Name : Samun Islam Ahmed
ID : 2019380182

Assignment-2

Problem - 2.2

Soln:

$$(x+y).(x+\bar{y}) = xx+x\bar{y}+xy+y\bar{y}$$

$$= x+xy+x\bar{y}+0 \quad [\because y.\bar{y}=0]$$

$$= x+xy+x\bar{y}$$

$$= x(1+y+\bar{y})$$

$$= x(1+1) \quad [\because x+\bar{x}=1]$$

$$= x.1 = x$$

Hence $(x+y).(x+\bar{y}) = x$ [proven].

Problem - 2.3

Soln:

$$L.H.S = xy+yz+\bar{x}z$$

$$= xy+(x+\bar{x})yz+\bar{x}z$$

$$= xy+xyz+\bar{x}yz+\bar{x}z$$

$$= xy(1+z)+\bar{x}z(y+1) = xy+\bar{x}z = R.H.S$$

$\therefore xy+yz+\bar{x}z = xy+\bar{x}z$ [proved].

problem - 2.7

ⓐ Soln: $\bar{x}_1 x_3 + x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 + x_1 \bar{x}_2 = \bar{x}_2 x_3 + x_1 \bar{x}_3 + x_2 \bar{x}_3 + \bar{x}_1 x_2 x_3$

$\therefore$ L.H.S $= \bar{x}_1 x_3 + x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 + x_1 \bar{x}_2$

$= \bar{x}_1 (\bar{x}_2 + x_2) x_3 + x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 (\bar{x}_3 + x_3) + x_1 \bar{x}_2 (\bar{x}_3 + x_3)$

$= \bar{x}_1 \bar{x}_2 x_3 + \bar{x}_1 x_2 x_3 + x_1 x_2 \bar{x}_3 + x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 x_3 + x_1 \bar{x}_2 \bar{x}_3 + x_1 \bar{x}_2 x_3$

$= (\bar{x}_1 \bar{x}_2 x_3 + x_1 \bar{x}_2 x_3) + (x_1 x_2 \bar{x}_3 + x_1 \bar{x}_2 \bar{x}_3) + (x_1 x_2 \bar{x}_3 + \bar{x}_1 x_2 \bar{x}_3) + \bar{x}_1 x_2 x_3$

$= (\bar{x}_1 + x_1) \bar{x}_2 x_3 + x_1 (x_2 + \bar{x}_2) \bar{x}_3 + (x_1 + \bar{x}_1) x_2 \bar{x}_3 + \bar{x}_1 x_2 x_3$

$= 1 (\bar{x}_2 x_3) + x_1 \cdot 1 \cdot \bar{x}_3 + 1 (x_2 \bar{x}_3) + \bar{x}_1 x_2 x_3$

$= (\bar{x}_2 x_3) + (x_1 \bar{x}_3) + (x_2 \bar{x}_3) + \bar{x}_1 x_2 x_3$

$=$ R.H.S

$\therefore$ L.H.S = R.H.S (same) → valid.

(b) Solⁿ.

$R.H.S = (x_1 + \bar{x}_2 + x_3)(x_1 + x_2 + \bar{x}_3)(\bar{x}_1 + x_2 + \bar{x}_3)$

~~$= ((x_2 + \bar{x}_3) + x_1)((x_2 + \bar{x}_3) + x_1)$~~

$= ((\bar{x}_2 + x_3) + x_1)((x_2 + \bar{x}_3) + x_1)(x_1 + \bar{x}_2 + x_3)$

$= (x_2 + \bar{x}_3) \cdot (x_1 + \bar{x}_2 + x_3)$

$= x_1 x_2 + \underbrace{x_2 \bar{x}_2}_{0} + x_2 x_3 + x_1 \bar{x}_3 + \bar{x}_2 \bar{x}_3 + \underbrace{x_3 \bar{x}_3}_{0}$

$= x_1 x_2 + x_2 x_3 + x_1 \bar{x}_3 + \bar{x}_2 \bar{x}_3$

$= x_1 x_2 + x_1 \bar{x}_3 + \bar{x}_2 \bar{x}_3 + x_2 x_3$

$= x_1 x_2 (x_3 + \bar{x}_3) + x_1 \bar{x}_3 + \bar{x}_2 \bar{x}_3 + x_2 x_3$

$= x_1 x_2 x_3 + x_1 x_2 \bar{x}_3 + x_1 \bar{x}_3 + \bar{x}_2 \bar{x}_3 + x_2 x_3$

$$= (x_1 x_2 \bar{x}_3 + x_1 \bar{x}_3) + (x_1 x_2 x_3 + x_2 x_3) + \bar{x}_2 \bar{x}_3$$

$$= x_1 \bar{x}_3 (x_2 + 1) + x_2 x_3 (x_1 + 1) + \bar{x}_2 \bar{x}_3$$

$$= x_1 \bar{x}_3 + x_2 x_3 + \bar{x}_2 \bar{x}_3 = L.H.S$$

$\therefore$ L.H.S = R.H.S $\rightarrow$ valid.

(c) Soln: $(x_1 + x_3)(\bar{x}_1 + \bar{x}_2 + \bar{x}_3)(\bar{x}_1 + x_3) =$

$(x_1 + x_2)(x_2 + x_3)(\bar{x}_1 + \bar{x}_3)$

let $A = (x_1 + x_3)(\bar{x}_1 + \bar{x}_2 + \bar{x}_3)(\bar{x}_1 + x_2)$

$B = (x_1 + x_2)(x_2 + x_3)(\bar{x}_1 + \bar{x}_3)$

x_1	x_2	x_3	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	A	B
0	0	0	1	1	1	0.1.1 = 0	0.0.1 = 0
0	0	1	1	1	0	1.1.1 = 1	0.1.1 = 0
0	1	0	1	0	1	0.1.1 = 0	1.1.1 = 1
0	1	1	1	0	0	1.1.1 = 1	1.1.1 = 1
1	0	0	0	1	1	1.1.0 = 0	1.0.1 = 0
1	0	1	0	1	0	1.1.0 = 0	1.1.0 = 0
1	1	0	0	0	1	1.1.1 = 1	1.1.1 = 1
1	1	1	0	0	0	1.0.1 = 0	1.1.0 = 0

Therefore, the expression (c) is not valid.

Problem - 2.8

Soln:

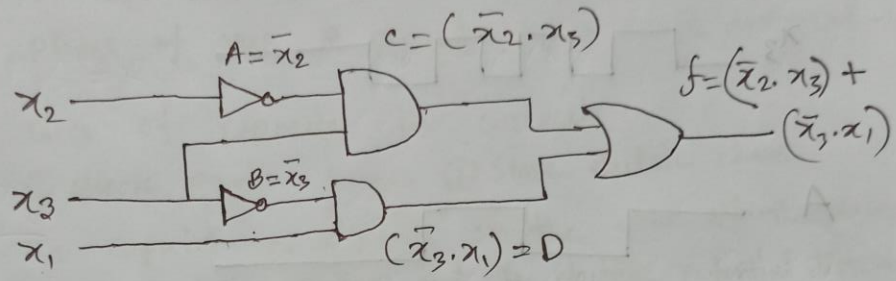
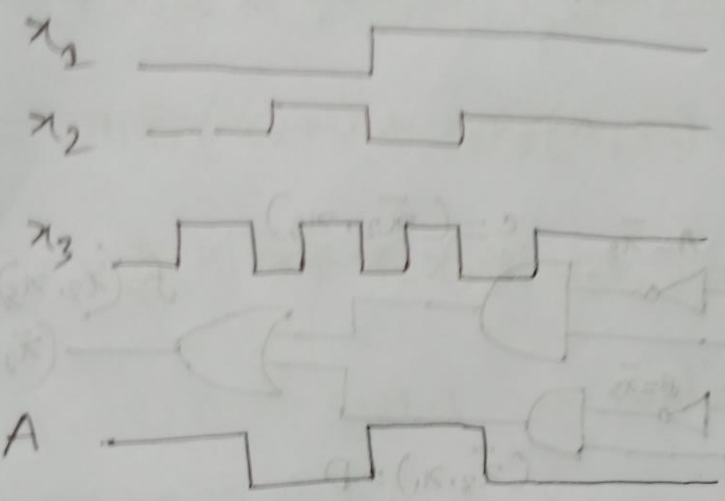
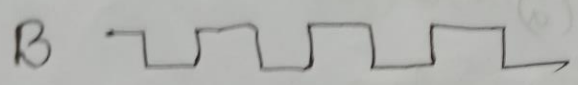


Fig. 2.24 (a)

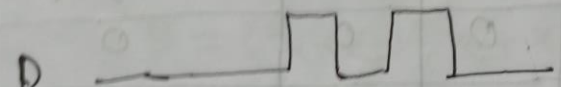
$f = (\bar{x}_2 x_3) + (\bar{x}_3 \cdot x_1)$

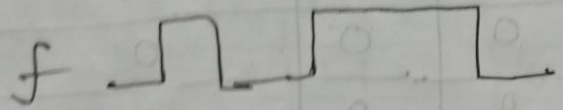
x_1	x_2	x_3	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	$\bar{x}_2 \cdot x_3$	$\bar{x}_3 \cdot x_1$	$f = (\bar{x}_2 x_3) + (\bar{x}_3 x_1)$
0	0	0	1	1	1	0	0	0
0	0	1	1	1	0	1	0	1
0	1	0	1	0	1	0	0	0
0	1	1	1	0	0	0	0	0
1	0	0	0	1	1	0	1	1
1	0	1	0	1	0	1	0	1
1	1	0	0	0	1	0	1	1
1	1	1	0	0	0	0	0	0


x_1
x_2
x_3
A


B


C


D


f