

4. DB

1

$$\boxed{P_1:} \quad I_{OL1} = 18.75 \text{ mA} \quad I_{IL1} = 1.91 \text{ mA} \\ I_{OH1} = 373.75 \mu\text{A} \quad I_{IH1} = 39.12 \mu\text{A}$$

$$\boxed{P_2:} \quad I_{0L2} = 9.39 \text{ mA} \quad I_{L2} = 0.3 \text{ mA}$$

$$I_{0H2} = 393.31 \mu\text{A} \quad I_{H2} = 15.69 \mu\text{A}$$

$$\frac{P_1}{P_2} (\text{low}) = \frac{I_{0L1}}{I_{1L2}} = \frac{16.75mA}{0.3mA} = 62$$

$$\frac{P_2}{P_1} (\text{low}) = \frac{I_{a2}}{I_{1L1}} = \frac{9.29mA}{1.91mA} = 4$$

$$\frac{P_1}{P_2} (\text{high}) = \frac{I_{OH1}}{I_{H2}} = \frac{373.75 \mu A}{15.69 \mu A} = 23$$

$$\frac{P_2}{P_1} (\text{high}) = \frac{I_{OHz}}{I_{IH1}} = \frac{393.31 \mu A}{39.12 \mu A} = 10$$

$$\frac{P_1}{P_2} (\text{z.u.}) = \min \{ \text{low}, \text{high} \} = 23$$

↳ zufriedenstellend erfüllt

$$\frac{P_2}{P_1} \text{ (Z.u.)} = \min \{ \text{low, high} \} = 4$$

(2) Positive Logika:  $-10V \equiv 0$   
 $10V \equiv 1$

$$f(A, B, C) = (B \cdot C) \cdot C \\ = B \cdot C$$

A	B	C	f
-10	-10	-10	-10
-10	-10	10	-10
-10	10	-10	-10
-10	10	10	10
10	-10	-10	-10
10	-10	10	-10
10	10	-10	-10
10	10	10	10

$$③ \quad u = 7V$$

$$f_1 = 127 \text{ MHz}$$

$$t_2 = t_1 + 23\%$$

$$c = \text{konst.}$$

$$U_2 = ?$$

$$P = f \cdot C \cdot u^2$$

$$U_1 \cdot U_1^2 = U_2 \cdot U_2^2$$

$$U_2^2 = \frac{U_1 \cdot U_1^2}{U_1} \sqrt{\Gamma} \Rightarrow U_2 = \sqrt{\frac{1.23 \cdot 1.23}{1.23 \cdot 1.23}} = 6.31V$$

(4) Diodna mreža

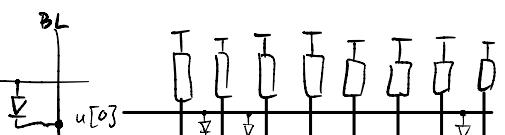
WL

BL → bit line

word line

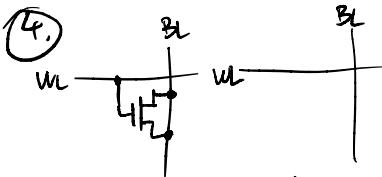
WL

- potražljena log. "0"



	$i[0]$	$i[1]$	$i[2]$	$i[3]$	$i[4]$	$i[5]$	$i[6]$	$i[7]$
$u[0]$	0	1	1	0	0	0	0	1
$u[1]$	0	0	1	1	1	0	0	0
$u[2]$	0	1	0	1	0	1	0	0
$u[3]$	0	1	1	1	0	1	1	1
$u[4]$	0	0	0	1	1	1	0	1
$u[5]$	1	1	0	1	0	0	0	1
$u[6]$	1	1	1	0	0	1	1	0
$u[7]$	1	0	0	0	0	1	0	1

= 61  
= 38  
= 54  
= 77  
= 10  
= D1  
= E6  
= 85



pohranjen  
log. "0"

pohranjen  
log. "1"

	+U						
u [0]	1	1	1	1	1	1	1
u [1]	1	1	1	1	1	1	1
u [2]	1	1	1	1	1	1	1
u [3]	1	1	1	1	1	1	1
u [4]	1	1	1	1	1	1	1
u [5]	1	1	1	1	1	1	1
u [6]	1	1	1	1	1	1	1
u [7]	1	1	1	1	1	1	1
i [0]	1	1	1	1	1	1	1
i [1]	1	1	1	1	1	1	1
i [2]	1	1	1	1	1	1	1
i [3]	1	1	1	1	1	1	1
i [4]	1	1	1	1	1	1	1
i [5]	1	1	1	1	1	1	1
i [6]	1	1	1	1	1	1	1
i [7]	1	1	1	1	1	1	1

Očitajte sadržaj memorije po lokacijama. U polja za unos rješenja potrebno je unijeti vrijednost memorijske lokacije u heksadekadikom obliku (kao dvije heksadekadiske znamenke); npr. E8 ili 2F.  
Pri tome bit [0] tretiraće kao bit napice težine.

Lokacija 0	1100 1101 (CD)
Lokacija 1	0100 1000 (48)
Lokacija 2	1100 1101 (CD)
Lokacija 3	0101 1101 (5D)
Lokacija 4	0010 1001 (29)

Lokacija 5	1111 1100 (FC)
Lokacija 6	1100 1100 (CC)
Lokacija 7	1010 1001 (A9)

(4)

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

$$A = 1$$

$$B = 1$$

$$C = V$$

↓

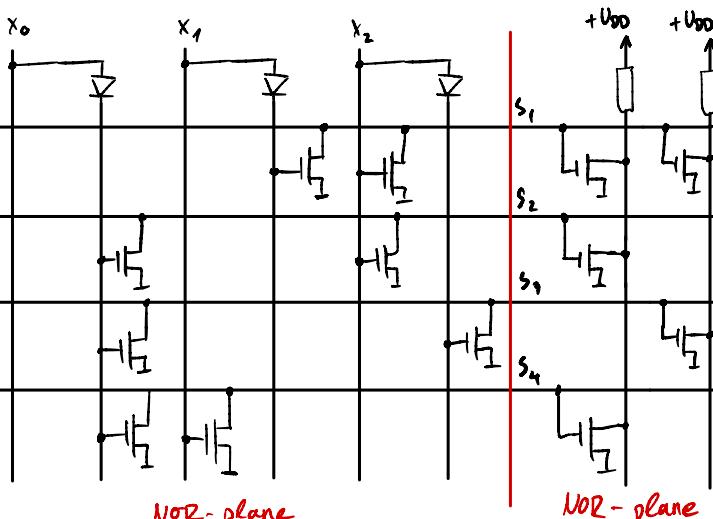
"uninitialized"

$$\begin{aligned} f(1, 1, V) &= \bar{1} \cdot 1 \cdot \bar{V} + \bar{1} \cdot \bar{1} \cdot V + 1 \cdot \bar{1} \cdot V \\ &= 0 \cdot 1 \cdot \cancel{V} + 0 \cdot \cancel{0} \cdot \cancel{V} + 1 \cdot \cancel{0} \cdot V \rightarrow 0 \\ &= 0 + 0 + 0 = 0 \end{aligned}$$

$$\bar{1} = 0, \bar{0} = 1, \bar{V} = V \quad | \quad V \cdot 0 = 0$$

$$V \cdot 1 = V$$

(5)



$$\bar{S}_1 = \bar{X}_1 + \bar{X}_2$$

$$\bar{S}_2 = \bar{X}_0 + \bar{X}_2$$

$$\bar{S}_3 = \bar{X}_0 + \bar{X}_1$$

$$\bar{S}_4 = \bar{X}_0 + X_1$$

$$\begin{aligned} f_1 &= \overline{\bar{S}_1 + \bar{S}_2 + \bar{S}_4} = \bar{S}_1 \cdot \bar{S}_2 \cdot \bar{S}_4 \\ f_1 &= (\bar{X}_1 + \bar{X}_2)(\bar{X}_0 + \bar{X}_2)(\bar{X}_0 + X_1) \\ &= (\bar{X}_0 \bar{X}_1 + \bar{X}_1 \bar{X}_2 + \bar{X}_0 \bar{X}_2 + X_0 \bar{X}_1) / (\bar{X}_0 + X_1) \\ &= \bar{X}_0 \bar{X}_1 + \bar{X}_0 \bar{X}_2 + \bar{X}_1 \bar{X}_2 + X_0 \bar{X}_1 \\ &= \bar{X}_0 \bar{X}_1 \bar{X}_2 + \bar{X}_0 \bar{X}_1 \bar{X}_2 + \bar{X}_0 X_1 \bar{X}_2 + X_0 \bar{X}_1 X_2 \\ &\quad \text{m}_1 \quad \text{m}_0 \quad \text{m}_3 \quad \text{m}_7 \end{aligned}$$

	00	01	11	10
0	1	1	1	2
1	4	5	7	6

$$f_2 = \bar{X}_0 \bar{X}_1 + X_1 X_2$$

$$f_3 = X_2 X_1 + \bar{X}_1 \bar{X}_0$$

$$\begin{aligned} f_2 &= \overline{\bar{S}_1 + \bar{S}_3} = \bar{S}_1 \cdot \bar{S}_3 \\ &= (\bar{X}_1 + \bar{X}_2)(\bar{X}_0 + \bar{X}_2) \\ &= \bar{X}_0 \bar{X}_1 + \bar{X}_1 \bar{X}_2 + \bar{X}_0 \bar{X}_2 + X_0 \bar{X}_1 \\ &= \bar{X}_0 \bar{X}_1 \bar{X}_2 + \bar{X}_0 \bar{X}_1 \bar{X}_2 + X_0 \bar{X}_1 \bar{X}_2 + X_0 \bar{X}_1 X_2 \\ &\quad \text{m}_0 \quad \text{m}_1 \quad \text{m}_4 \quad \text{m}_3 \end{aligned}$$

X <sub>1</sub> X <sub>2</sub>	00	01	11	10
0	1	1	1	1
1	4	5	7	6

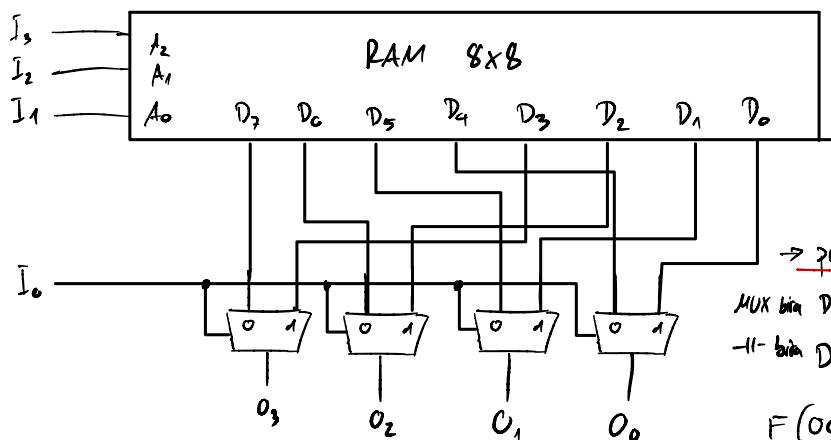
X <sub>2</sub> X <sub>1</sub> X <sub>0</sub>	00	01	11	10
0	1	1	1	1
1	4	5	7	6

$$f_1 = X_2 X_1 + \bar{X}_1 \bar{X}_0$$

$$f_2 = \bar{X}_1 \bar{X}_2 + X_1 X_2$$

$$f_3 = X_2 \bar{X}_0 + \bar{X}_2 X_0$$

7.



$\rightarrow$  priča o  $D_7 - D_0$

MUX bin  $D_7 - D_0$  kada  $I_0 = 0$

-II bin  $D_3 - D_0$  kada  $I_0 = 1$

$$F(i) = \sum_{j=0}^{i-1} 2^j$$

Na lokaciji: 34

$$i = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$$

$$M[2] = \{8, 15, 9, 15, 4, 12, 5, 8, 15, 14, 1, 11, 13, 12, 5, 9\}$$

HEX: 8 F 9 F 4 C 5 8 F E 1 B D C 5 9

"Slajemo redom članove niza  
prijeđi da niz potinje s 3, 4, ... dok ne popunimo memoriju"  
D24 - 2009/LO (GitHub)

$F(i) = i$ -ti element

$$F(0) = 8, F(1) = 15$$

$$0 = 0000 \quad 1 = 0001$$

$$I_3 \downarrow I_2 \downarrow I_1 \downarrow I_0$$

$$\begin{aligned} i_3 \dots i_0 = 0 & \\ F(0000) = 8 & \\ i_3 \dots i_0 = 1 & \\ F(0001) = 15 & \end{aligned}$$

$$\begin{aligned} i_3 \dots i_0 = 0 & \\ F(0010) = 9 & \\ i_3 \dots i_0 = 1 & \\ F(0011) = 15 & \end{aligned}$$

$$F(0100) = 4$$

$$F(0101) = 12$$

$$F(0110) = 5$$

$$F(0111) = 8$$

	$I_3$	$I_2$	$I_1$	$D_7$	$D_6$	$D_5$	$D_4$	$D_3$	$D_2$	$D_1$	$D_0$
L0K0	0	0	0	1	0	0	0	1	1	1	1
L0K1	0	0	1	1	0	0	1	1	1	1	1
L0K2	0	1	0	0	1	0	0	1	1	0	0
L0K3	0	1	1	0	1	0	1	1	0	0	0
L0K4	1	0	0	1	1	1	1	1	1	1	0
L0K5	1	0	1	0	0	0	1	1	0	1	1
L0K6	1	1	0	1	1	0	1	1	1	0	0
L0K7	1	1	1	0	1	0	1	1	0	0	1

$$= [8 \ F]$$

$$= [9 \ F]$$

$$= [4 \ C]$$

$$= [5 \ 8]$$

$$= [F \ E]$$

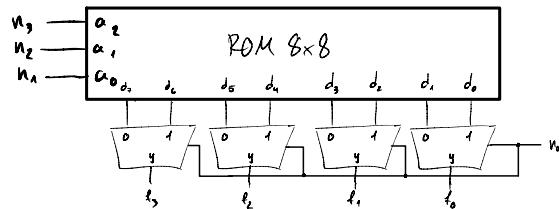
$$= [1 \ B]$$

$$= [D \ C]$$

$$= [5 \ 9]$$

$$\begin{array}{l|l|l|l|l} F(1000) = 15 & F(1010) = 1 & F(1100) = 13 & F(1110) = 5 \\ \hline F(1001) = 14 & F(1011) = 11 & F(1101) = 12 & F(1111) = 9 \end{array}$$

(8)



$n_3$	$n_2$	$n_1$	$d_7$	$d_6$	$d_5$	$d_4$	$d_3$	$d_2$	$d_1$	$d_0$
0	0	0								
0	0	1								
0	1	0								
0	1	1								
4	1	0	1	0	1	1	0	0	0	1
5	1	0	1	1	0	1	1	1	1	0
6	1	1	0	1	0	0	0	1	1	0
7	1	1	1	1	0	0	0	0	0	1

broj

se:

 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$ 
 $n_6=0 \quad n_5=1 \quad n_4=0 \quad n_3=1 \quad n_2=0 \quad n_1=1 \quad n_0=1$ 

$f(n) : \{0, \dots, 15\} \rightarrow (n \text{ XOR } m)$

$N = n_3 n_2 n_1 n_0$

$m = n_0 n_3 n_2 n_1$

$$\begin{array}{r} n_3 \\ \downarrow \\ N = 1000 \\ \oplus 0100 \\ \hline 1100 \end{array}$$

$$\begin{array}{r} n_0 \\ \downarrow \\ N = 001 \\ \oplus 1100 \\ \hline 0101 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 1010 \\ \oplus 0101 \\ \hline 1111 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 1011 \\ \oplus 1101 \\ \hline 0110 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 110 \\ \oplus 0110 \\ \hline 1010 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 1101 \\ \oplus 1110 \\ \hline 0011 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 1110 \\ \oplus 0111 \\ \hline 1001 \end{array}$$

$$\begin{array}{r} n_6 \\ \downarrow \\ N = 1111 \\ \oplus 1111 \\ \hline 0000 \end{array}$$

Rj. b1, b5, b6, b7, b8

(11) SG i SG 2

TRENUTNO	PREDUDA	SLEDEĆE	TRENUTNI izl.
SG	0	S4	1
SG	1	S2	1
Sg	0	S5	1
Sg	1	S7	1

stanja su ekvivalentna ako:

→ izlazi su isti

→ prelaze u ista ili ekvivalentna stanja

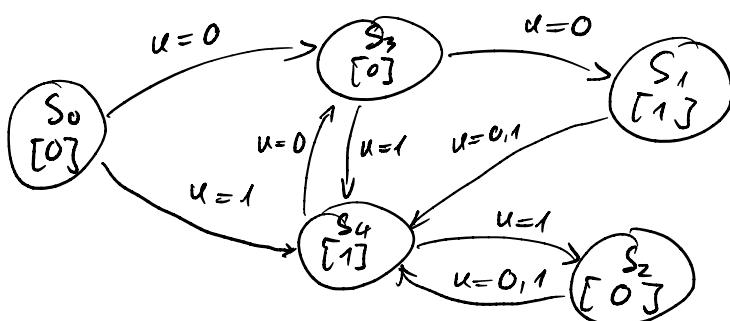
Rj. → izlazi isti ✓  
→ ista ili ekvivalentna?

→ ne prelaze u ista

→ ne znam jesu li S4-S5 i S2-S7 ekvivalentna

⇒ stanja su možda ekvivalentna

(10.)


 $\begin{matrix} S_3 & S_6 & S_7 \\ [0] & [1] & [1] \end{matrix}$ 
 $\dots \quad \begin{matrix} S_0 & S_2 & S_4 \\ [0] & [0] & [1] \end{matrix}$ 
 $\begin{matrix} S_5 & S_1 \\ [0] & [1] \end{matrix}$ 

⇒ Mooreov

	Moore	Mealy	prese razlikujuće
S2	0	S2	0
S2	0	S2	0
S5	0	S5	1
S5	0	S5	1
S6	{ } -11-	S6	0
S6	1	S6	1
S6	1	S6	1
⋮	⋮	⋮	⋮

(9)

	$Q_2^n$	$Q_1^n$	$Q_0^n$	$U$	$Q_2^{n+1}$	$Q_1^{n+1}$	$Q_0^{n+1}$	$J_2$	$K_2$	$J_1$	$K_1$	$J_0$	$K_0$	$O_2$	$O_1$	$O_0$	
$S_6$	0	0	0	0	0	0	0	0	X	0	X	0	X	0	1	0	
	1	0	0	0	1	0	1	1	0	X	1	X	1	X	1	0	1
$S_5$	2	0	0	1	0	0	1	0	0	X	1	X	X	1	0	0	1
	3	0	0	1	1	0	0	0	X	0	X	X	1	1	0	1	
$S_4$	4	0	1	0	0	0	0	0	X	X	1	0	X	1	0	1	
	5	0	1	0	1	0	1	0	X	X	0	0	X	1	1	1	
$S_3$	6	0	1	1	0	1	1	1	X	X	0	X	X	1	1	1	
	7	0	1	1	1	0	0	0	X	X	1	X	1	0	1	1	
$S_2$	8	1	0	0	0	0	1	1	X	1	X	1	X	1	1	0	
	9	1	0	0	1	0	0	X	0	X	0	X	0	1	0	0	
$S_1$	10	1	0	1	0	0	1	X	1	X	X	1	X	1	0	1	
	11	1	0	1	1	1	1	X	0	X	1	X	X	0	0	0	
$S_0$	12	1	1	0	0	1	0	X	0	X	0	X	0	1	1	1	
	13	1	1	0	1	0	1	X	1	X	0	X	1	0	1	1	
$S_7$	14	1	1	1	0	1	0	0	X	X	1	X	X	1	0	1	
	15	1	1	1	1	1	0	1	X	0	X	1	X	0	0	0	

=&gt; pomoc:

$Q_n$	$Q_{n+1}$	$J$	$K$
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

 $O_2:$ 

$Q_2 U$	00	01	11	10
$Q_2 K_1$	00	0	1	1
$Q_2 K_0$	01	1	1	0
	11	1	0	0
	10	1	0	1

 $O_1:$ 

$Q_1 U$	00	01	11	10
$Q_1 K_1$	00	1	0	0
$Q_1 K_0$	01	0	1	1
	11	1	0	0
	10	1	0	1

 $O_0:$ 

$Q_0 U$	00	01	11	10
$Q_0 K_1$	00	0	1	1
$Q_0 K_0$	01	1	1	1
	11	1	0	1
	10	0	0	1

$$O_2 = \bar{Q}_2 \bar{Q}_1 U + \bar{Q}_2 Q_1 \bar{U} + Q_2 \bar{Q}_1 \bar{U} + \bar{Q}_2 U + Q_1 \bar{Q}_0$$

$$O_1 = \bar{Q}_1 \bar{Q}_0 \bar{U} + \bar{Q}_2 Q_1 U + \bar{Q}_2 Q_1 Q_0 + Q_2 \bar{Q}_0 \bar{U}$$

$$O_0 = \bar{Q}_2 U + Q_2 \bar{U} + Q_1 \bar{Q}_0$$

 $J_0:$ 

$Q_2 U$	00	01	11	10
$Q_2 K_1$	00	1	X	X
$Q_2 K_0$	01	0	X	X
	11	0	X	X
	10	1	0	X

 $K_0:$ 

$Q_2 U$	00	01	11	10
$Q_2 K_1$	X	X	1	1
$Q_2 K_0$	01	X	X	X
	11	X	X	X
	10	1	1	X

 $J_1:$ 

$Q_2 U$	00	01	11	10
$Q_2 K_1$	00	0	1	1
$Q_2 K_0$	01	X	X	X
	11	X	X	X
	10	1	0	1

 $K_1:$ 

$Q_2 U$	00	01	11	10
$Q_2 K_1$	X	X	1	1
$Q_2 K_0$	01	X	X	X
	11	X	X	X
	10	X	X	X

$$J_2 = Q_1 \cdot Q_0 \cdot \bar{U}$$

$$K_2 = \bar{Q}_1 \bar{U} + Q_1 \bar{Q}_0 U$$

$$J_1 = \bar{Q}_2 \bar{Q}_1 U + Q_2 \bar{U} + Q_1 \bar{U} + Q_2 Q_0$$

$$K_1 = \bar{Q}_2 \bar{Q}_0 \bar{U} + Q_0 U + Q_2 Q_0$$