Practice Paper-7.

① ⓐ $(13AF)_{16} \rightarrow (1\times16^3 + 3\times16^2 + 10\times16^1 + 15\times16^0)_{10}$
$= (5039)_{10}$

ⓑ $(25E6)_{16} \rightarrow (2\times16^3 + 5\times16^2 + 14\times16^1 + 6\times16^0)_{10}$
$= (9702)_{10}$

ⓒ $(B4.C9)_{16} \rightarrow (11\times16^1 + 4\times16^0 + 12\times16^{-1} + 9\times16^{-2})_{10}$
$= (180.7851\ldots)_{10}$

ⓐ $(13AF)_{16} \rightarrow (\underbrace{0001}_{1}\underbrace{0011}_{3}\ \underbrace{1010}_{A}\ \underbrace{1111}_{F})_2 = (1001110101111)_2$

ⓑ $(25E6)_{16} \rightarrow (\underbrace{0010}_{2}\ \underbrace{0101}_{5}\ \underbrace{1110}_{E}\ \underbrace{0110}_{6})_2 = (10010111100110)_2$

ⓒ $(B4.C9)_{16} \rightarrow (\underbrace{1011}_{B}\ \underbrace{0100}_{4} . \underbrace{1100}_{C}\ \underbrace{1001}_{9})_2$

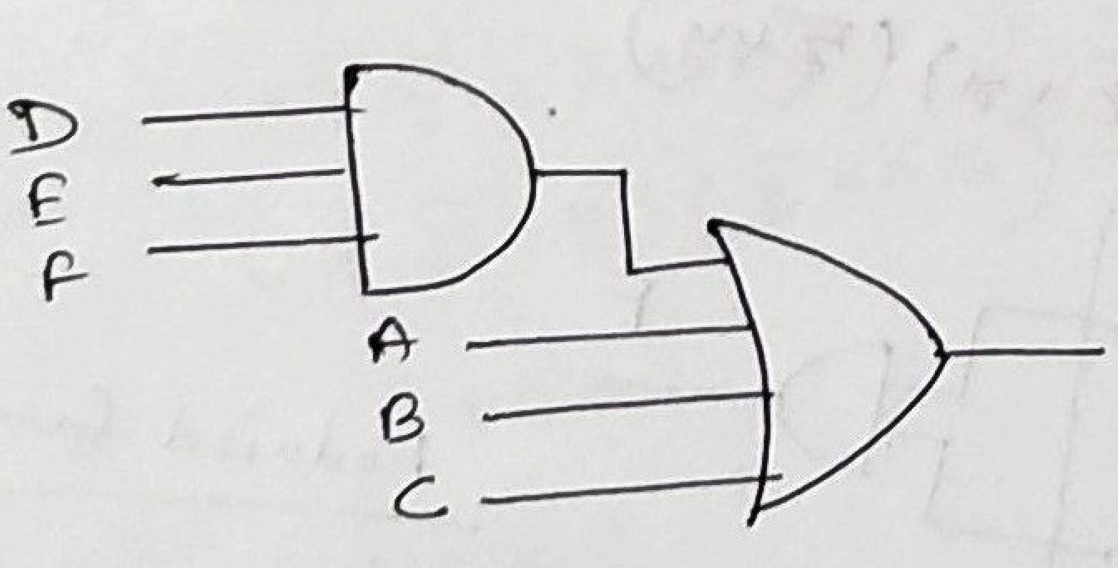
② ⓐ $(56.2)_8 \rightarrow (5\times8^1 + 6\times8^0 + 2\times8^{-1})_{10} = (46.25)_{10}$
↳ $(\underbrace{101}_{5}\ \underbrace{110}_{6} . \underbrace{010}_{2})_2 \rightarrow (101110.01)_2$

ⓑ $(16.2)_8 \rightarrow (1\times8^1 + 6\times8^0 + 2\times8^{-1})_{10} = (14.25)_{10}$
↳ $(\underbrace{001}_{1}\ \underbrace{110}_{6} . \underbrace{010}_{2})_2 = (1110.01)_2$

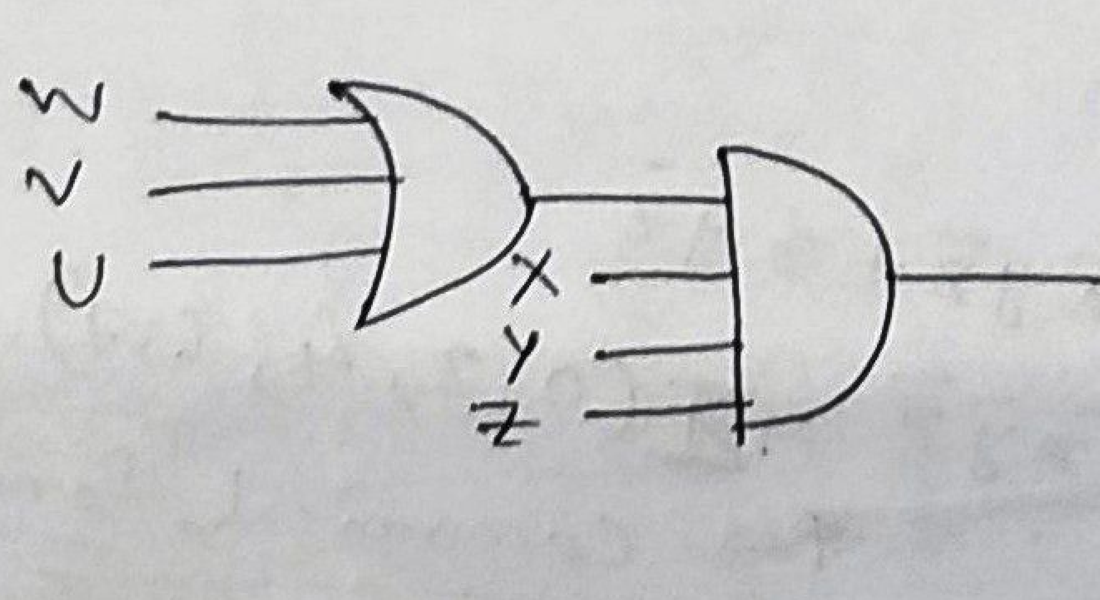
ⓒ $(20.45)_8 \rightarrow (2\times8^1 + 0 + 4\times8^{-1} + 5\times8^{-2})_{10} = (16.578125)_{10}$
↳ $(\underbrace{010}_{2}\ \underbrace{000}_{0} . \underbrace{100}_{4}\ \underbrace{101}_{5})_2 = (10000.100101)_2$
$(10000.100101)_2$

③ (a) $(A+B+C+D)(A+B+C+E)(A+B+C+F)$
$= (A+B+C) + DEF$

$\left[\begin{aligned} &(x+u)(x+y)(x+z) \\ &= (x+uy)(x+z) \text{ ; as } (x+y)(x+z) = x+yz \\ &= x+uyz. \end{aligned}\right.$



(b) $WXYZ + VXYZ + UXYZ$
$= XYZ(W+V+U)$



(4) (a) $AB + \bar{C}\bar{D}$

$= (AB+\bar{C})(AB+\bar{D})$

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

↑ Reduced farm.

(b) $wx + w\bar{y}x + zyx$

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

$= x[w(1+\bar{y}) + zy]$

$= x[w + zy]$

$= \underline{x(w+z)(w+y)}$

(c) $xyz + \bar{w}z + x\bar{Q}z$

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

$= z[x(y+\bar{Q}) + \bar{w}]$

$= \underline{z(\bar{w}+x)(\bar{w}+y+\bar{Q})}$

(d) $\bar{A}BC + EF + DE\bar{F}$

$= \bar{A}BC + E(F + D\bar{F})$

$= \bar{A}BC + E(F+\bar{F})(F+D)$

$= \bar{A}BC + E(F+D)$

$= (\bar{A}BC + E)(\bar{A}BC + F + D)$

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

[* $x + uvw = (x+u)(x+v)(x+w)$
* $x + \bar{x} = 1$, $x \cdot \bar{x} = 0$.] $\boxed{\text{Remember}}$

(5) (a) $(x+\bar{y}z) + \overline{(x+\bar{y}z)} = \underline{1}.$; [as $x+\bar{x}=1$]

(b) $[w + \bar{x}(y+z)][\bar{w} + \bar{x}(y+z)] = \bar{x}(y+z) + \underbrace{w.\bar{w}}_{0}$.

$= \underline{\bar{x}(y+z)}$; [$x+yz=(x+y)(x$

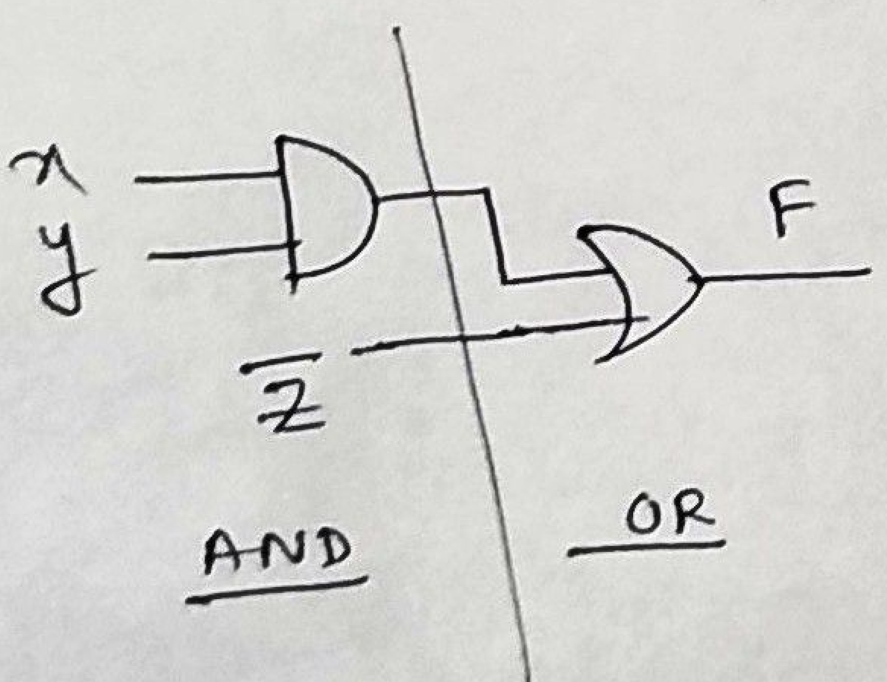
(c) $\overline{(\bar{V}W + UX)}\,(UX + Y + Z + \bar{V}W)$; let, $A = \bar{V}W + UX$

$= \bar{A}(A+Y+Z)$

$= \bar{A}(Y+Z)$; as $A.\bar{A} = 0$.

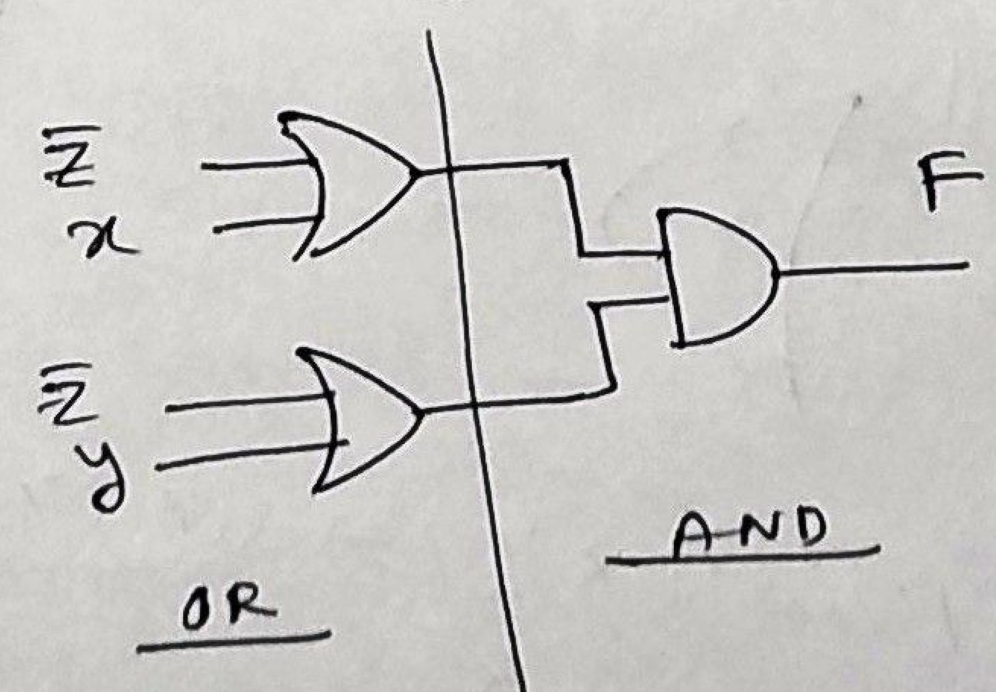
$= \underline{\overline{(\bar{V}W+UX)}\,(Y+Z)}$

(6) $F = xy + \bar{z}$



$F = xy + \bar{z}$

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



Reduced farm

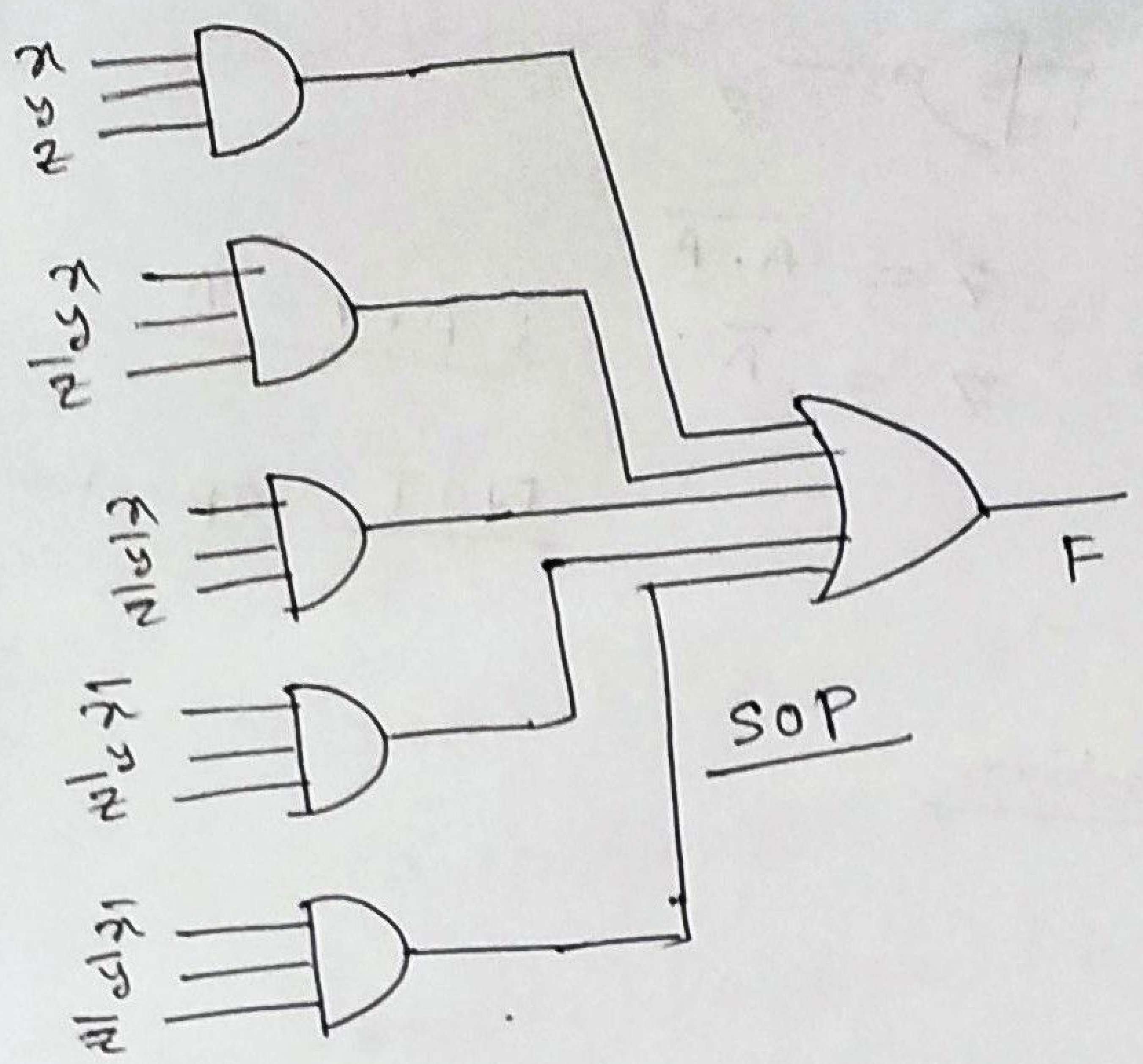
$F = xy + \bar{z}$

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

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

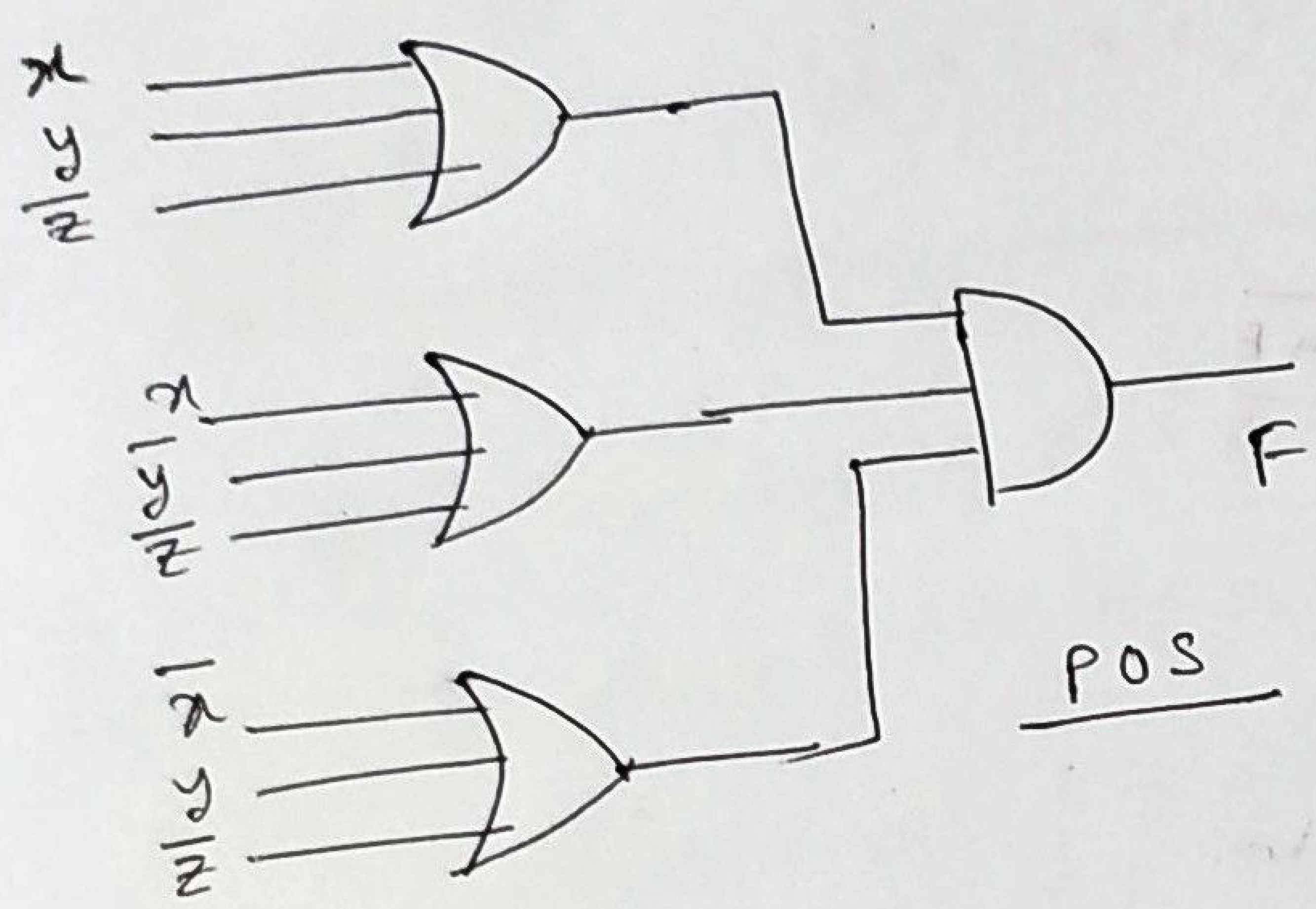
$= xyz + xy\bar{z} + xy\bar{z} + x\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}\bar{y}\bar{z}$

$= \underbrace{xyz}_{111} + \underbrace{xy\bar{z}}_{110} + \underbrace{x\bar{y}\bar{z}}_{100} + \underbrace{\bar{x}y\bar{z}}_{010} + \underbrace{\bar{x}\bar{y}\bar{z}}_{000} = \Sigma(0,2,4,6,7)$ ← Canonical farm



$$F = xy + \bar z$$
$$= (x+\bar z)(y+\bar z)$$
$$= (x+\bar z + y\cdot\bar y)(y+\bar z + x\cdot\bar x)$$
$$= \underset{1}{(x+y+\bar z)}\underset{3}{(x+\bar y+\bar z)}(x+y+\bar z)(\bar x+y+\bar z)$$
$$= \underset{1}{(x+y+\bar z)}\underset{3}{(x+\bar y+\bar z)}\underset{5}{(\bar x+y+\bar z)}$$
$$= \Pi(1,3,5)$$

↑ canonical form



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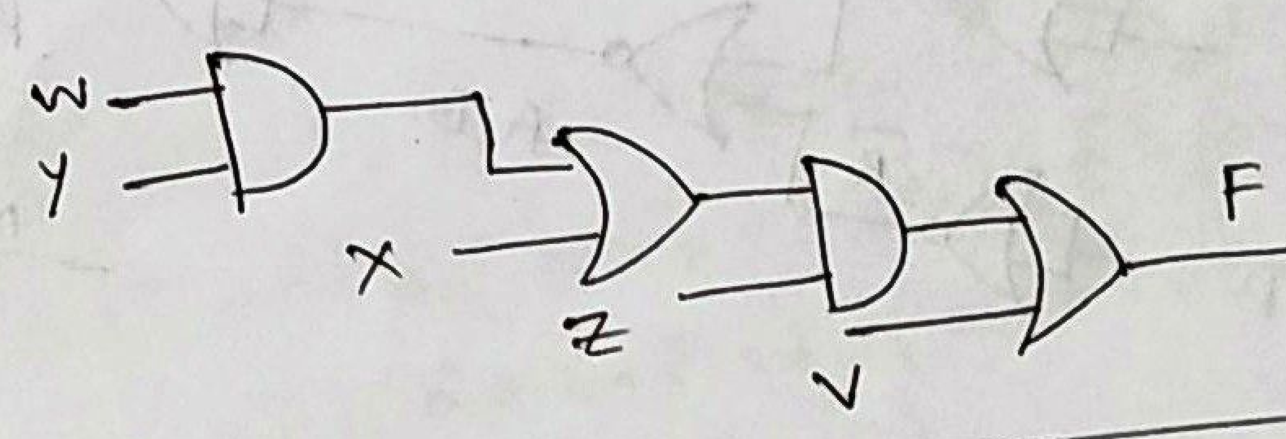
(7) $F = (V+W+X)(V+X+Y)(V+Z)$

$= (V+X'+W)(V+X+Y)(V+Z)$

$= (V+X+WY)(V+Z)$

$= V + Z(X+WY)$



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(8) (a) $A\bar B C\bar D + \bar A B C D + C\bar D$

$= C\bar D(A\bar B+1) + \bar A BCD$

$= C\bar D + \bar A BCD$

$= C(\bar D + \bar A BD)$

$= C(\bar D + D)(\bar D + \bar A B)$

$= C(\bar D + \bar A B)$

$= C\bar D + \bar A B C$

(b) $A\bar B\bar C + C\bar D + B\bar C\bar D$

$= A\bar B\bar C + \bar D(C + B\bar C)$

$= A\bar B\bar C + \bar D(B+C)$

$= A\bar B\bar C + B\bar D + C\bar D$

(c) $(A+\bar B)(\bar A+\bar B+D)(\bar B+C+\bar D)$

$= \bar B + A(\bar A+D)(C+\bar D)$

$= \bar B + AD(C+\bar D)$

$x+uvw$
$= (x+u)(x+v)(x+w)$

$A\cdot\bar A = 0$.

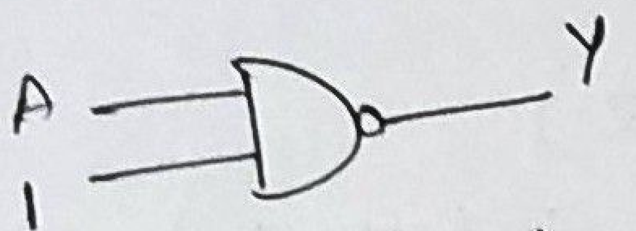
(d) $(\bar A+B+\bar C+D)(\bar A+\bar C+D+E)(\bar A+\bar C+D+\bar E)$. AC

$= [(\bar A+\bar C+D) + B\cdot E\cdot\bar E]\,AC$

$= (\bar A+\bar C+D)AC$

$= ACD$; $(\bar A\cdot AC = \bar C\cdot AC = 0)$

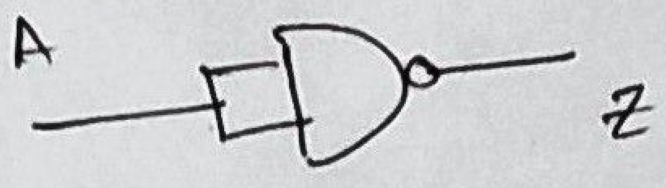
(9)



NAND gate

x y	z
0 0	1
0 1	1
1 0	1
1 1	0

$\left.\right\}$ → any i/p = 0, o/p = 1



$Z = \overline{A \cdot A}$; $A \cdot A = A$

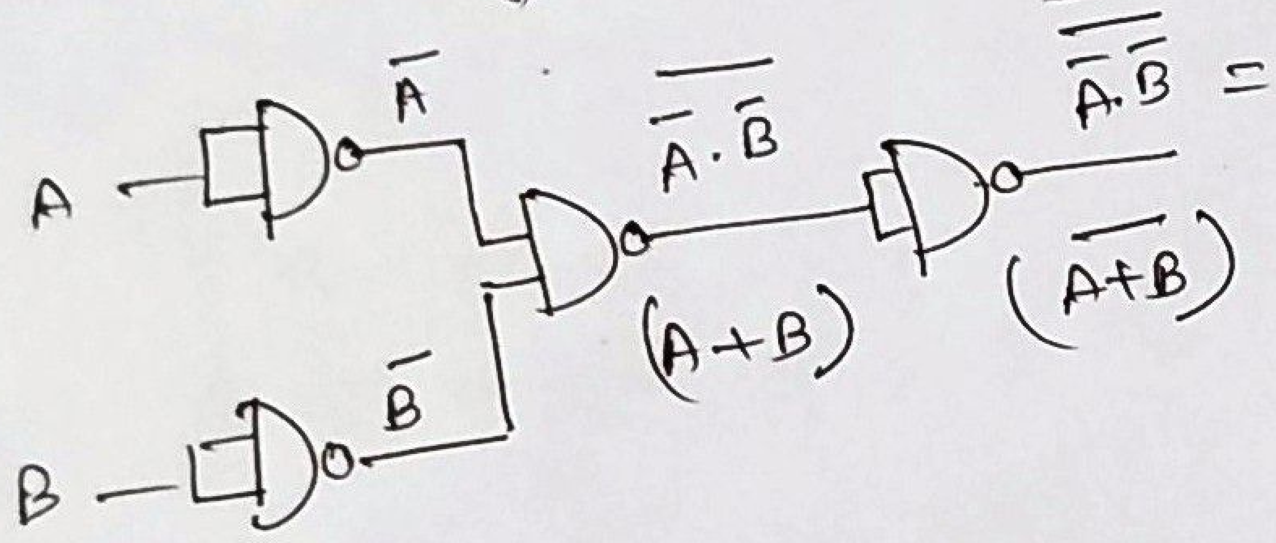
$Z = \overline{A}$

NOT operation

if, $A = 0$, o/p $(Y) = 1$
$A = 1$, o/p $(Y) = 0$ } NOT operation

ans. $Y = \overline{A \cdot 1} = \overline{A}$

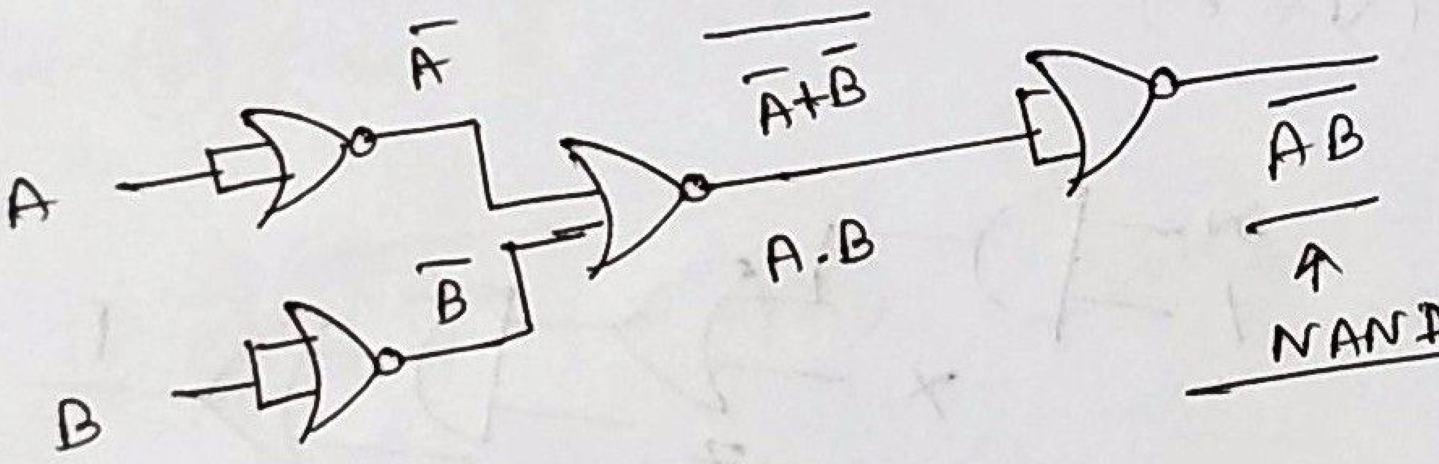
(10) NOR operation using NAND gates:



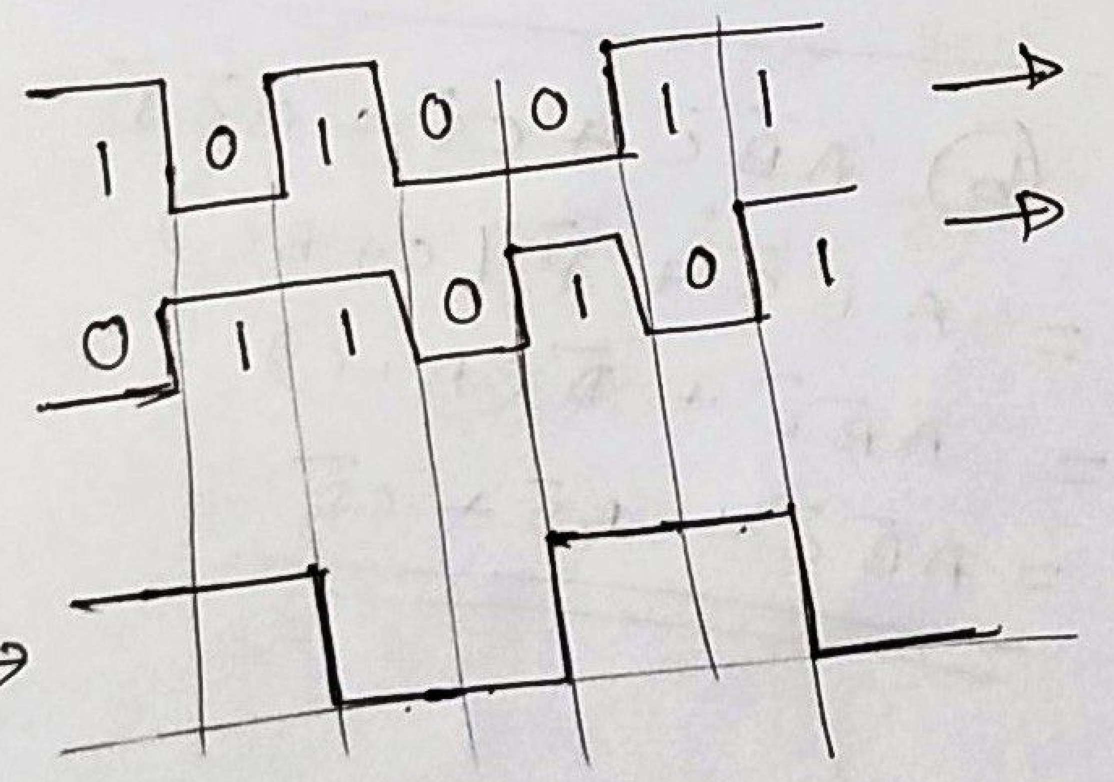
$\overline{\overline{\overline{A} \cdot \overline{B}}} = \overline{A} \cdot \overline{B} = \overline{A+B}$

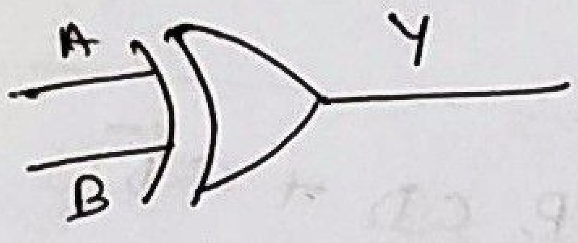
NOR

NAND operation using NOR gates:



(11)



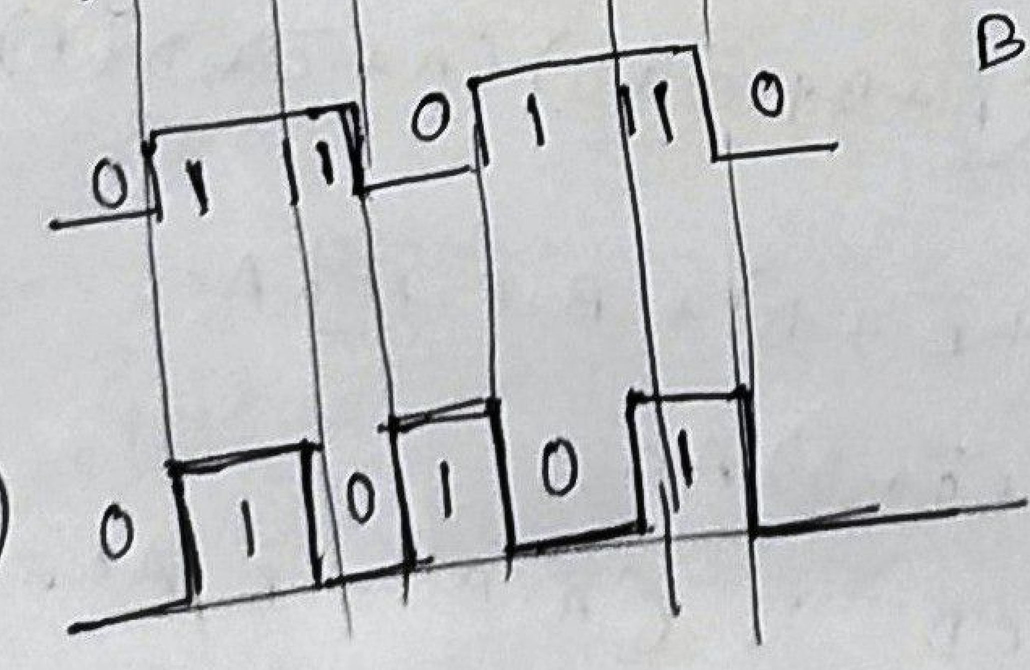


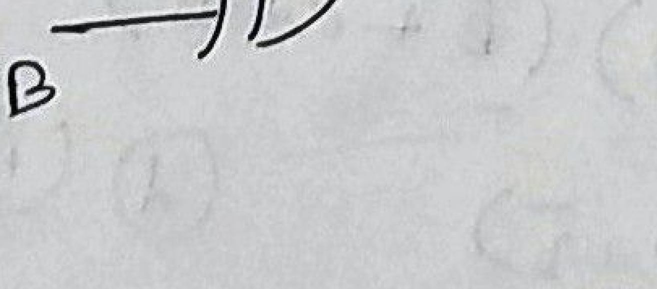
XOR

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

→ '1' when A & B are different.

XNOR





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

'1' when A & B are same.

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

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

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

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

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

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

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

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

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

$F = \bar{a}(\bar{b} + d) + c\bar{d}(a + \bar{b})$

$= \bar{a}\bar{b} + \bar{a}d + ac\bar{d} + c\bar{b}\bar{d}$

$= \bar{a}\bar{b}c + \bar{a}\bar{b}\bar{c} + \bar{a}bd + \bar{a}\bar{b}d + abc\bar{d} + a\bar{b}c\bar{d} + a\bar{b}c\bar{d} + \bar{a}\bar{b}c\bar{d}$

$= \bar{a}\bar{b}cd + \bar{a}\bar{b}c\bar{d} + \bar{a}\bar{b}\bar{c}d + \bar{a}\bar{b}\bar{c}\bar{d} + \bar{a}bcd + \bar{a}b\bar{c}d +$

$= \bar{a}\bar{b}cd + \bar{a}\bar{b}c\bar{d} + \bar{a}\bar{b}\bar{c}d + abc\bar{d} + a\bar{b}c\bar{d} + a\bar{b}c\bar{d} + \bar{a}\bar{b}c\bar{d}$

$\bar{a}\bar{b}cd + \bar{a}\bar{b}\bar{c}d + abc\bar{d} + a\bar{b}c\bar{d} + \bar{a}\bar{b}\bar{c}\bar{d} + \bar{a}bcd + \bar{a}b\bar{c}d +$

$abc\bar{d} + abc\bar{d}$

$= \bar{a}\bar{b}cd + \bar{a}\bar{b}c\bar{d} + \bar{a}\bar{b}\bar{c}d + \bar{a}\bar{b}\bar{c}\bar{d} +$

ab \ cd	00	01	11	10
00	1	1	1	1
01	0	1	1	0
11	0	0	0	1
10	0	0	0	1

$F = \prod(4, 6, 8, 9, 10, 12, 13, 15)$

$= (a + \bar{b} + c + d)(a + \bar{b} + \bar{c} + d)(\bar{a} + b + c + d)$

$(\bar{a} + b + c + \bar{d})(\bar{a} + b + \bar{c} + \bar{d})(\bar{a} + \bar{b} + c + d)$

$(\bar{a} + \bar{b} + c + \bar{d})(\bar{a} + \bar{b} + \bar{c} + \bar{d})$

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(13) De Morgan's Theorem: (Three variable)

$\overline{x + y + z} = \bar{x}\bar{y}\bar{z}$

x y z	$x + y + z$	$\overline{x + y + z}$	$\bar{x}$	$\bar{y}$	$\bar{z}$	$\bar{x}\bar{y}\bar{z}$
0 0 0	0	1	1	1	1	1
0 0 1	1	0	1	1	0	0
0 1 0	1	0	1	0	1	0
0 1 1	1	0	1	0	0	0
1 0 0	1	0	0	1	1	0
1 0 1	1	0	0	1	0	0
1 1 0	1	0	0	0	1	0
1 1 1	1	0	0	0	0	0

So, $\overline{x + y + z} = \bar{x}\bar{y}\bar{z}$

$\overline{xyz} = \bar{x} + \bar{y} + \bar{z}$

x y z	x y z	$\overline{xyz}$	$\bar{x}$	$\bar{y}$	$\bar{z}$	$\bar{x} + \bar{y} + \bar{z}$
0 0 0	0	1	1	1	1	1
0 0 1	0	1	1	1	0	1
0 1 0	0	1	1	0	1	1
0 1 1	0	1	1	0	0	1
1 0 0	0	1	0	1	1	1
1 0 1	0	1	0	1	0	1
1 1 0	0	1	0	0	1	1
1 1 1	1	0	0	0	0	0

So, $\overline{xyz} = \bar{x} + \bar{y} + \bar{z}$