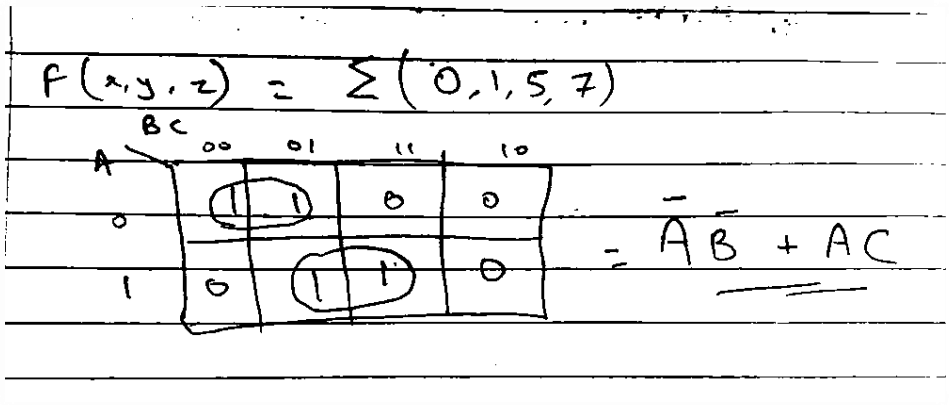
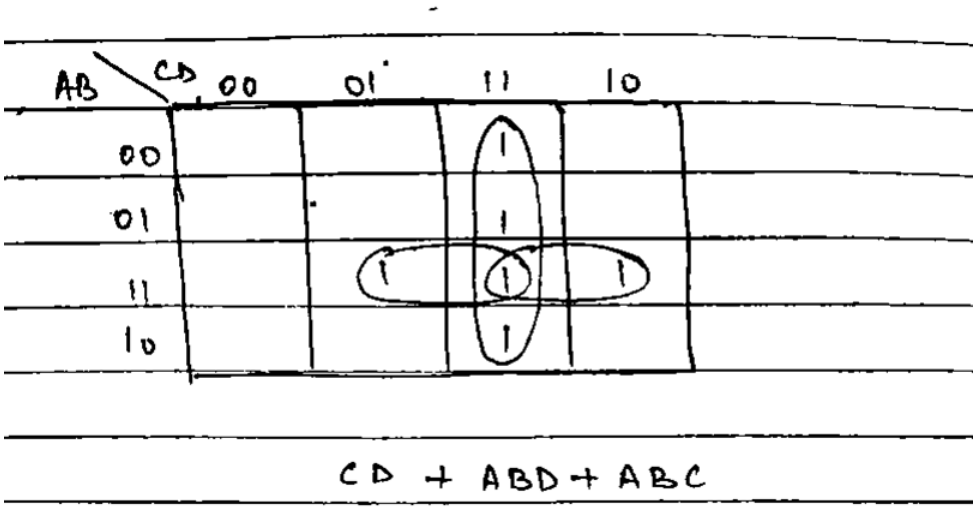
Practice sheet 2 solutions

Q1.

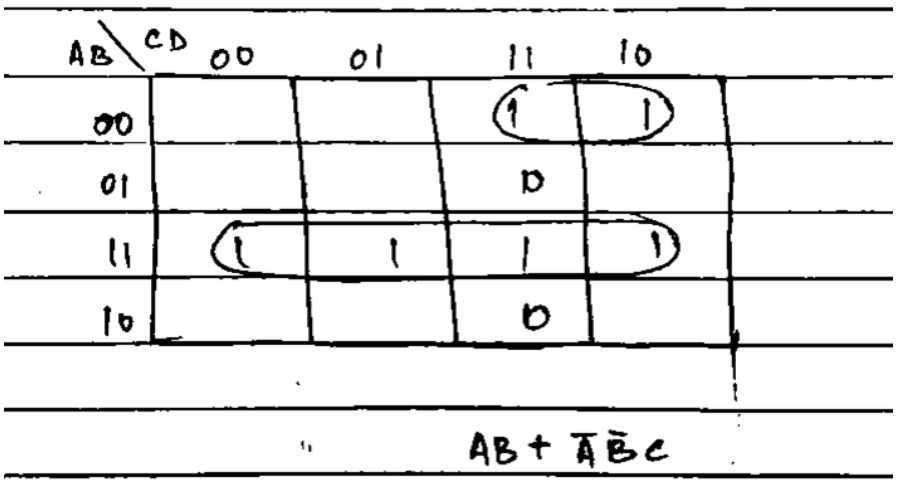
a.



b.



c.



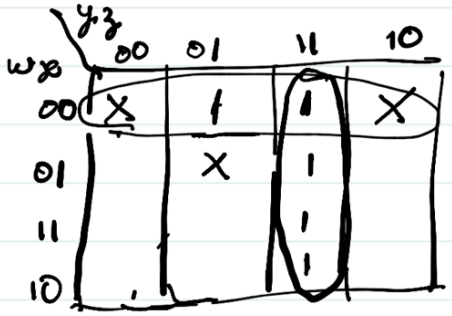
d.

$$F(w,x,y,z) = \Sigma(1,3,7,11,15)$$

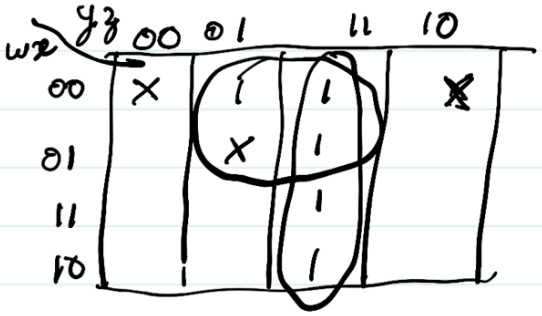
$$d(w,x,y,z) = \Sigma(0,2,5)$$

$$F = (0001, 0011, 0111, 1011, 1111)$$

$$d = (0000, 0010, 0101)$$



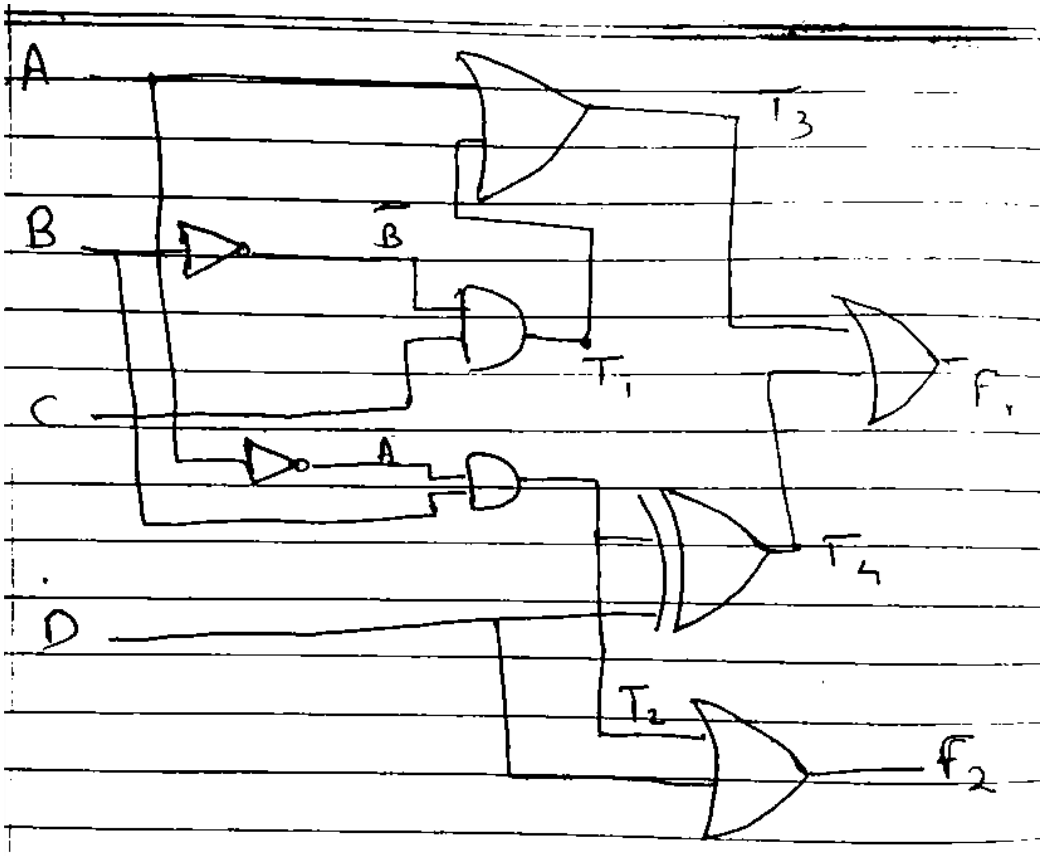
$$= w'x' + yz$$



$$w'z + yz$$

$$= (w' + y)z$$

2.



$T_1 = \bar{B} \cdot C \quad T_2 = \bar{A}B \quad T_3 = A + \bar{B}C \quad T_4 = \bar{A}B \oplus D$

$F_2 = \bar{A}B + D$

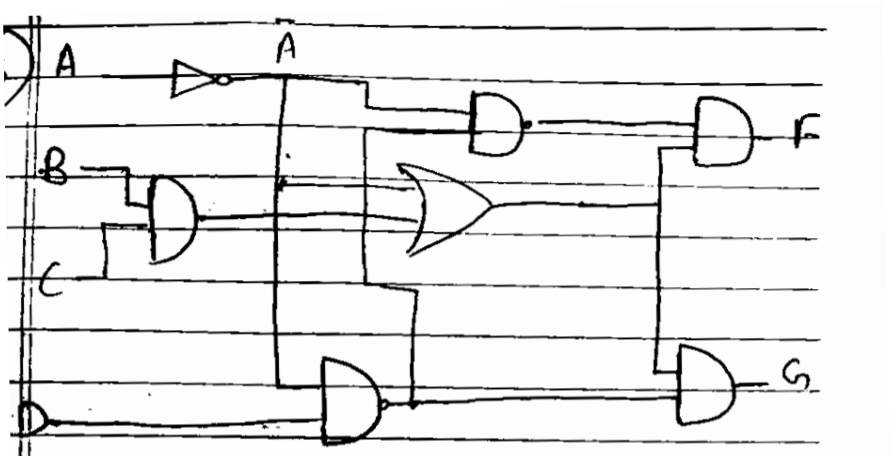
$F_1 = [A + \bar{B}C] + \bar{D}\bar{A}B + DA + D\bar{B}$

$= A + \bar{B}C + AD + \bar{B}D + \bar{A}B\bar{D}$

$= A + B'C + B'D + BD'$

$= A + B'(C + D) + BD'$

3.

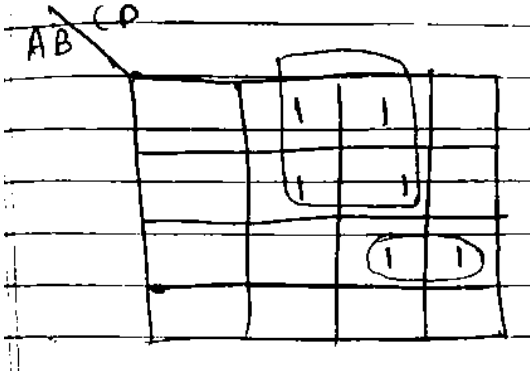


$F = [\bar{A}(A+\bar{D})]' \cdot [\bar{A}+BC]$

$= [A+D][\bar{A}+BC] = ABC + \bar{A}D + BCD$

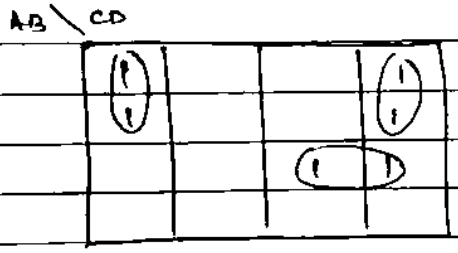
$G = [\bar{A}+BC][A+\bar{D}] = \bar{A}\bar{D} + ABC + BC\bar{D}$

$ABC + \bar{A}D + BCD$



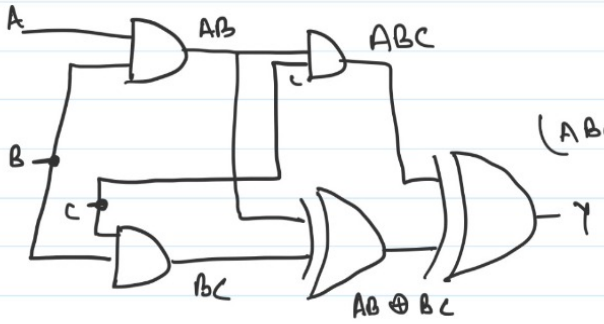
$F = \bar{A}D + ABC$

$\bar{A}\bar{D} + ABC + BC\bar{D}$



$G = \bar{A}\bar{D} + ABC$

4.

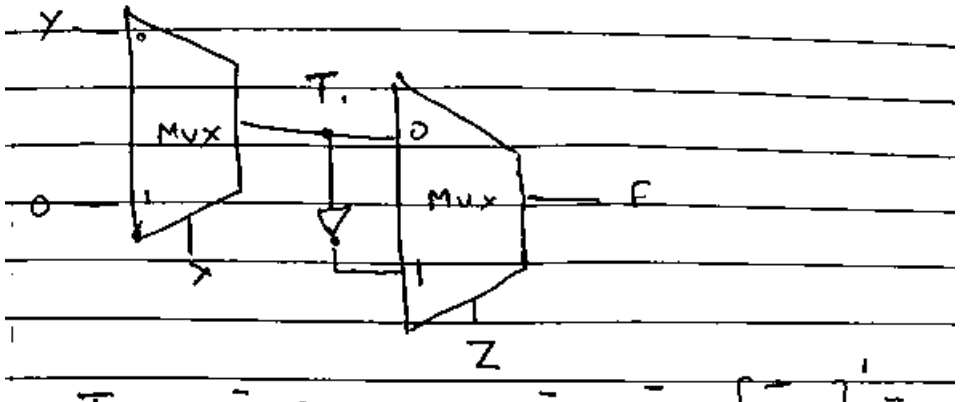


$(ABC) \oplus \overline{AB} \oplus \overline{BC}$

$ABC \Rightarrow AB$ and BC $\therefore ABC \Rightarrow Y$

$$
\begin{aligned}
&ABC + AB \oplus BC \\
&= ABC + B(A \oplus C) \\
&= B(AC + A \oplus C) \\
&= B(AC + AC' + A'C) \\
&= B(A + C)
\end{aligned}
$$

5.



$T_1 = \bar{X} Y$; $F = \bar{X} Y \bar{Z} + [\bar{X} Y]' Z$

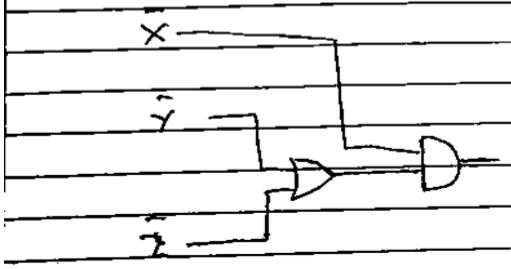
$F = \bar{X} Y \bar{Z} + Z X + Z \bar{Y}$

6.

a.

X	Y	Z	out
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

$$f(x,y,z) = \bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z + \bar{x}y\bar{z}$$
$$= \bar{x}\bar{y} + \bar{x}y\bar{z}$$
$$= \bar{x}(\bar{y} + \bar{z})$$



b.

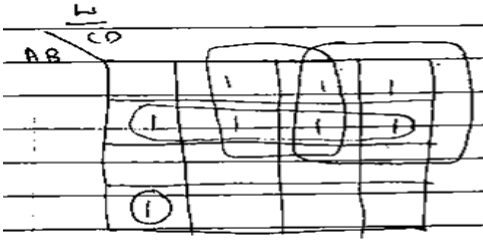
X	Y	Z	OUT
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

$$= f(x,y,z)$$
$$= \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}\bar{z} + xy\bar{z}$$
$$= \bar{x}\bar{z} + x\bar{z}$$
$$= \bar{z}$$

7.

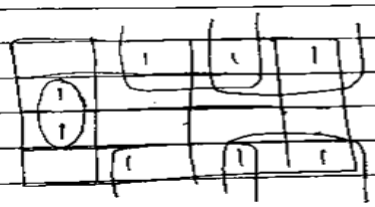
Inputs	Outputs
0 0 0 0	0 0 0 0
0 0 0 1	1 1 1 1
0 0 1 0	1 1 1 0
0 0 1 1	1 1 0 1
0 1 0 0	1 1 0 0
0 1 0 1	1 0 1 1
⋮	⋮
1 1 1 1	0 0 0 1

W



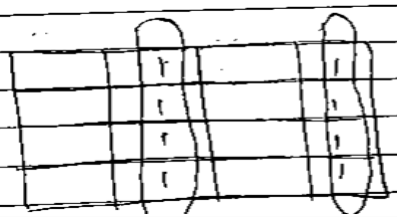
$W = A'(B+C+D) + AB'C'D'$

X



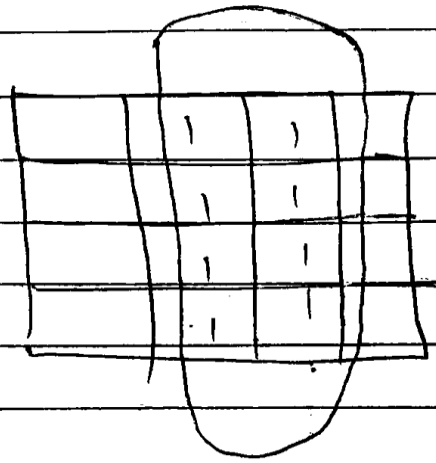
$X = B'(C+D) + BC'D'$

Y



$Y = CD' + C'D$

Z



$Z = D$