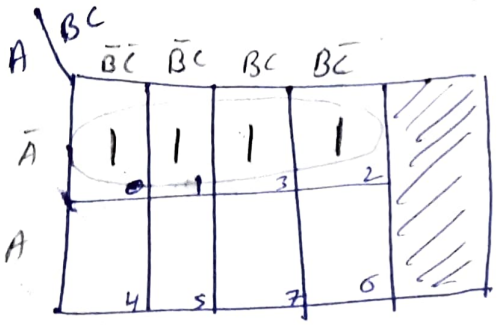
Q1

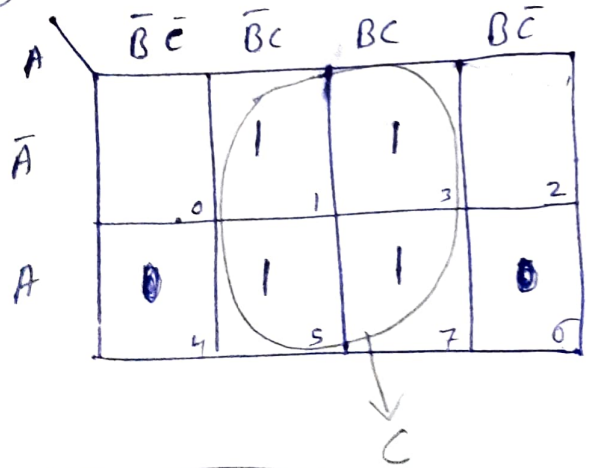
(a)

A	B	C	Y_1	Y_2
0	0	0	1	0
0	0	1	1	1
0	1	0	1	0
0	1	1	1	1
1	0	0	0	0
1	0	1	0	1
1	1	0	0	0
1	1	1	0	1



$$Y_1 = \bar{A}$$

(b)

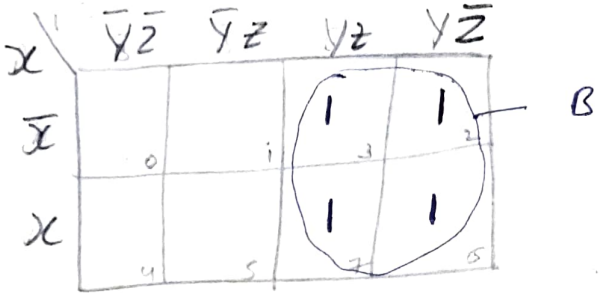


$$Y_2 = C$$

Q2

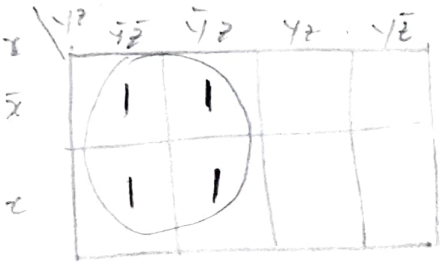
x	y	z	A	B	C
0	0	0	0	1	0
0	0	1	0	1	1
0	1	0	0	0	0
0	1	1	1	0	1
1	0	0	1	0	1
1	0	1	0	1	0
1	1	0	0	1	1
1	1	1	1	0	0
			1	0	1

for A



$$A = yB$$

for B



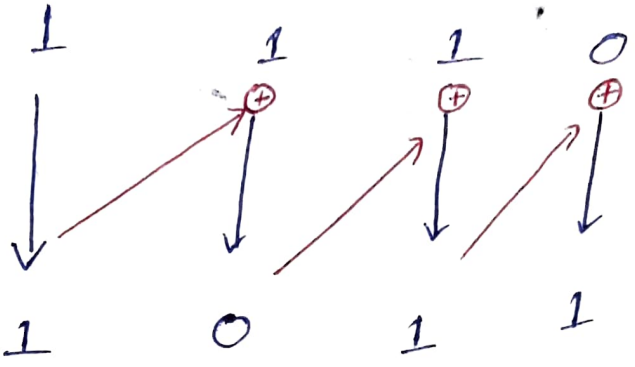
$$B = \bar{y}$$

Similarly

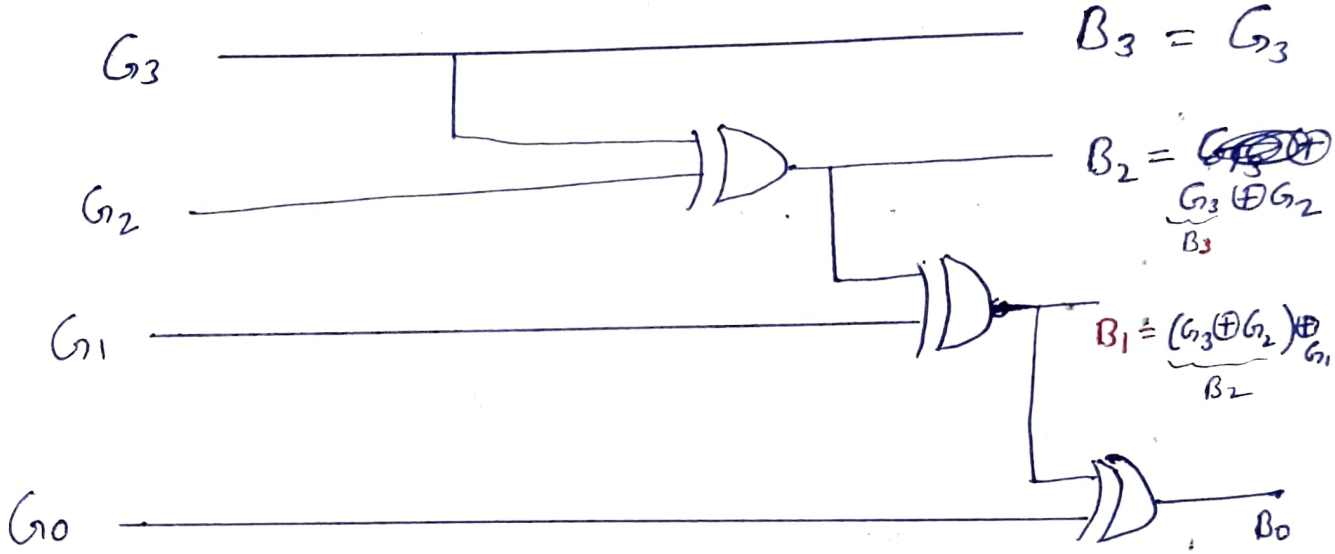
$$C = z$$

Q3

Gray ⇒ G3 G2 G1 G0



Binary ⇒ B3 B2 B1 B0

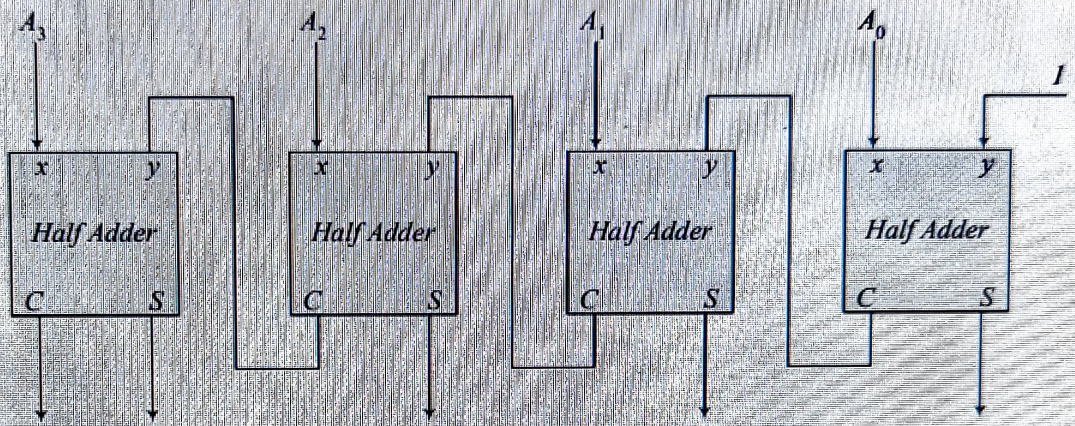


$B_0 = \underbrace{(G_3 \oplus G_2 \oplus G_1)}_{B_1} \oplus G_0$

Note:- one can solve by using logic table & expression minimization.

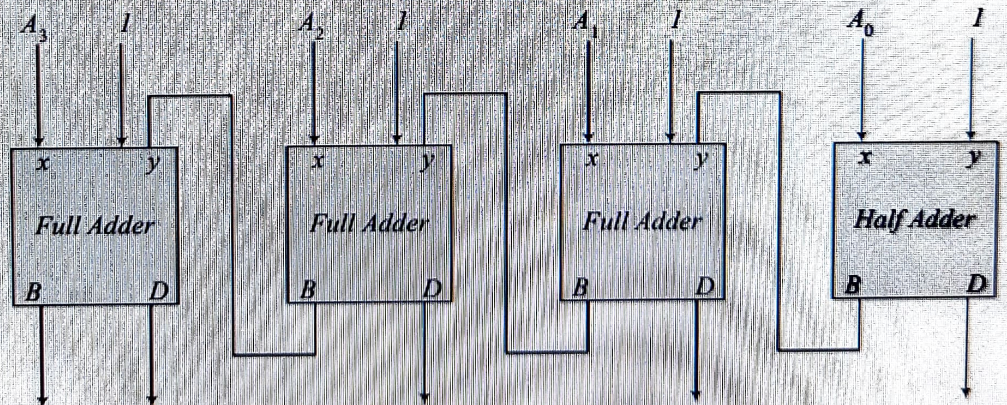
4.11

(a)



Note: 5-bit output

(b)

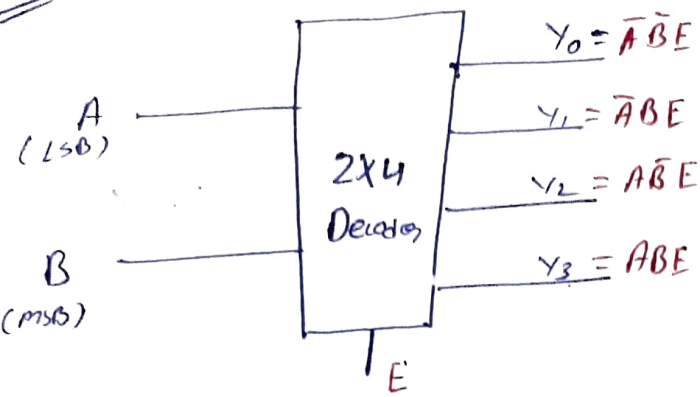


Note: To decrement the 4-bit number, add -1 to the number. In 2's complement format (add F_h) to the number. An attempt to decrement 0 will assert the borrow bit. For waveforms, see solution to Problem 4.52.

4.12

Q 6

(a)



POS of

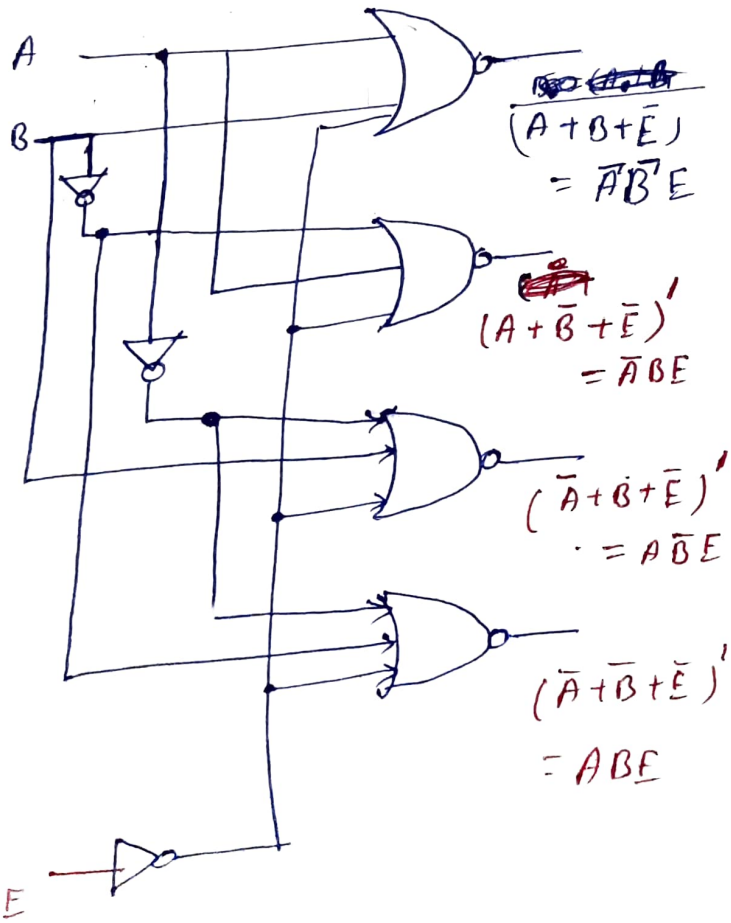
$Y_0 = (A + B + \bar{E})$

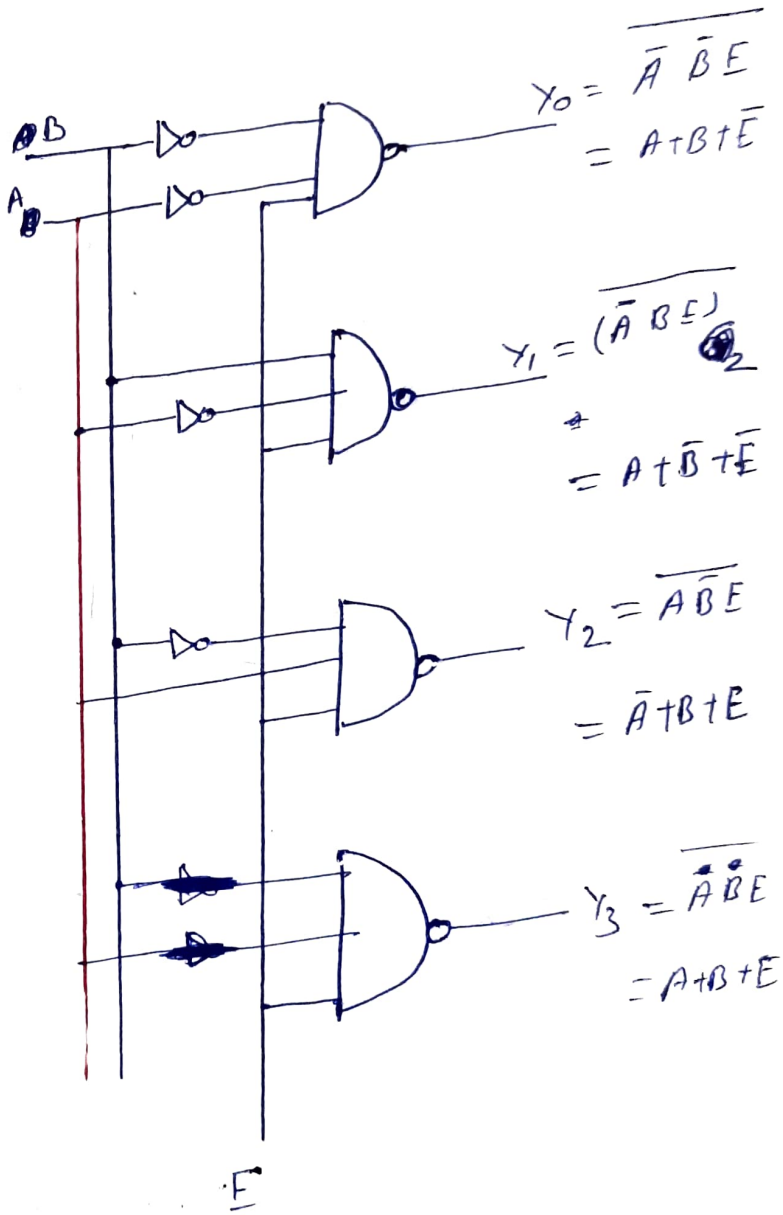
$Y_1 = (A + \bar{B} + \bar{E})$

$Y_2 = (\bar{A} + B + \bar{E})$

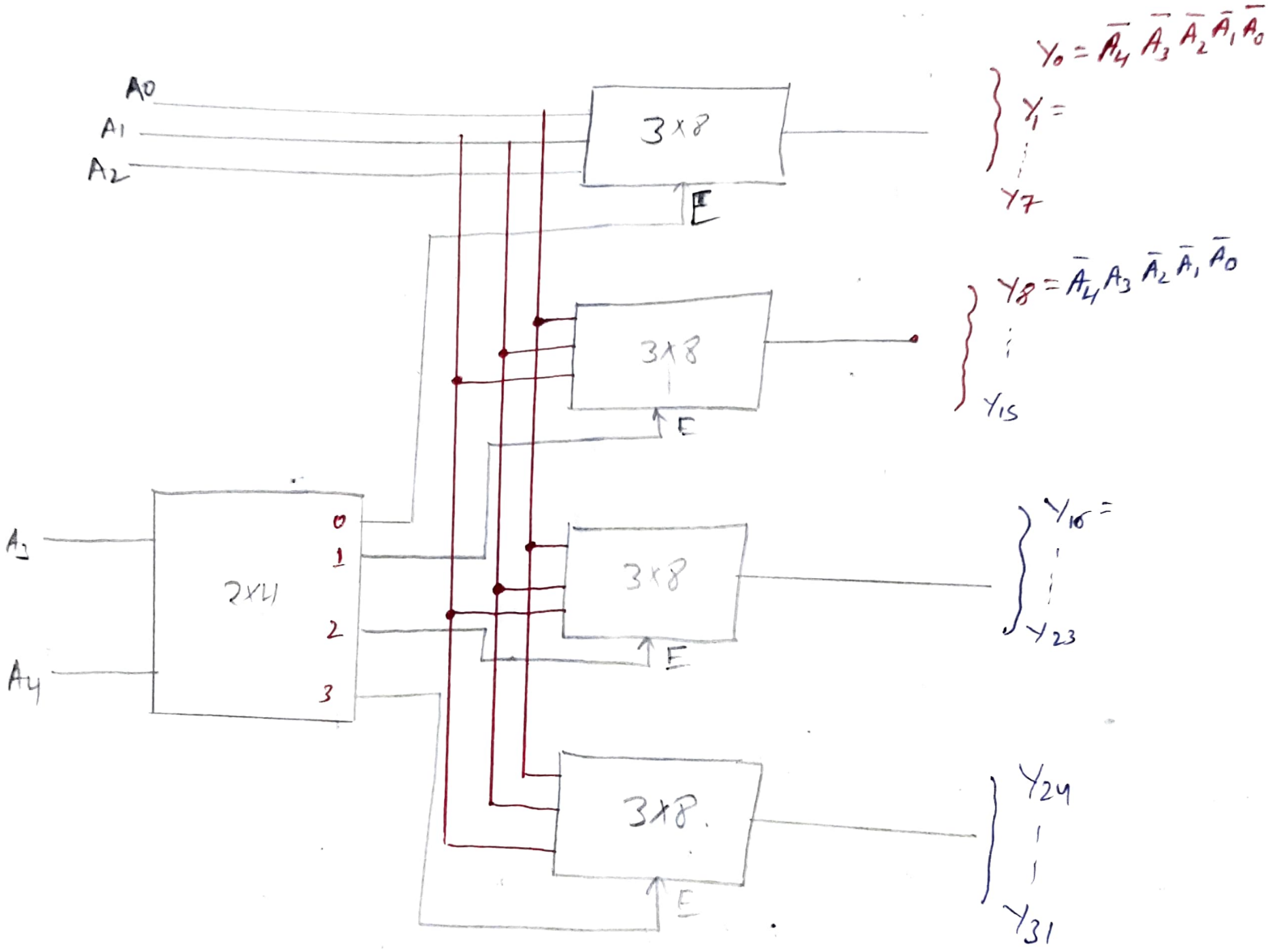
$Y_3 = (\bar{A} + \bar{B} + \bar{E})$

E	A	B	Y_3	Y_2	Y_1	Y_0
0	X	X	0	0	0	0
1	0	0	0	0	0	ϕ
1	0	1	0	0	1	0
1	1	0	0	1	0	0
1	1	1	1	0	0	0





07

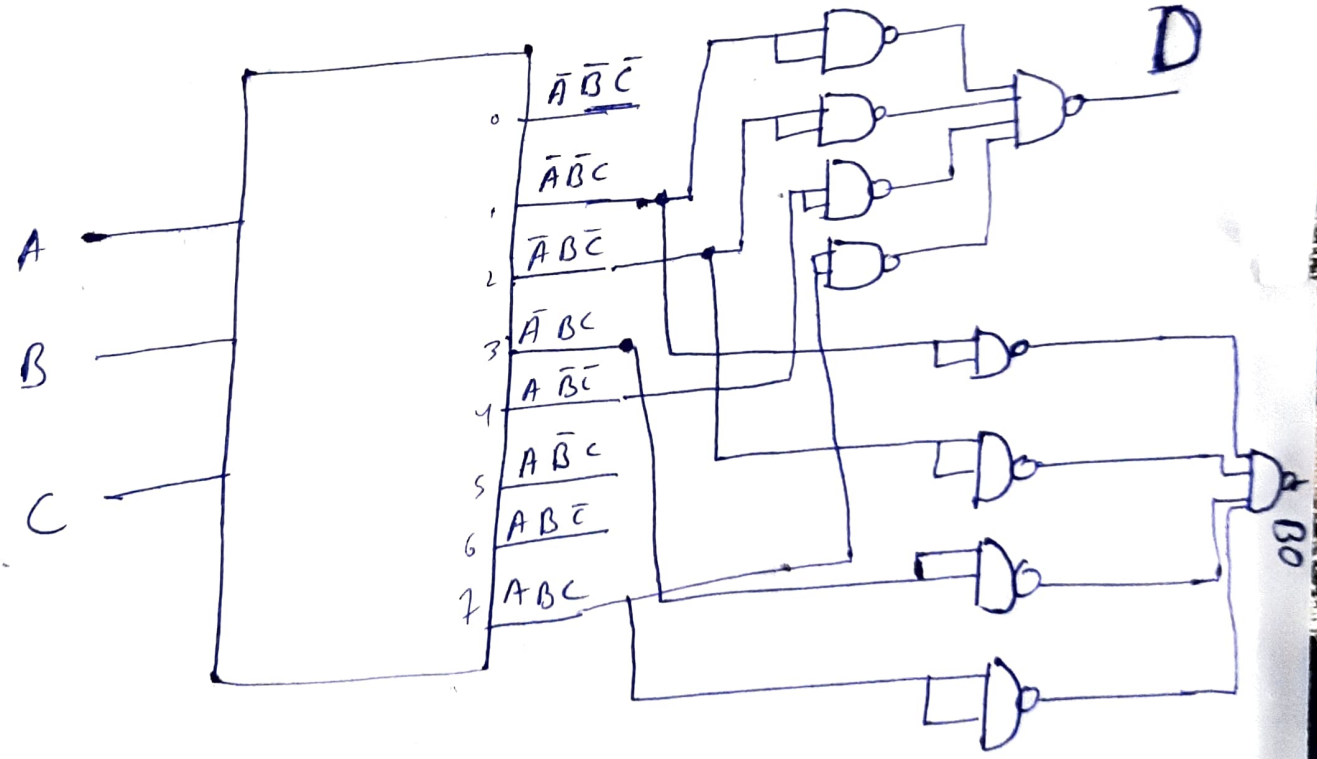

A0
A1
A2
3×8
E
$Y_0 = \bar{A}_4 \bar{A}_3 \bar{A}_2 \bar{A}_1 \bar{A}_0$
Y_1 =
Y_7
3×8
E
$Y_8 = \bar{A}_4 A_3 \bar{A}_2 \bar{A}_1 \bar{A}_0$
Y_{15}
A3
A4
2×4
0
1
2
3
3×8
E
Y_{16} =
Y_{23}
3×8.
E
Y_{24}
Y_{31}

Q 3

Full Subtractor

Diff → $\sum m(1, 2, 4, 7)$

Borrow → $\sum M(1, 2, 3, 7)$



Q9

(a) $F_1 = (y' + x)z$

$= y'z + zx$

(b) $F_2 = y'z' + xy' + yz'$

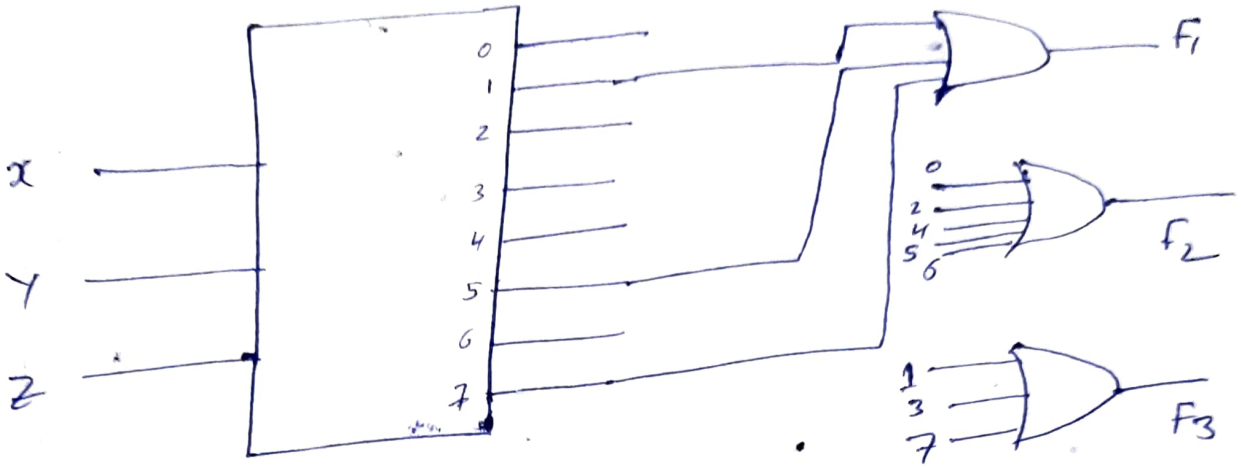
(c) $F_3 = zx' + yz$

(a)

x \ yz	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$		1		
x		1	1	

$\Downarrow$

$\sum(1,5,7) \equiv F_1$



(c)

x \ yz	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	1 (0)	1 (1)		(2)
x			1 (7)	(6)

(4) (5)

$F_3 = \sum(1,3,7)$

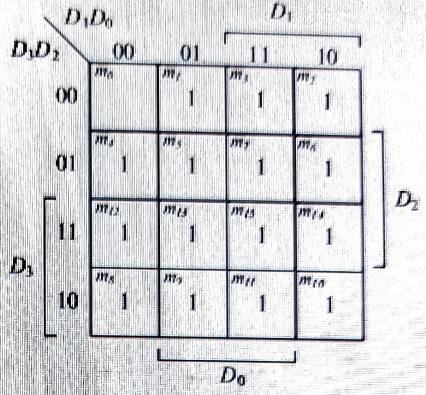
(b)

x \ yz	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	1 (0)	(1)	(3)	1 (2)
x	1 (4)	1 (5)	(7)	1 (6)

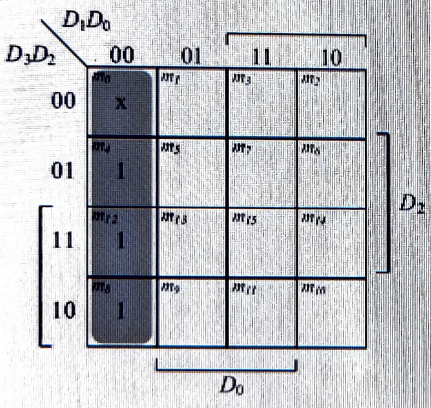
$F_2 = \sum(0,2,4,5,6)$

9

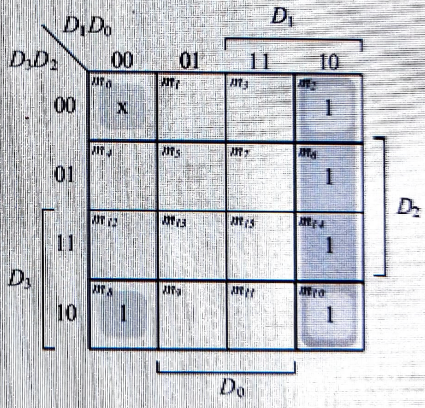
Inputs $D_3\ D_2\ D_1\ D_0$	Outputs $x\ y\ V$
0 0 0 0	x x 0
x x x 1	0 0 1
x x 1 0	0 1 1
x 1 0 0	1 0 1
1 0 0 0	1 1 1



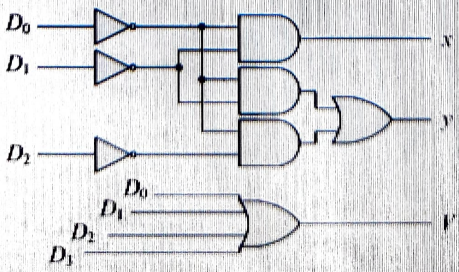
$V = D_0 + D_1 + D_2 + D_3$

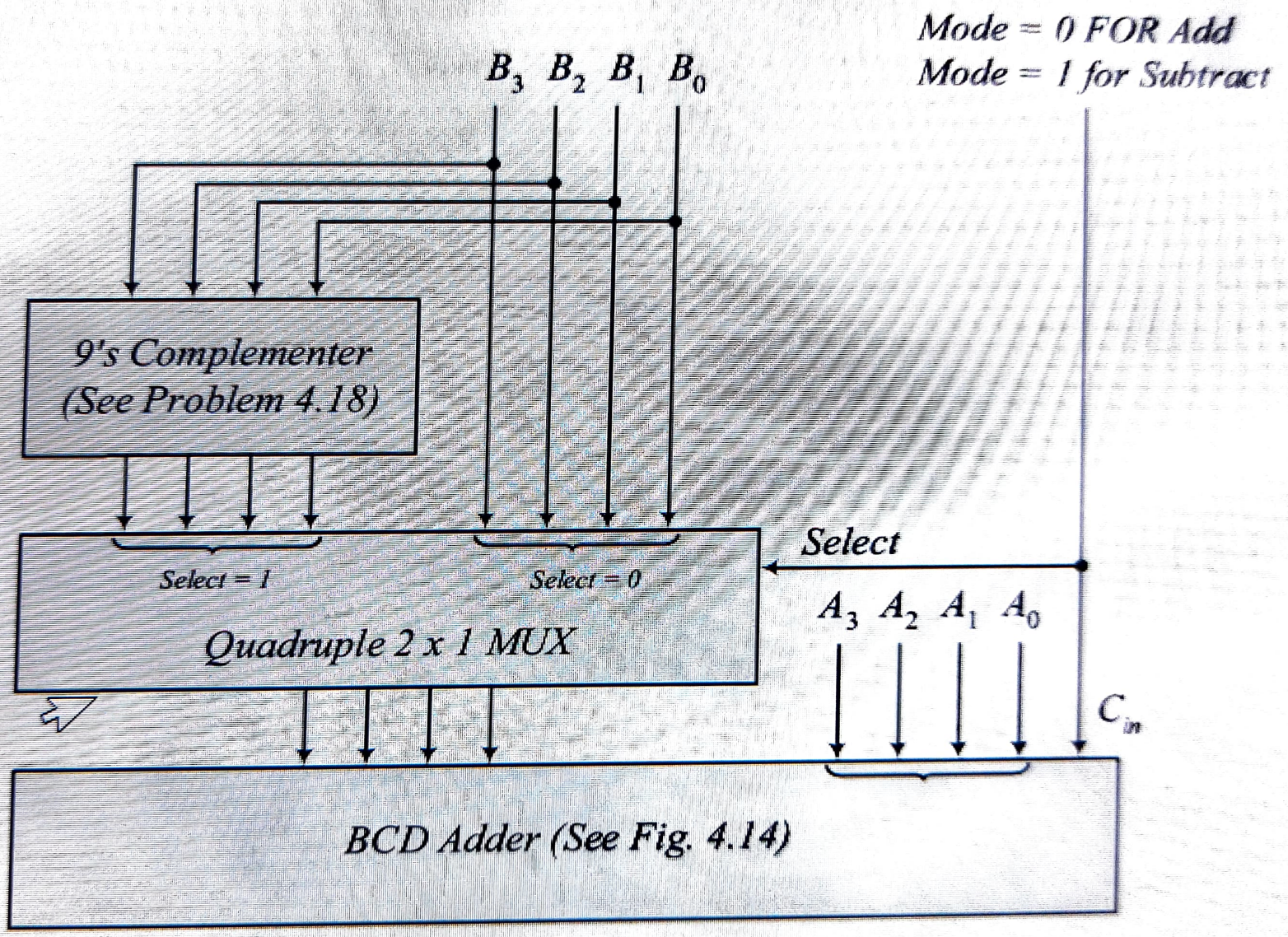


$x = D_1'D_0'$



$y = D_0'D_2' + D_1D_0'$




Mode = 0 FOR Add
Mode = 1 for Subtract
B_3 B_2 B_1 B_0
9's Complementer
(See Problem 4.18)
Select
Select = 1
Select = 0
Quadruple 2 x 1 MUX
A_3 A_2 A_1 A_0
C_{in}
BCD Adder (See Fig. 4.14)