

1

ASSIGNMENT-3

Dtd: 21/2/22

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$$Q_1 (a) F(x,y,z) = xy + x'z$$

$$= xyz + xyz' + x'yz + x'y'z$$

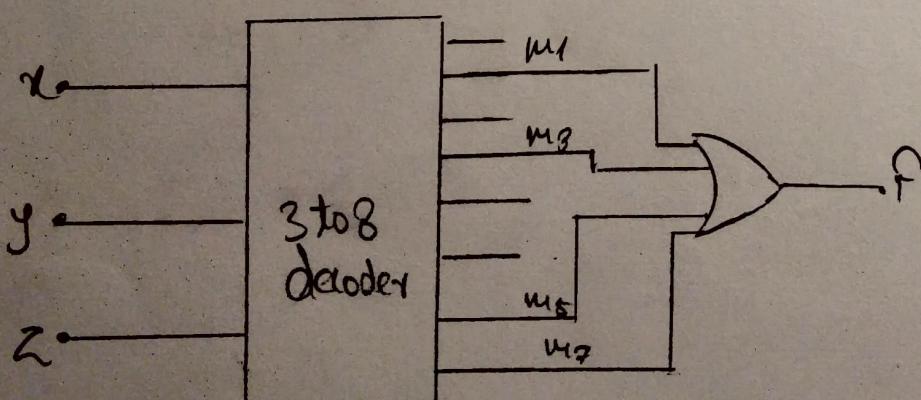
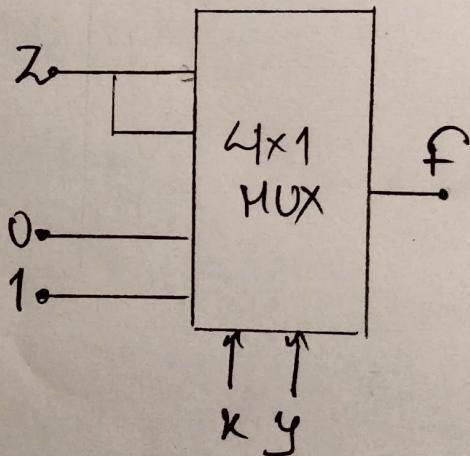
x	y	z
1	1	0
1	1	1

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

$$F = \Sigma(1, 3, 6, 7)$$

Select

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1



$$⑥) F_1 = (\bar{x} + \bar{y} + z)xz + y \quad , \quad f_2 = xyz + xz$$

$$F_1 = \bar{x}xz + x\bar{y}z + xz \cdot z + y$$

$$= xyx + \cancel{xz} + y \quad (a \cdot \bar{a} = 0, a \cdot a = a)$$

	x	y	z		
m_5	1	0	1		
m_7	1	1	1		

	x	y	z		
	0	1	0	m_2	
	0	1	1	m_3	
f	1	0	0	m_6	
	1	1	1	m_7	

$$\Rightarrow F_1 = \Sigma(2, 3, 5, 6, 7)$$

$$F_2 = xyz + xz = xyz + xz(y + \bar{y})$$

$$F_2 = xyz + xy\bar{z} \quad (a + a = a)$$

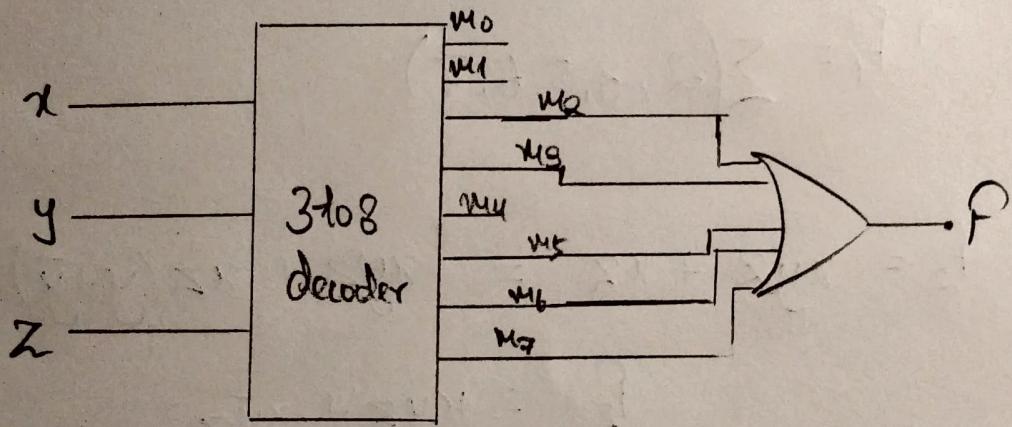
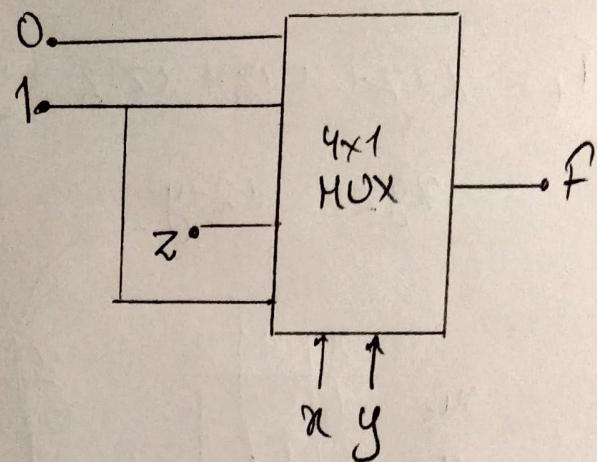
$$\Rightarrow F_2 = \Sigma(5, 7)$$

$$\Rightarrow F = F_1 + F_2 = \Sigma(2, 3, 5, 6, 7)$$

3

Select

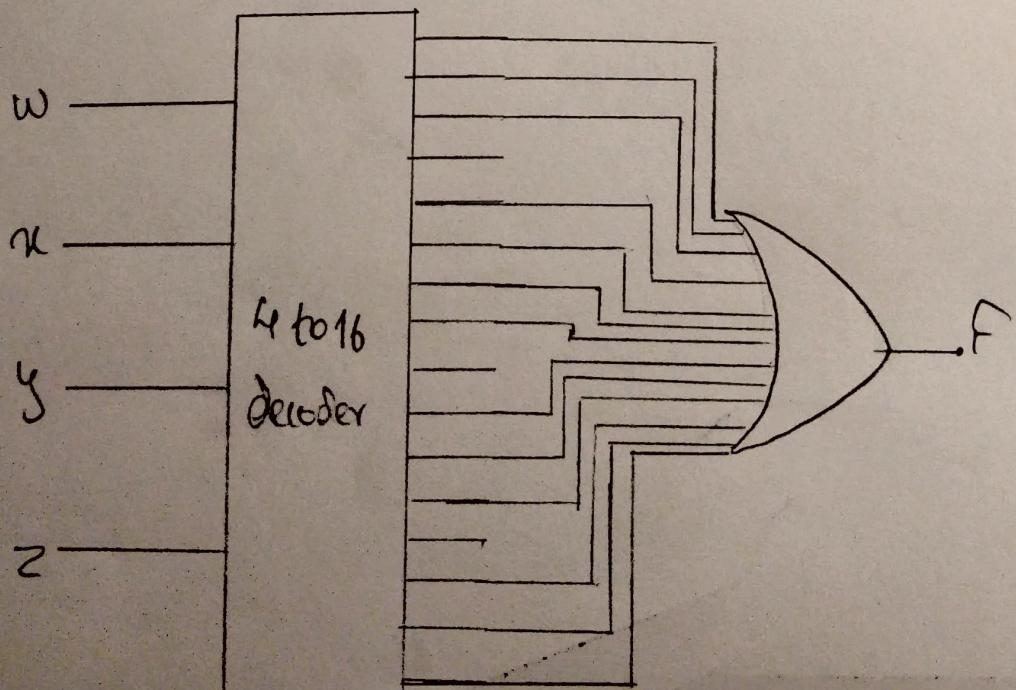
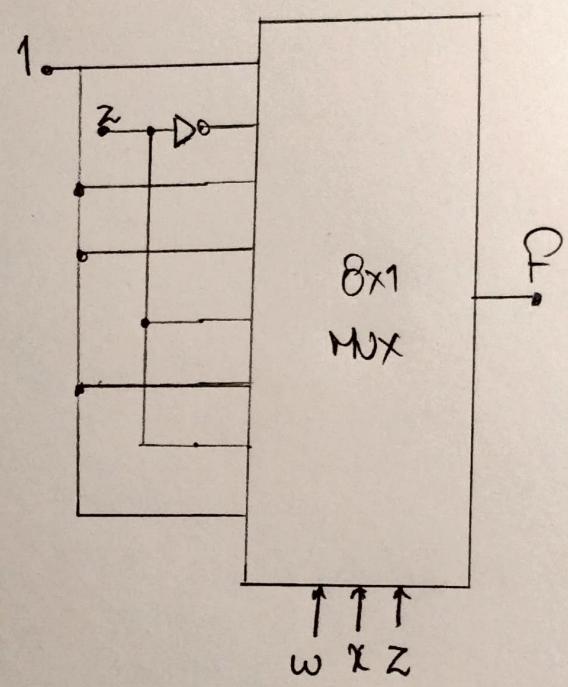
x	y	z	F
0	0	0	0] $\rightarrow 0$
0	0	1	0] $\rightarrow 1$
0	1	0	1] $\rightarrow 1$
0	1	1	1] $\rightarrow 1$
1	0	0	0] $\rightarrow 2$
1	0	1	1] $\rightarrow 2$
1	1	0	1] $\rightarrow 1$
1	1	1	1] $\rightarrow 1$



$$(c) F = \pi(3, 8, 12) = \sum (0, 1, 2, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15)$$

Select lines

w	x	y	z	F
0	0	0	0	1]>1
0	0	0	1	1
0	0	1	0	1]> \bar{z}
0	0	1	1	0
0	1	0	0	1]>1
0	1	0	1	1]>1
0	1	1	0	1]>1
0	1	1	1	1]>1
1	0	0	0	0]>z
1	0	0	1	1
1	0	1	0	1]>z
1	0	1	1	1]>1
1	1	0	0	0]>z
1	1	0	1	1]>z
1	1	1	0	1]>1
1	1	1	1	1]>1



5

Q2 (a) 16x1 MUX

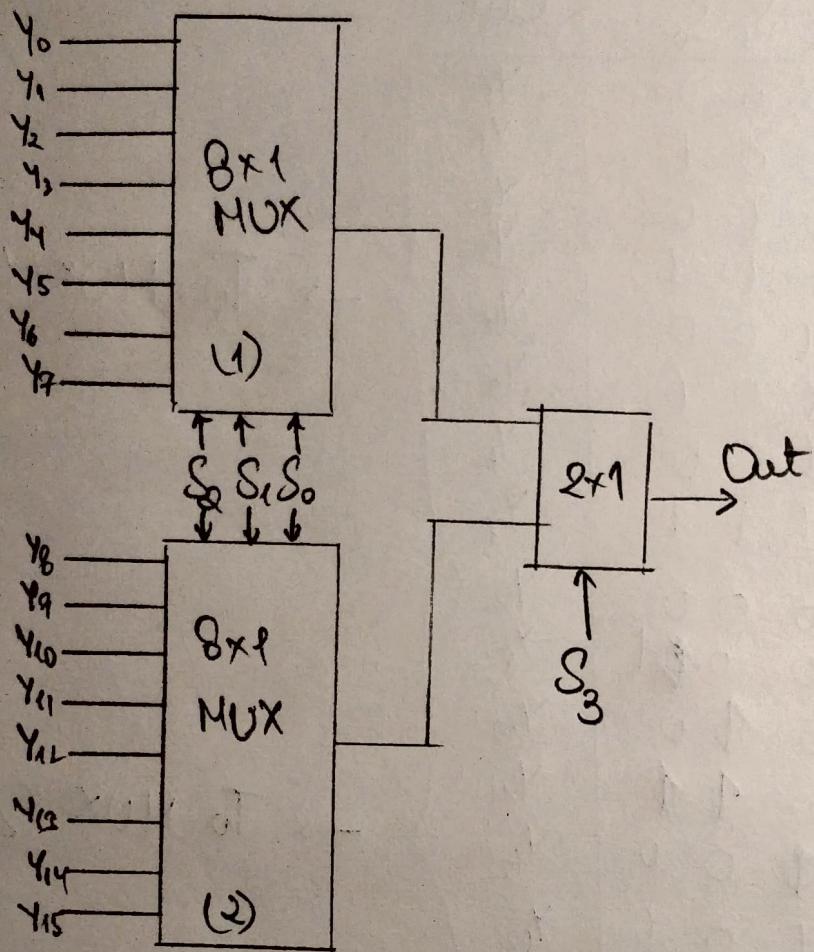
S_3	S_2	S_1	S_0	Out
0	0	0	0	y_0
0	0	0	1	y_1
0	0	1	0	y_2
0	0	1	1	y_3
0	1	0	0	y_4
0	1	0	1	y_5
0	1	1	0	y_6
0	1	1	1	y_7
1	0	0	0	y_8
1	0	0	1	y_9
1	0	1	0	y_{10}
1	0	1	1	y_{11}
1	1	0	0	y_{12}
1	1	0	1	y_{13}
1	1	1	0	y_{14}
1	1	1	1	y_{15}

} → To MUX(1)

} → To MUX(2)

Switching b/w MUX(1) and (2) using
a 2×1 MUX with Select line S_3 .

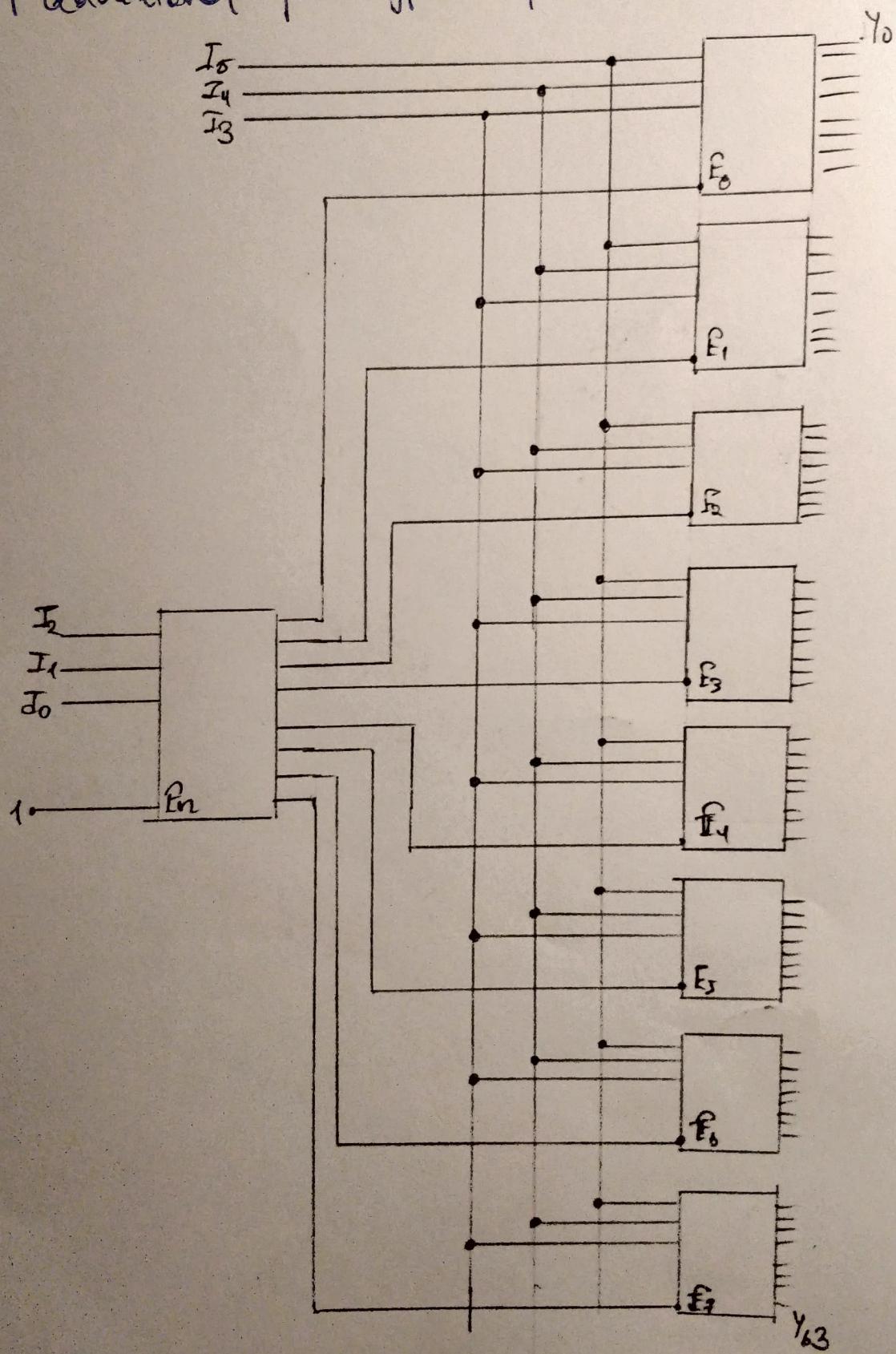
b



7

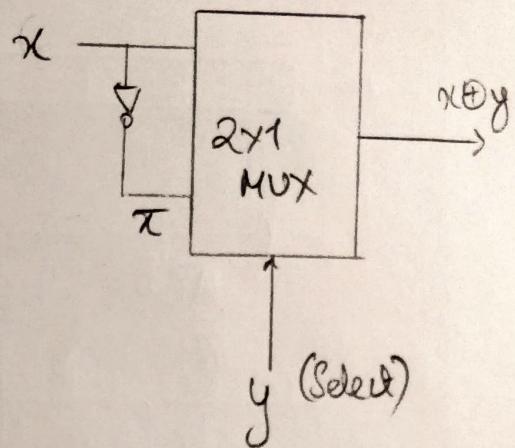
Q2 (b) 6x64 decoder using 3x8
 8 (8x8) decoders to get 64 outputs

1 additional for different input + enable



Q2 (c) XOR gate using MUX:

<u>2</u>	<u>y</u>	<u>Select</u>	$x \oplus y$
0	0	0	0 $\Rightarrow x$
0	1	1	1 $\Rightarrow \bar{x}$
1	0	1	1 $\Rightarrow x$
1	1	0	0 $\Rightarrow \bar{x}$



Q2 (d) 8,4,-2,-1 to BCD

8	4	-2	-1	Decimal Equivalent	8	4	-2	-1
A	B	C	D		W	X	Y	Z
0	0	0	0	0	0	0	0	0
0	0	0	1	-1	X	X	X	X
0	0	1	0	-2	X	X	X	X
0	0	1	1	-3	X	X	X	X
0	1	0	0	4	0	1	0	0
0	1	0	1	3	0	0	1	1
0	1	1	0	2	0	0	1	0
0	1	1	1	1	0	0	0	1
1	0	0	0	8	1	0	0	0
1	0	0	1	7	0	1	1	1
1	0	1	0	6	0	1	1	0
1	0	1	1	5	0	1	0	1
1	1	0	0	12	X	X	X	X
1	1	0	1	11	X	X	X	X
1	1	1	0	10	X	X	X	X
1	1	1	1	9	1	0	0	1

Q

W

AB	00	01	11	10
00		X	X	X
01				
11	X	X	1	X
10	1			

$A\bar{C}\bar{D}$

$$W = AB + A\bar{C}\bar{D}$$

AB	00	01	11	10
00		X	X	X
01	1			
11	X	X		X
10	1	1	1	1

\overline{BC}

\overline{BD}

\overline{BC}

$$\begin{aligned} X &= B\bar{C}\bar{D} + \bar{B}D + \bar{B}C \\ &= B(\bar{C}+D) + \bar{B}(C+D) \end{aligned}$$

(DeMorgan's law)

$$X = B \oplus (C+D)$$

$$Y = \bar{C}D + C\bar{D} = C \oplus D$$

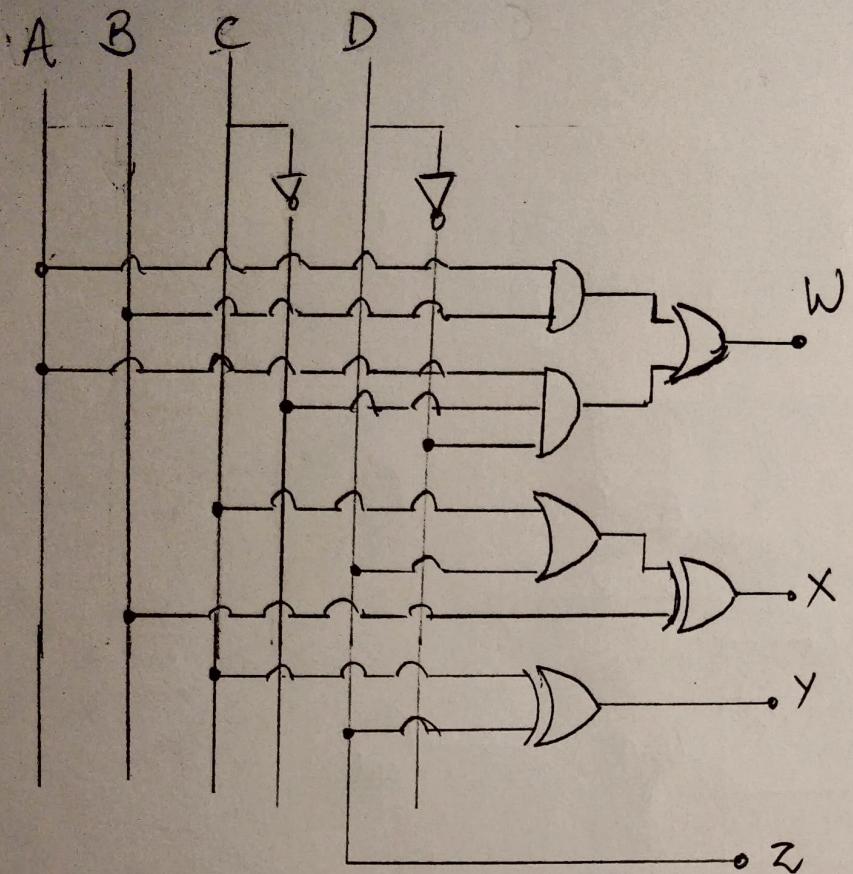
AB	00	01	11	10
00	X	X	X	
01	1			1
11	X	X		X
10	1		1	1

\overline{CD}

$$Z = D$$

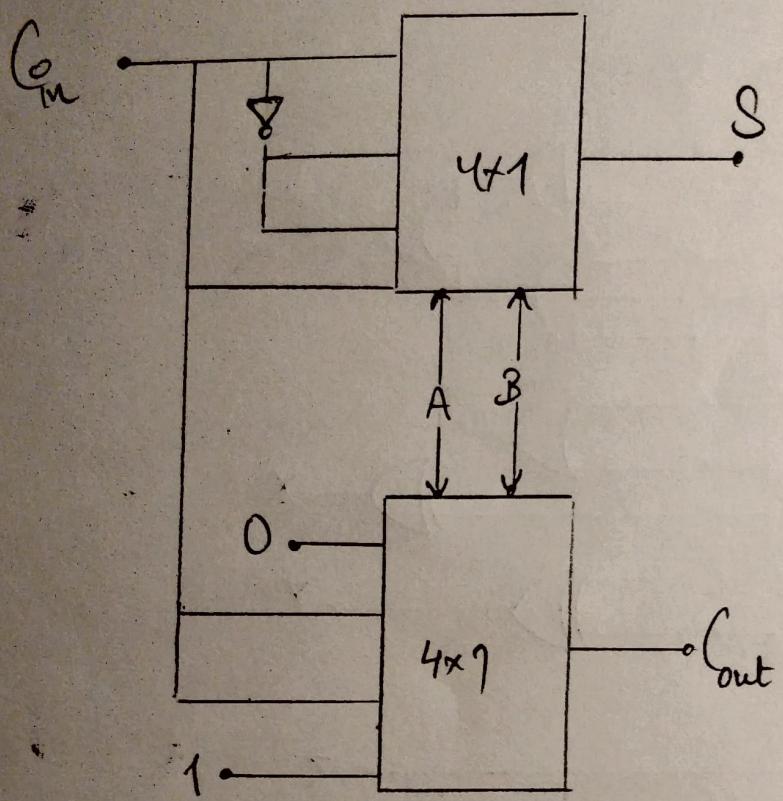
AB	00	01	11	10
00	X	X	X	
01	1	1		
11	X	X	1	X
10	1	1		

10



Select lines

	A	B	C_{in}	S	C_{out}	
(e)	0	0	0	0	0	(0)
	0	0	1	1	0	
	0	1	0	1	0	(C_{in})
	0	1	1	0	1	
	1	0	0	1	0	(C_{in})
	1	0	1	0	1	
	1	1	0	0	1	(1)
	1	1	1	1	1	



Q3

$$D = A \oplus B \oplus C$$

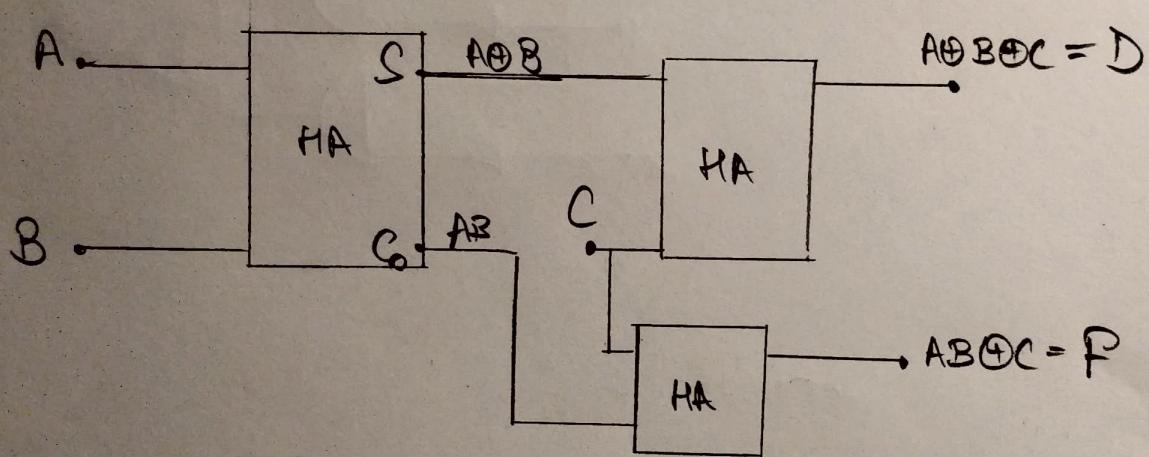
$$F = AB\bar{C} + (\bar{A} + \bar{B})C = \cancel{(\bar{A} + \bar{B})} \bar{C}$$

$$F = ABC\bar{C} + (\bar{A}\bar{B})C \quad (\text{De Morgan's law})$$

$$\Rightarrow F = AB \oplus C$$

$$\text{HA} \rightarrow \text{Sum} = A \oplus B$$

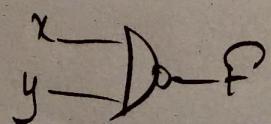
$$\text{Carry} = AB$$



Q4. For 2 inputs

x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

$$\text{ii) } F = \bar{x}\bar{y} = \bar{x} + \bar{y} \quad (\text{DeMorgan's law})$$



13

For 3 inputs

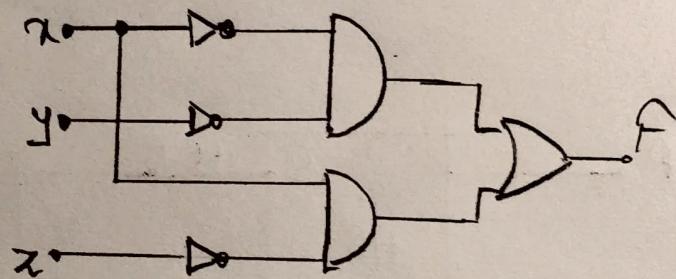
x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$\bar{y}\bar{z}$

\bar{x}	00	01	11	10
0	1	1		1
1				

$\bar{x} \bar{z}$

$$F = \bar{y}\bar{z} + \bar{x}\bar{z}$$



Q5

Select				F
A	B	C	D	

0	0	0	0	1	$I_0 = 101$
0	0	0	1	1	
0	0	1	0	1	$I_1 = 101$
0	0	1	1	1	
0	1	0	0	0	$I_2 = 0$
0	1	0	1	0	
0	1	1	0	1	$I_3 = 3 = 1$
0	1	1	1	1	

1	0	0	0	0	$I_4 = D$
1	0	0	1	1	
1	0	1	0	1	$I_5 = D'$
1	0	1	1	0	
1	1	0	0	0	$I_6 = D$
1	1	0	1	1	
1	1	1	0	0	$I_7 = D$
1	1	1	1	1	

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

↓ A $\bar{C}D$ ↓ $\bar{B}CD$

$$\Rightarrow F = \sum (0, 1, 2, 3, 6, 7, 9, 10, 13, 15)$$

$$F = \bar{A}\bar{B} + \bar{A}C + ABD + A\bar{C}D + \bar{B}CD$$