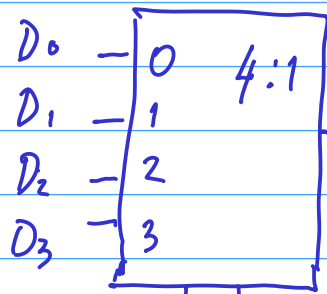


# Circuitos combinacionais

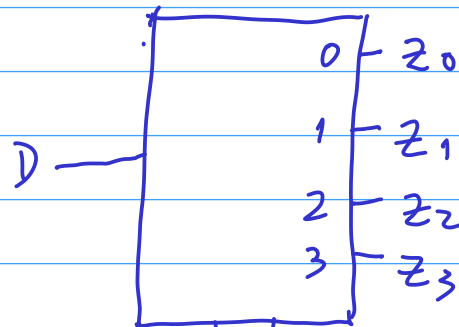
MUX



$S_1, S_0$   
2 bits selectors

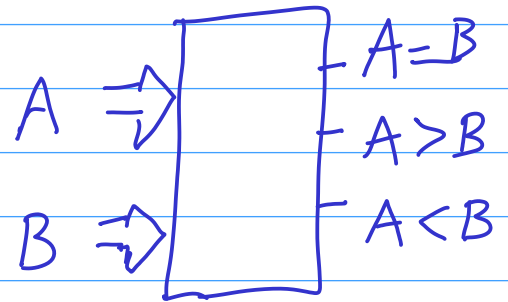
$$Z = D_0 \bar{S}_1 \bar{S}_0 + D_1 \bar{S}_1 S_0 + D_2 S_1 \bar{S}_0 + D_3 S_1 S_0$$

DEMUX



$S_1, S_0$

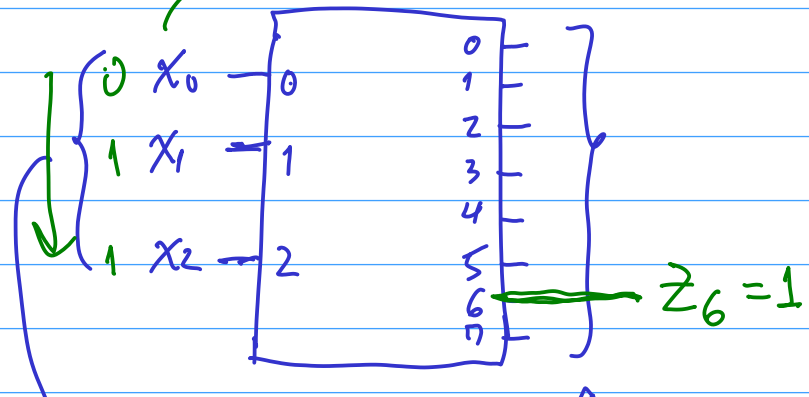
Compara dores



UCLA (comp. + soma dos)

# Decodificador

← 110 = 6<sub>(10)</sub>



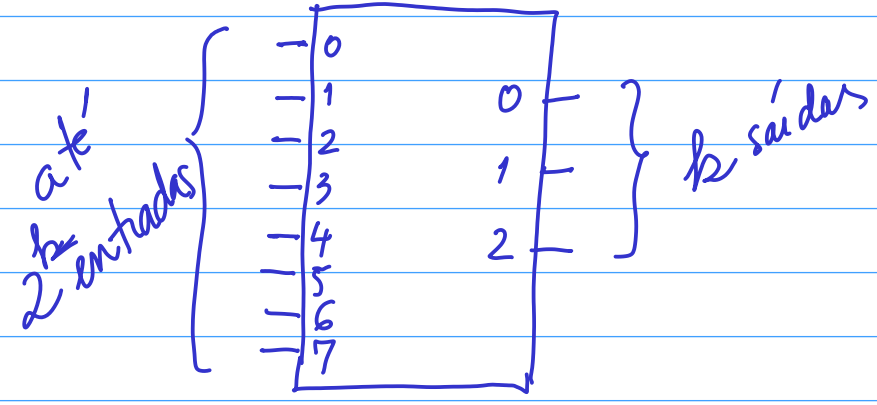
$k$  entradas

$2^k$  saídas

$$z_i = 1 \Leftrightarrow \sum_{j=0}^{k-1} x_j 2^j = i_{(10)}$$

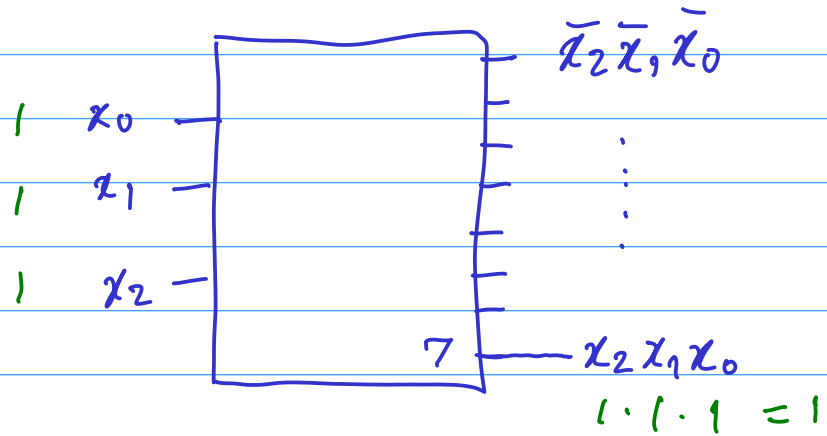
$\uparrow$  base 10  
 $\downarrow$  binário

# Codificador



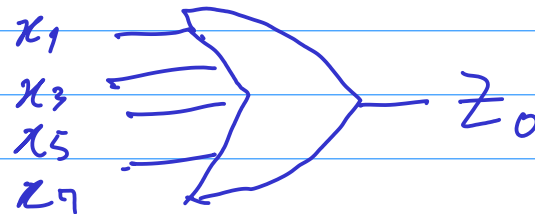
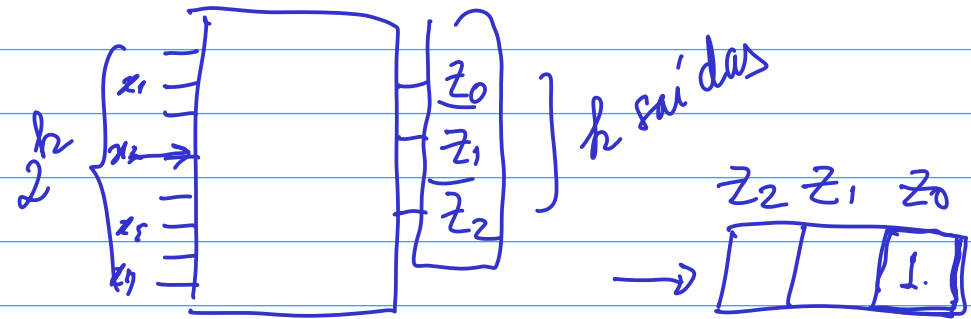
# Implementação (portas lógicas)

## Decodificador

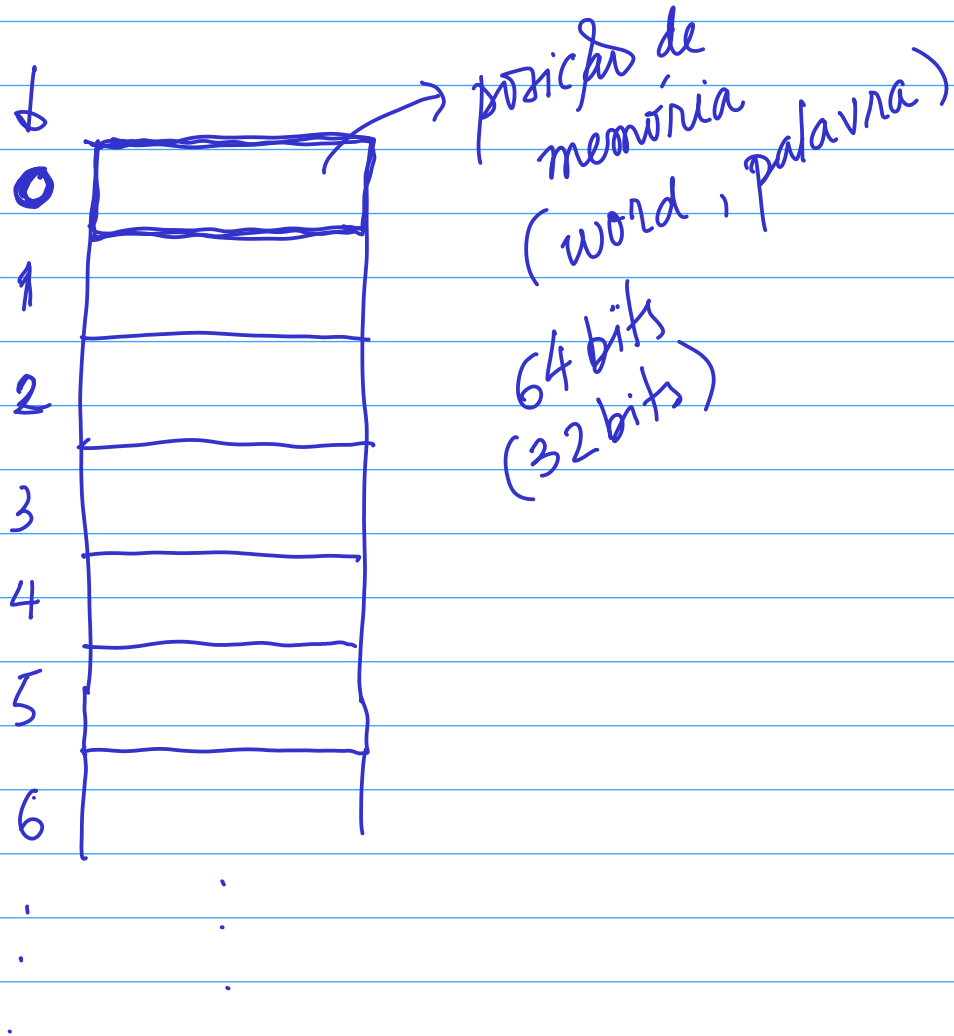


$2^k$  portas E  
(minterms)

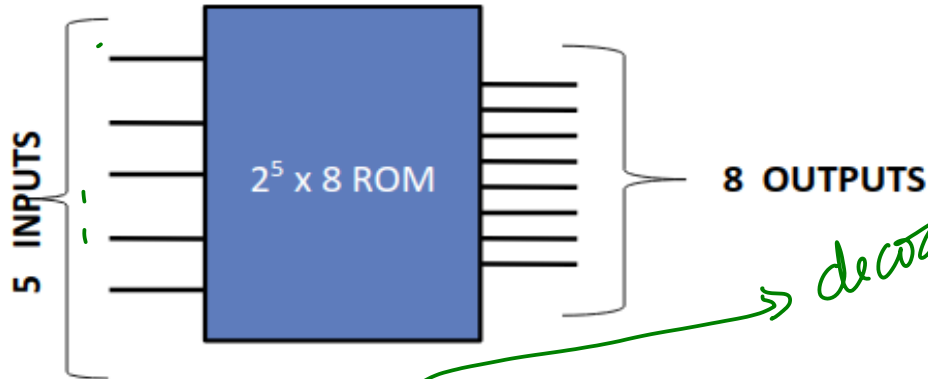
## Codificador



# Memória ROM (Read Only Memory)



Read Only Memory (ROM)

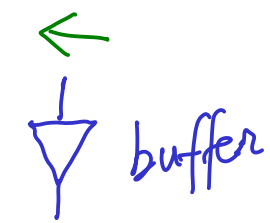
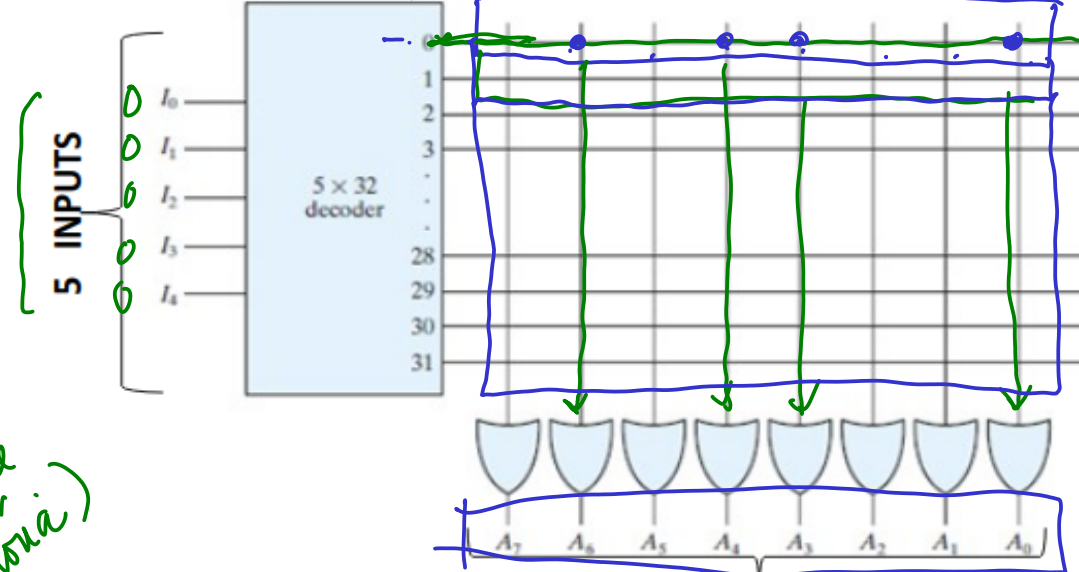


*decodificadores*

*palavra de 8 bits*

**01011001**

(Internal Circuit)



*buffer*

**0 1 0 1 1 0 0 1**

*codigo binario de um endereco (posicao de memoria)*

# FPGA

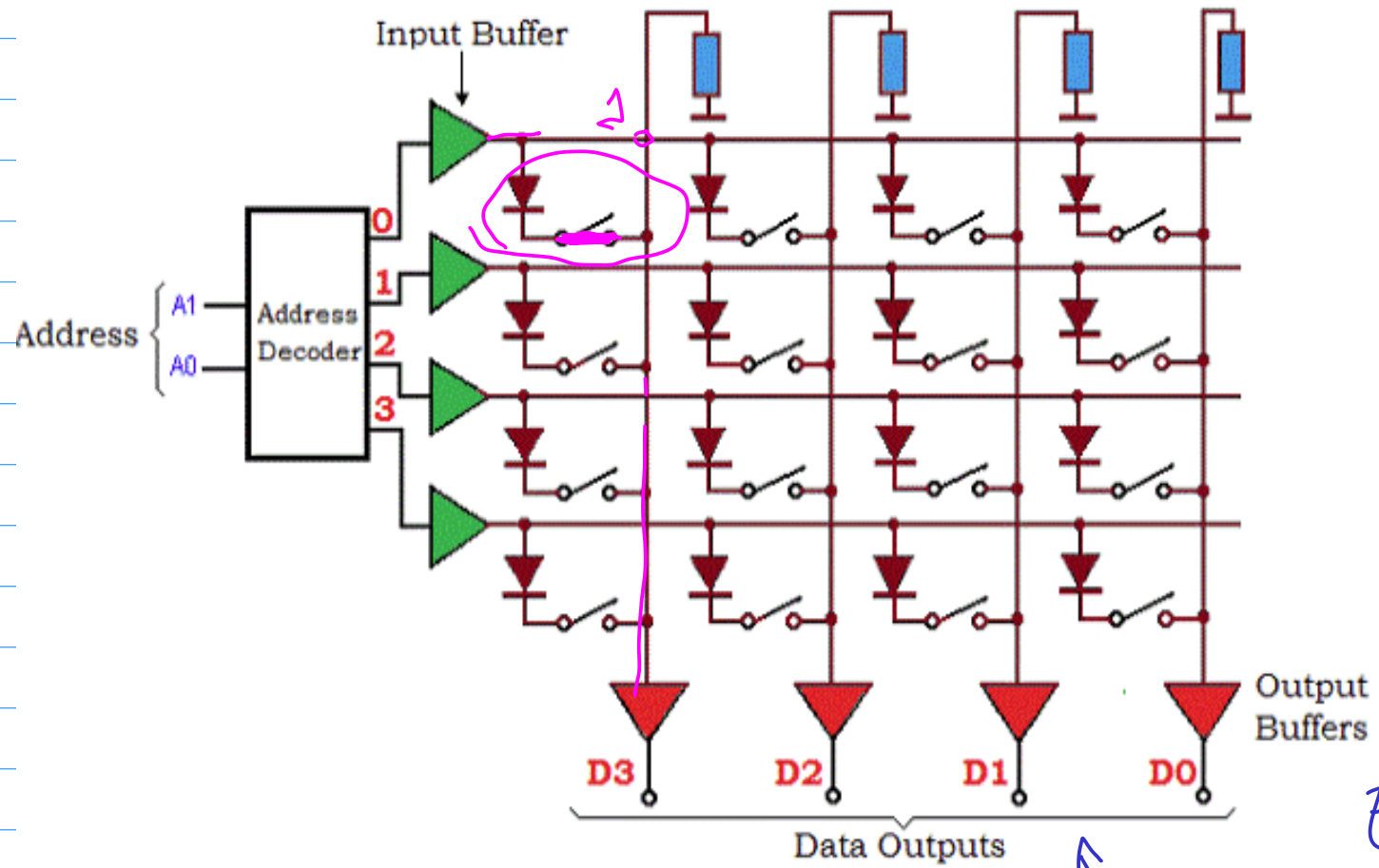
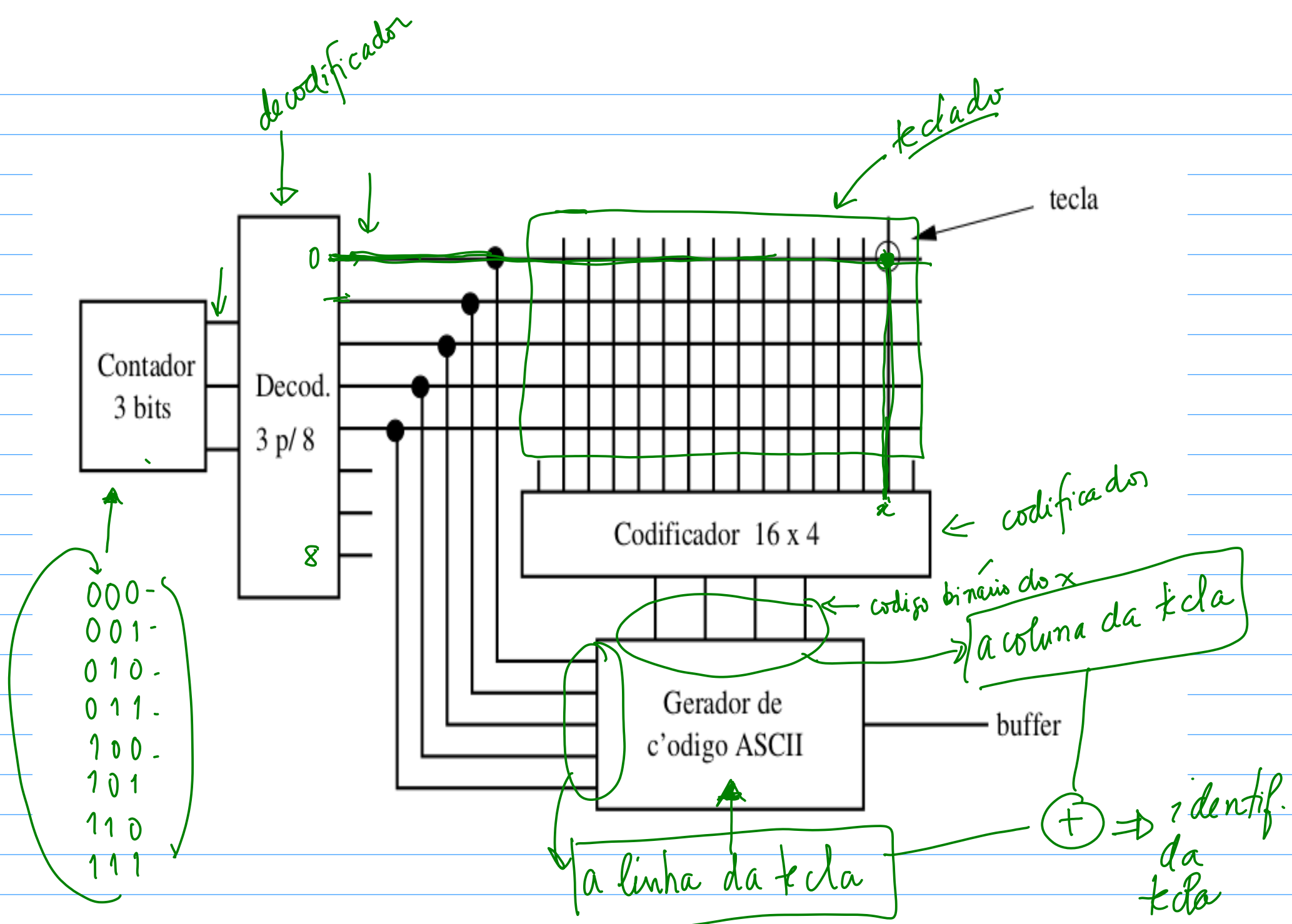


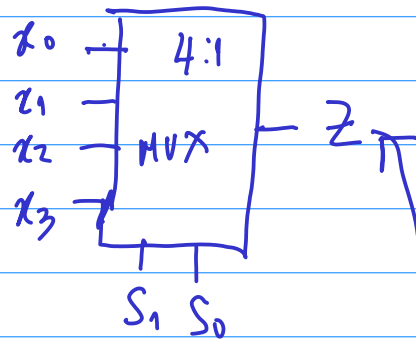
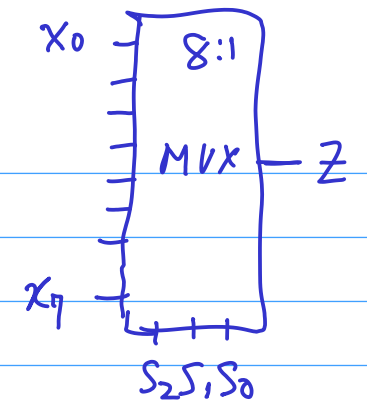
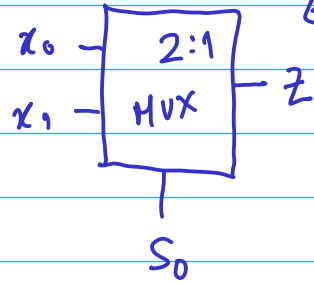
Fig.2 - Diode Grid in Read Only Memory (ROM)

ROM  
PROM  
↑  
programmável  
EPROM  
↑  
Erasable programmável

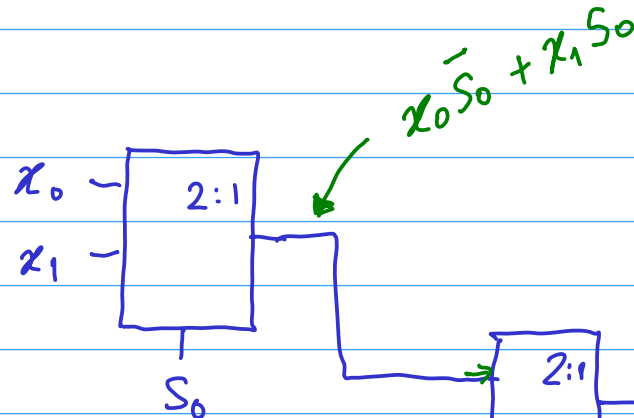


# Uso de MUX pl implementada de MUX

tenho vários desses



Quero



$$x_0 \bar{S}_0 + x_1 S_0$$

$$x_2 \bar{S}_0 + x_3 S_0$$

$$(x_0 \bar{S}_0 + x_1 S_0) \bar{S}_1 + (x_2 \bar{S}_0 + x_3 S_0) S_1$$

$$x_0 \bar{S}_1 \bar{S}_0 + x_1 \bar{S}_1 S_0 + x_2 S_1 \bar{S}_0 + x_3 S_1 S_0$$

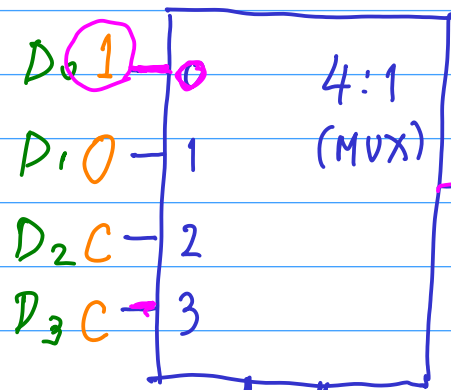


Uso de MUX p/ implementar funções booleanas

$$f(a,b,c) = \bar{a}\bar{b} + ac$$

MUX 4:1

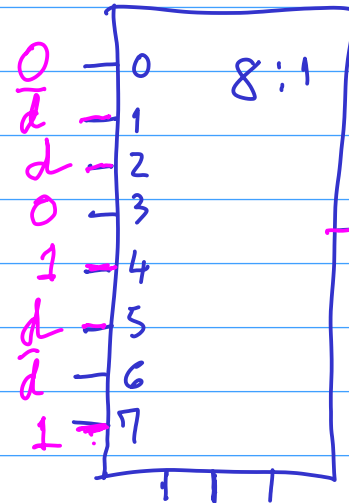
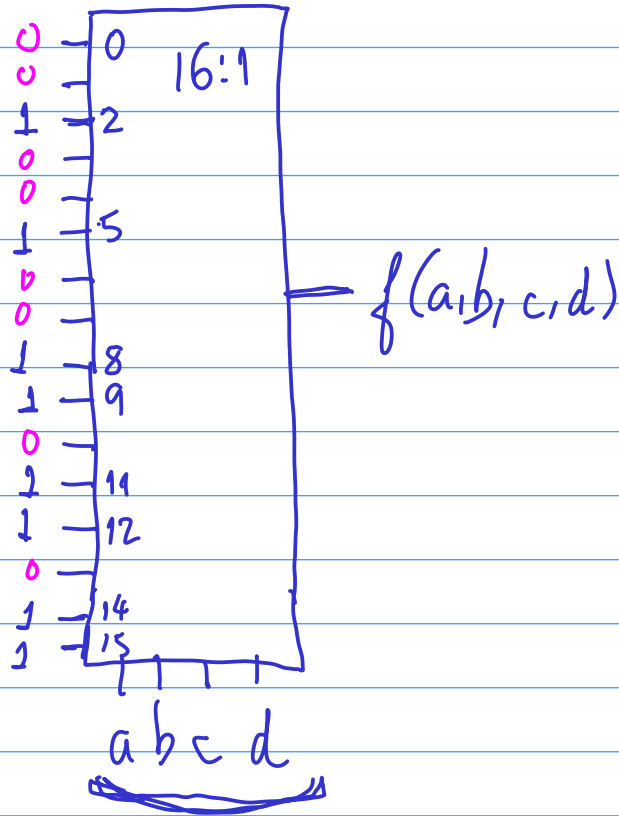
a	b	c	f(a,b,c)
0	0	0	1 ✓
0	0	1	1 ✓
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1



$$f(a,b,c) = \underbrace{1}_{D_0} \bar{a}\bar{b} + \underbrace{0}_{D_1} \bar{a}b + \underbrace{C}_{D_2} a\bar{b} + \underbrace{C}_{D_3} ab$$

$$\begin{aligned} \bar{a}\bar{b} + ac &= \bar{a}\bar{b}(\overset{1}{c+\bar{c}}) + a(b+\bar{b})c \\ &= \bar{a}\bar{b}c + \bar{a}\bar{b}\bar{c} + \underbrace{abc}_{\uparrow} + \underbrace{a\bar{b}c}_{\uparrow} + \bar{a}\bar{b} \cdot \underset{\uparrow}{0} \\ &\quad \downarrow \\ &= \bar{a}\bar{b} \cdot \boxed{1} \end{aligned}$$

$$f(a,b,c,d) = \sum m(\underline{2}, \underline{5}, 8, 9, 11, 12, 14, 15)$$



abc  
001

$$a=0, b=0, c=1, d=0$$

	a	b	c	d	
2 →	0	0	1	0	← → $f=1 \Leftrightarrow d=0$
3 →	0	1	0	1	←
8 →	1	0	0	0	} $\bar{d}+d=1$
9 →	1	0	0	1	
11 →	1	0	1	1	
12 →	1	1	0	0	
14 →	1	1	1	0	
15 →	1	1	1	1	

