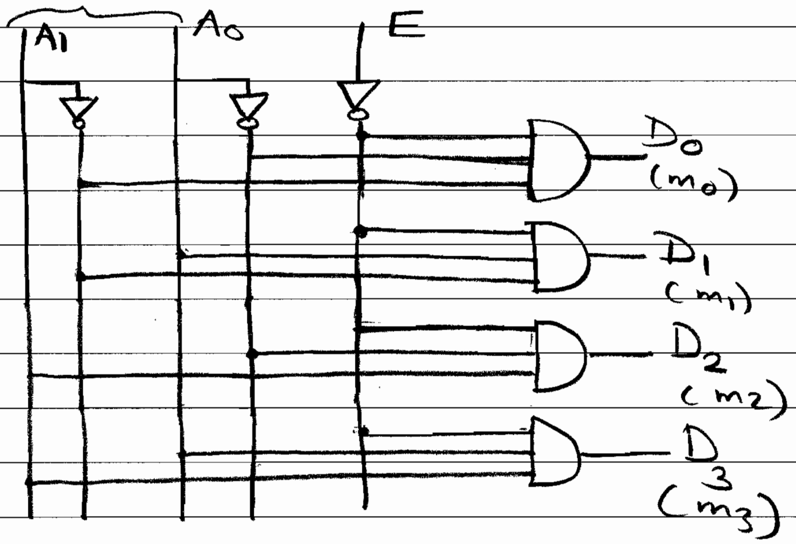
1. a. with E = 0, the decoder is enabled.

A_1	A_0	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

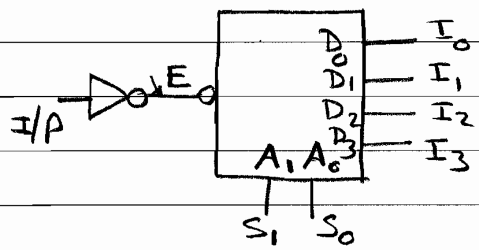
b. with E = 1, the decoder is disabled and all outputs = 0

c.

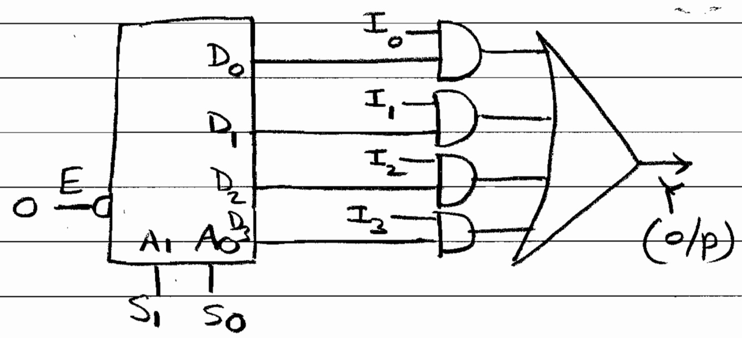


d.

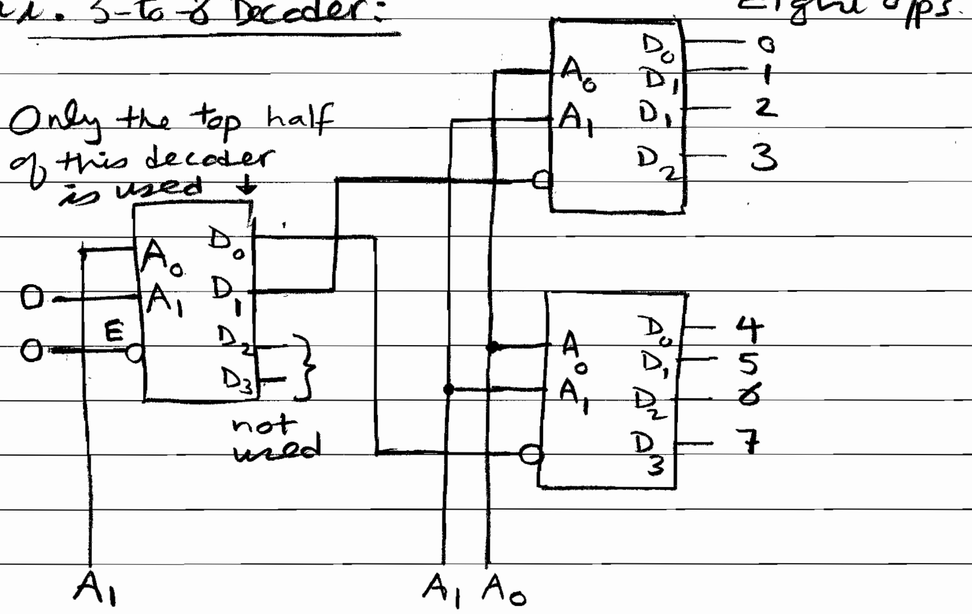
i. 1-to-4 DeMux



ii. 4-to-Mux



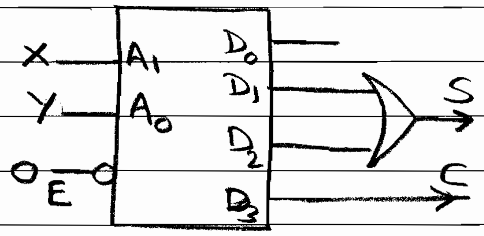
iii. 3-to-8 Decoder:



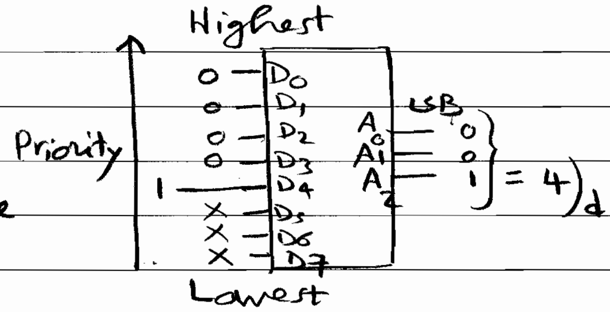
iv. Half-adder

Truth Table

	X	Y	S	C
0	0	0	0	0
1	0	1	1	0
2	1	0	1	0
3	1	1	0	1



2. a. i. see Fig →



ii. Each of the 3 don't care (X) i/ps can be either 0 or 1

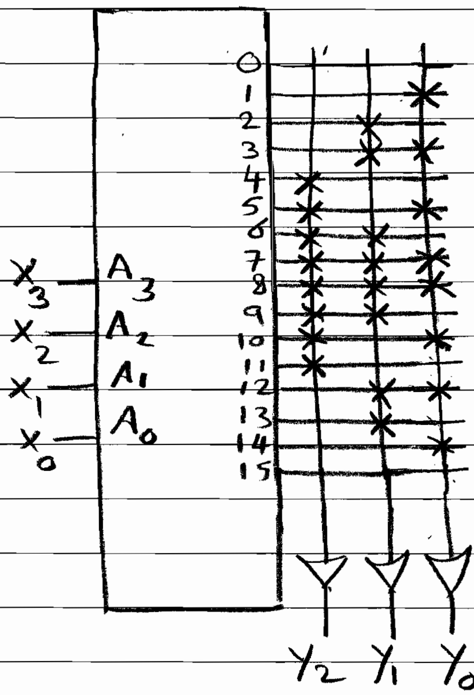
i.e we can make $2^3 = 8$ changes without affecting the o/p code.

b. D7 6 5 4 $\boxed{3}$ 2 1 D0
1 1 0 1 1 0 0 0 → o/p code = 3 = $\overset{A_2 A_1 A_0}{011}$

3.

	I/P				O/P		
	X_3	X_2	X_1	X_0	Y_2	Y_1	Y_0
0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	1
2	0	0	1	0	0	1	0
3	0	0	1	1	0	1	1
4	0	1	0	0	1	0	0
5	0	1	0	1	1	0	1
6	0	1	1	0	1	1	0
7	0	1	1	1	1	1	1
8	1	0	0	0	1	1	1
9	1	0	0	1	1	1	0
10	1	0	1	0	1	0	1
11	1	0	1	1	1	0	0
12	1	1	0	0	0	1	1
13	1	1	0	1	0	1	0
14	1	1	1	0	0	0	1
15	1	1	1	1	0	0	0

4-to-16 Decoder



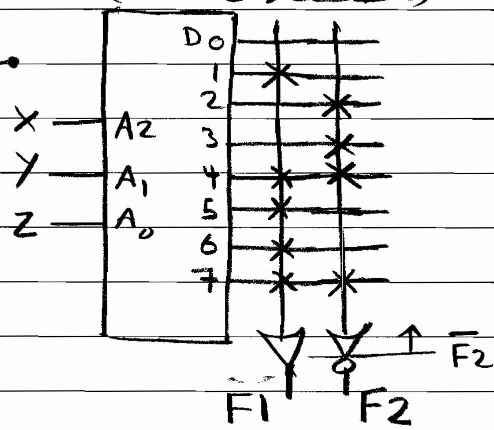
4. a.

	x	y	z	F1	F2	F3
0	0	0	0	0	1	1
1	0	0	1	1	1	0
2	0	1	0	0	0	1
3	0	1	1	0	0	1
4	1	0	0	1	0	0
5	1	0	1	1	1	1
6	1	1	0	1	1	0
7	1	1	1	1	0	0

$$F1 = (x+\bar{y})(x+z)$$
$$= x + xz + x\bar{y} + \bar{y}z$$

(3-to-8 Decoder)

b, c.

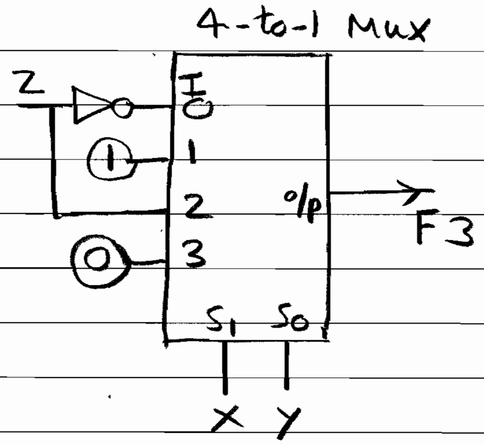


d

Mux Select

i.

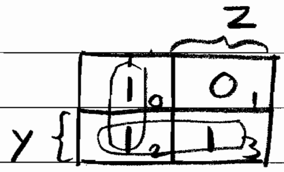
	X	Y	Z	F3	
0	0	0	0	1	$F3 = \bar{Z}$
1	0	0	1	0	
2	0	1	0	1	$F3 = 1$
3	0	1	1	1	
4	1	0	0	0	$F3 = Z$
5	1	0	1	1	
6	1	1	0	0	$F3 = 0$
7	1	1	1	0	



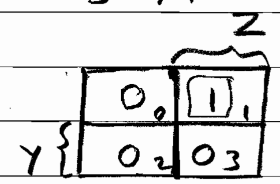
Mux select

ii

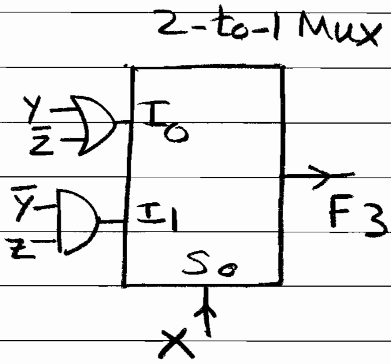
	X	Y	Z	F3
0	0	0	0	1
1	0	0	1	0
2	0	1	0	1
3	0	1	1	1
0	1	0	0	0
1	1	0	1	1
2	1	1	0	0
3	1	1	1	0



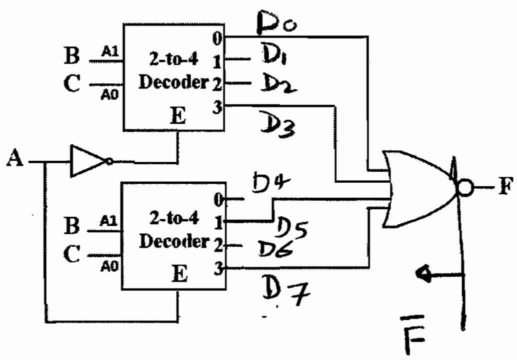
$F3 = Y + \bar{Z}$



$F3 = \bar{Y} Z$



5.



a.

$\bar{F} = \sum(0, 3, 5, 7)$

$F = \sum(1, 2, 4, 6)$

b.

$F = \prod(0, 3, 5, 7)$

$= M_0 \cdot M_3 \cdot M_5 \cdot M_7$

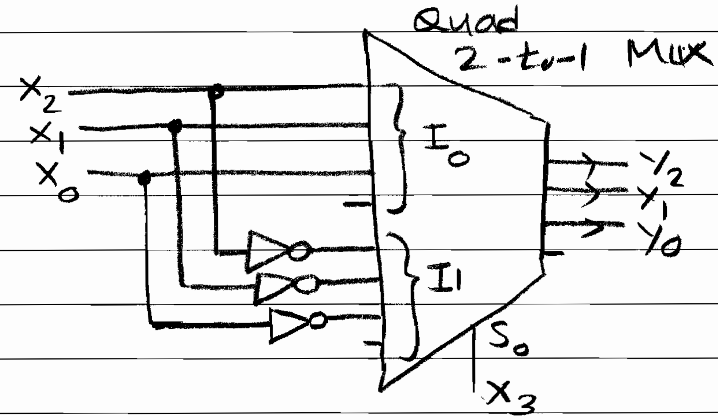
$= M_{000} \cdot M_{011} \cdot M_{101} \cdot M_{111}$

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

6. I/p in signed-1's compoement is $X_3X_2X_1X_0$ (sign bit: X_3)

o/p $Y = |X|$ in 3-bit

$$Y = \begin{cases} x_2x_1x_0 & \text{if } x_3 = 0 \\ \bar{x}_2\bar{x}_1\bar{x}_0 & \text{if } x_3 = 1 \\ \text{(1's comp.)} & \end{cases}$$



7.