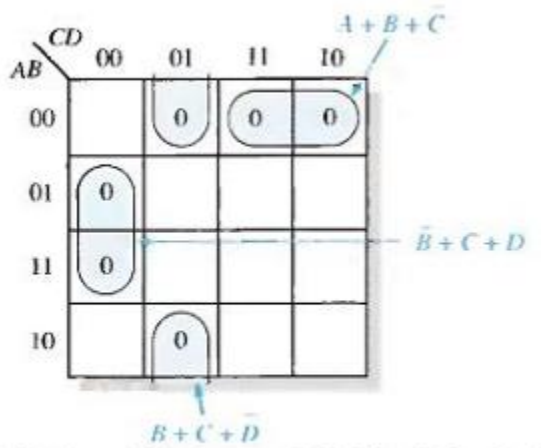
Tutorial-3 Solution

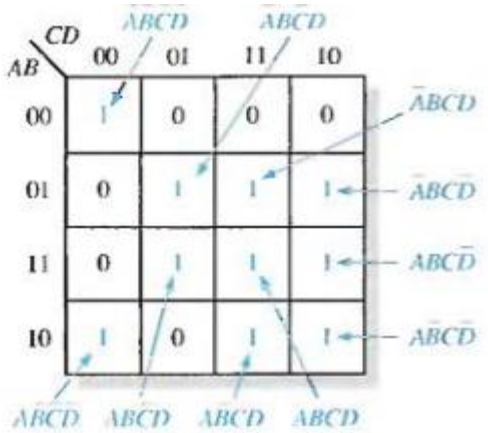
1. Series combination of n-MOS is equivalent to AND and parallel combination is equivalent to OR

$$\text{So, } Y = \overline{C.(A+B)}$$
$$Y = \overline{C} + \overline{(A+B)}$$
$$Y = \overline{C} + \overline{A}.\overline{B}$$

2. XOR (X, Y)
3.

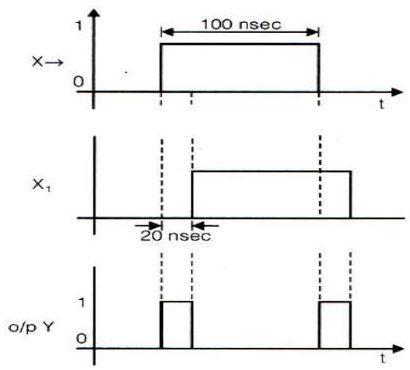


(a) Minimum POS: $(A + B + C)(\bar{B} + \bar{C} + D)(B + C + \bar{D})$



(b) Standard SOP:
$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BCD + \bar{A}BC\bar{D} + ABC\bar{D} + A\bar{B}C\bar{D} +$
$A\bar{B}\bar{C}\bar{D} + AB\bar{C}D + A\bar{B}CD + ABCD$

4.



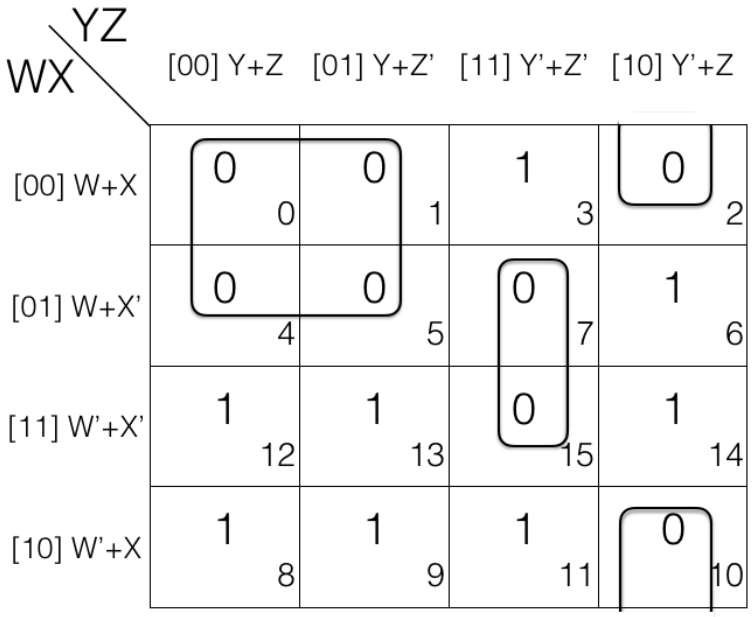
5.

X	Y	Q	Z
0	0	OFF	0
0	+5V	OFF	+5V
+5V	0	ON	0
+5V	+5V	ON	0

$Z=\bar{X}Y$

6. NOR
7. NOR Gate
8. XY
9. NAND

10.



Now we will write down the marked groups and find the reduced expression.

quad = M0 . M1 . M4 . M5
= [(W+X+Y+Z) . (W+X+Y+Z')]
. [(W+X'+Y+Z) . (W+X'+Y+Z')]
= (W+X+Y) . (W+X'+Y) [Z' changed, so removed]
= (W+Y) [X' changed, so removed]

1st pair = M7 . M15
= [(W+X'+Y'+Z') . (W'+X'+Y'+Z')]
= (X'+Y'+Z') [W' changed to W, so removed]

2nd pair = M2 . M10
= [(W+X+Y'+Z) . (W'+X+Y'+Z)]
= (X+Y'+Z) [W' changed to W, so removed]

Now we AND (.) the results to get the final reduced expression.

F = (W+Y) . (X'+Y'+Z') . (X+Y'+Z)