

# Assignment 2. (3 Sep)

Q1. (a)  $ABC + A'B + ABC'$

$$B(AC + A' + AC')$$

$$B(A' + C + AC')$$

$$B(A' + C + A)$$

$$B(1 + C) = \boxed{B}$$

(b)  $x'yz + xz$

$$z(x'y + z)$$

$$z(x + y)$$

$$\boxed{xz + yz}$$

using absorption prop.  
 $A + A'B \rightarrow A + B$

(c)  $(x+y)'(x'+y')$   
 demorgan's

$$x'y'(x' + y')$$

$$x'y' + x'y'$$

$$\boxed{x'y'} \text{ idempotency}$$

(d)  $xy + x(wz + wz')$

$$xy + xw(z + z')$$

$$x(y + w)$$

$$\boxed{xy + xw}$$

(e)  $(BC' + AD)(AB' + CD')$

$$BC'(AB' + CD') + AD(AB' + CD')$$

$$BB'(AC') + CC'(BD') + (AA'(DB')) + (A'C)DD'$$

$$\boxed{0} \text{ complementary}$$

Q2. (a)  $(w' + x')(y + z)$

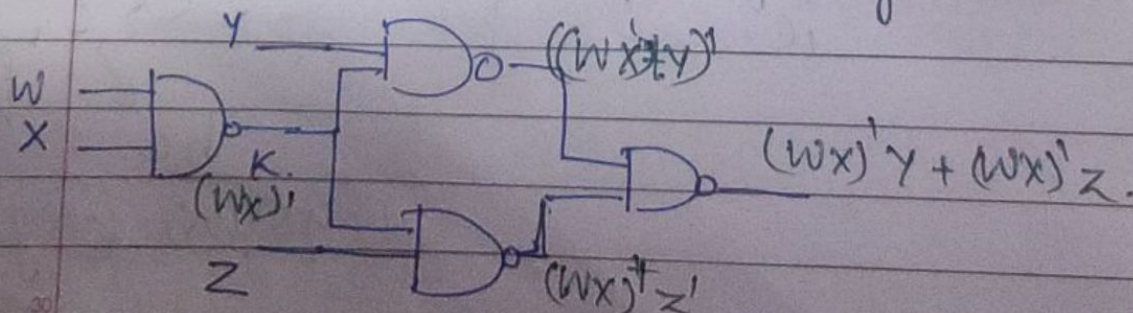
$$(wx)'(y + z) \text{ demorgan's}$$

$$(wx)'y + (wx)'z \text{ distributive}$$

let  $(wx)' = K$

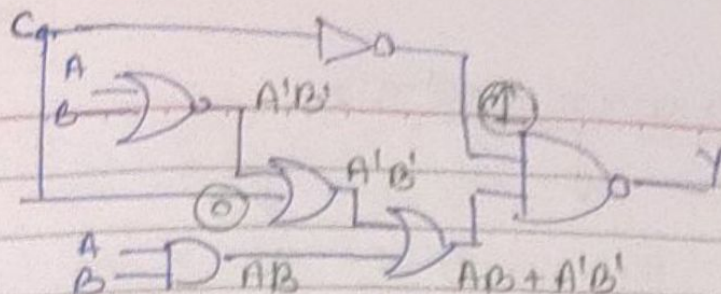
$$Ky + Kz$$

$$((Ky)'(Kz)')' \text{ demorgan's}$$





Q2(b).



If  $C=0$

$$\begin{aligned} Y &= (AB + A'B')' \\ &= (AB)' \cdot (A+B) \\ &= (A'+B') \cdot (A+B) \\ &= A'B + AB' = A \oplus B \end{aligned}$$

XOR gate.

Q3. (a)  $(xy+z)(y+xz) = xy + yzx + yz + xz$   
 $= xy + yz + xz$

| x | y | z | Y |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |

$$Y = xyz' + xy'z + x'yz + xyz = \sum m(3, 5, 6, 7)$$

$$Y = \prod M(0, 1, 2, 4)$$

$$= [(x+y+z)(x'+y+z)(x+y'+z)(x+y+z')]$$

(b)  $(A'+B)(B'+C) = A'B' + A'C + BC$

$$= A'B'C + A'B'C' + A'CB + A'CB' + ABC + A'BC$$

| A | B | C | Y |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

$$Y = \sum m(0, 1, 3, 7)$$

$$= A'B'C' + A'B'C + A'BC + ABC$$

$$Y = \prod M(2, 4, 5, 6)$$

$$= (xy'+x)(x'+y+z)(x'+y+z')(x'+y'+x')$$



(c)  $y'z + wxy' + wxz' + w'x'z$

| w | x | y | z |         |   |
|---|---|---|---|---------|---|
| 0 | 0 | 0 | 0 | 0+0+0+0 | 0 |
| 0 | 0 | 0 | 1 | 1+0+0+0 | 1 |
| 0 | 0 | 1 | 0 | 0+0+0+0 | 0 |
| 0 | 0 | 1 | 1 | 0+0+0+1 | 1 |
| 0 | 1 | 0 | 0 | 0+0+0+0 | 0 |
| 0 | 1 | 0 | 1 | 1+0+0+0 | 1 |
| 0 | 1 | 1 | 0 | 0+0+0+0 | 0 |
| 0 | 1 | 1 | 1 | 0+0+0+0 | 0 |
| 1 | 0 | 0 | 0 | 0+0+0+0 | 0 |
| 1 | 0 | 0 | 1 | 1+0+0+0 | 1 |
| 1 | 0 | 1 | 0 | 0+0+0+0 | 0 |
| 1 | 0 | 1 | 1 | 0+0+0+0 | 0 |
| 1 | 1 | 0 | 0 | 0+1+1+0 | 1 |
| 1 | 1 | 0 | 1 | 1+1+0+0 | 1 |
| 1 | 1 | 1 | 0 | 0+0+1+0 | 1 |
| 1 | 1 | 1 | 1 | 0+0+0+0 | 0 |

$= \sum m(1, 3, 5, 9, 12, 13, 14)$

$= w'x'y'z + w'x'yz + w'xy'z + wx'y'z + wxy'z' + wxy'z + wxyz'$

$= \prod M(0, 2, 4, 6, 7, 8, 10, 11, 15)$

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

Q4.  $F_1 = x'$  ;  $F_n = (F_{n-1})' + X$  for  $n \in \text{even} \rightarrow X$   
 $2. n \in \text{odd} \rightarrow 1, n > 1$

$((F_1)') \dots 2n-1 \rightarrow F_1'$   
 $((F_1)') \dots 2n \rightarrow F_1$

$\left. \begin{array}{l} F_1 = x' \\ F_2 = F_1' + X = X \\ F_3 = F_2' + X = 1 \\ F_4 = F_3' + X = X \end{array} \right\} n=1; F_1 = x'$

Ans



Q5. (a)  $F(A, B, \dots, Z) = C' \cdot F(A, B, 0, \dots, Z) + C \cdot F(A, B, 1, \dots, Z)$

Dual  $\cdot F(A, B, C, \dots, Z) = [C' + F(A, B, 1, \dots, Z)] \cdot [C + F(A, B, 0, \dots, Z)]$

(b)  $F(0, 0, 0) = 1$   
 $F(0, 0, 1) = 0$   
 $F(0, 1, 0) = 0$   
 $F(0, 1, 1) = 1$   
 $F(1, 0, 0) = 1$   
 $F(1, 0, 1) = 0$   
 $F(1, 1, 0) = 0$   
 $F(1, 1, 1) = 1$

$F(x, y, z) = ?$

$$= [x + y + z + F(0, 0, 0)] \cdot [x + y + z' + F(0, 0, 1)]$$

$$[x + y' + z + F(0, 1, 0)] \cdot [x' + y + z + F(1, 0, 0)]$$

$$[x + y' + z' + F(0, 1, 1)] \cdot [x' + y + z' + F(1, 0, 1)]$$

$$[x' + y' + z + F(1, 1, 0)] \cdot [x' + y' + z' + F(1, 1, 1)]$$

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

$$(x' + y + z') (x' + y' + z)$$

$$= \Pi M(1, 5, 6)$$

Q6 (a)

$$(x + y)(x + y') + (xy' + x')$$

$$x \cdot (y + y') + (xy' + x')$$

$$x + (xy')' x$$

$$= x (1 + (xy')')$$

$$\Rightarrow x$$

(b)  $(A + B + C)(A + B' + C') \rightarrow$  POS SOP.  $A'B'C + A'BC' + AB'C' + AB'C + ABC' + ABC$

$$\Pi M(0, 3)$$

$$= \Sigma m(1, 2, 4, 5, 6, 7)$$

Q7. (i)  $F(A, B, C) = C(B + C')(Ae' + B')$

$$BC(Ae' + B')$$

$$A(CC') + BB'C = 0$$



Q7 (ii)  $F(A, B, C, D, E, F)$

$$\begin{aligned}
 &= BCD + AD'F' + AD(C + EF')(Bc' + D'E) \\
 &= BCD + AD'F' + (ACD + ADEF)(Bc' + D'E) \\
 &= BCD + AD'F' + ABC'DEF
 \end{aligned}$$

$$= BD(C + C'EF) + AD'F'$$

$$= BD(C + EF) + AD'F'$$

$$= BCD + BDEF + AD'F'$$

Q8.

$$f(SW_1, SW_2, SW_3, SW_4).$$

$$TP_1 = \sum m(6, 7, 14, 15)$$

$$\begin{aligned}
 &= S_1'S_2S_3S_4' + S_1'S_2S_3S_4 + S_1S_2S_3S_4' \\
 &\quad + S_1S_2S_3S_4
 \end{aligned}$$