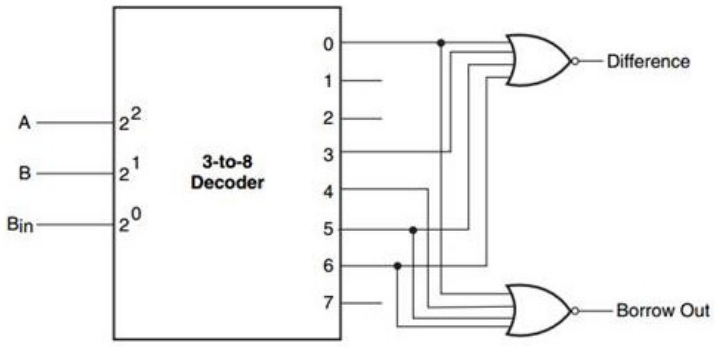
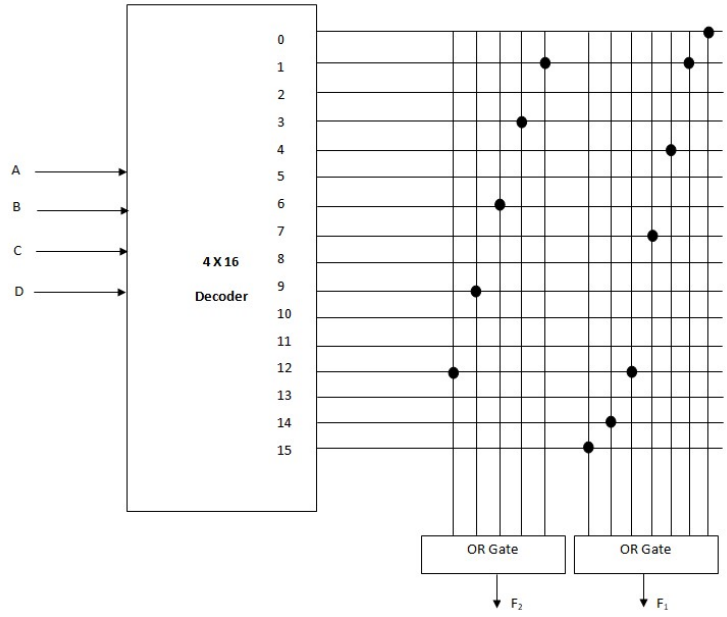
Solution Tutorial 6

Ans 1

Full Subtractor-Truth Table				
Input			Output	
A	B	C	Difference	Borrow
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

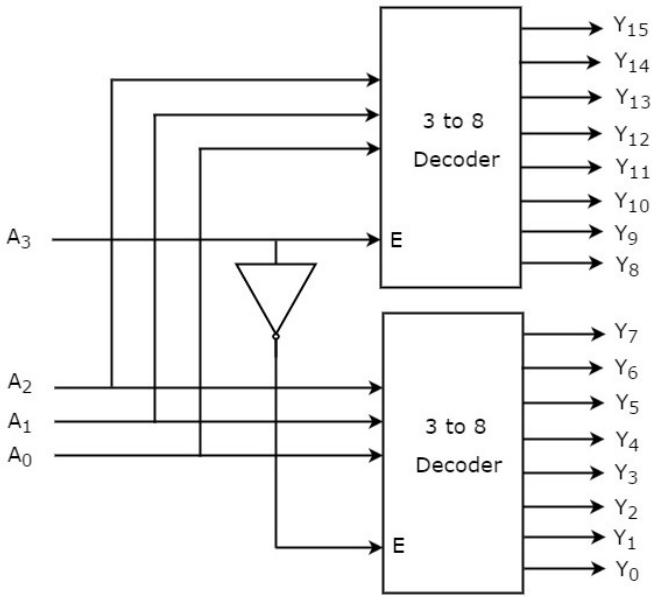


Ans 2



Similarly, F_3 and F_4 can be implemented.

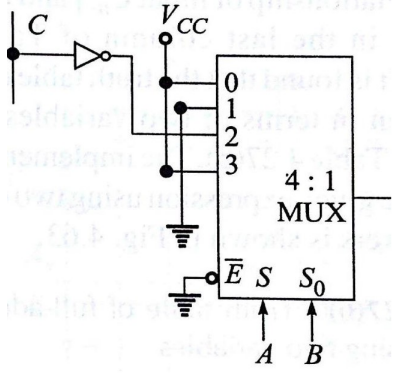
Ans 3



Ans4 (a)

Truth table of $Y(A, B, C) = \Sigma m(0, 1, 4, 6, 7)$

A	B	C	Y	
0	0	0	1	$Y = 1$
0	0	1	1	
0	1	0	0	$Y = 0$
0	1	1	0	
1	0	0	1	$Y = \overline{C}$
1	0	1	0	
1	1	0	1	$Y = 1$
1	1	1	1	



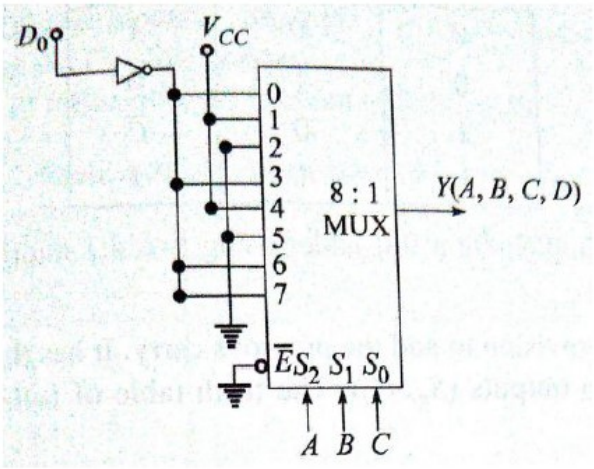
(b)

Truth table of $Y = \Sigma m(0, 2, 3, 6, 8, 9, 12, 14)$

Digit	A	B	C	D	Y	
0	0	0	0	0	1	$Y = \overline{D}$
1	0	0	0	1	0	
2	0	0	1	0	1	$Y = 1$
3	0	0	1	1	1	
4	0	1	0	0	0	$Y = 0$
5	0	1	0	1	0	
6	0	1	1	0	1	$Y = \overline{D}$
7	0	1	1	1	0	
8	1	0	0	0	1	$Y = 1$
9	1	0	0	1	1	
10	1	0	1	0	0	$Y = 0$
11	1	0	1	1	0	
12	1	1	0	0	1	$Y = \overline{D}$
13	1	1	0	1	0	
14	1	1	1	0	1	$Y = \overline{D}$
15	1	1	1	1	0	

Truth table of Y using three variables

A	B	C	Y
0	0	0	$\overline{D}$
0	0	1	1
0	1	0	0
0	1	1	$\overline{D}$
1	0	0	1
1	0	1	0
1	1	0	$\overline{D}$
1	1	1	$\overline{D}$



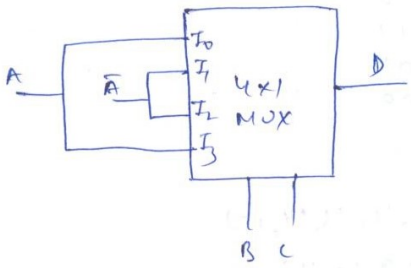
(c)

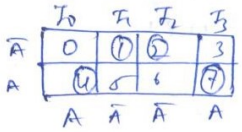
A B C	D	B_0
0 0 0	0	0
0 0 1	1	1
0 1 0	1	1
0 1 1	0	1
1 0 0	1	0
1 0 1	0	0
1 1 0	0	0
1 1 1	1	1

$D(A,B,C) = \Sigma m(1,2,4,7)$

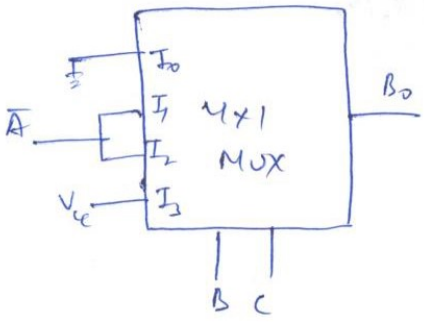
$B_0(A,B,C) = \Sigma m(1,2,3,7)$

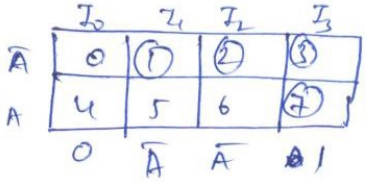
For D





For B_0



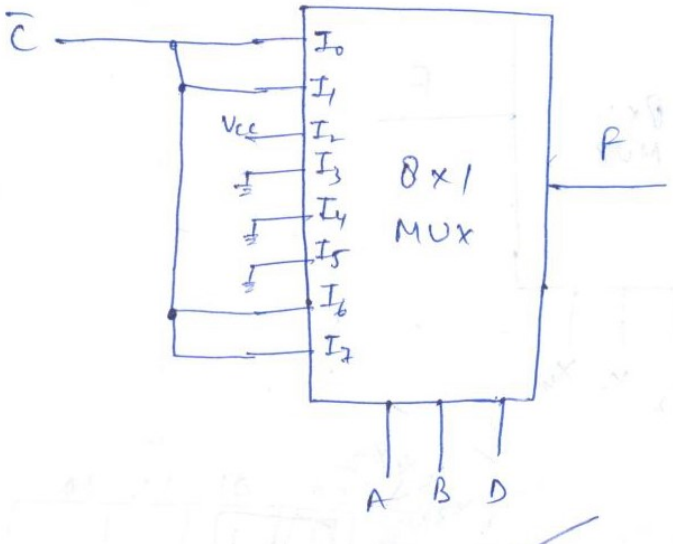


(d)

$F(A, B, C, D) = \Sigma m(0, 1, 4, 6, 12, 13)$

using 8×1 MUX.

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{C}$	(0)	(1)	(4)	5	8	9	(12)	(13)
C	2	3	(6)	7	10	11	14	15
	$\bar{C}$	$\bar{C}$	1	0	0	0	$\bar{C}$	$\bar{C}$



Ans 5 (a) 2×1 MUX

	I_0	I_1
$\bar{A}\bar{B}$	0	1
$\bar{A}B$	2	3
$A\bar{B}$	4	5
AB	6	7

$I_0 = A\bar{B}$

$I_1 = \bar{A}\bar{B} + A\bar{B} + AB$

$= \bar{B} + AB$

$= (\bar{B} + A)(\bar{B} + B)$ (using Boolean law)

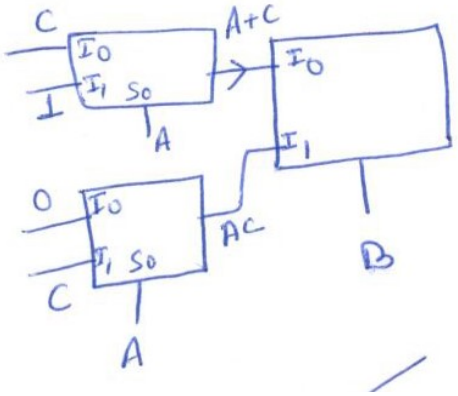
$I_1 = \bar{B} + A$

$B = 0$

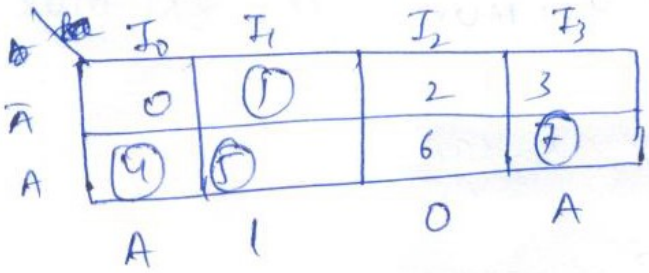
$f = A + \bar{A}C$

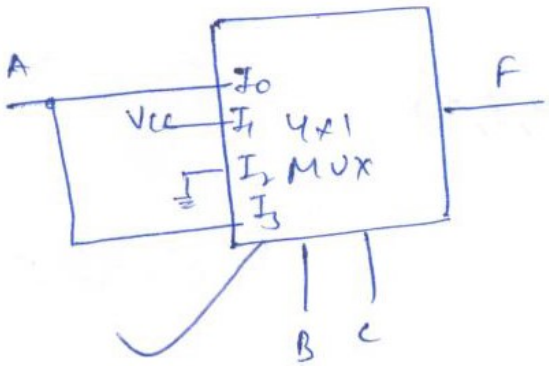
$= A + C$

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



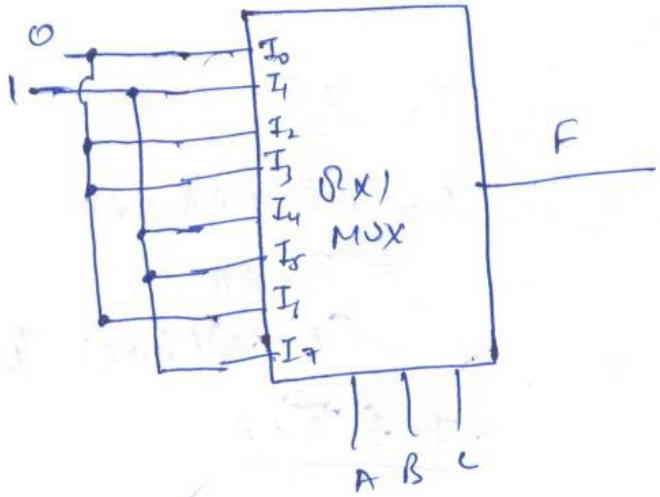
(b) 4x1 MUX





(c) 8x1 MUX

$f_2 \Sigma m(1,4,5,7)$



Ans 6

$$F = A\bar{B} + ABP$$
$$= A[\bar{B} + BP] = A[\bar{B} + P]$$

where

$$P = \bar{C}\bar{D} + C\bar{D} + CD \cdot E$$
$$= \bar{D} + CDE = \bar{D} + CE$$

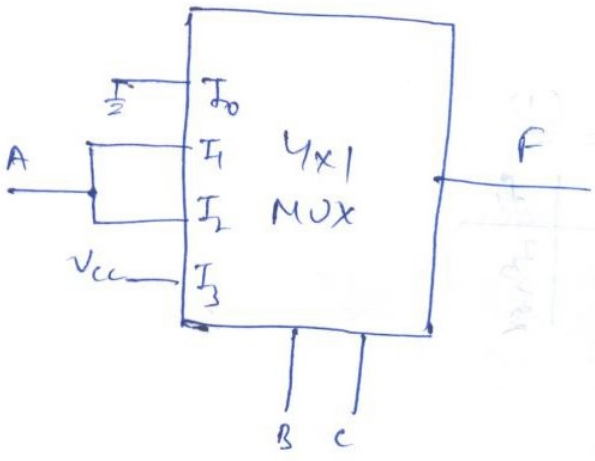
So

$$F = A[\bar{B} + \bar{D} + CE]$$
$$= A\bar{B} + A\bar{D} + ACE$$

Ans 7

$$F = \Sigma m(3, 5, 6, 7)$$

	I_0	I_1	I_2	I_3
$\bar{A}$	0	1	2	(3)
A	4	(5)	(6)	(7)
	0	A	A	1



Ans 8

Binary I/p	Gray Code O/p
A B C D	W X Y Z
0 0 0 0	0 0 0 0
0 0 0 1	0 0 0 1
0 0 1 0	0 0 1 1
0 0 1 1	0 0 1 0
0 1 0 0	0 1 1 0
0 1 0 1	0 1 1 1
0 1 1 0	0 1 0 1
0 1 1 1	0 1 0 0
1 0 0 0	1 1 0 0
1 0 0 1	1 1 0 1
1 0 1 0	1 1 1 1
1 0 1 1	1 1 1 0
1 1 0 0	1 0 1 0
1 1 0 1	1 0 1 1
1 1 1 0	1 0 0 1
1 1 1 1	1 0 0 0

W = Σm (8, 9, 10, 11, 12, 13, 14, 15)

X = Σm (4, 5, 6, 7, 8, 9, 10, 11)

Y = Σm (2, 3, 4, 5, 10, 11, 12, 13)

Z = Σm (1, 2, 5, 6, 9, 10, 13, 14)

Implement it by using 4×1 MUX.