6	1	1	0
p_7	1	1	1

DEKODER

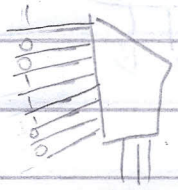


Realizacija funkcije

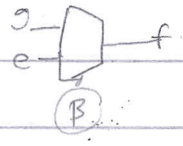
$f(A,B,C)$



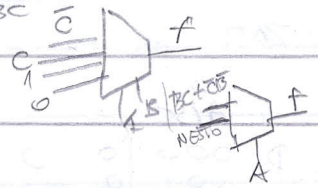
A	B	C	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0



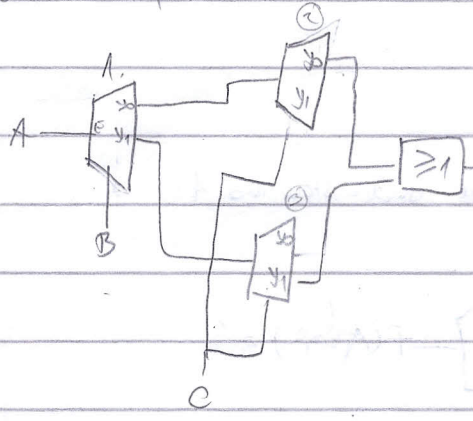
ZAD. $f = \overline{B}(ACDG + \overline{C}EF) + B(\overline{A}CD)$ — propusteći ulazi



B	
0	$ACDG + \overline{C}EF + 0$
1	$0 + 0 + \overline{A}CD$



ZAD. Sklop = 3 dekodera — kako glasi njegov izlaz



1. $y_0 = A\overline{B}$

$y_1 = AB$

2. $y_0 = A\overline{B}\,\overline{C}$

$y_1 = A\overline{B}C$

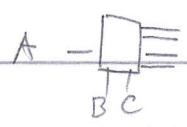
3. $y_0 = AB\overline{C}$

$y_1 = ABC$

$f = A\overline{B}\,\overline{C} + ABC$

$f = A(\overline{B}\,\overline{C} + BC)$

$f = A \cdot \overline{B \oplus C}$



$y_0 = A\overline{B}\,\overline{C}$

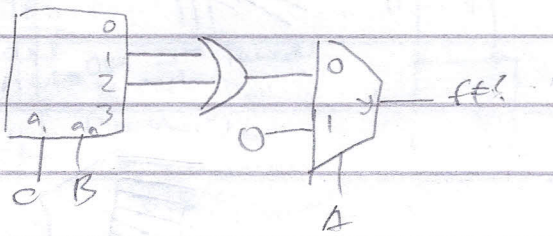
$y_1 = A\overline{B}C$

$y_2 = AB\overline{C}$

$y_3 = ABC$

0 $C\bar{B}$
1 $\bar{C}B$ +
2 $C\bar{B}$
3 CB

$$f = \bar{A}(\bar{C}B + C\bar{B}) + A(D)$$



Ovdje mi je već malo popustila koncentracija 😐 nadam se da sam bar ovo ostalo vidi i da je od neke koristi 😊

ZAD

	ABC		
D_3	000	0	0
	001	0	
D_1	010	1	1
	011	1	
D_2	100	0	C
	101	1	
D_3	110	1	
	111	0	$\bar{C}$

ZAD

ako su isti C i izlaz = 0, a ako ne onda stavimo 1

A	B	C	f	C=0	
0	0	0	1	1	1
0	0	1	0	1	
0	1	0	1	1	1
0	1	1	0	1	
1	0	0	0	0	0
1	0	1	1	0	
1	1	0	0	0	0
1	1	1	1	0