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Basic Electronics

Tutorial on Digital Logic

(12EC14/24)

Shwetha. Prabhu
Asst. Prof
Dept of ECE.

1 (a)

$$Y = \overline{\overline{(A\bar{B} + ABC)} + A(B + A\bar{B})}$$

$$= \overline{\overline{A(\bar{B} + BC)} + A(B+A)}$$

$$= \overline{\overline{A(\bar{B} + C)} + A(B+A)}$$

$$= \overline{\overline{A\bar{B} + AC} + A(B+A)}$$

$$= \overline{\overline{A\bar{B}} \cdot \overline{AC} + AB + A}$$

$$= \overline{(\bar{A} + \bar{\bar{B}}) \cdot (\bar{A} + \bar{C}) + AB + A}$$

$$= \overline{((\bar{A} + B) \cdot (\bar{A} + \bar{C}) + AB + A)}$$

$$= \overline{\bar{A}\bar{A} + \bar{A}\bar{C} + B\bar{A} + B\bar{C} + AB + A}$$

$$= \overline{\bar{A} + \bar{A}\bar{C} + B\bar{A} + B\bar{C} + AB + A}$$

$$= \overline{\bar{A} + B\bar{A} + B\bar{C} + AB + A}$$

$$= \overline{\bar{A} + B\bar{C} + AB + A}$$

$$= \overline{\bar{A} + B\bar{C} + A(\cancel{B+1})}$$

$$= \overline{B\bar{C} + 1}$$

$$= \bar{1} = \underline{\underline{0}}$$

1(b) $y = AB + (\overline{AC}) + ABC\,(AB + C)$

$= AB + \bar{A} + \bar{C} + ABC\cdot\cancel{AB} + ABC\cdot C$

$= AB + \bar{A} + \bar{C} + ABC + ABC$

$= \underline{AB} + \bar{A} + \bar{C} + \underline{ABC}$

$= AB\,\cancel{(1+C)}^{1} + \bar{A} + \bar{C}$

$= \underbrace{AB + \bar{A}} + \bar{C}$

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

1(c) $y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + \bar{A}\bar{B}C$

$= \bar{A}\bar{C}\,(\bar{B} + B) + \bar{B}\,(A\bar{C} + \bar{A}C)$

$= \underline{\bar{A}\bar{C}} + A\bar{B}\bar{C} + \underline{\bar{A}\bar{B}C}$

$= \bar{A}\,(\bar{C} + \bar{B}C) + A\bar{B}\bar{C}$

$= \bar{A}\,(\bar{C} + \bar{B}) + A\bar{B}\bar{C}$

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

$= \bar{A}\bar{C} + \bar{B}\,(\bar{A} + A\bar{C})$

$= \bar{A}\bar{C} + \bar{B}\,(\bar{A} + \bar{C})$

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

$(A+\bar{B}+C).(\bar{A}+B+\bar{C}).(\bar{A}+B)$

$= (A+\bar{B}+C)(\bar{A}\bar{A}+\bar{A}B+\bar{A}\bar{C}+\bar{A}B+\cancel{B\bar{B}}^{\,0}+B\bar{C})$

$= (A+\bar{B}+C)(\bar{A}+\bar{A}B+\bar{A}\bar{C}+\bar{A}B+B\bar{C})$

$= (A+\bar{B}+C)(\bar{A}(\underbrace{1+B}_{1})+\bar{A}\bar{C}+\bar{A}B+B\bar{C})$

$= (A+\bar{B}+C)(\bar{A}+\bar{A}\bar{C}+\bar{A}B+B\bar{C})$

$= (A+\bar{B}+C)(\bar{A}+\bar{A}B+B\bar{C})$

$= (A+\bar{B}+C)(\bar{A}+B\bar{C})$

$= \cancel{A\bar{A}}^{\,0}+\bar{A}\bar{B}+\bar{A}C+AB\bar{C}+\cancel{\bar{B}B}^{\,0}\bar{C}+\cancel{B\bar{C}C}^{\,0}$

$= \bar{A}\bar{B}+\bar{A}C+AB\bar{C}$

$= \bar{A}(\bar{B}+C)+AB\bar{C}$

) $y = AB+\bar{A}C+\bar{B}C$

$= AB + C(\bar{A}+\bar{B})$

$= AB + C(\overline{AB})$

$= \underline{\underline{AB+C}}$

A \ BC	00	01	11	10
0		1	1	
1		1	1	1

$= \underline{\underline{AB+C}}$

(f) = $y = \overline{\left[\overline{(A+B)}.\overline{(CD)}+E+\bar{F}\right]}$

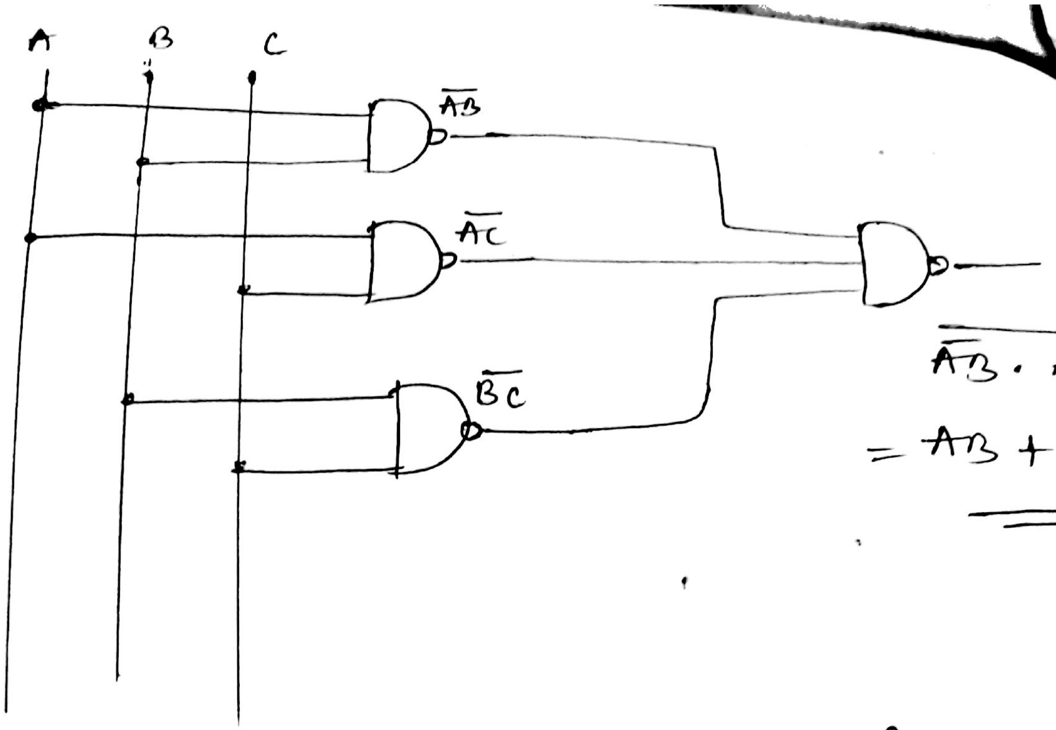
$= \overline{\overline{(A+B)}+\bar{C}D+E+\bar{F}}$

$= \overline{\overline{A+B}+\bar{C}+\bar{D}+E+\bar{F}}$

$= \overline{\overline{A+B}}\cdot\bar{\bar{C}}\cdot\bar{D}\cdot\bar{E}\cdot\bar{\bar{F}}$

$= (A+B)\,C\,D\,\bar{E}\,F = \underline{\underline{ACD\bar{E}F+BCD\bar{E}F}}$

(2)



$$\overline{\overline{AB}\cdot\overline{AC}\cdot\overline{BC}}$$

$$= AB + AC + BC$$

(3)

A	B	C	D	X	Y	Z
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	1	0	0
0	1	0	0	0	1	0
0	1	0	1	1	0	0
0	1	1	0	1	0	0
0	1	1	1	0	0	1
1	0	0	0	0	1	0
1	0	0	1	1	0	0
1	0	1	0	1	0	0
1	0	1	1	0	0	1
1	1	0	0	1	0	0
1	1	0	1	0	0	1
1	1	1	0	0	0	1
1	1	1	1	0	0	1

Expⁿ :- Realize using **NOR**

$$x = AB + AC + AD + BC + BD + CD.$$

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

$$z = ABC + BCD + ACD + ABD$$