ASC

- $12 = 1\cdot10^1 + 2\cdot10^0$ în baza 10

  $12 = 1100 = 1\cdot2^3 + 1\cdot2^2 + 0\cdot2^1 + 0\cdot2^0$ în baza 2

- $(3145)_{16} = \overline{C49}$

$$\begin{array}{r|l} 3145 & 16 \\ \underline{16} & \overline{196} \\ =154 & \\ \underline{144} & \\ =105 & \\ \underline{96} & \\ ==9 & \end{array} \qquad \begin{array}{r|l} 196 & 16 \\ \underline{16} & \overline{12} \\ =36 & \\ \underline{32} & \\ =4 & \end{array} \qquad \begin{array}{r|l} 12 & 16 \\ \underline{0} & \overline{0} \\ 12 & \\ \parallel & \\ C & \end{array}$$

- $(107)_2 = \overline{1101011}$

$$\begin{array}{r|l} 107 & 1 \\ 53 & 1 \\ 26 & 0 \\ 13 & 1 \\ 6 & 0 \\ 3 & 1 \\ 1 & 1 \\ 0 & \end{array}$$

- x, y mașini

  $P_x > P_y \iff T_x < T_y$

  $$\boxed{\frac{P_x}{P_y} = n \iff \frac{T_y}{T_x} = n}$$

  s = secunde, c = cicli

  $F = \frac{1}{s}$ ← durata ciclului

  ↑

  frecvența

$$\boxed{T = C \times D = \frac{C}{F}}$$

cicli executați

CPI ← cicli pe instrucțiune

I ← instrucțiuni executate de program

$$CPI = \frac{C}{I}$$

$$\boxed{T = I \times CPI \times D = \frac{I \cdot CPI}{F}}$$ ecuația elementară a performanței

$CPI_K = CPI\ ClK$ ← nr. clasei de i

i_K ← nr de instrucțiuni din clasa K

$$\boxed{C \simeq \sum_{K=1}^{n} (CPI_K \times I_K)}$$

$$\boxed{FI = \frac{I}{T}} \qquad \boxed{MIPS = \frac{I}{T \cdot 10^6}}$$

Ex

	C_+	C_*
Timp 1	10 c	100 c
Timp 2	12 c	70 c

$> 93,75\%$ => implementare $\begin{cases} 1 \\ 2 \end{cases}$

$<$

$$C^{P,j} = C_+^{P,j} + C_*^{P,j}$$

$$I^P = I_+^P + I_*^P$$

$$C^{P,j} = C_+^{P,j} + C_*^{P,j} = I_+^P \cdot C_+^j + I_*^P \cdot C_*^j = I^P \cdot a^P \cdot C_+^j + I^P(1-a^P) \cdot C_*^j =$$

$$= I^P(a^P(C_+^j - C_*^j) + C_*^j)$$

$$C^{P,1} < C^{P,2} \iff a^P(10-100)+100 < a^P(12-70)+70$$

$$C^{P,1} = I^P(a^P(10-100)+100)c$$

$$C^{P,2} = I^P(a^P(12-70)+70)c$$

$$C^{P,1} < C^{P,2} \iff a^P(-90)+30 < a^P(-58)$$

$$a^P(-90+58) < -30$$

$$a^P(-32) < -30 \quad |\cdot(-1)$$

$$a^P > \frac{30}{20} = 93,75\%$$

Ex M_1, M_2 mașini

Pg_1, Pg_2 programe

	M_1 (200 MHz)	M_2 (300 MHz)
Pg_1	10 s $200 \cdot 10^6$ instrucțiuni	5 s $160 \cdot 10^6$ instrucțiuni
Pg_2	3 s	4 s

1) ~~Cât~~ Ce mașină e mai rapidă pentru fiecare program și cu cât?

$P_{M_j}^{Pg_i}$ $\quad$ $T_{M_j}^{Pg_i}$

$Pg_1 \longrightarrow M_2$, $Pg_2 \longrightarrow M_1$

$$\frac{P_{M_2}^{Pg_1}}{P_{M_1}^{Pg_2}} = \frac{T_{M_1}^{Pg_1}}{T_{M_2}^{Pg_1}} = \frac{10\,s}{5\,s} = 2\,s \quad \Bigg| \quad \frac{P_{M_1}^{Pg_2}}{P_{M_1}^{Pg_2}} = \frac{T_{M_2}^{Pg_2}}{T_{M_1}^{Pg_2}} = \frac{4\,s}{3\,s} = 1,(3)\,s$$

2) Care este frecvența de executare a programului 1 pe mașina $j=1,2$?

$$FI^{P_1}_{M_1} = \frac{I^{P_1}_{M_1}}{T^{P_1}_{M_1}} = \frac{200 \cdot 10^6 i}{10 s} = 20 \cdot 10^6 i/s = 20 \text{ mips}$$

$$FI^{P_1}_{M_2} = \frac{I^{P_1}_{M_2}}{T^{P_1}_{M_2}} = \frac{160 \cdot 10^6 i}{5 s} = 32 \text{ mips}$$

3) $CPI^{Pg_1}_{M_j}$ $j=1,2$?

$$CPI^{Pg_1}_{M_1} = \frac{C^{Pg_1}_{M_1}}{I^{Pg_1}_{M_1}} = \frac{T^{P_1}_{M_1} \cdot F_{M_1}}{I^{P_1}_{M_1}} = \frac{10 s \cdot 200 \text{ MHz}}{200 \cdot \cancel{10^6} i} = 10 c/i$$

$$CPI^{Pg_1}_{M_2} = \frac{C^{Pg_1}_{M_2}}{I^{Pg_1}_{M_2}} = \frac{5 \cdot 160 \cdot 10^6 \text{ MHz}}{160 \cdot 10^6 I} = 9,375 c/i$$

Ex $M_1 \to$ întregi
$M_2 \to$ întregi
UM $\to$ virgulă mobilă

M_1 (100 MHz)

cl	CPI
* UM	6
+ UM	4
/ UM	20
i	2

M_2 (100 MHz)

cl	CPI
i	2

cl de UM	Nr de i
* UM	30
+ UM	20
/ UM	50

P
* UM = 10%
+ UM = 15%
/ UM = 5%
i = 70%

$$\left(\overline{101,01(110)}\right)_2^{-1} = \left(\overline{101} + \frac{1110-1}{\overline{11100}}\right)_2^{-1} = (\overline{101})_2^{-1} + \frac{(1110-1)_2^{-1}}{(\overline{11100})_2^{-1}} =$$

$$= (\overline{101})_2^{-1} + \frac{(1110)_2^{-1} - (1)_2^{-1}}{(\overline{11100})_2^{-1}} = 5 + \frac{14-1}{28} = 5 + \frac{13}{28} = \frac{153}{28} = 5,464(28571$$

- $\overline{2B,8}_{16} = \overline{101011,1}_2$ $\qquad \overbrace{0010}^{2}, \overbrace{1011}^{B}, \overbrace{1000}^{8}$

- $\overline{101100,1012}_2 = \overline{2C,A}$ $\qquad \underbrace{0010}_{2} \cdot \underbrace{1100}_{C}, \underbrace{1010}_{A}$

- $b=2$

```
 111011 +
  10111
-------
1010010
```

- $b=16$

```
DA -
5C
--
7E
```

$\left(\begin{matrix} 10 & -12 \\ A & -C \end{matrix}\right)$

- $b=2$

```
      101,11 *
       1,101
      ------
       10111
     10111
   10111
  ----------
  1001.01011
```

- $b=2$

```
10100,011 | 11
11        |---------------
 100      | 110,110(01)
  11
 100
  11
   11
   11
    1
    0
   10
    0
  100
```

$$C_1 = 6 * I * \frac{10}{100} + 4 * I * \frac{15}{100} + 20 * I * \frac{5}{100} + 2 * I * \frac{70}{100} =$$

$$= \frac{I}{100}(60 + 60 + 100 + 140) = 360 \cdot \frac{I}{100} = 3{,}6\ Ic$$

$$C_2 = I * \frac{10}{100} * 30 * 2 + I * \frac{15}{100} * 20 * 2 + I * \frac{5}{100} * 50 * 2 + I * \frac{70}{100} * 2 =$$
$$= \frac{I}{100}(600 + 600 + 500 + 140) = \frac{1840}{100} Ic = 18{,}4\ Ic$$

$$FI = \frac{I}{T} = \frac{I}{\frac{c}{F}} = \frac{I \times F}{c \times 10^6}$$

$$T = \frac{c}{F}$$

$$MIPS\ 1 = \frac{I * 100\,\cancel{MHz}}{3{,}6\,Ic \cdot \cancel{10^6}} = \frac{100}{3{,}6}\ MIPS$$

$$MIPS\ 2 = \frac{I * 100\,\cancel{MHz}}{18{,}4\,c * \cancel{10^6}} = \frac{100}{18{,}4}\ MIPS$$

- $(19{,}45)_2 = \overline{10011{,}01(1100)}$

19	1
9	1
4	0
2	0
1	1
0	

$0{,}45 * 2 = 0{,}9$
$0{,}9 * 2 = 1{,}8$
$0{,}8 * 2 = 1{,}6$
$0{,}6 * 2 = 1{,}2$
$0{,}2 * 2 = 0{,}4$
$0{,}4 * 2 = 0{,}8$
$0{,}8 * 2 = 1{,}6$

- $(8{,}(6))_2 = \overline{1000{,}(10)}$

8	0
4	0
2	0
1	1
0	

$0{,}(6) * 2 = \frac{6}{9} * 2 = \frac{2}{3} * 2 = \frac{4}{3} = 1 + \frac{1}{3}$

$\frac{1}{3} * 2 = 0 + \frac{2}{3}$

$\frac{2}{3} * 2 = \frac{4}{3} = 1 + \frac{1}{3}$

Ex $[x]_n^{\Delta} \longrightarrow$ în complement față de 2 (în PC)

Δ ← semn

n ↘ pe câți biți

$$[x]_n^{\Delta} = \begin{cases} (x)_2^n & \text{, dacă } x \geq 0 \\ (2^n + x)_2^n & \text{, dacă } x < 0 \end{cases}$$

1) $97 - 100$ în C_2 pe 8 biți

Determinăm $[97]_8^{\Delta}$, $[100]_8^{\Delta}$

$\boxed{\sim}\ [100]_8^{\Delta} = \ldots$

↖ complementul pe 8 biți

$1 \oplus (\boxed{\sim}\ [100]_8^{\Delta}) = \ldots$

100	0
50	0
25	1
12	0
6	0
3	1
1	1
0	

97	1
48	0
24	0
12	0
6	0
3	1
1	1
0	

$[100]_8^{\Delta} = (100)_8^2 = 01100100$

$\boxed{\sim}\ [100]_8^{\Delta} = 10011011$

$1 \oplus (\boxed{\sim}\ [100]_8^{\Delta}) = 10011100$

$[97]_8^{\Delta} = (97)_8^2 = 01100001$

$[97]_8^{\Delta} \oplus (1 \oplus (\boxed{\sim}\ [100]_8^{\Delta})) = 11111101 = (2^8 - 1 - 2)_2^8 = (253)_2^8 = (z + 256)_2^8$

$(253)_2^8 = (z + 256)_2^8$

$253 = z + 256 \Rightarrow z = -3$

Rotație

s	c	f
1	K	m-K-1 / p-1

$p = n - K$

$E_{min} = -2^{K-1} + 2$

$E_{max} = 2^{K-1} - 1 = bias$

$x = (-1)^s \times 2^E \times \overline{1f}$

$E_{min} \leq E \leq E_{max}$

s	E + bias	f

$1 \leq E + bias \leq 2^K - 2$

între 0...01 și 1...10

Nr. denormalizate

$x = (-1)^s * 2^{E_{min}} \times \overline{0,f}$ $\quad f \neq 0$

s	0	f

$0,00.001.0010\,1101 \quad \times 2$

$\pm 2^{E_{min}} \times \overline{1.0} = \pm 2^{E_{min}}$

$\overline{0.1} < 1$

$x = (-1)^s \times 2^{E_{min}} \times \overline{0,0}$

s	0	0

$x = \pm \infty$

s	1 ... 1	0

x = NaN $\quad$ sNaN $\quad$ qNaN

1	1 ... 1	≠ 0

Să reprezentăm ca single $x = 7{,}75$

$n = 32$

$K = 8$

$p = 24$

$E_{min} = -126$

$E_{max} = bias = 127$

7	1
3	1
1	1
0	

$0,75 * 2 = 1,5$

$0,5 * 2 = 1,0$

$0 * 2 = 0,$

$\overline{111,11} = \overline{1,1111} * 2^2$

$-126 \leq 2 \leq 127$

$4 \leq 32$

$s = 0$

$(2 + 127)_2^8 = (129)_2^8 = 10000001$

$c = 10000001$

$f = \underbrace{1111\,0...0}_{32\ biți}$

$\overbrace{\underbrace{0100}_{4}.\underbrace{0000}_{0}.\underbrace{1111}_{f}.\underbrace{10}_{8}\underbrace{..}_{0}\underbrace{..}_{0}\underbrace{..}_{0}\underbrace{0}_{0}}^{32\ biți}$

40f80000

- n biți, K caracteristica

$P = n - K$ mantisa

$E_{min} = -2^{K-1} + 2$

$E_{min} = 2^{K-1} - 1$

$X = (-1)^s \cdot 2^E \cdot 1f$

$\underbrace{|s\,|\,E+bin\,|\,f|}$

$E_{min} \leq E \leq E_{max}$

$1 \leq E_{bin} \leq 2^K - 2$

0..01   0..0   1...10

1--1

$X = (-1)^s * 2^{E_{min}} * \overline{0,f}$ $f \neq 0$

$\underbrace{|s\,|\,0\,|\,f|}$

$X = (-1)^s * 2^{E_{min}} * \overline{0,0}$

$\underbrace{|s\,|\,0\,|\,0|}$

$X = \pm\infty$

$\underbrace{|s\,|\,1 - 1 - 1\,|\,0|}$

$X = NaN$

$\underbrace{|s\,|\,1 \ldots 1\,|\,\neq 0|}$ qNaN quiet NaN; sNaN single NaN

- single:

$n = 32$ biți $K = 8$

$P = 24$

$|f| = 23$

$E_{min} = -126$

$E_{max} = 127$

7.75

Ex $n = 8$ $K = 3$

$P = 5$ $|f| = 4$

$E_{min} = -2^2 + 2 = -2$

$E_{max} = 2^2 - 1 = 3$

$2^{-2} = 0,25$

Să se reprezinte în virgulă mobilă

$X = -0,125$

$(-0,125)_2 = -\overline{0,001} = -\overline{1,0} \cdot 2^{-3} = -\overline{0,1} \cdot 2^{-2}$

$0,125 * 2 = 0,25$

$0,25 * 2 = 0,5$

$0,5 * 2 = 1,0$

$0 * 2 = 0$

$-2 \leq -3 \leq 3$

$s = 1$

$C = 000$

$f = 1000$

$\overline{\underbrace{1000}_{8}\,\underbrace{1000}_{8}}_2 = \overline{88}_{16}$

Ex Interpretați ca single BF000000

$\underbrace{1}_{s}, \underbrace{01111110}_{c}\overbrace{\underbrace{0 - - 0}_{24}}^{f}$

$c \neq \begin{matrix} 0 - - 0 \\ 1 - - 1 \end{matrix}$ n. normalizat

$s = 1$

$E + \text{bias} = (01111110)_2^{-1} = 126 \Rightarrow E = 126 - 127 = -1$

$\overline{1.f} = \overline{1.0}$

$\overline{\underbrace{1 - - 1}_{8}} - \overline{\underbrace{10 - - 0}_{7}} - \overline{1} = 2^8 - 1 - 2^7 - 1 = 128 - 2 = 126$

$X = (-1)^1 \ast 2^{-1} \times \overline{1.0} = -1 \ast 2^{-1} \ast 1 = -0,5$

Ex Interpretați în virgulă mobilă $n = 8$ $K = 3$: 85

$85_{16} = \overline{\underbrace{1}_{s}\underbrace{000}_{c}\underbrace{0101}_{f}}_2$

$s = 1$

$E = 2^{-2}$

$m = \overline{0,0101}$

$X = (-1)^1 \ast 2^{-2} \ast \overline{0,0101} = -\frac{1}{2^2}\left(\frac{1}{2^2} + \frac{1}{2^4}\right) = -\left(\frac{1}{2^4} + \frac{1}{2^6}\right) =$

$= -\frac{2^2+1}{2^6} = -\frac{2^2+1}{2^6} = -\frac{5}{64} = -0,078125$

Ex Adunați ca single nr. $x = 7,75$ și $y = -0,5$

$x = 7,75 = \overline{1,1111} * 2^2$

$y = -0,5 = -\overline{1,0} * 2^{-1}$

$-1 < 2$

modificăm y

$y = -\overline{1,0} * 2^{-1} = -\overline{0,0010} * 2^2$

$$\begin{array}{r} 1,1111 - \\ 0,0010 \\ \hline 1,1101 \end{array}$$

$x + y = \overline{1,1101} * 2^2 = \frac{29}{16} \cdot 4 = 7,25$

1101 încape pe 23 biți? DA

$1,1101 = \frac{11101}{2^4} = \frac{\overline{11111} - \overline{10}}{2^4} = \frac{29}{16}$

Ex Inmulțirea ca single $7,75 * (-0,5)$

$2 + (-1) = 1$

$$\begin{array}{r} 1,1111 * \\ 1,0 \\ \hline 1,1111 \end{array}$$

$|x * y| = \overline{1,1111} * 2^1 = -\underbrace{\overline{1,1111}}_{\text{încape pe 23 biți? DA}} * 2^1 = -1 \cdot \frac{11111}{2^4} \cdot 2 = -\frac{31}{8} = -3,875$

normalizat

Algebre boole

$AB: (B, +, \cdot, -, 0, 1)$

asociativitatea $(ab)c = a(bc)$
$(a+b)+c = a+(b+c)$

comutativitatea $ab = ba$ $\Longrightarrow$ latice

absorție $a(a+b) = a$ $\quad a+ab = a$

distributivitate $a(b+c) = ab+ac$
$a+bc = (a+b)(a+c)$

mărginire $0 \leq a \leq 1$ $(0+a=a, 0\cdot a = 0, 1+a = 1, 1\cdot a = 1)$

Într-o latice se definește relația de ordine $a \leq b \Leftrightarrow$
$\Leftrightarrow ab = a \Leftrightarrow a+b = b$ și rez. că $\forall a,b$ $\exists \begin{cases} \inf\{a,b\} = a\cdot b \\ \sup\{a,b\} = a+b \end{cases}$

complementare $a+\bar{a} = 1$ $\quad a\bar{a} = 0$

$a \oplus b = a\bar{b} + \bar{a}b$

$a \to b = \bar{a} + b$

Legile lui Morgen $\overline{a+b} = \bar{a}\cdot\bar{b}$

$\overline{ab} = \bar{a} + \bar{b}$

$a+b = \overline{\bar{a}\,\bar{b}}$

$ab = \overline{\bar{a}+\bar{b}}$

Legea dublei negații $\bar{\bar{a}} = a$

Absorția boolean $a + \bar{a}b = a + b$

$$a(\bar{a} + b) = ab$$

Idempotența $a + a = a$

$$aa = a$$

$$a + b = 0 \Leftrightarrow a = b = 0$$

$$ab = 1 \Leftrightarrow a = b = 1$$

Ex Calculăm $\overline{a \oplus b} = \overline{a\bar{b} + \bar{a}b} = \overline{a\bar{b} \cdot \bar{a}b} = \overline{a\bar{b}} \cdot \overline{\bar{a}b} =$

$$= (\bar{a} \cdot \bar{\bar{b}})(\bar{\bar{a}} \cdot \bar{b}) = (\bar{a} + b)(a + \bar{b}) =$$

$$= \bar{a}a + \bar{a}\bar{b} + ba + b\bar{b} = \bar{a}\bar{b} + ab$$

funcții boolean $f : B_2^n \longrightarrow B_2^p$, $p = 1$ fct. scalară

FND: $f(x_1 \ldots x_n) = \sum\limits_{\substack{\alpha_1 \ldots \alpha_n \in \{0,1\} \\ f(\alpha_1 \ldots \alpha_n) = 1}} x_1^{\alpha_1} \ldots x_n^{\alpha_n}$

FNC: $f(x_1 \ldots x_n) = \prod\limits_{\substack{\alpha_1 \ldots \alpha_n \in \{0,1\} \\ f(\alpha_1 \ldots \alpha_n) = 0}} (x_1^{\bar{\alpha}_1} + \ldots + x_n^{\bar{\alpha}_n})$

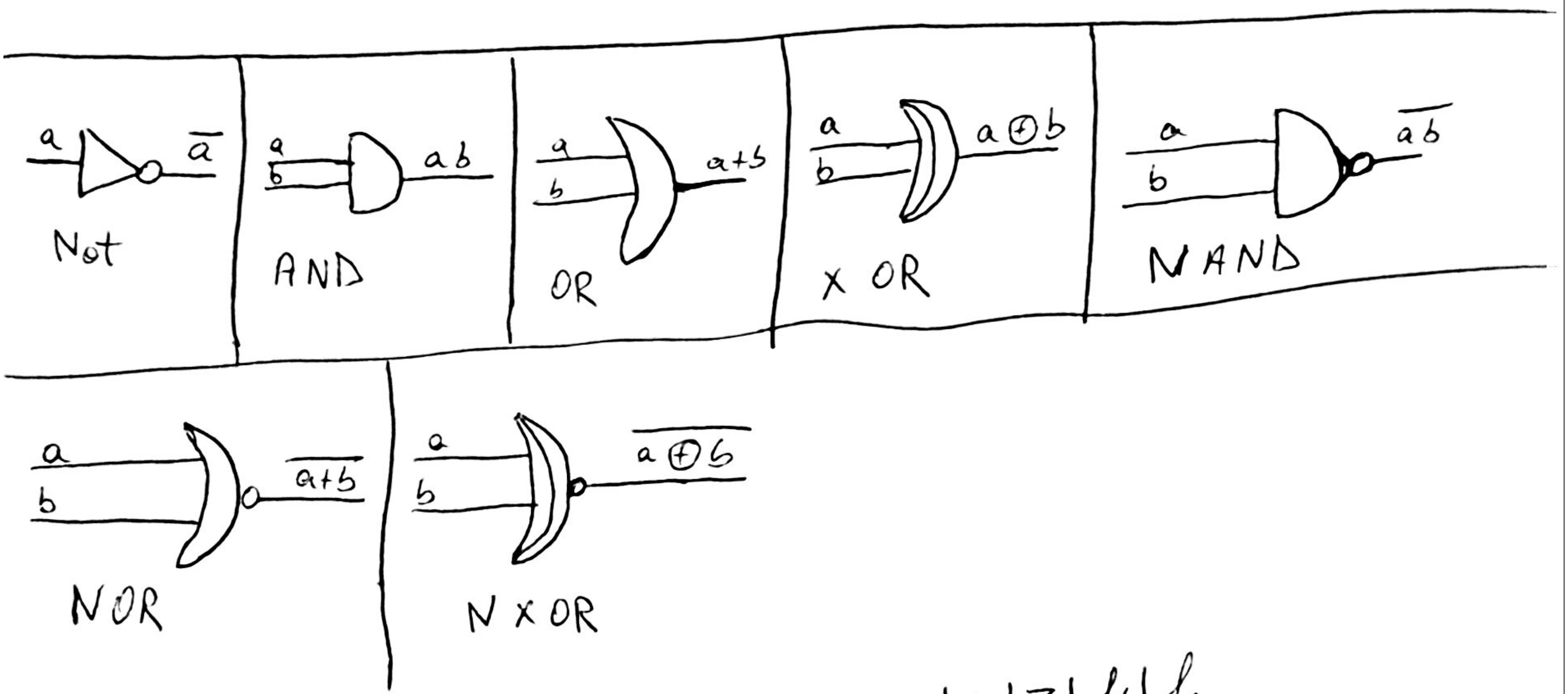
Ex $f : B_2^3 \longrightarrow B_2$

$f(x, y, z) = x\bar{y} + y\bar{z}$

x	y	z	$\bar{y}$	$\bar{z}$	$x\bar{y}$	$y\bar{z}$	f
0	0	0	1	1	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	1	0	1	1
0	1	1	0	0	0	0	0
1	0	0	1	1	1	0	1
1	0	1	1	0	1	0	1
1	1	0	0	1	0	1	1
1	1	1	0	0	0	0	0

$FND = \bar{x} y \bar{z} + x\bar{y}\bar{z} + x\bar{y}z + xy\bar{z}$

$FNC = (x+y+z)(x+y+\bar{z})(x+\bar{y}+\bar{z})(\bar{x}+\bar{y}+\bar{z})$



<u>Ex</u> $f: B_2^3 \to B_2^2$

$$f(x,y,z) = (\underbrace{(x \oplus \bar{y}) y z}_{f_1(x,y,z)}, \underbrace{x(\bar{x} \otimes z)}_{f_2(x,y,z)})$$

x	y	z	f_1	f_2
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	0	0
1	0	1	0	1
1	1	0	0	0
1	1	1	1	1

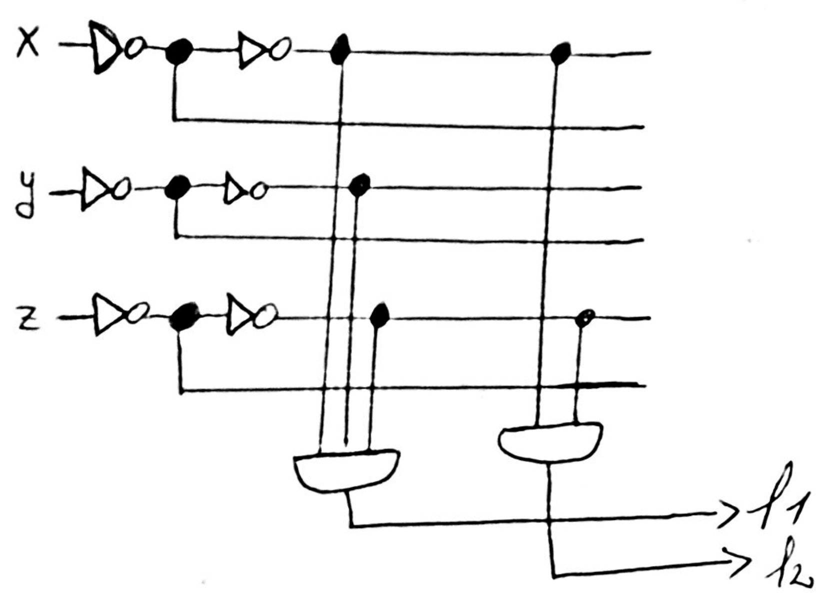
FND: $f_1(x,y,z) = xyz$

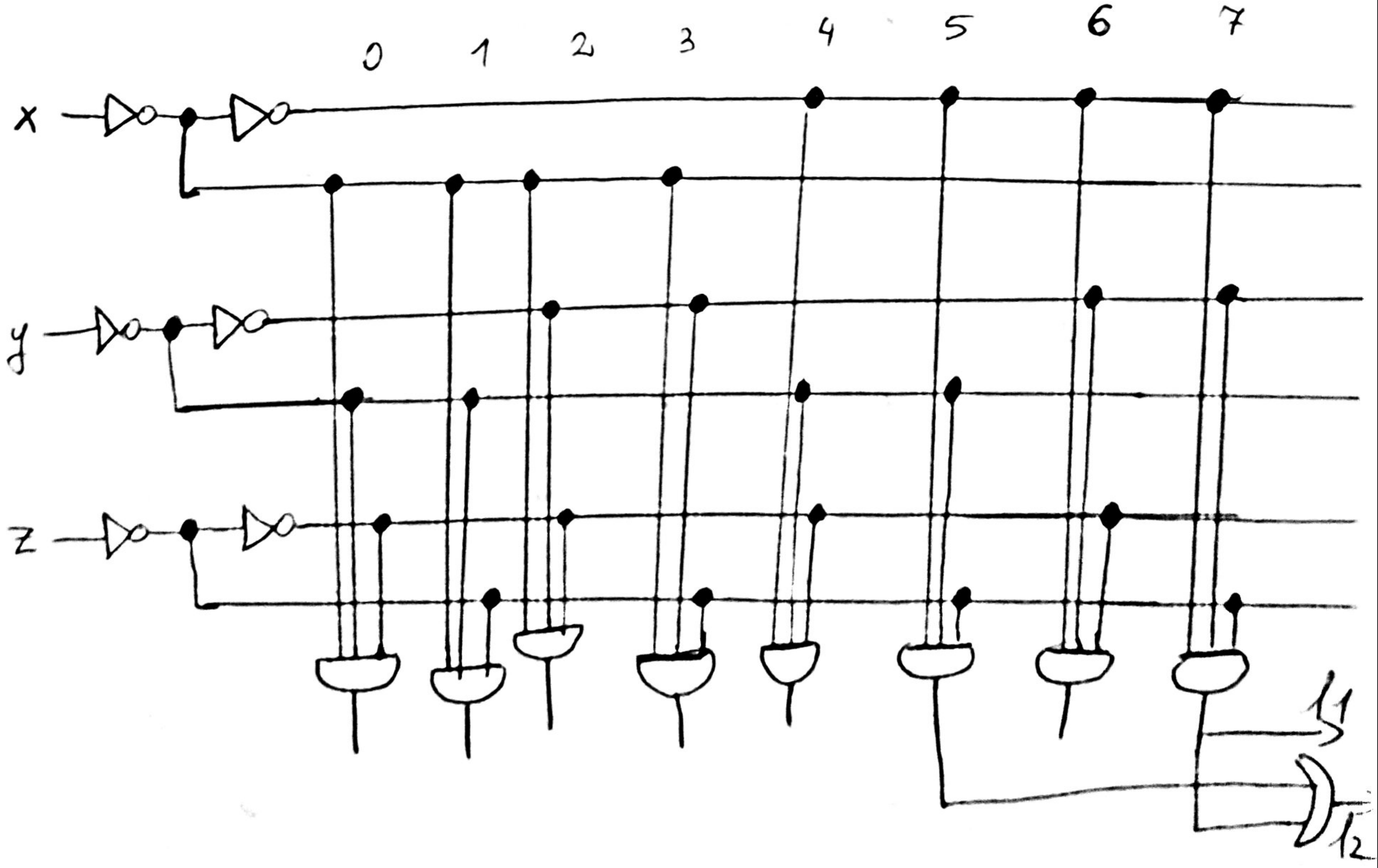
$f_2(x,y,z) = x\bar{y}z + xyz$

Ex Implementați pe f cu un circuit universal cu nr. minim și complet de AND

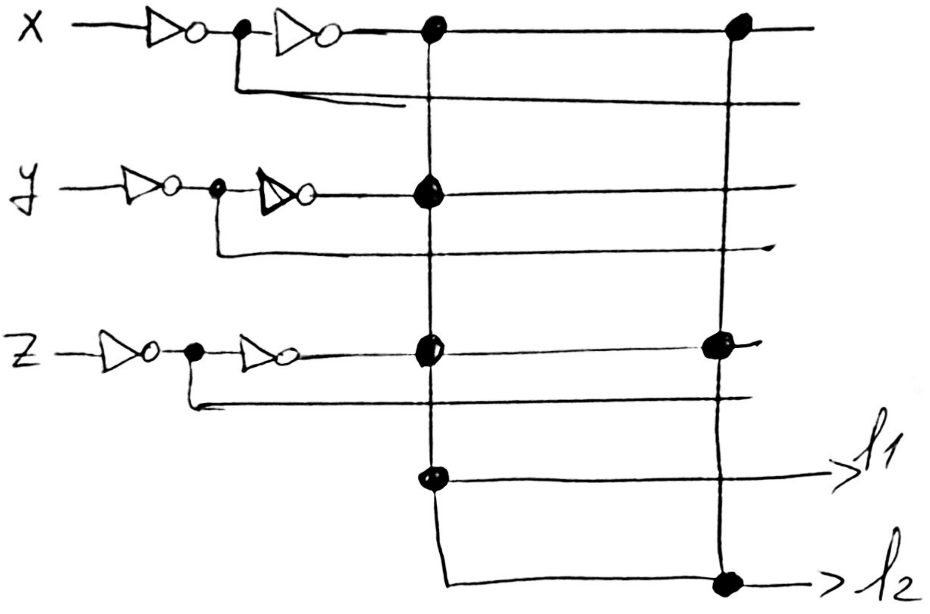
$f_1(x,y,z) = x\,y\,z$

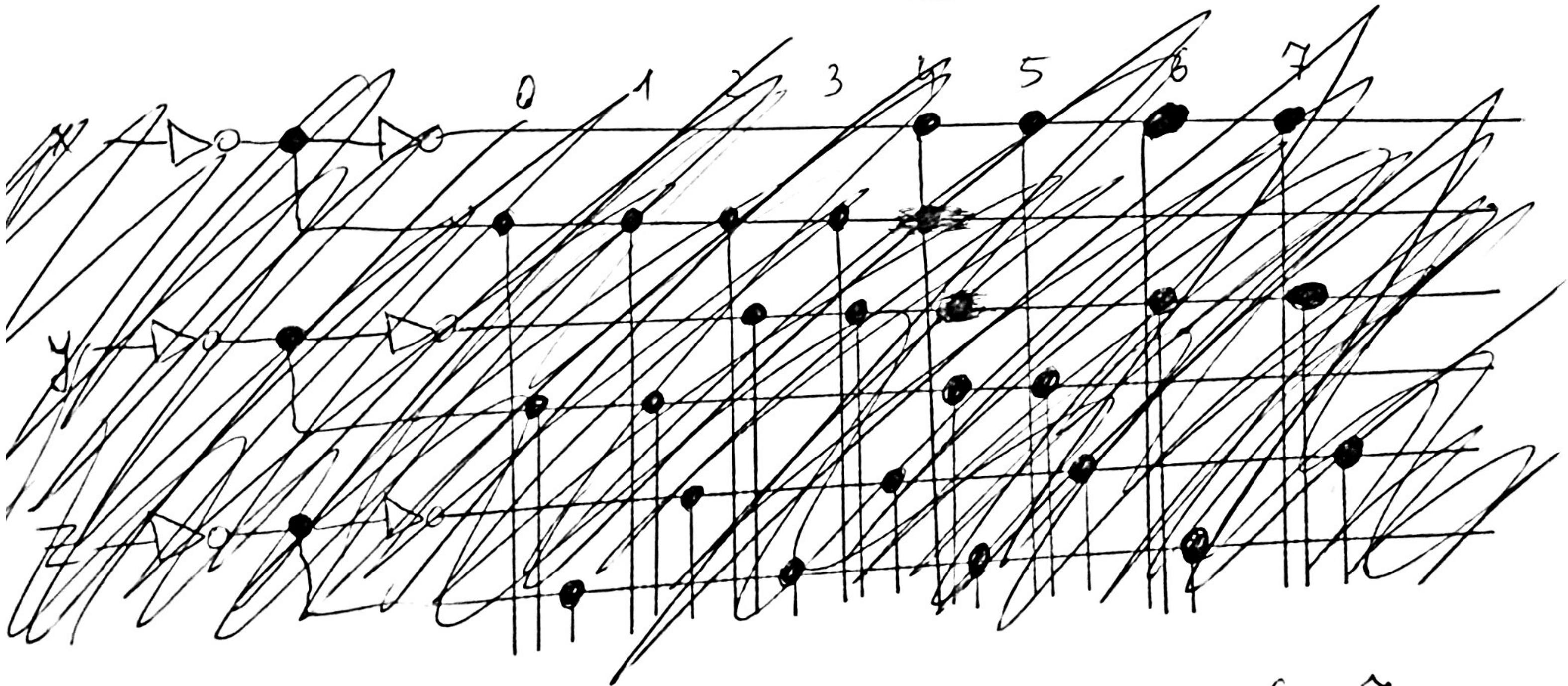
$f_2(x,y,z) = x\,\bar{y}\,z + x\,y\,z = x\,z\underbrace{(\bar{y}+y)}_{1} = x\,z$

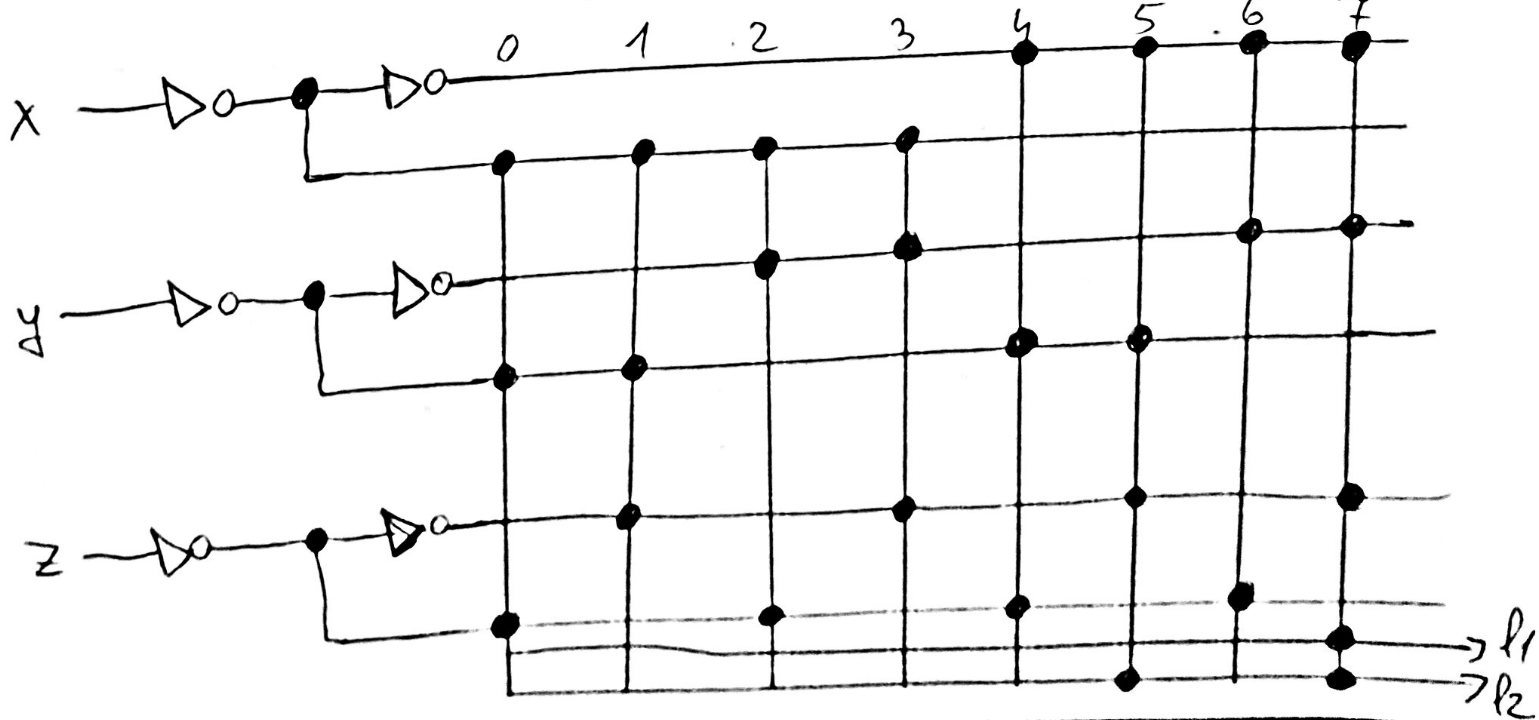


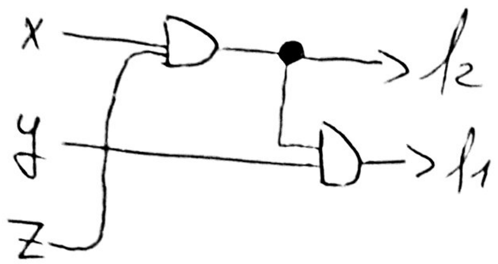


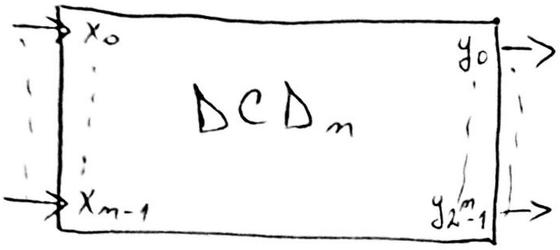
Ex Desenați circuitele ca PLA și PLOM











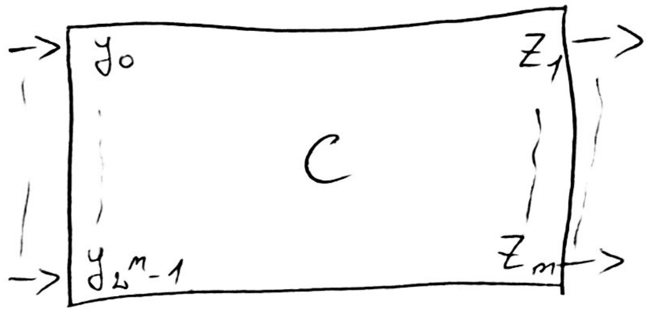
$$(X_{m-1},\dots,X_0)=K\in\overline{0,2^m-1}$$

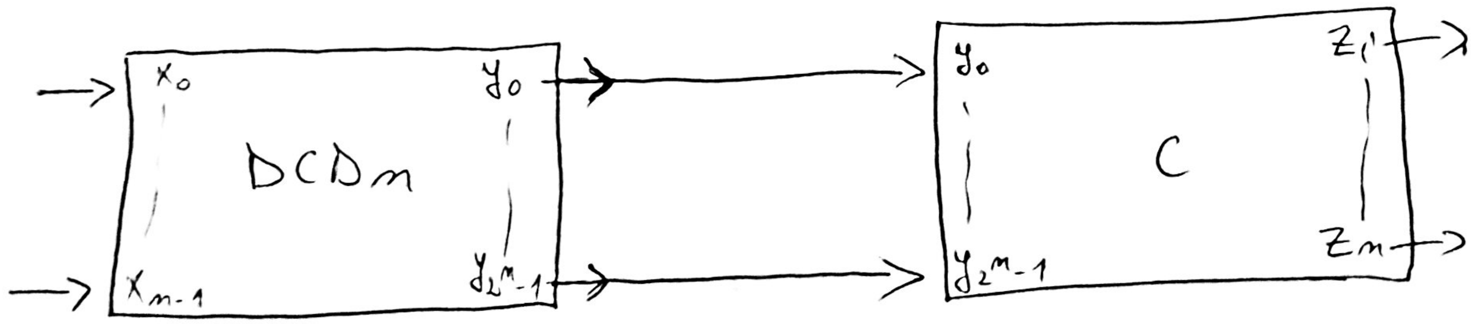
$$(0,\dots,0,\overset{K}{1},0,\dots 0)$$

$$\Downarrow$$

$$(\dots,Z_i,\dots)$$

$$\overset{\shortparallel}{Z_i(K)}$$





$$(X_{m-1},\dots,X_0)=K\in\overline{0,2^m-1}$$

$$\Downarrow$$

$$(0,\dots 0,1,0,\dots,0)$$

$$\Downarrow$$

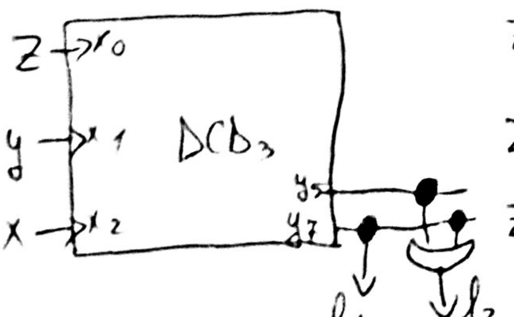
$$Z_i(K,\dots)$$

$$\shortparallel$$

$$Z_i(X_{m-1},\dots,X_0)$$

$$\shortparallel$$

$$Z_i: B_2\to B_2$$



$$Z=(Z_1,\dots,Z_m): B_2^m\to B_2$$

<u>Ex</u> Codificatorul care pt. o secvență de n biți, scoate bitul majoritar (la 2x0 și 2x1 scoate 0)

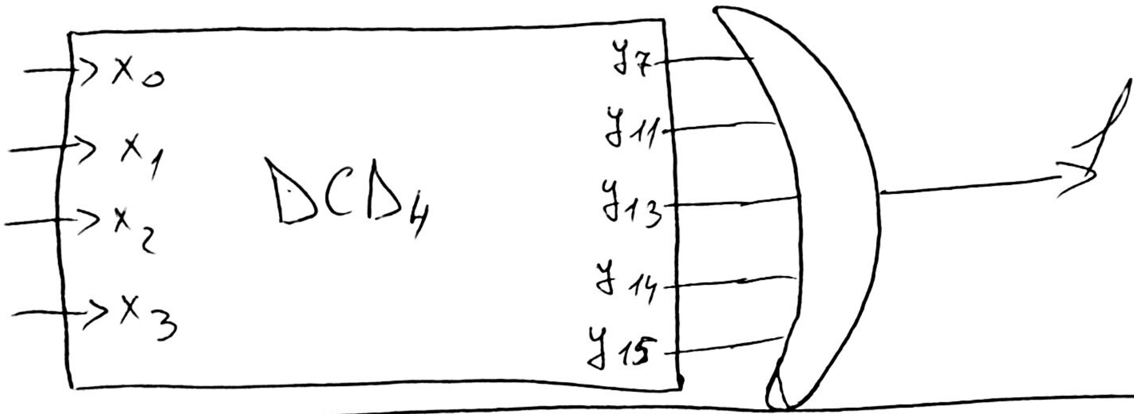
$1 \; 1 \; 1 \; 1 \longrightarrow 15$

$1 \; 1 \; 1 \; 0 \longrightarrow 14$

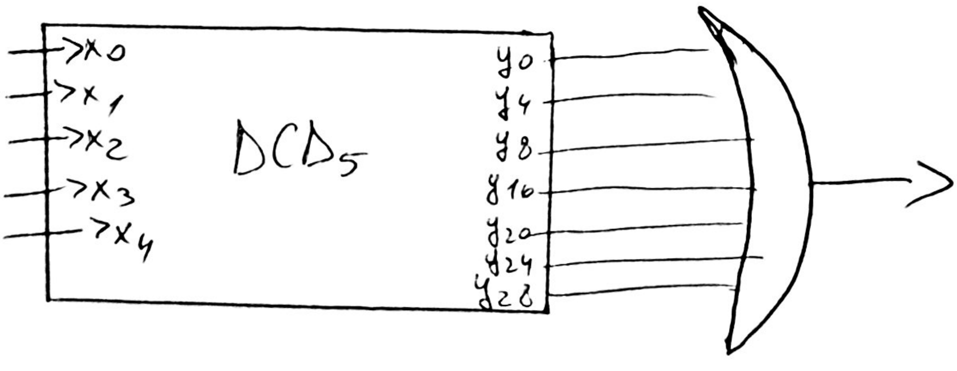
$1 \; 1 \; 0 \; 1 \longrightarrow 13$

$1 \; 0 \; 1 \; 1 \longrightarrow 11$

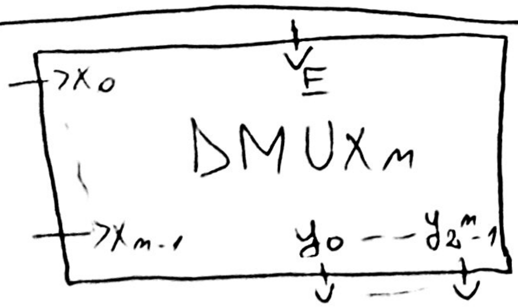
$0 \; 1 \; 1 \; 1 \longrightarrow 7$



<u>Ex</u> Codificatorul care pt. o secventă de 5 biți, scoate 1 dacă $X \vdots 4$

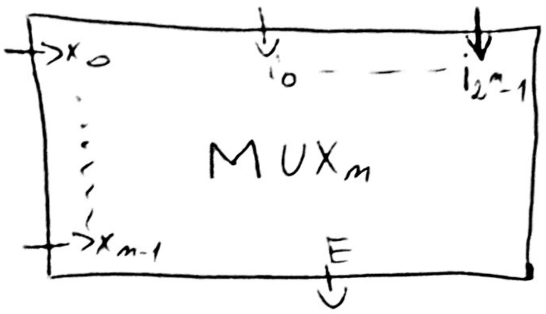


<u>Ex</u>



$$(x_{n-1}, \ldots, x_0) = k \in \overline{0, 2^n - 1}, \quad E \in \{0,1\} \; \Bigg| \Rightarrow (0, \ldots, 0, E, 0, \ldots, 0)$$

Ex



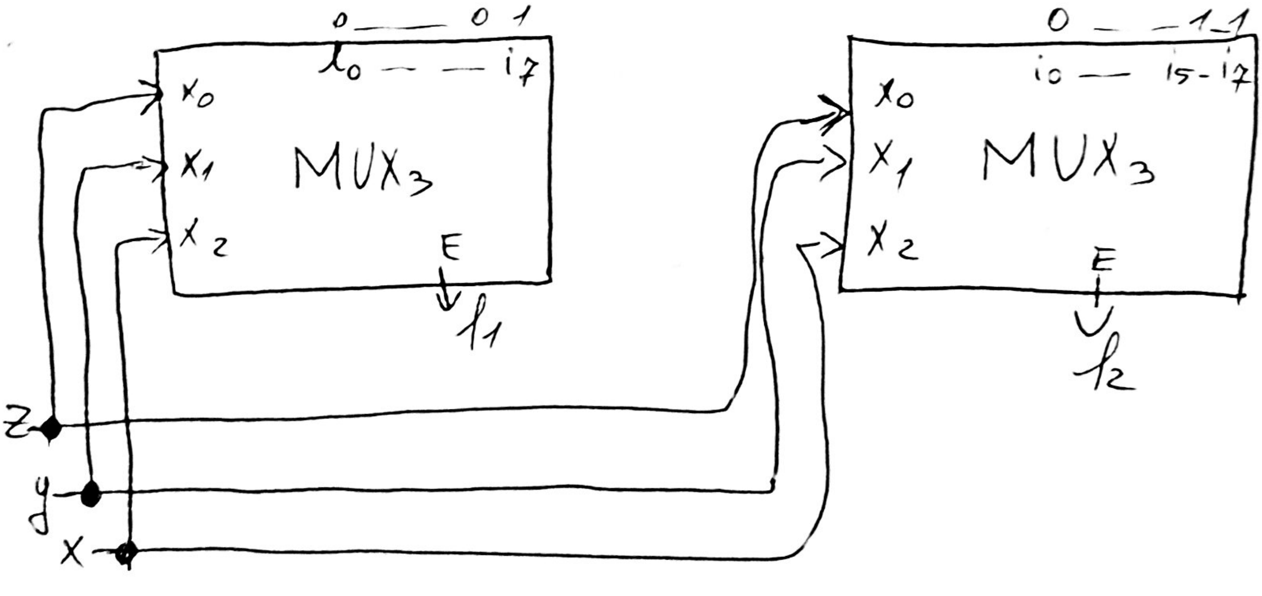
$$(x_{n-1}, \dots, x_n) = k \in \overline{0, 2^n-1}$$

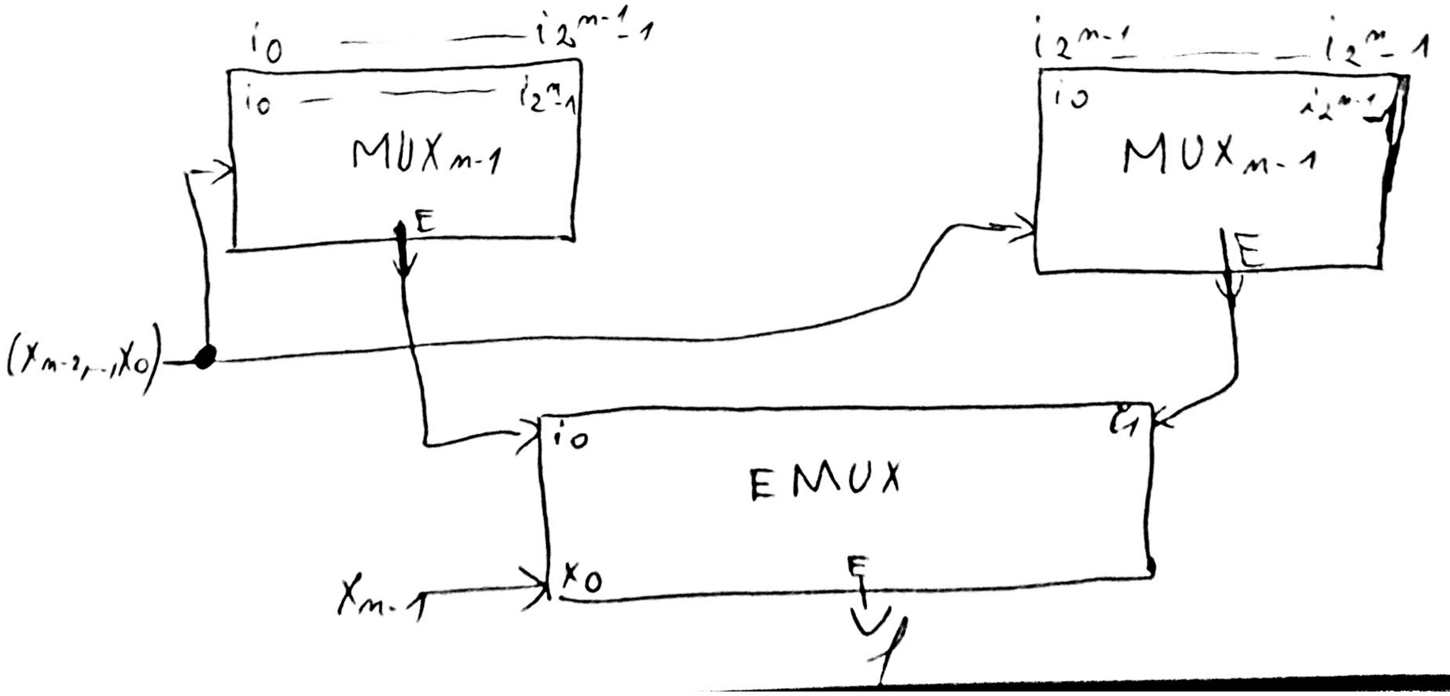
$$(i_0, \dots, i_{2^n-1}) \in \{0,1\}^{2^n}$$

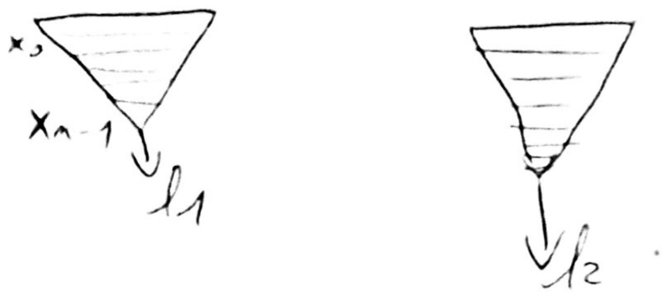
$$\Downarrow$$

$$i_k$$

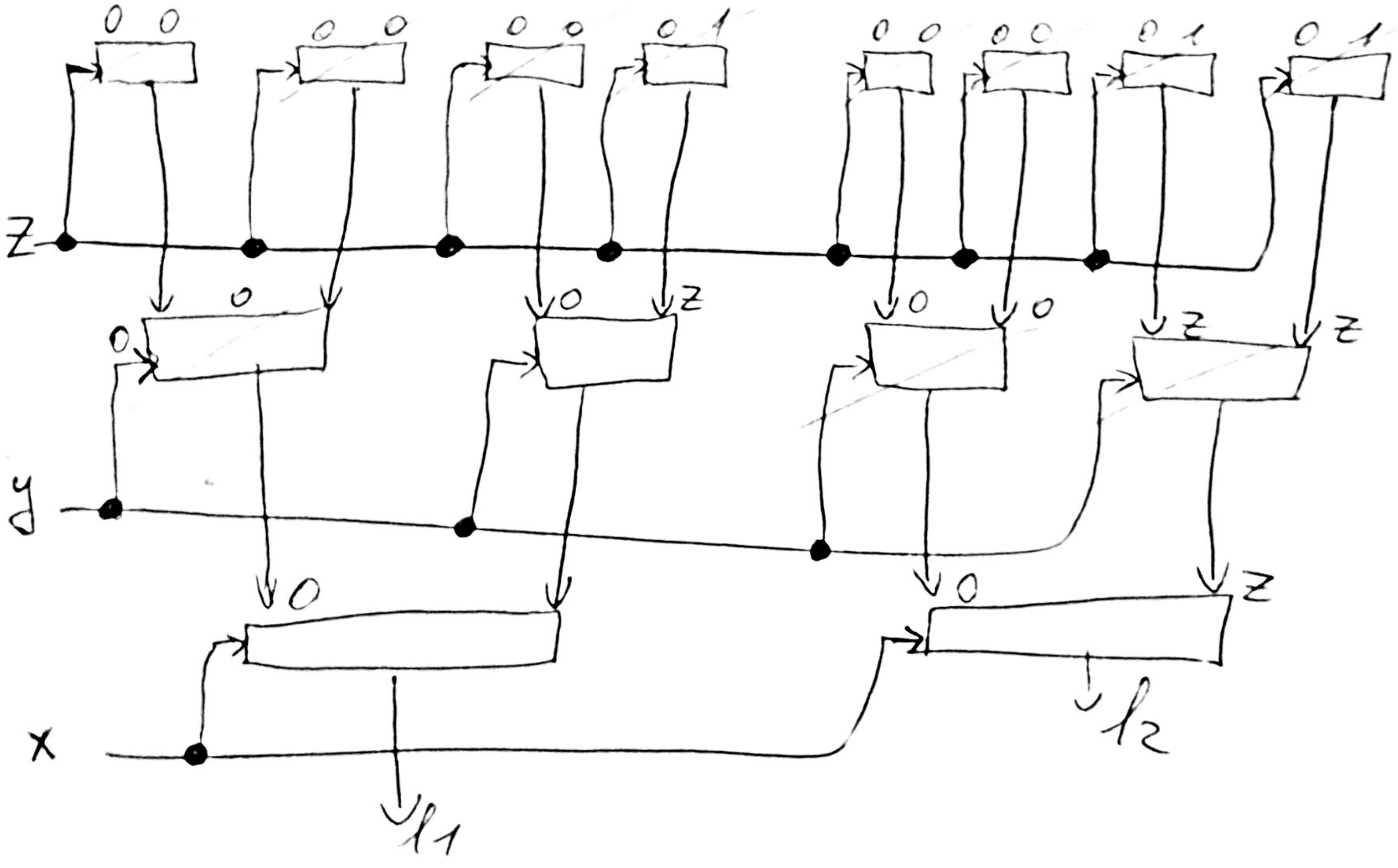
Ex Implementați f cu MUX

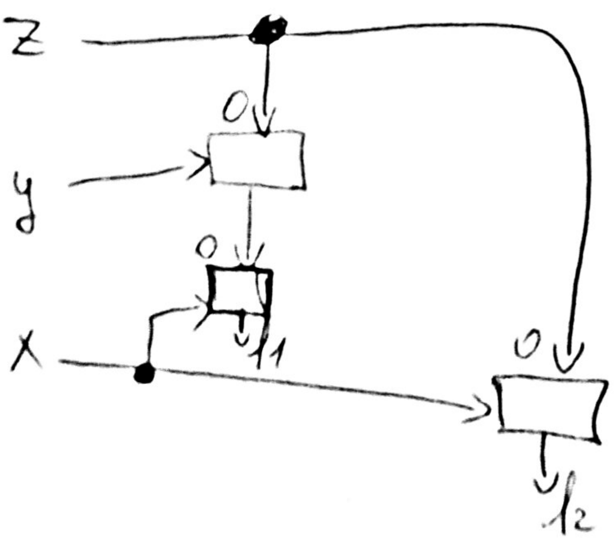






Ex Implementați cu EMUX





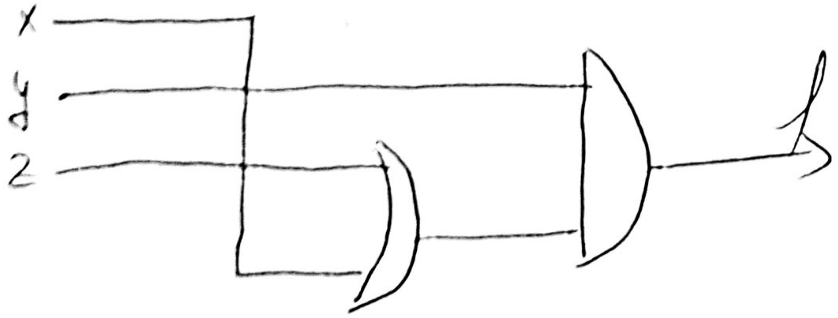
Ex Fie $f: B_2^3 \longrightarrow B_2$ dat prin:

x	y	z	f	mini
0	0	0	0	
0	0	1	0	
0	1	0	0	
0	1	1	1	3
1	0	0	0	
1	0	1	0	
1	1	0	1	6
1	1	1	1	7

Implementați f — cu nr. min de porți
— cu nanduri (NAND)

a) $f(x,y,z) = \bar{x} y z + x y \bar{z} + x y z = \bar{x} y z + x y (\underbrace{\bar{z} + z}_{1}) =$

$= \bar{x} y z + x y = y(\bar{x} z + x) = y(x+z$



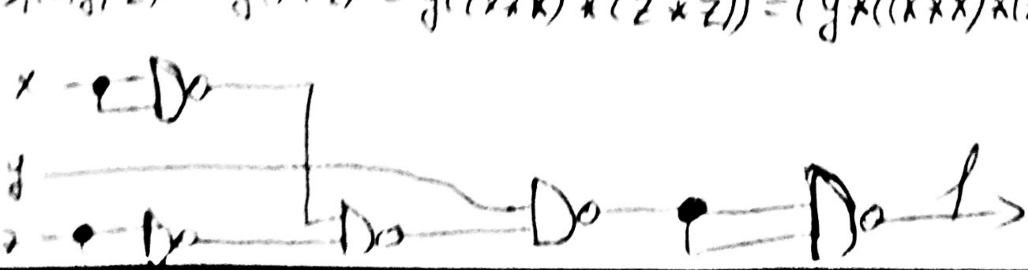
b) $x * y = \overline{xy}$ (NAND)

$\bar{a} = \overline{a \cdot a} = a * a$

$a + b = \overline{\bar{a}\,\bar{b}} = (a*a)*(b*b)$

$a b = \overline{\overline{ab}} = \overline{a*b} = (a*b)*(a*b)$

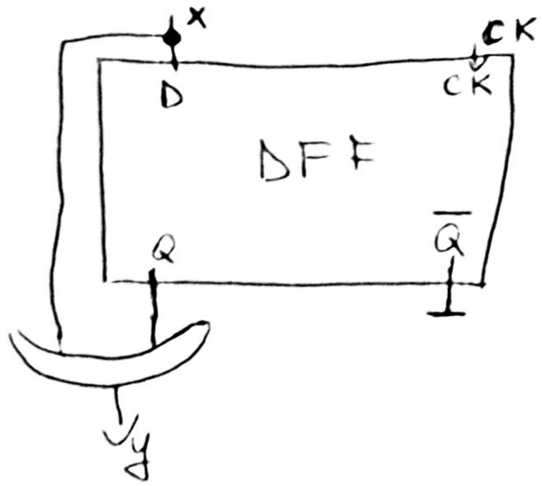
$f(x,y,z) = y(x+z) = y((x*x)*(z*z)) = (y*((x*x)*(z*z)))*(y*((x*x)*(z*$

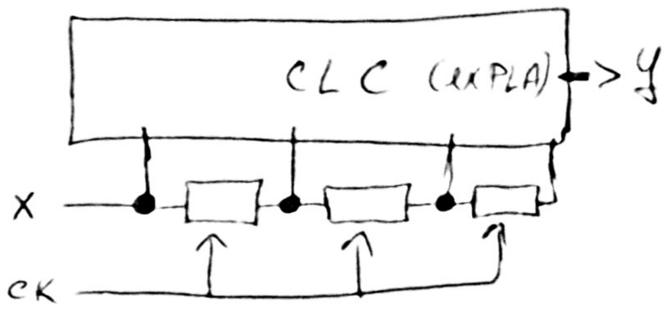


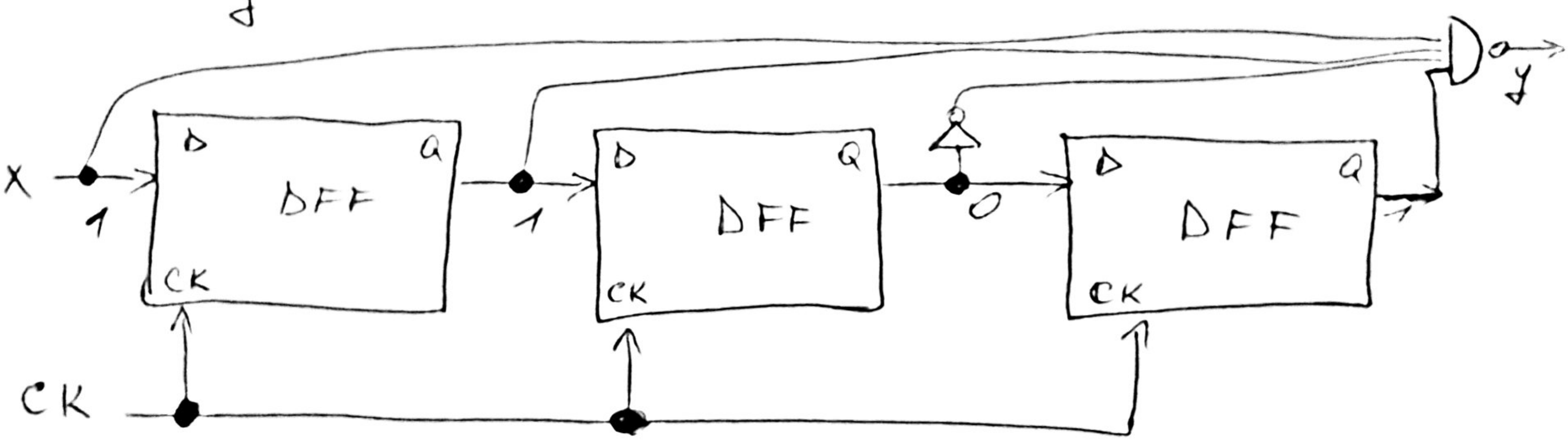
Fie DFF. Circuit care scoate 1 dacă DFF schimbă starea

I: 0 0 1 1 0

O: 0 0 1 0 1







<u>Def</u> Automat finit (AF) = sistem $A = (Q, X, Y, \delta, \lambda)$ unde Q, X, Y mulțimi finite nevide

$\delta : Q \times X \to Q$

$\lambda : Q \times X \to Y$ (automat)

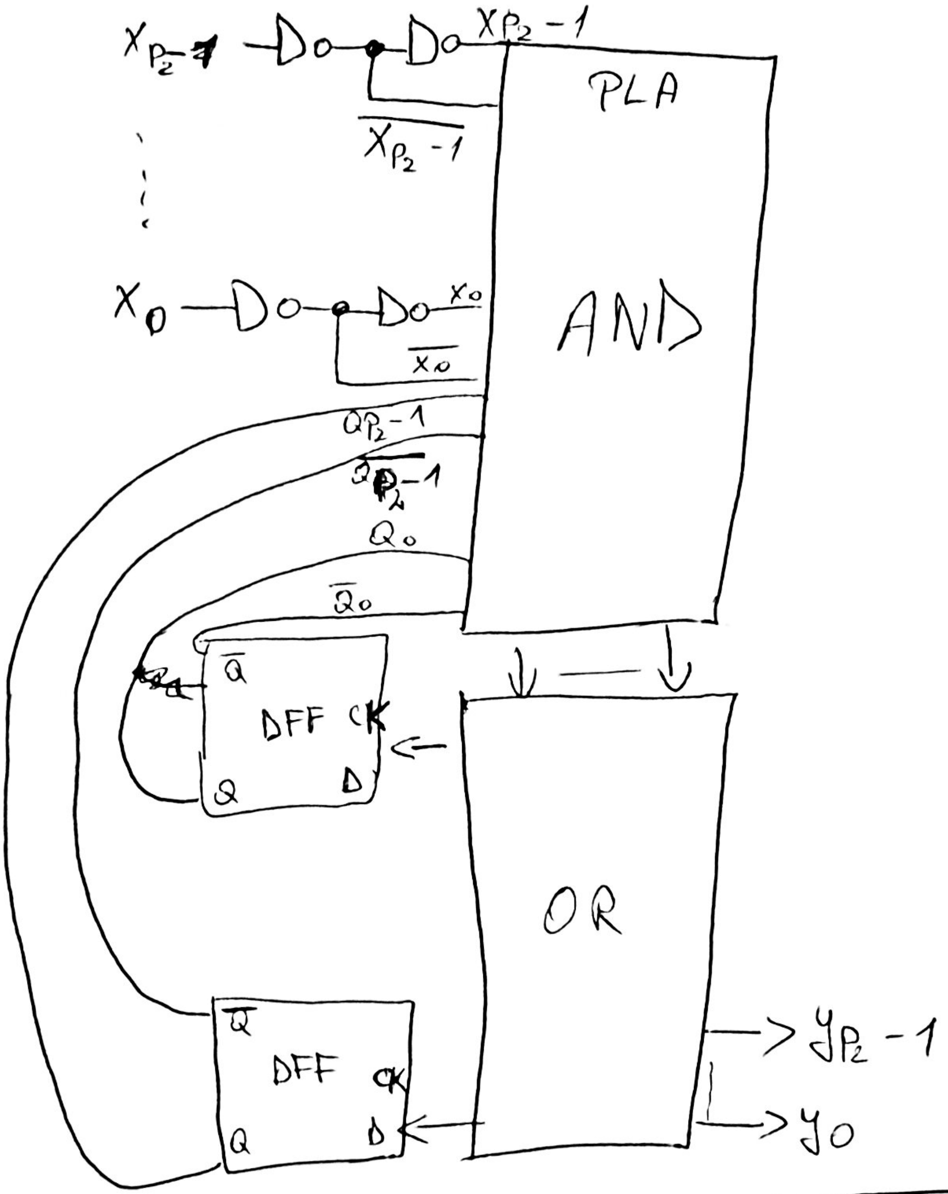
Specific Q, X, Y prin enumerare

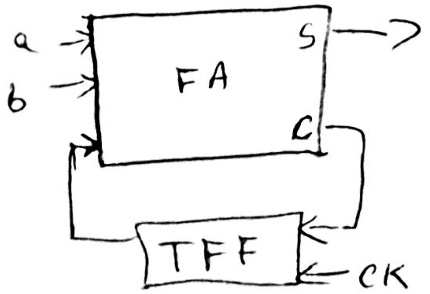
δ, λ prin
- tabel
- graf

$q \xrightarrow{x/y} r$

$\delta(q, x) = r$

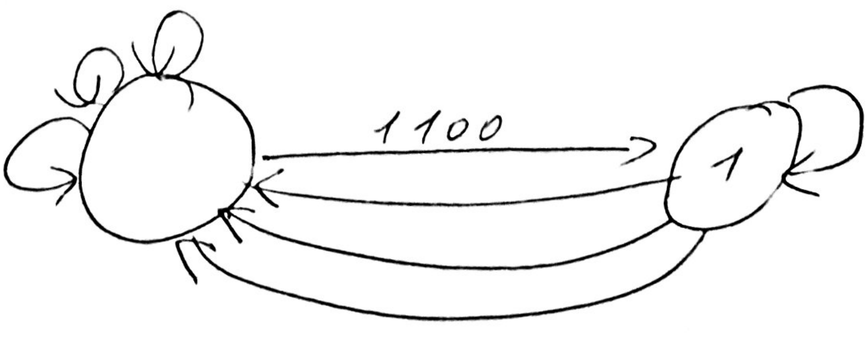
$\lambda(q, x) = y$





z	00	01	10	11
0	0	1	1	0
1	1	0	0	1

S	00	01	10	11
0	0	0	0	1
1	1	0	0	0



DFF

$Q^t = D$

$D = n$ pt $\delta \exists n$

T	Q^+
0	Q
1	$\overline{Q}$

$$T = \begin{cases} n, & 0 \to n \\ \overline{n}, & 1 \to n \end{cases}$$

J	K	Q^+
0	0	Q
0	1	0
1	0	1
1	1	Q

JK = { n [redacted] , 0 -> n

[redacted] $\overline{n}$, 1 -> n