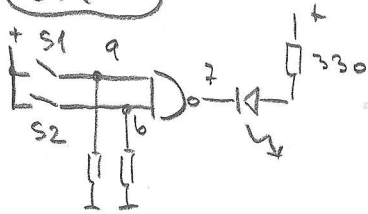


DIQ 1



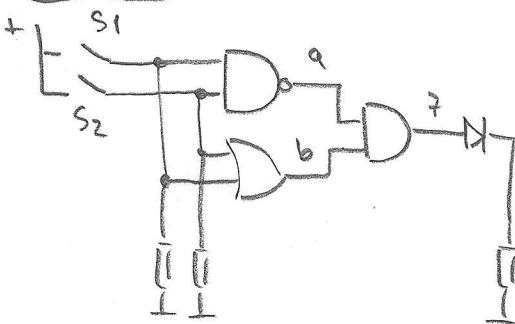
LED svetli, ko je izh. signal  $z = 0$

S2	S1	z
0	0	1
0	1	1
1	0	1
1	1	0

u tem primeru!

ko stisnes obe sklopi hkrati

DIQ 2



LED svetli, ko je izh. signal  $z = 1$

S2	S1	a	b	z
0	0	1	0	0
0	1	1	1	1
1	0	1	1	1
1	1	0	1	0

u tem primeru

$$\left. \begin{aligned} a &= \overline{S_1 \cdot S_2} \\ b &= S_1 + S_2 \end{aligned} \right\}$$

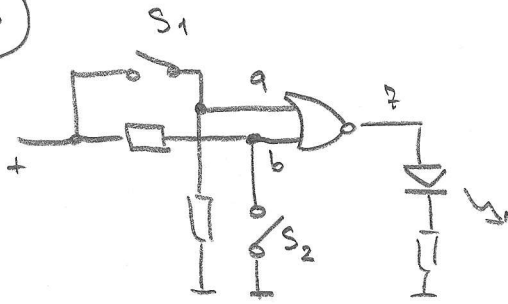
$$z = a \cdot b = \overline{S_1 \cdot S_2} \cdot (S_1 + S_2)$$

$$= (\overline{S_1} + \overline{S_2}) \cdot (S_1 + S_2)$$

$$= \underbrace{\overline{S_1} \cdot S_1}_0 + \overline{S_1} \cdot S_2 + \overline{S_2} \cdot S_1 + \underbrace{\overline{S_2} \cdot S_2}_0$$

$$= \overline{S_1} \cdot S_2 + S_1 \cdot \overline{S_2} \equiv \text{XOR}$$

DI 3



$S_1$	$S_2$	a	b	z
0	0	0	1	0
0	1	0	0	1 ← tule suhi
1	0	1	1	0
1	1	1	0	0

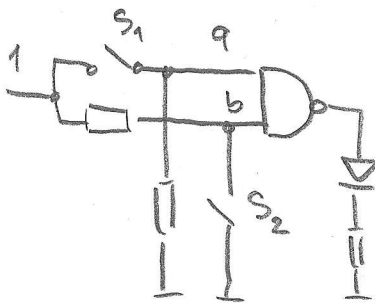
resitev:  $S_1$  razklenjen  
 $S_2$  sklenjen

$$a = S_1, \quad b = \overline{S_2} \quad ; \quad z = a + b = \overline{S_1 + \overline{S_2}}$$

$$= \overline{S_1} \cdot \overline{\overline{S_2}} = \overline{S_1} \cdot S_2$$

↑ razklenjen
← sklenjen

DI 4



$S_1$	$S_2$	a	b	z
0	0	0	1	1
0	1	0	0	1
1	0	1	1	0
1	1	1	0	1

resitev: suhi kadar

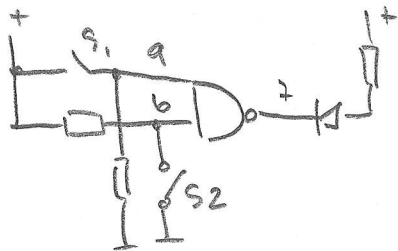
$S_1$  in  $S_2$  razklenjena ali

$S_1$  razklenjen in  $S_2$  sklenjen ali

$S_1$  in  $S_2$  sklenjena

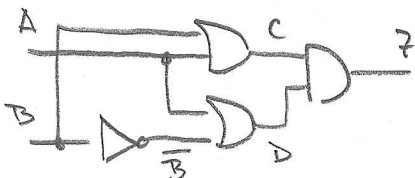
$$a = S_1, \quad b = \overline{S_2} \quad ; \quad z = a \cdot b = \overline{S_1 + \overline{S_2}} = \overline{S_1} + S_2$$

**195**



$S_1, S_2$	a	b	z
0 0	0	1	1
0 1	0	0	1
1 0	1	1	0 ← svetli
1 1	1	0	1

**196**



A	B	$\bar{B}$	C	D	z
0	0	1	0	1	0
0	1	0	1	0	0
1	0	1	1	1	1
1	1	0	1	1	1

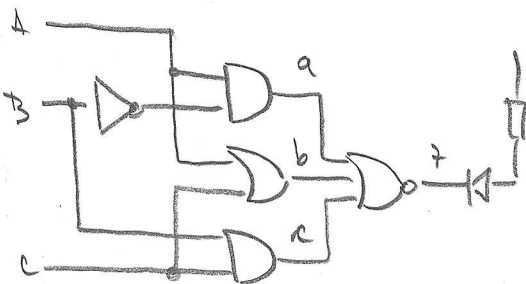
$z = A$

$$C = A + B, \quad D = A \cdot \bar{B}, \quad z = C \cdot D = (A + B) \cdot (A + \bar{B})$$

$$= \underbrace{A \cdot A}_A + \underbrace{A \cdot \bar{B} + A \cdot B}_{A(B + \bar{B})} + \underbrace{B \cdot \bar{B}}_0$$

$z = A + A = \underline{\underline{A}}$

**197**



$$\left. \begin{aligned} a &= A \cdot \bar{B} \\ b &= A + C \\ c &= B \cdot C \end{aligned} \right\} z = \overline{a + b + c}$$

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

LED svetli, če je  $z=0$   
 torej me zanima  
 kdaj je  $z=0$

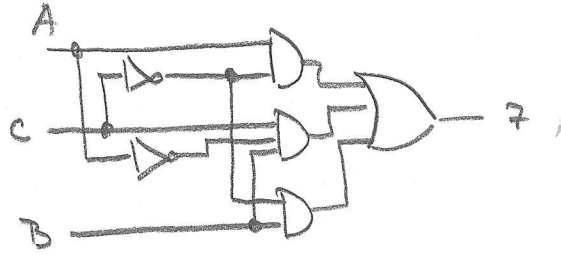
$$\bar{z} = A \cdot \bar{B} + (A + C) + B \cdot C$$

$$= A \cdot \bar{B} + A + C + B \cdot C = A \cdot (\underbrace{\bar{B} + 1}_{1}) + C (\underbrace{B + 1}_{1}) = \underline{\underline{A + C}}$$

LED svetli, če sta A ali C enaka 1

5198

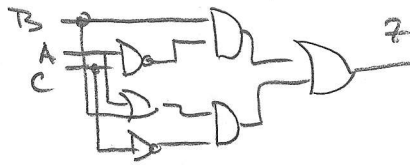
$$Z = A\bar{C} + C\bar{A}B + B\bar{C}$$



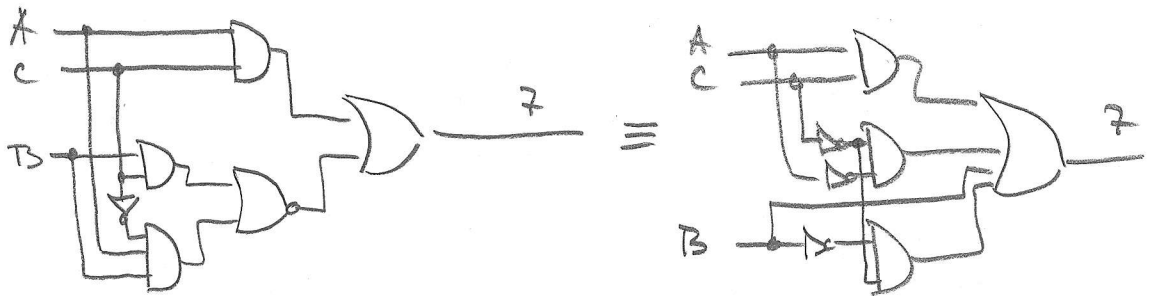
C	A	$C\bar{A} + \bar{C}$
0	0	1
0	1	1
1	0	1
1	1	0

} NAND!

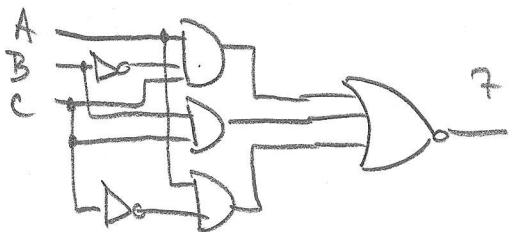
ali pa :  $Z = (A+B)\bar{C} + B(C\bar{A} + \bar{C})$   
 $= (A+B)\bar{C} + B \cdot \overline{A \cdot C}$



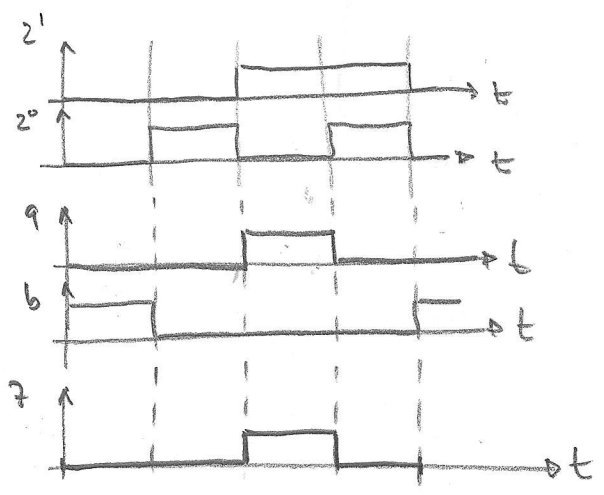
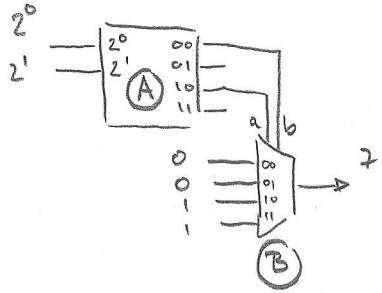
$$\begin{aligned} Z &= AC + \overline{C \cdot AB} + BC = AC + \overline{C \cdot AB} \cdot \overline{BC} \\ &= AC + (\bar{C} + \bar{A} + \bar{B}) \cdot (\bar{B} + \bar{C}) \\ &= AC + (\underline{BC} + C\bar{C} + \bar{A}\bar{B} + \bar{A}\bar{C} + \bar{B}\bar{B} + \bar{B}\bar{C}) \\ &= AC + \bar{A}\bar{C} + BC + \bar{B}\bar{C} + B \\ &= AC + \bar{A}\bar{C} + B + \bar{B}\bar{C} \end{aligned}$$



$$Z = \bar{A}\bar{B}C + A\bar{B}C + BC + A\bar{C}$$



519 9

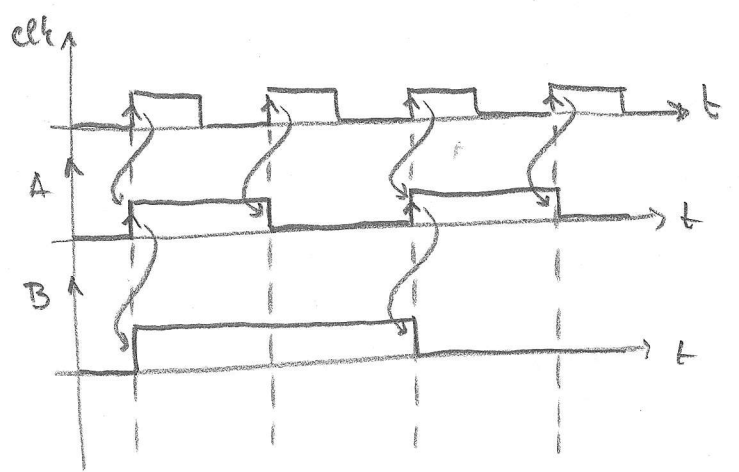
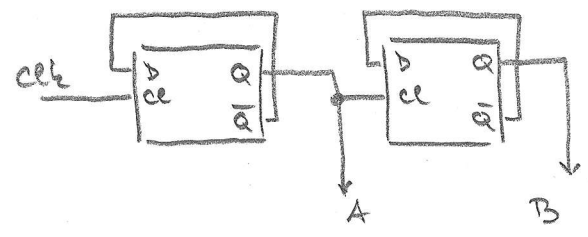


- (A) selektor
- (B) multiplexer

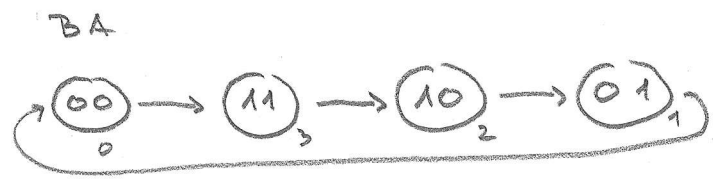
$$b = \overline{z^0} \cdot \overline{z^1} \quad , \quad a = \overline{z^0} \cdot z^1$$

$$\underline{\underline{z = a = \overline{z^0} \cdot z^1}}$$

519 10

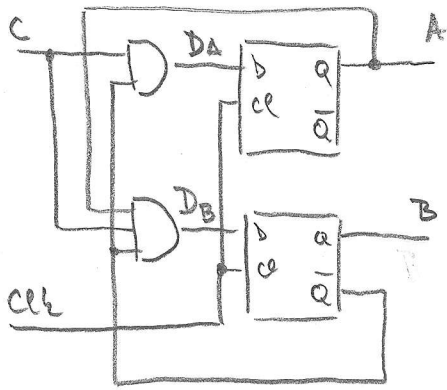


D-FF  
prožen na  $\uparrow \equiv \text{clk}$



številni, šteje navzdol, ima 4 stanja, asinkron

DIG 11

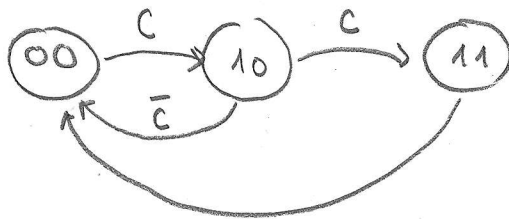


$$D_A = C \cdot \bar{B}$$

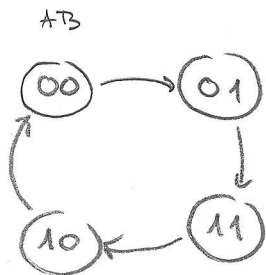
$$D_B = C \cdot A \cdot \bar{B}$$

C	B	A	$D_A$	$D_B$
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	1	0
1	0	1	1	1
1	1	0	0	0
1	1	1	0	0

A B

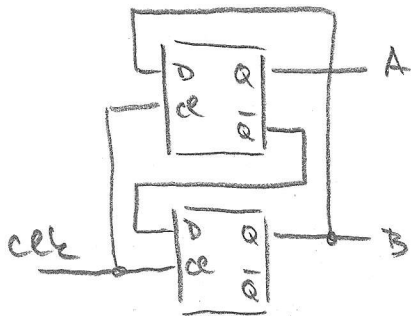


DIG 12

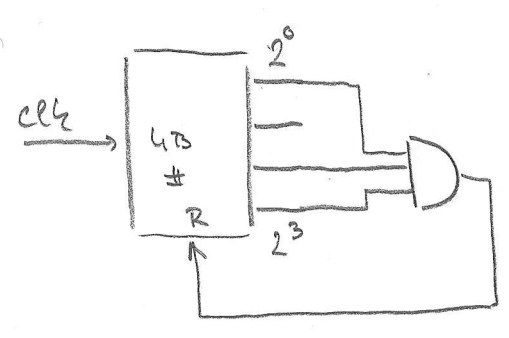


AB	$A^+ B^+$	$D_A$	$D_B$
00	01	0	1
01	11	1	1
11	10	1	0
10	00	0	0

$D_B = \bar{A}$   
 $D_A = B$



**§19 13**



$$R = 2^3 \cdot 2^2 \cdot 2^0$$

števil resetiramo, ko postane njegova vsebina enaka  $8 + 4 + 1 = \underline{\underline{13}}$

Torej števil šteje clk pulze  $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow \dots \rightarrow 11 \rightarrow 12$   
 $\underbrace{\hspace{15em}}_{13}$

Torej, ko vsebina postane 13, se rešimo reset in flip-flopi v številu se postavljejo v stanje 0. Možno je, da se nekateri FF postavijo v 0 hitreje od drugih, zato reset signal izine in števil ne gre v '0000'. Rešitev: podeljšaj signal za reset tako, da bodo vsi FF hkrati prešli v 0.

**§19 14**

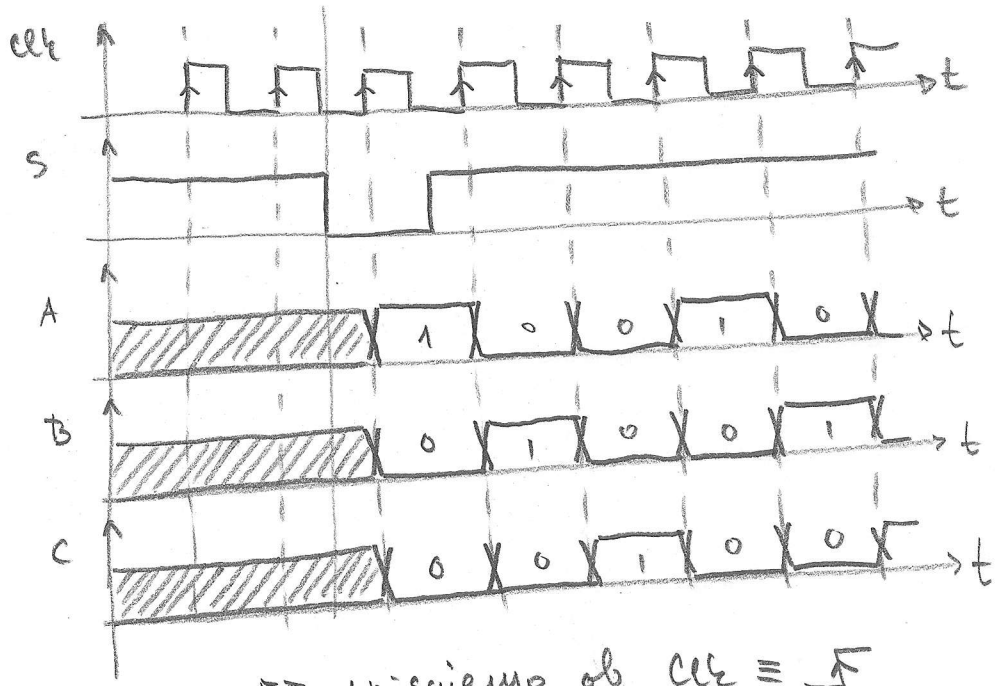
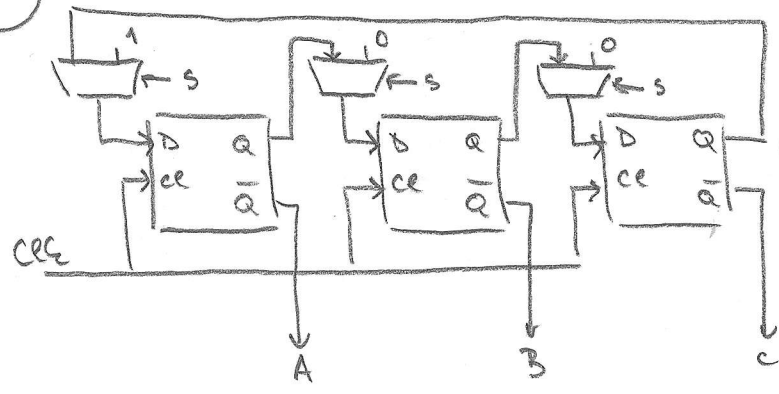
$$724_{10} \rightarrow \dots_2$$

- $724 : 2 = 362 + 0$
- $362 : 2 = 181 + 0$
- $181 : 2 = 90 + 1$
- $90 : 2 = 45 + 0$
- $45 : 2 = 22 + 1$
- $22 : 2 = 11 + 0$
- $11 : 2 = 5 + 1$
- $5 : 2 = 2 + 1$
- $2 : 2 = 1 + 0$
- $1 : 2 = 0 + 1$

$$724_{10} = 1011010100_2$$

$$= 2B4_{16}$$

DIQ 15



v FF vpisujemo ob  $ce \equiv \uparrow$   
 MUX izbirajo vhodne signale v FF:  $S=0$ : stalno 100  
 $S=1$ : pomik v desno  
 tule vpisemo v FF '100'  
 tule pa pomikamo, zaradi tega en FF, v desno

DIQ 16

$-45_{10} = \dots_2$

- $45_{10} : 2 = 22 + 1$
- $22 : 2 = 11 + 0$
- $11 : 2 = 5 + 1$
- $5 : 2 = 2 + 1$
- $2 : 2 = 1 + 0$
- $1 : 2 = 0 + 1$

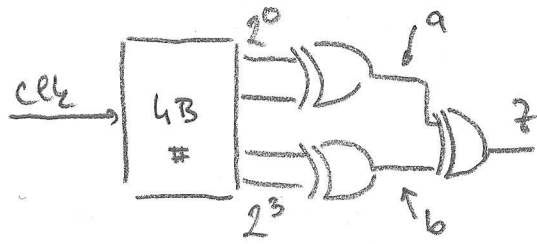
$45_{10} \equiv 101101_2$

komplement:  
 $1111010010_2$   
 $+ 1$

$-45 \equiv 11010011_2$   
 dvojiški komplement



**DIK 17**



$$z = a \oplus b$$

$$= (2^0 \oplus 2^1) \oplus (2^2 \oplus 2^3)$$

$2^3$	$2^2$	$2^1$	$2^0$	b	a	z
0	0	0	0	0	0	0
0	0	0	1	0	1	1
0	0	1	0	0	1	1
0	0	1	1	0	0	0
0	1	0	0	1	0	1
0	1	0	1	1	1	0
0	1	1	0	1	1	0
0	1	1	1	1	0	1
1	0	0	0	1	0	1
1	0	0	1	1	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	1
1	1	0	0	0	0	0
1	1	0	1	0	1	1
1	1	1	0	0	1	1
1	1	1	1	0	0	0

$x_1$	$x_0$	XOR
0	0	0
0	1	1
1	0	1
1	1	0

1  
2  
4  
7  
8  
2  
2  
3 → z=1  
1 → z=1  
2  
2  
3 → z=1  
1 → z=1  
2  
2  
3 → z=1  
2  
3 → z=1  
3 → z=1  
4

↑  
nič smiselnega!  
|||  
določni zapis

↑  
številko nič 0  
0 število 0  
↓  
parity odd/even