		x_3	x_2	x_1	x_0	
✓	(0,1)	0	0	0	–	0
✓	(0,4)	0	–	0	0	
	(1,3)	0	0	–	1	1
✓	(1,5)	0	–	0	1	
✓	(4,5)	0	1	0	–	
✓	(4,12)	–	1	0	0	
✓	(5,13)	–	1	0	1	2
✓	(12,13)	1	1	0	–	
✓	(12,14)	1	1	–	0	
✓	(13,15)	1	1	–	1	3
✓	(14,15)	1	1	1	–	

	x_3	x_2	x_1	x_0	
(0,1,4,5)	0	–	0	–	0
(0,4,1,5)	0	–	0	–	
(4,5,12,13	–	1	0	–	1

(4,12,5,13)	–	1	0	–	1
(12,13,14,15)	1	1	–	–	
(12,14,13,15)	1	1	–	–	2

$$(1,3) = \bar{x}_3 \bar{x}_2 x_0 = a$$

$$(0,1,4,5) = \bar{x}_3 \bar{x}_1 = b$$

$$(4,5,12,13) = x_2 \bar{x}_1 = c$$

$$(12,13,14,15) = x_3 x_2 = d$$

c) $f = \Sigma(0,1,3,4,5,12,13,14,15)$

	0	1	3	4	5	12	13	14	15
a		*	*						
b	*	*		*	*				
c				*	*	*	*		
d						*	*	*	*

$a + b + d$

$x_3x_2 \backslash x_1x_0$	00	01	11	10
00	1	1	1	
01	1	1		
11	1	1	1	1
10				

$(1,3) = \bar{x}_3\bar{x}_2 x_0 = a$

$(0,1,4,5) = \bar{x}_3\bar{x}_1 = b$

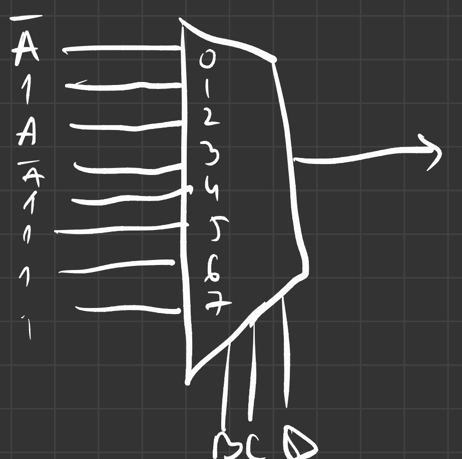
$(4,5,12,13) = x_2\bar{x}_1 = c$

$(12,13,14,15) = x_3x_2 = d$

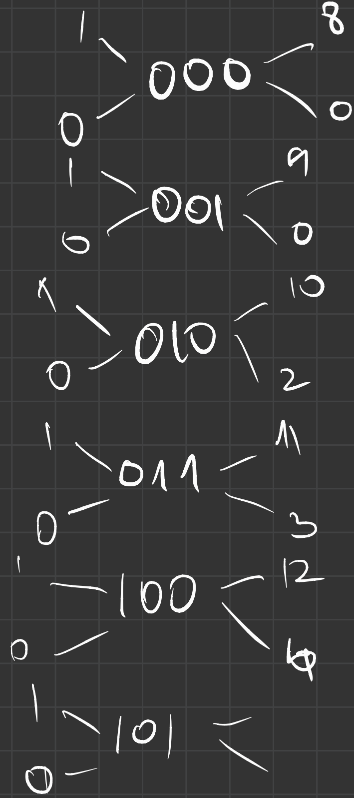
$$f: a+b+d = \bar{x}_3\bar{x}_2 x_0 + \bar{x}_3\bar{x}_1 + x_3x_2$$

$$x_3x_2 + \bar{x}_3\bar{x}_1 + \bar{x}_3\bar{x}_2 x_0$$

d) $f: (\bar{A}+B)\cdot(\bar{A}+C+B)\cdot(A+\bar{C}+D)$



AB \ CD	00	01	11	10
00	1_{0}	1_{1}	1_{3}	0_{2}
01	1_{4}	1_{5}	X_{7}	X_{6}
11	1_{12}	1_{13}	1_{15}	1_{14}
10	0_{8}	X_{9}	0_{11}	X_{10}



S_2

a) $S = A \oplus B \oplus C_{in}$

$C_{out} = AB + AC_{in} + BC_{in}$

A	B	C_{in}	S	C_{out}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1

1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Cin \ AB	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$$C_{in}\bar{A}\bar{B} + \bar{A}B\overline{C_{in}} + C_{in}AB + \overline{C_{in}}A\bar{B}$$

$$C_{in}(\bar{A}\bar{B} + AB) + \overline{C_{in}}(\bar{A}B + \bar{B}A)$$

$$C_{in}(\overline{A \oplus B}) + \overline{C_{in}}(A \oplus B)$$

$$C_{in} \oplus A \oplus B$$

Cin \ AB	00	01	11	10
0	0	0	1	0
1	0	1	1	1

$$f: C_{in}B + C_{in}A + AB$$

b) $21_{10} = 10101_2 = 101011$

1111

C2

C2

0 - 0000	0 - 0000		
1 - 0001	1 - 1111	(15)	
2 - 0010	2 - 1110	(14)	
3 - 0011	3 - 1101	(13)	
4 - 0100	4 - 1100	(12)	
⋮	⋮		
15 1111	15 - 0001	(1)	

A B 1110

$A_3 A_2 A_1 A_0$ $B_3 B_2 B_1 B$

1 — 2 = −1

15 — 14 = 1

15 + (−14) 15 + (−14)

-1 2

1111 +

BCD	C_2
1 – 0001	1 – 1111
2 – 0010	2 – 1110
3 – 0011	3 – 1101
4 – 0100	4 – 1100
5 – 0101	5 – 1011
6 – 0110	6 – 1010
7 – 0111	7 – 1001
8 – 1000	8 – 1000
9 – 1001	9 – 0111
10 – 1010	10 – 0110
11 – 1011	11 – 0101
12 – 1100	12 – 0100
13 – 1101	13 – 0011
14 – 1110	14 – 0010

15 - 1111   15 = 0001

$3 - 4 = -1$

$-5 - (-4) =$

$$\begin{array}{r} 1101 + \\ 0100 \\ \hline 10001 \end{array}$$

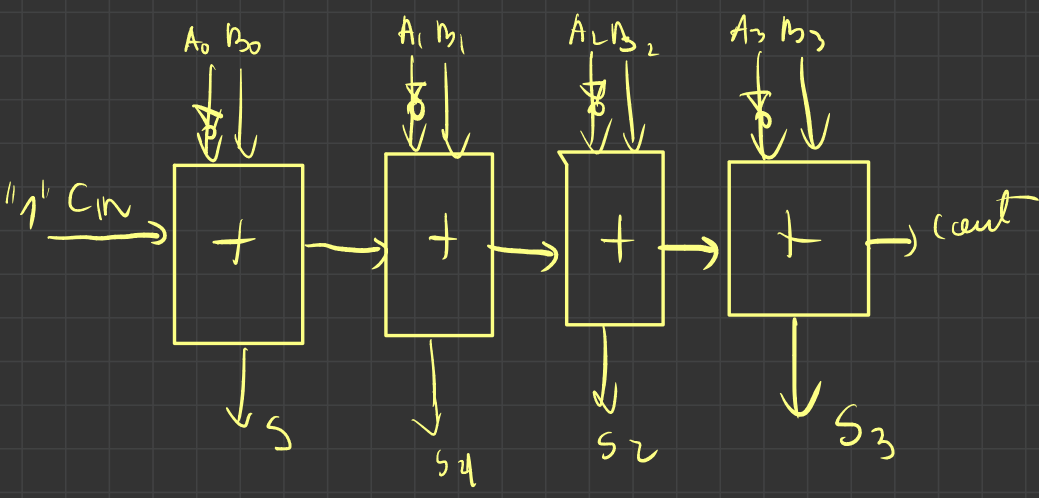
$1110 = 10010$

$2 - 1$

$$\begin{array}{r} 1111 - \\ 1110 \\ \hline 0001 \end{array}$$

$-6 - (-7) =$

$7 - 6$



$A - B = A + B'$

④ $f = \sum(1, 2, 5, 7, 8, 9, 10, 13, 15)$

	X_3	X_2	X_1	X_0	
1	0	0	0	1	
2	0	0	1	0	1
8	1	0	0	0	
5	0	1	0	1	
9	1	0	0	1	2
10	1	0	1	0	
7	0	1	1	1	3
13	1	1	0	1	
15	1	1	1	1	4

	X_3	X_2	X_1	X_0	
✓ (1,5)	0	–	0	1	
✓ (1,9)	–	0	0	1	1
× (2,10)	–	0	1	0	
× (8,9)	1	0	0	–	
× (8,10)	1	0	–	0	
✓ (5,7)	0	1	–	1	
✓ (5,13)	–	1	0	1	2
✓ (9,13)	1	–	0	1	
✓ (7,15)	–	1	1	1	3
✓ (13,15)	1	1	–	1	

	x_3	x_2	x_1	x_0
(1,5,9,13)	-	-	0	1
(1,9,5,13)	-	-	0	1
(5,7,13,15)	-	1	-	1
(5,13,7,15)	-	1	-	1

$(2,10) - \bar{x}_2 x_1 \bar{x}_0 = a$

$(8,9) - x_3 \bar{x}_2 \bar{x}_1 = b$

$(8,10) - x_3 \bar{x}_2 \bar{x}_0 = c$

$(1,5,9,13) - \bar{x}_1 x_0 = d$

$(5,7,13,15) - x_2 x_0 = e$

	1	2	5	7	8	9	10	13	15
a		*					*		
b					*	*			
c					*		*		
d	*		*			*		*	
e			*	*				*	*

$f = d + a + e + b$

$x_3x_2 \backslash x_1x_0$	00	01	11	10
00	0	1	0	1
01	0	1	1	0
11	0	1	1	0
10	1	1	0	1

$$f = \underbrace{x_3\bar{x}_2\bar{x}_1}_{b} + \underbrace{\bar{x}_1 x_0}_{d} + \underbrace{x_2 x_0}_{e} + \underbrace{\bar{x}_2 x_1 \bar{x}_0}_{a}$$

⑦ O. Creț,

$$f = \sum(0, 1, 2, 7, 9, 14, 15) + \sum_{\emptyset}(3, 4, 5)$$

a) $2^3 = 8$

b) FCC și FCD

$AB \backslash CD$	00	01	11	10
00	1_0	1_1	X_3	1_2
01	X_4	X_5	1_7	0_6
11	0_{12}	0_{13}	1_{15}	1_{14}
10	0_8	1_9	0_{11}	0_{10}

FCD: $\bar A\bar B\bar C\bar D + \bar A\bar B\bar C D + \bar A\bar B C\bar D + \bar A B C D + A\bar B\bar C D +$

$A B C \bar D + ABCD$

FCC: $(A+\bar B+\bar C+D)\cdot(\bar A+B+C+D)\cdot(\bar A+B+\bar C+D)$

$\cdot(\bar A+B+\bar C+\bar D)\cdot(\bar A+\bar B+C+D)\cdot(\bar A+\bar B+C+\bar D)$

c)

AB \ CD	00	01	11	10
00	1_0	1_1	X_3	1_2
01	X_4	X_5	1_7	0_6
11	0_{12}	0_{13}	1_{15}	1_{14}
10	0_8	1_9	0_{11}	0_{10}

f_{DM}: $\bar A\bar B + BCD + ABC + \bar B\bar C D$

f_{CM}: $(\bar B + C)\cdot(\bar A + C + D)\cdot(\bar A + B + \bar C)$

$\cdot(A + \bar B + D)$

8) F: $\overline{(x \otimes y)\cdot x}$

G: $(x \otimes y) \oplus \overline{x \cdot y}$

9) $f = \sum(0,1,5,7,9,12) + \sum_{\emptyset}(2,8,11,15)$ ✓

a) $2^4 = 16$ $\quad$ 3 4 6 10 13 14

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

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

AB \ CD	00	01	11	10
00	1_0	1_1	0_3	X_2
01	0_4	1_5	1_7	0_6
11	1_{12}	0_{13}	X_{15}	0_{14}
10	X_8	1_9	X_{11}	0_{10}

c) $f_{DM}: \bar{B}\bar{C} + A\bar{C}\bar{D} + \bar{A}BD$ ✓

11

AB \ CD	00	01	11	10
00	a	0	1	1
01	0	0	1	0
11	1	$\overline{a+c}$	0	bc
10	0	0	c	0

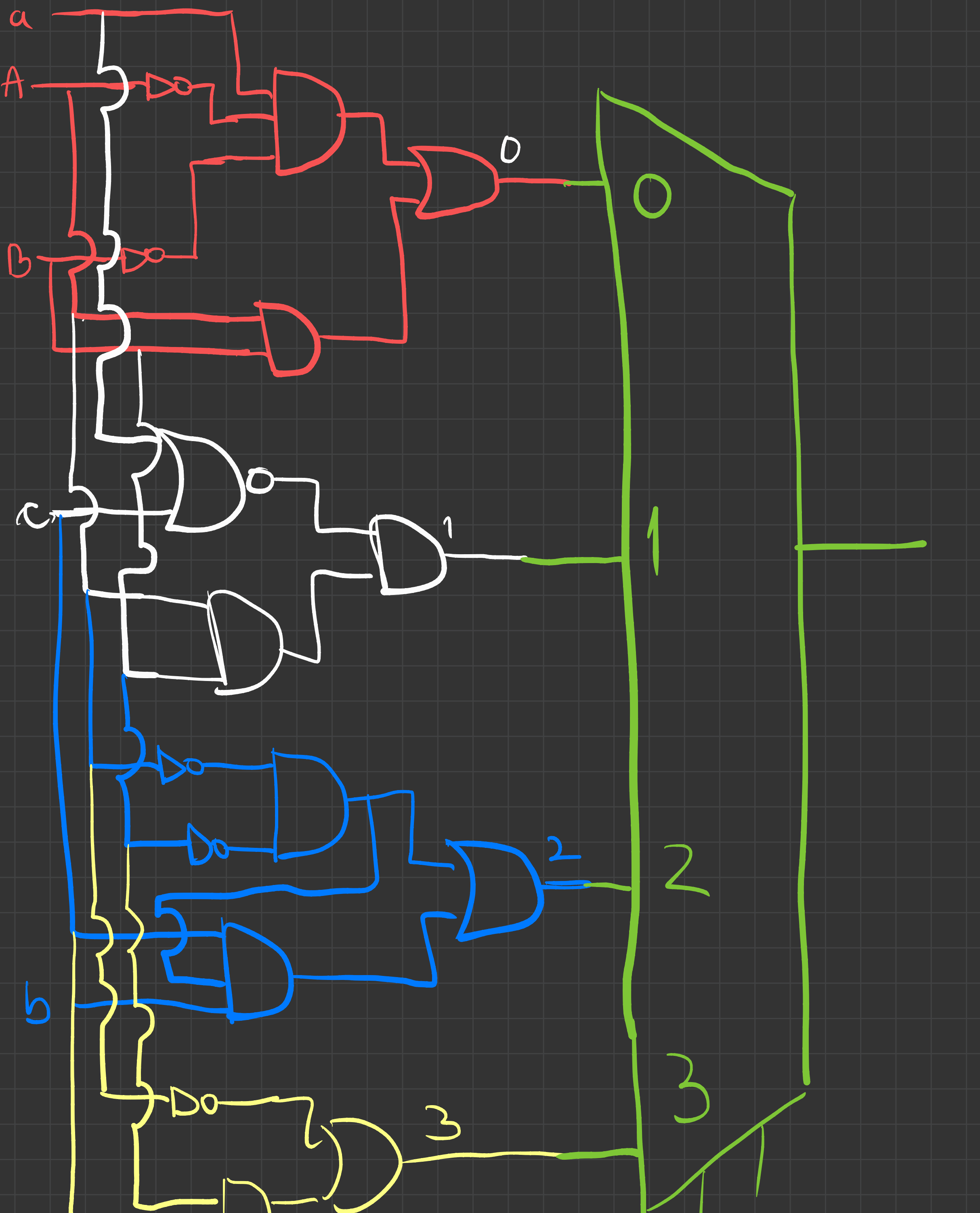
MUX 4:1

$0 - \bar{A}\bar{B}a + AB$

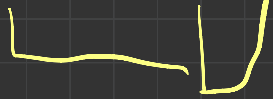
$1 - \overline{a+c} \cdot AB$

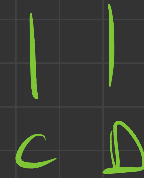
$2 - \bar{A}\bar{B} + AB\,bc$

$3 - \bar{A} + \bar{B}c$



a
A
B
C
b
0
1
2
3
0
1
2
3





AB \ CD	00	01	11	10
00	a	0	1	1
01	0	0	1	0
11	1	$\bar a + c$	0	bc
10	0	0	c	0

D=0

AB \ C	0	1
00	a	1
01	0	0
11	1	b
10	0	0

$f: \bar A \bar B \cdot a + AB bc$

D=1

AB \ C	0	1
00	0	1
01	0	1
11	$\bar a + c$	0
10	0	c

$f: \bar A C + \bar B C c + AB \bar a + c$

g_3	g_2	g_1	g_0	b_3	b_2	b_1	b_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	1	0	0	1	0
0	0	1	0	0	0	1	1
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
0	1	0	1	0	1	1	0
0	1	0	0	0	1	1	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	1	1	0	1	0
1	1	1	0	1	0	1	1
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	0	0	1	1	1	1	0
1	0	0	0	1	1	1	1

b_3:

$g_3g_2 \backslash g_1g_0$	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	1	1	1	1

$$b_3 = g_3$$

b_2:

$g_3g_2 \backslash g_1g_0$	00	01	11	10
00				
01	1	1	1	1
11				
10	1	1	1	1

$$b_2 = \bar{g}_3 g_2 + g_3 \bar{g}_2$$
$$= g_3 \oplus g_2$$

b_1

$g_3g_2 \backslash g_1g_0$	00	01	11	10
00			1	1
01	1	1		
11			1	1
10	1	1		

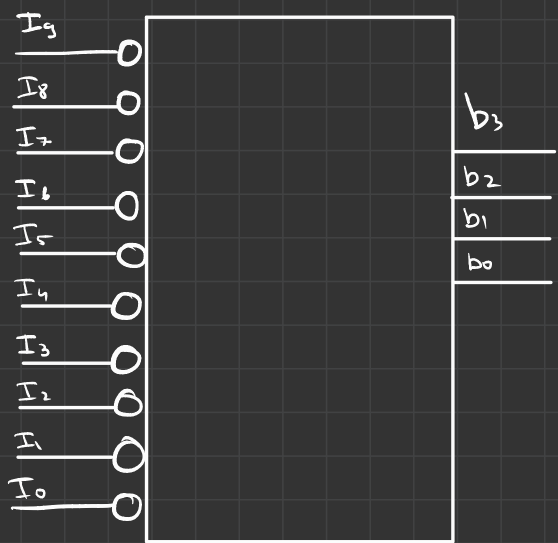
$\bar{A}\bar{B}$ $\qquad\qquad\qquad\qquad$ $A \quad B$

$$b_1 = \underline{\boxed{\bar{g}_3 \bar{g}_2} g_1} + \bar{g}_3 g_2 \bar{g}_1 + \underline{\boxed{g_3 g_2} g_1}$$
$$+ g_3 \bar{g}_2 \bar{g}_1$$

$$b_1 = g_1(\overline{g_3 g_2} + g_3 g_2) + \bar{g}_1(\bar{g}_3 g_2 + g_3 \bar{g}_2)$$

$g_1 \oplus g_2 \oplus g_3$

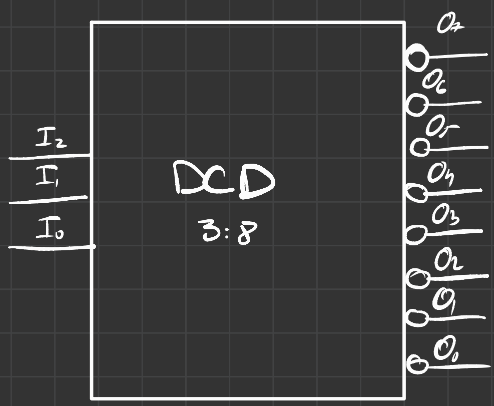
Priority Encoder



I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	2^3	2^2	2^1	2^0
0	1	1	1	1	1	1	1	1	1	0	0	0	0
X	0	1	1	1	1	1	1	1	1	0	0	0	1
X	X	0	1	1	1	1	1	1	1	0	0	1	0
X	X	X	0	1	1	1	1	1	1	0	0	1	1
X	X	X	X	0	1	1	1	1	1	0	1	0	0
X	X	X	X	X	0	1	1	1	1	0	1	0	1
X	X	X	X	X	X	0	1	1	1	0	1	1	0
X	X	X	X	X	X	X	0	1	1	0	1	1	1
X	X	X	X	X	X	X	X	0	1	1	0	0	0
X	X	X	X	X	X	X	X	X	0	1	0	0	1

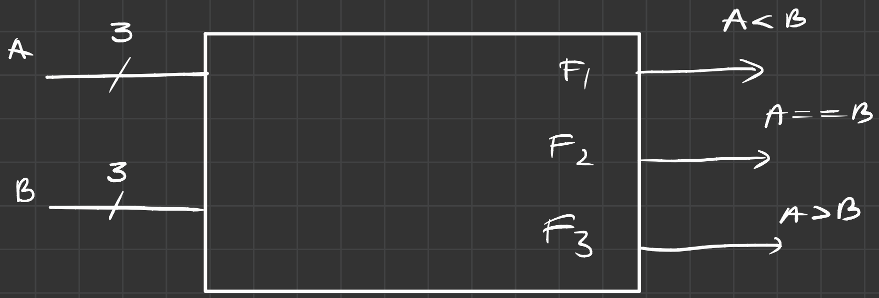
DECODER

4:10 , 4:16 , 3:8



I_2	I_1	I_0	O_0	O_1	O_2	O_3	O_4	O_5	O_6	O_7
0	0	0	0	1	1	1	1	1	1	1
0	0	1	1	0	1	1	1	1	1	1
0	1	0	1	1	0	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1
1	0	0	1	1	1	1	0	1	1	1
1	0	1	1	1	1	1	1	0	1	1
1	1	0	1	1	1	1	1	1	0	1
1	1	1	1	1	1	1	1	1	1	0

COMPARATOR



$$F_1 = (\bar{a}_2 \cdot b_2) + [(a_2 \otimes b_2) \cdot (\bar{a}_1 \cdot b_1)] + [(a_2 \otimes b_2) \cdot (a_1 \otimes b_1) \cdot (\bar{a}_1 \cdot b_1)]$$

$$F_2 = (a_2 \otimes b_2) \cdot (a_1 \otimes b_1) \cdot (a_0 \otimes b_0)$$

$$F_3 = (a_2 \cdot \bar{b}_2) + [(a_2 \otimes b_2) \cdot (a_1 \cdot \bar{b}_1)] + [(a_2 \otimes b_2) \cdot (a_1 \otimes b_1) \cdot (a_0 \cdot \bar{b}_0)]$$

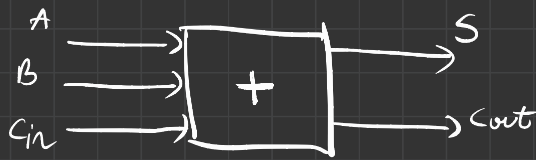
SUMUATOR HALF

A	B	S	Cout
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

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

$C_{out} = A B$

SUMATOR FULL



A	B	Cin	S	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$$S = \bar{A}\bar{B}\,Cin + A\bar{B}\,\overline{Cin} + \bar{A}B\,\overline{Cin} + AB\,Cin$$

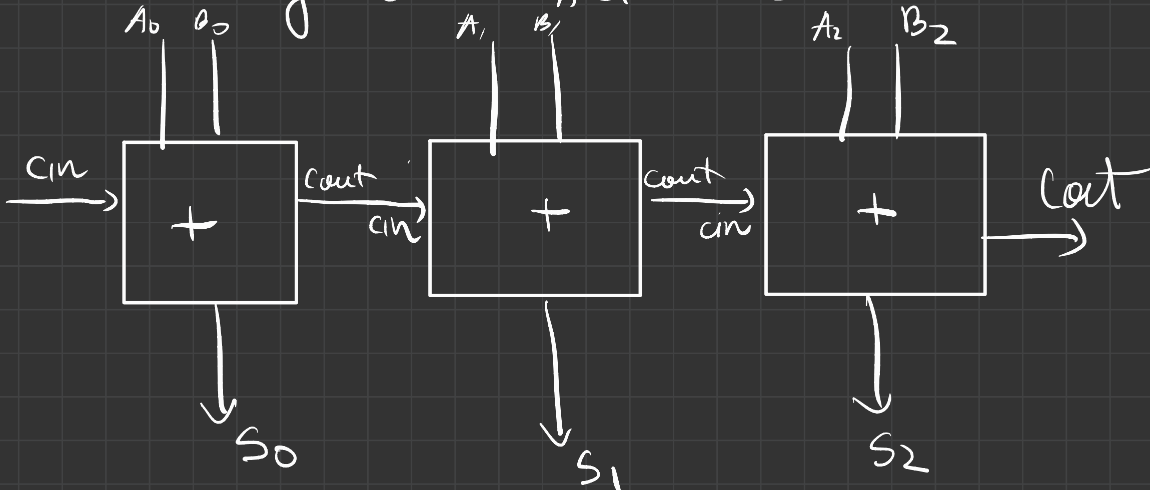
$$= cin(\bar{A}\bar{B} + AB) + \overline{cin}(A\bar{B} + \bar{A}B)$$

$$cin(\overline{A \oplus B}) + \overline{cin}(A \oplus B)$$

$$A \oplus B \oplus Cin.$$

A \ $B c_{in}$	00	01	11	10
0	0	0	1	0
1	0	1	1	1

$$f: B c_{in} + A c_{in} + AB$$



HALF-SUBTRACTOR

A	B	D	Bout
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

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

$$B_{out}: \bar{A}B$$

FULL SUBTRACTOR

A	B	Bin	D	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

$D = A \oplus B \oplus B_{in}$

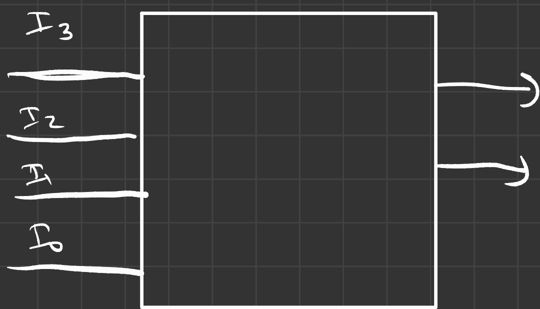
A \ BBin	00	01	11	10
0	0	1	1	1
1	0	0	1	0

$B_{out} = \bar{A} B_{in} + \bar{A} B + B B_{in}$

$B_{in}(\bar{A} + B) + \bar{A} B$

B_{in} \ AB	00	01	11	10
0		1		
1	1	1	1	

$$f: B_{in}\bar{A} + B_{in}B + \bar{A}B$$



I_0	I_1	I_2	I_3	b_1	b_0
1	0	0	0	0	0
X	1	0	0	0	1
X	X	1	0	1	0
X	X	X	1	1	1

b_0:

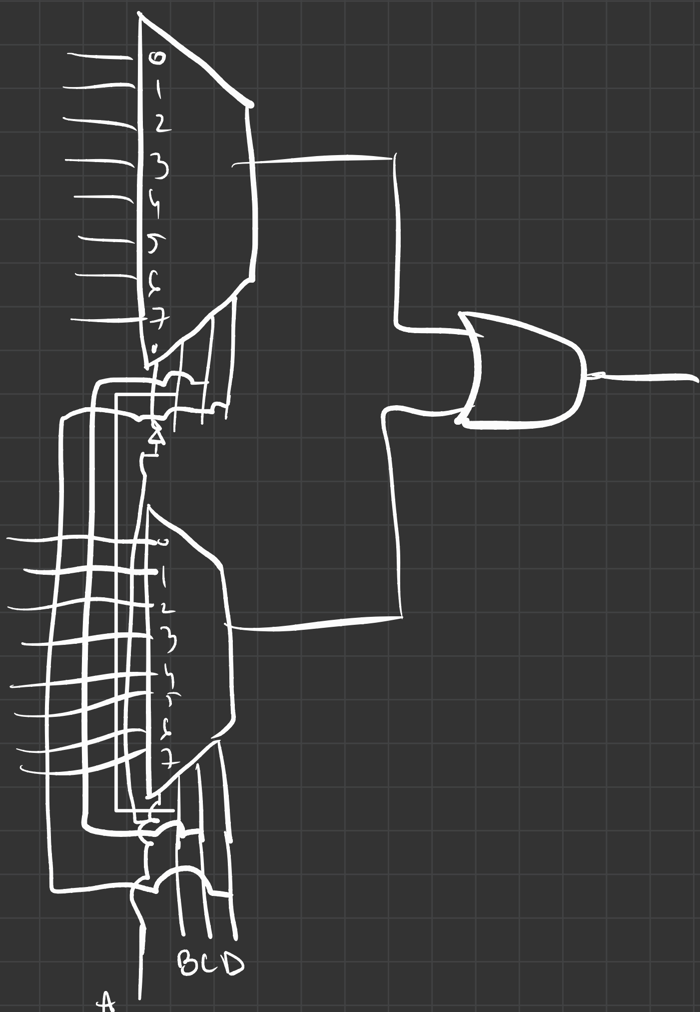
I_3I_2 \ I_1I_0	00	01	11	10
00	0	0	1	1
01	0	0	0	0
11	1	1	1	1
10	1	1	1	1

$$b_1 = I_3 + I_2 \cdot \bar{I}_3$$

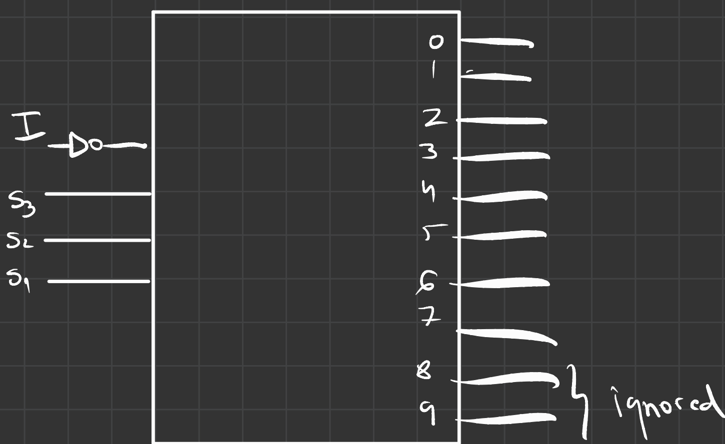
$$b_0 =$$

I_3I_2 \ I_1I_0	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

3.



4) DMUX cu decoder zecimal

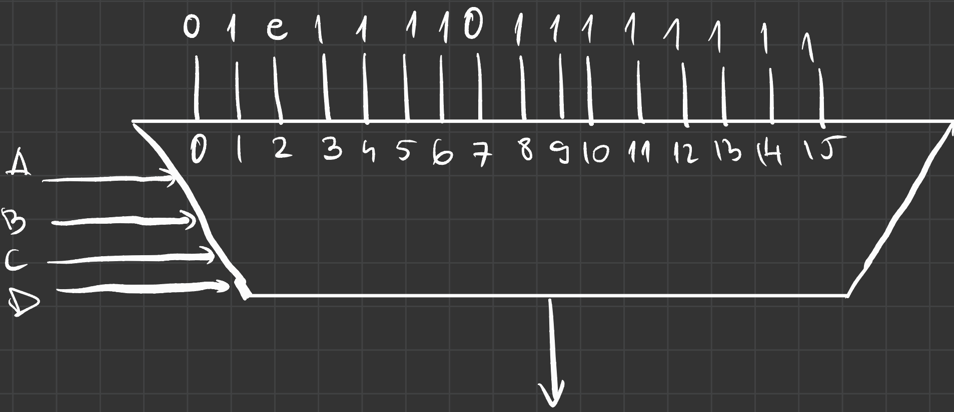


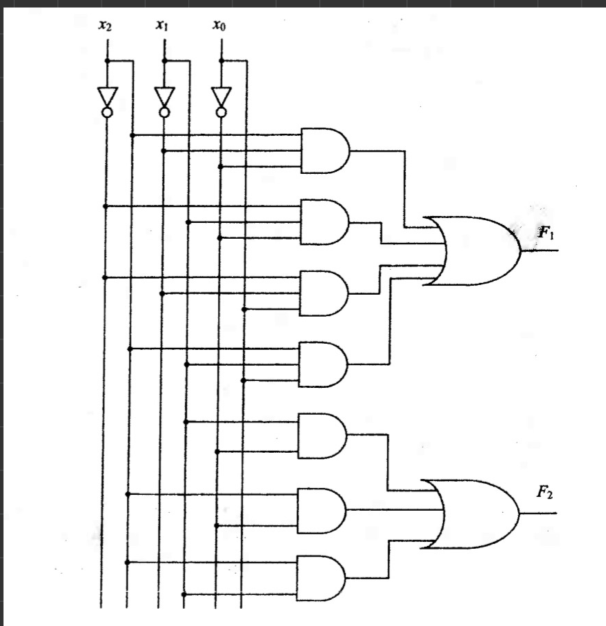
…plementați funcția: 8. Implement the function:

$$f(A,B,C,D,E) = A + \overline{C} \bullet D + B \bullet \overline{D} + \overline{B} \bullet D + \overline{B} \bullet C \bullet E$$

$$f = A + \overline{C}D + B\overline{D} + \overline{B}D + \overline{B}Ce$$

AB \ CD	00	01	11	10
00	0	1	1	e
01	1	1	0	1
11	1	1	1	1
10	1	1	1	1





$$F_1 = x_2\bar{x}_1\bar{x}_0 + \bar{x}_2 x_1 \bar{x}_0 + \bar{x}_2\bar{x}_1 x_0 + x_2 x_1 x_0$$

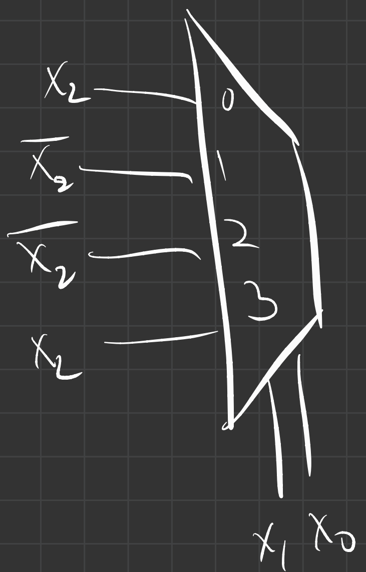
$$F_2 = x_1\bar{x}_0 + x_2\bar{x}_0 + x_2 x_1$$

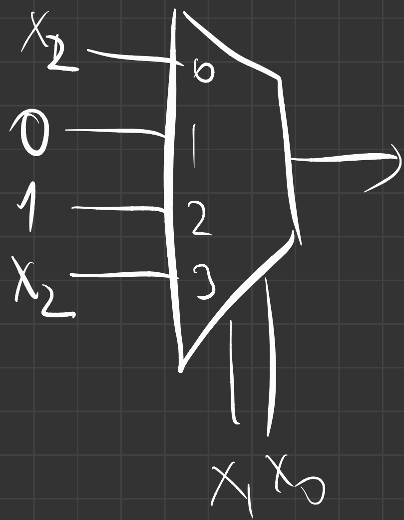
F_1:

$x_2 \backslash x_1x_0$	00	01	11	10
0	0	1	0	1
1	1	0	1	0

F_2

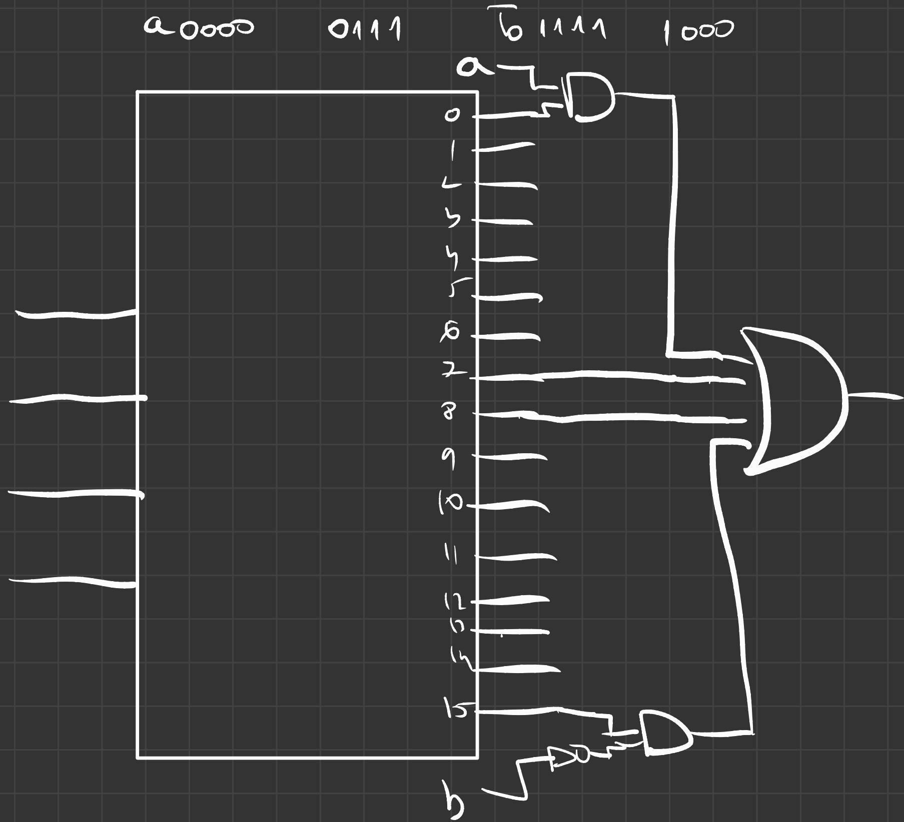
$x_2 \backslash x_1x_0$	00	01	11	10
0				1
1	1		1	1





x_3x_2 \ x_1x_0	00	01	11	10
00	a (0)	**0** (1)	**0** (3)	**X** (2)
01	**0** (4)	**0** (5)	**1** (7)	**X** (6)
11	**X** (12)	**X** (13)	$\bar{b}$ (15)	**X** (14)
10	**1** (8)	**X** (9)	**X** (11)	**X** (10)

$$f = a\,\overline{x_3}\,\overline{x_2}\,\overline{x_1}\,\overline{x_0} + \overline{x_3}\,x_2\,x_1\,x_0 + \bar{b}\,x_3\,x_2\,x_1\,x_0 + x_3\,\overline{x_2}\,\overline{x_1}\,\overline{x_0}$$

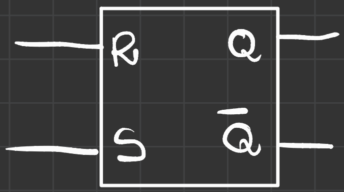


a 0000
0111
b̄ 1111
1000
a
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
b

BISTABILE

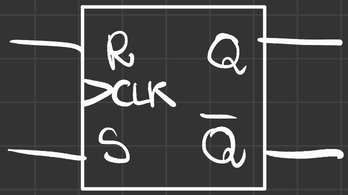
RS asincron

S	R	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	*



RS sincron

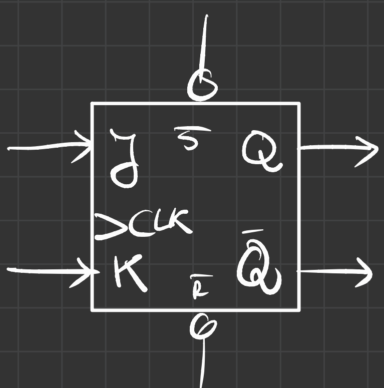
S	R	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	*



Q_n	Q_{n+1}	R	S
0	0	X	0
0	1	0	1
1	0	1	0
1	1	0	1

JK sincron

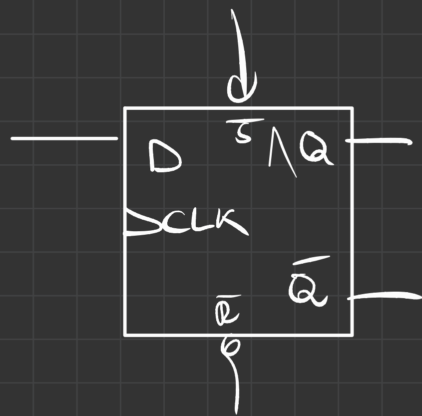
J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$



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

Delay sincron

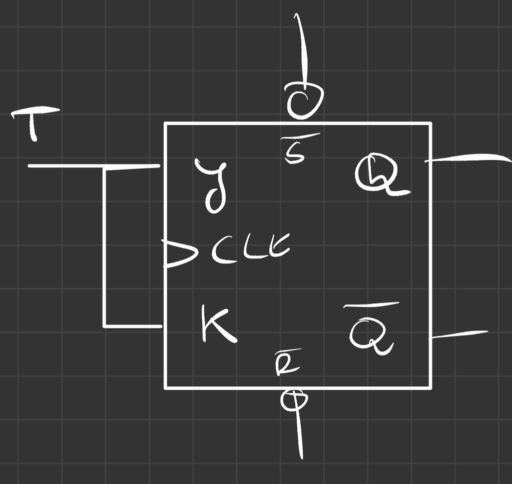
D	Q_{n+1}
0	0
1	1



Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

Toggle sincron

T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$



J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

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

T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

D	Q_{n+1}
0	0
1	1

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

S	R	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	*

Q_n	Q_{n+1}	R	S
0	0	X	0
0	1	0	1
1	0	1	0
1	1	0	X

J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

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

D	Q_{n+1}
0	0
1	1

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

Q_n	Q_{n+1}	R	S
0	0	X	0
0	1	0	1
1	0	1	0
1	1	0	X

1 3 7 2 5 4 6 cu JK

Q_2	Q_1	Q_0	Q_2^+	Q_1^+	Q_0^+	J_2	K_2	J_1	K_1	J_0	K_0	T_2	T_1	T_0
0	0	1	0	1	1	0	X	1	X	X	0	0	1	
0	1	1	1	1	1	1	X	X	0	X	0	1	0	
1	1	1	0	1	0	X	1	X	0	X	1	1	0	
0	1	0	1	0	1	1	X	X	1	1	X	1	1	
1	0	1	1	0	0	X	0	0	X	X	1	0	0	
1	0	0	1	1	0	X	0	1	X	0	X	0	1	
1	1	0	0	0	1	X	1	X	1	1	X	1	1	

Q_n	Q_{n+1}	J	K
0	0	0	x
0	1	1	x
1	0	x	1
1	1	x	0

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

J_2 :

Q_2 \ Q_1Q_0	00	01	11	10
0	X	0	1	1
1	X	X	X	X

$J_2 = Q_1$

K_2

Q_2 \ Q_1Q_0	00	01	11	10
0	X	X	X	X
1	0	0	1	1

$K_2 = Q_1$

1	1	1	0	1
1	0	0	0	0
0	0	0	0	0
1	0	0	1	1
0	1	0	0	0
0	1	0	1	1
0	0	0	1	1

T_2

Q_2 \ Q_1Q_0	00	01	11	10
0	X	0	1	1
1	0	0	1	1

$T_2 = Q_1$

T_1

Q_2 \ Q_1Q_0	00	01	11	10
0	X	1	0	1
1	1	0	0	1

$T_1 = \overline{Q_0} + \overline{Q_2}\,\overline{Q_1}$

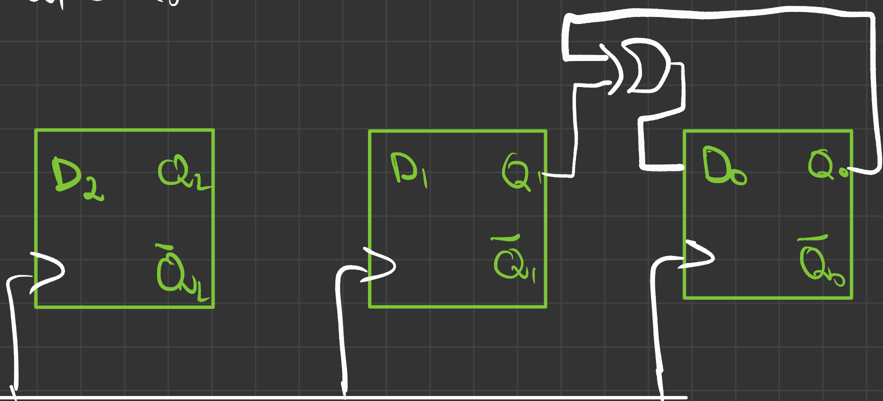
$D_1 = \overline{Q_2 \oplus Q_1 \oplus Q_0}$

Q_2	Q_1	Q_0	Q_2^+	Q_1^+	Q_0^+	D_2	D_1	D_0
0	0	0	0	1	0	0	1	0
0	1	0	0	0	1	0	0	1
0	0	1	1	0	1	1	0	1
1	0	1	1	1	1	1	1	1
1	1	1	0	0	0	0	0	0

0	0	0
1	0	1
0	1	1
1	1	0
0	1	1

1
0
0
1
0

$Q_1 \oplus Q_0 =$



$D_0 = Q_1 \oplus Q_0$

$D_2 = Q_1$

$D_1 = Q_2 + Q_1$

$Q_2 \cdot Q_0 =$

$\otimes$ $\oplus$

$$D_2 = \overline{(Q_2 \cdot Q_1)} \oplus Q_0$$

00 - - 0

- - 00 -

00 - - -

- - - - 0

0 - 00 -

000 - -

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

1 2 3 6 4 7 5 0

Q_2	Q_1	Q_0	Q_2^+	Q_1^+	Q_0^+	T_2	T_1	T_0
0	0	1	0	1	0	0	1	1
0	1	0	0	1	1	0	0	1
0	1	1	1	1	0	1	0	1
1	1	0	1	0	0	0	1	0
1	0	0	1	1	1	0	1	1
1	1	1	1	0	1	0	1	0
1	0	1	0	0	0	1	0	1
0	0	0	0	0	1	0	0	1

T_2: $Q_2 \backslash Q_1Q_0$	00	01	11	10
0	0	0	1	0
1	0	1	0	0

$$T_2 = Q_2\overline{Q}_1Q_0 + \overline{Q}_2Q_1Q_0$$

T_0	00	01	11	10
0	1	1	1	1
1	1	1	0	0

$$T_0 = \overline{Q}_2 + \overline{Q}_1$$

T_1: $Q_2 \backslash Q_1Q_0$	00	01	11	10
0	0	1	0	0
1	1	0	1	1

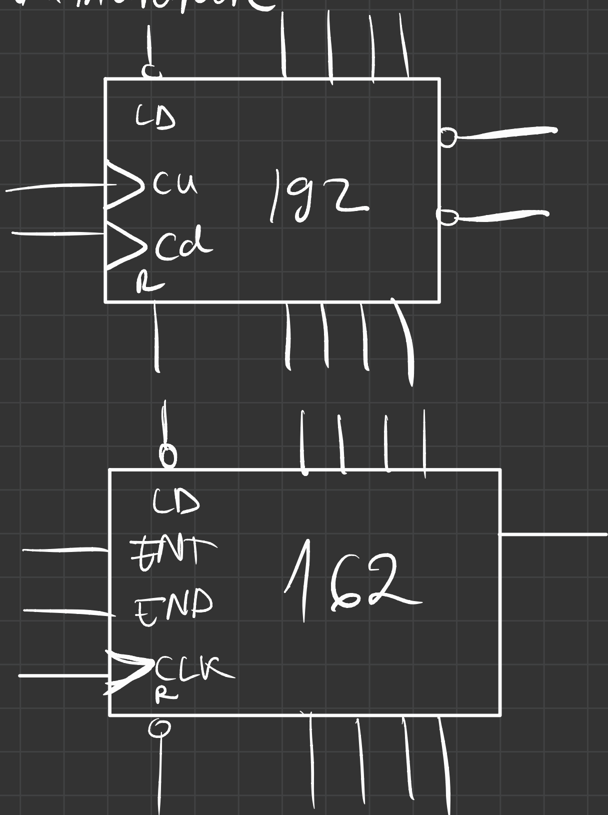
$$T_1: Q_2\overline{Q}_0 + \overline{Q}_2\overline{Q}_1Q_0 + Q_2Q_1$$

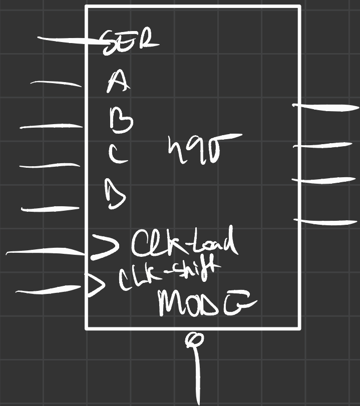
Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

$$T_0 = \overline{Q_2 \cdot Q_1}$$

Numărătoare

(0,9)



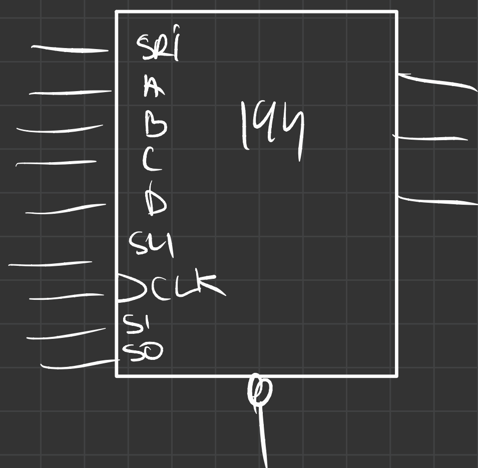


Mode 0 - Clk shift

Ser

Mode 1 - Clk Load

memorare

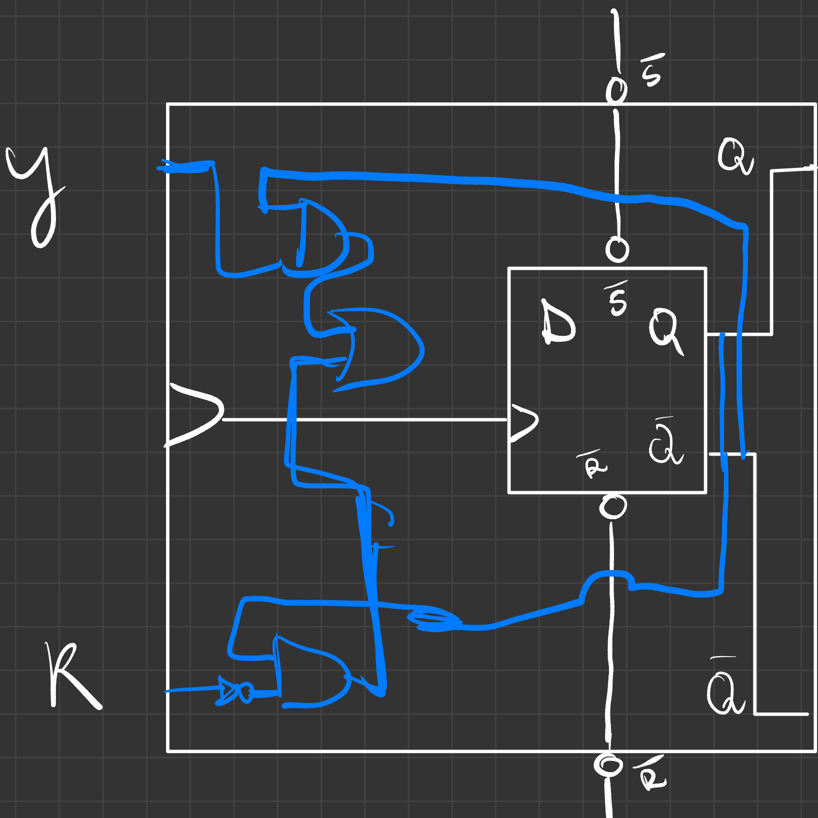


S_1	S_0	
0	0	hold
0	1	R shift
1	0	L shift
1	1	Load

SINTEZA

Mealy automats → inputs and current state

Moore automata → current state



Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

S / J	R / K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

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

S / J	R / K	Q_n	Q_{n+1}	D
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

$y \backslash KQ_n$	00	01	11	10
0	0	1	0	0
1	1	1	0	1

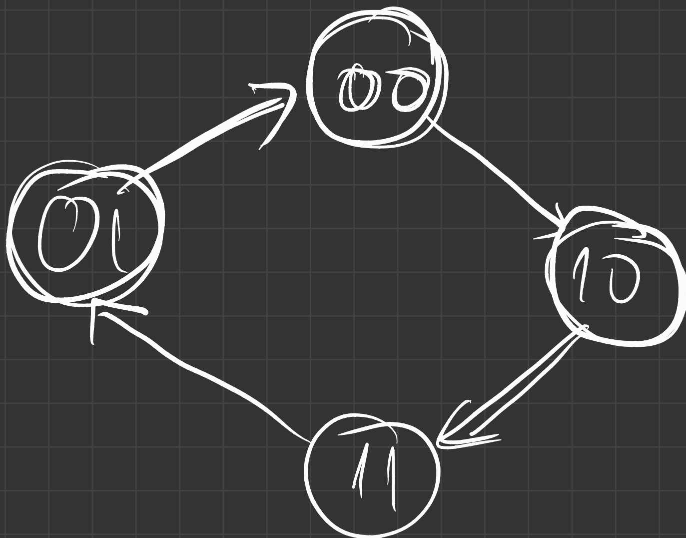
$$D = \overline{K}Q_n + y\overline{Q_n}$$

0	1	1
0	0	0
1	1	0
1	0	1

$$J_1 = K_1 = Q_1 \oplus \overline{Q_0} = Q_1Q_0 + \overline{Q_1}\,\overline{Q_0}$$

$$J_0 = K_0 = Q_0 \oplus Q_1 = Q$$

		S	R	S	R		
Q_1	Q_0	J_1	K_1	J_0	K_0	Q_1^+	Q_0^+
0	0	1	1	0	0	1	0
0	1	0	0	1	1	0	0
1	0	0	0	1	1	1	1
1	1	1	1	0	0	0	1



Q_n	Q_{n+1}	Y	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

$T = A \cdot Q_0$

$$Y = K = Q_1 \oplus Q_0 \qquad \overset{1\ 0}{Q_1\overline{Q_0}} + \overset{0\ 1}{\overline{Q_1}Q}$$

Q_1	Q_0	A	T	Y	K	Q_1^+	Q_0^+
0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	1	0	0	1	1	0	0
0	1	1	1	1	1	1	0
1	0	0	0	1	1	1	1
1	0	1	0	1	1	1	1
1	1	0	0	0	0	0	1
1	1	1	1	0	0	0	1

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

3

-2^2 ; 2^2

-4 4

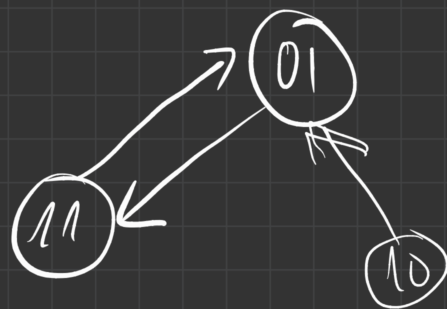
000	0
001	1
010	2
011	3
100	-0
101	-1
110	-2
111	-3

$$D_1 = Q_0 \cdot \overline{Q_1}$$

$$D_0 = Q_1 + Q_0$$

Q_1	Q_0	D_1	D_0	Q_1^+	Q_0^+
0	0	0	0	0	0
0	1	1	1	1	1
1	0	0	1	0	1
1	1	0	1	0	1

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1



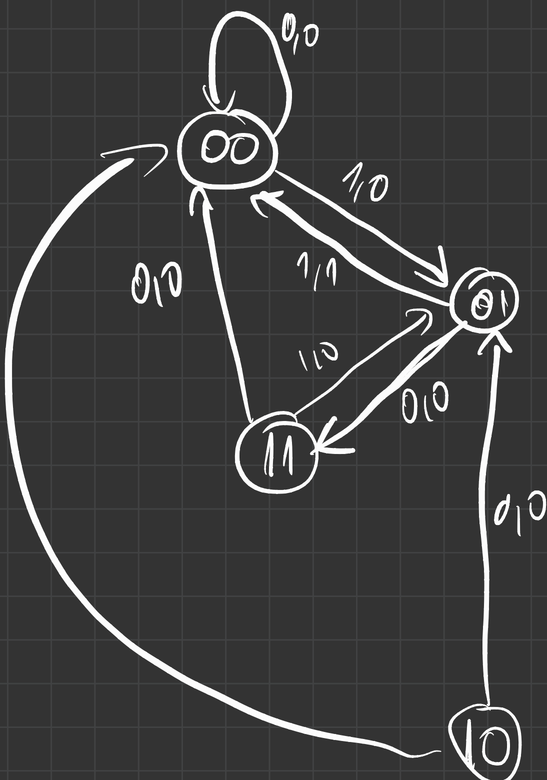
$$J_1 = \bar{A} Q_0 \quad , \quad K_1 = 1 \qquad \Big| \qquad Z = \overline{Q_1} Q_0 \bar{A}$$

$$J_0 = K_0 = Q_1 \oplus A$$

Q_1	Q_0	A	J_1	K_1	J_0	K_0	Q_1^+	Q_0^+	Z
0	0	0	0	1	0	0	0	0	0
0	0	1	0	1	1	1	0	1	0
0	1	0	1	1	0	0	1	1	0
0	1	1	0	1	1	1	0	0	1
1	0	0	0	1	1	1	0	1	0
1	0	1	0	1	0	0	0	0	0

1	1	0	1	1	1	1	0	0	0
1	1	1	0	1	0	0	0	1	0

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



$1101 = 4 \Rightarrow m = 4$

$$2^p \ge (m+p)+1$$

$$2^p \ge p+5 \Rightarrow 3$$

P_3	P_2	P_1
C_1	C_2	C_3
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

loc unde stau

câți biți 1 ai
par => 0
imp => 1

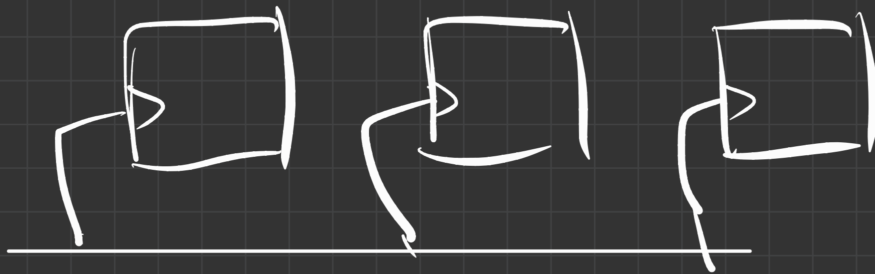
$p_1 = \{1, 3, 5, 7\}$

$p_2 = \{2, 3, 6, 7\}$

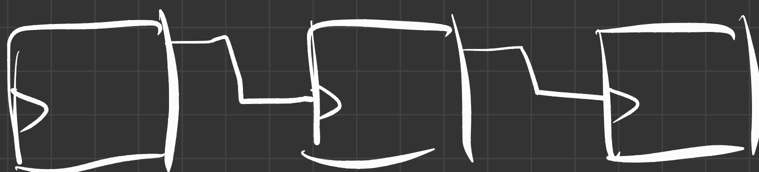
$p_3 = \{4, 5, 6, 7\}$

1	2	3	4	5	6	7
P_1	P_2	m_1	P_3	m_2	m_3	m_4
1	0	1	0	1	0	1

sincron



asincron cresc



asincron desc