TUTORIAL 2 SOLUTIONS

Ans 1.

Sol^n - 1. (a) $x + \bar{x} \cdot y = x + y$

L.H.S : $x + \bar{x} y$

$\Rightarrow x \cdot 1 + \bar{x} y$

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

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

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

$= x + y \cdot 1$

$= x + y \Rightarrow$ R.H.S

(b) $x \cdot y + y \cdot z + \bar{x} \cdot z = x \cdot y + \bar{x} z$

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

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

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

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

$= xy + \bar{x} z \Rightarrow$ R.H.S

(c) $(x+y).(\bar{x}+z).(y+z) = (x+y).(\bar{x}+z)$

L.H.S : $(x.\bar{x} + xz + y.\bar{x} + yz)(y+z)$

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

$= xyz + x.z + y\bar{x} + \bar{x}yz + yz + yz$

$= xyz + xz + y\bar{x} + \bar{x}yz + yz$

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

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

$= yz + xz + \bar{x}y$

R.H.S : $(x+y).(\bar{x}+z)$

$\Rightarrow x.\bar{x} + y\bar{x} + xz + yz$

$= y\bar{x} + xz + yz$

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

(d) Same as part (a).

Ans 2 :

Ans 2

Given: $X = X_1 X_0$

$Y = Y_1 Y_0$

Condition:

$F \Rightarrow 1 \quad X \leq Y$

$F \Rightarrow 0 \quad$ otherwise

So, According to the condition, truth-table will be :

X_1	X_0	Y_1	Y_0	F	
0	0	0	0	1	$(X = Y)$
0	0	0	1	1	$(X < Y)$
0	0	1	0	1	$(X < Y)$
0	0	1	1	1	$(X < Y)$
0	1	0	0	0	$(X > Y)$
0	1	0	1	1	$(X = Y)$
0	1	1	0	1	$(X < Y)$
0	1	1	1	1	$(X < Y)$
1	0	0	0	0	$(X > Y)$
1	0	0	1	0	$(X > Y)$
1	0	1	0	1	$(X = Y)$
1	0	1	1	1	$(X < Y)$
1	1	0	0	0	$(X > Y)$
1	1	0	1	0	$(X > Y)$
1	1	1	0	0	$(X > Y)$
1	1	1	1	1	$(X = Y)$

Note: first we have to compare the MSB of X and Y and then LSB.

(2) Minimized expression can be obtained by either laws of Boolean algebra or K-map.

K-map:

$X_1X_0 \backslash Y_1Y_0$	$\bar{Y}_1\bar{Y}_0$	$\bar{Y}_1 Y_0$	$Y_1 Y_0$	$Y_1 \bar{Y}_0$
$\bar{X}_1\bar{X}_0$	1 (0)	1 (1)	1 (3)	1 (2)
$\bar{X}_1 X_0$	(4)	1 (5)	1 (7)	1 (6)
$X_1 X_0$	(12)	(13)	1 (15)	(14)
$X_1 \bar{X}_0$	(8)	(9)	1 (11)	1 (10)

**

$$\boxed{F = \bar{X}_1\bar{X}_0 + Y_1 Y_0 + \bar{X}_1 Y_0 + \bar{X}_1 Y_1 + \bar{X}_0 Y_1}$$

Ans

Ans 3 :

It is given that the bulb can be turned on and also off irrespective of the state of other switch hence XOR gate will be answer.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Explanation: lets take a case when A=0, irrespective of B value i.e either B=0 or B=1, output Y will be both 0 and 1.

$\boxed{\text{XOR Gate}}$ Ans

Ans 4

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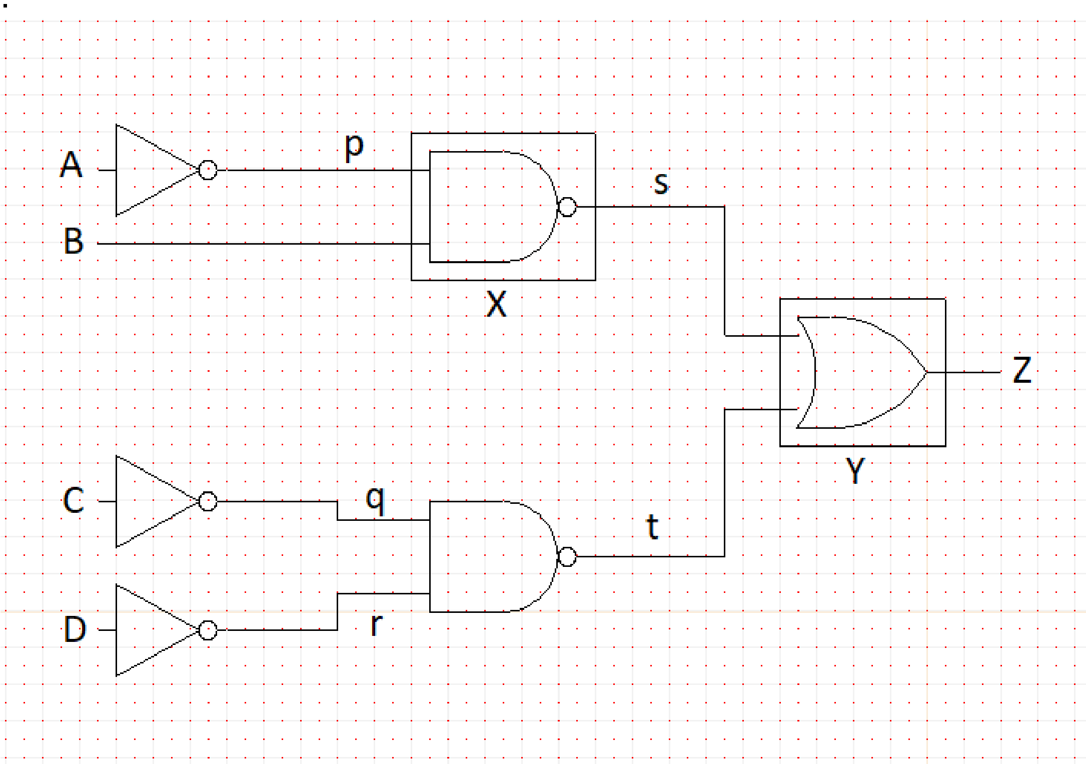


If we take X = NAND and Y = OR

$$p = \bar{A} \quad q = \bar{C} \quad r = \bar{D}$$

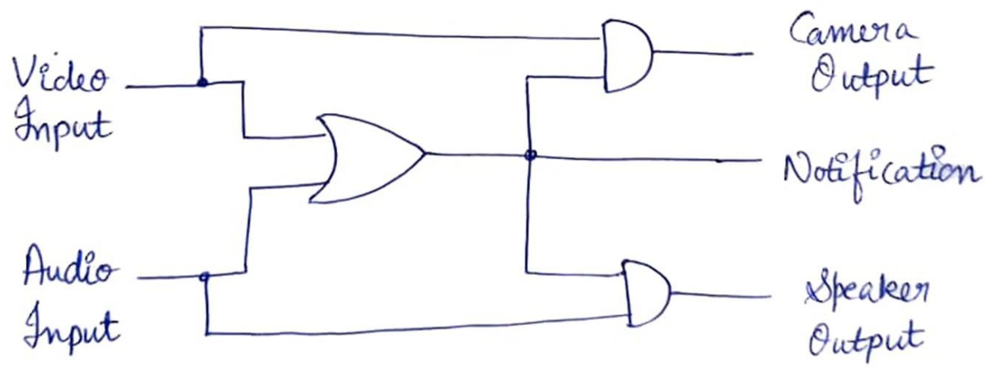
$$s = \overline{\bar{A}\,B} = \bar{\bar{A}} + \bar{B} = A + \bar{B}$$

$$t = \overline{\bar{C}\,\bar{D}} = \bar{\bar{C}} + \bar{\bar{D}} = C + D$$

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

Ans 5

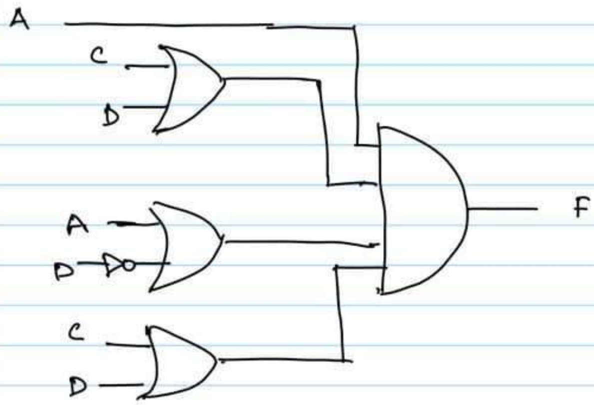
Q-5.



Video Input	Audio Input	Camera o/p	Notification	Speaker o/p
0	0	0	0	0
0	1	0	1	1
1	0	1	1	0
1	1	1	1	1

Ans 6
(a)

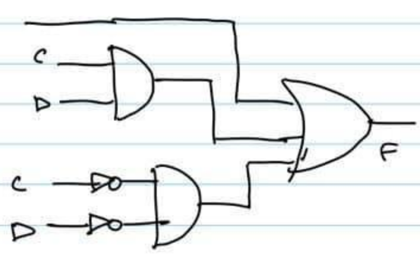
Q5 $F = A + CD + (A + \bar{D})(\bar{C} + D)$



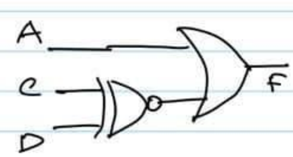
Simplification:

$$F = A + CD + (A + \bar{D})(\bar{C} + D)$$
$$= A + CD + A\bar{C} + AD + \bar{D}\bar{C} + \cancel{\bar{D}D}$$
$$= (A + A\bar{C}) + CD + \bar{C}\bar{D} + AD$$
(complement Law $x \cdot \bar{x} = 0$)
$$= A + AD + CD + \bar{C}\bar{D}$$
(Absorption Law $A + A\bar{C} = A$)
$$= \underline{A + CD + \bar{C}\bar{D}}$$
$$= \underline{\underline{A + C \odot D}}$$
[$CD + \bar{C}\bar{D} \rightarrow$ XNOR Gate]

Soln 1

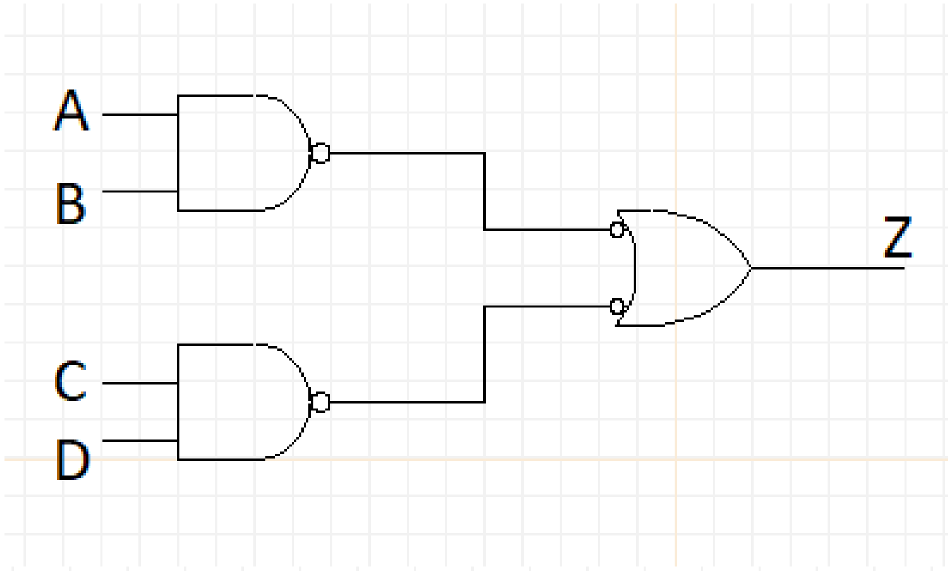


Soln 2

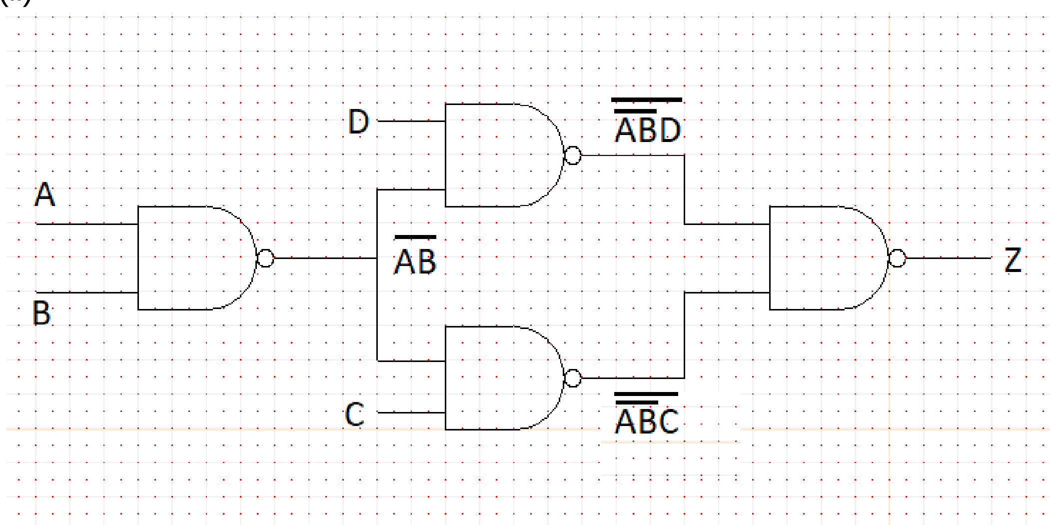


(b)

(i)



(ii)



$$Z = \overline{\overline{\overline{AB}D}\,\overline{\overline{AB}C}} \;=\; \overline{\overline{\overline{AB}D}} + \overline{\overline{\overline{AB}C}} \;=\; \overline{AB}D + \overline{AB}C$$

$$= \overline{AB}\,(D + C) \;=\; (\bar{A} + \bar{B})(C + D)$$