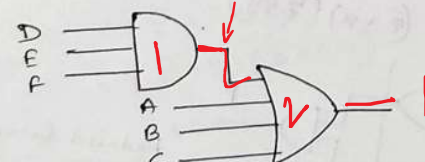
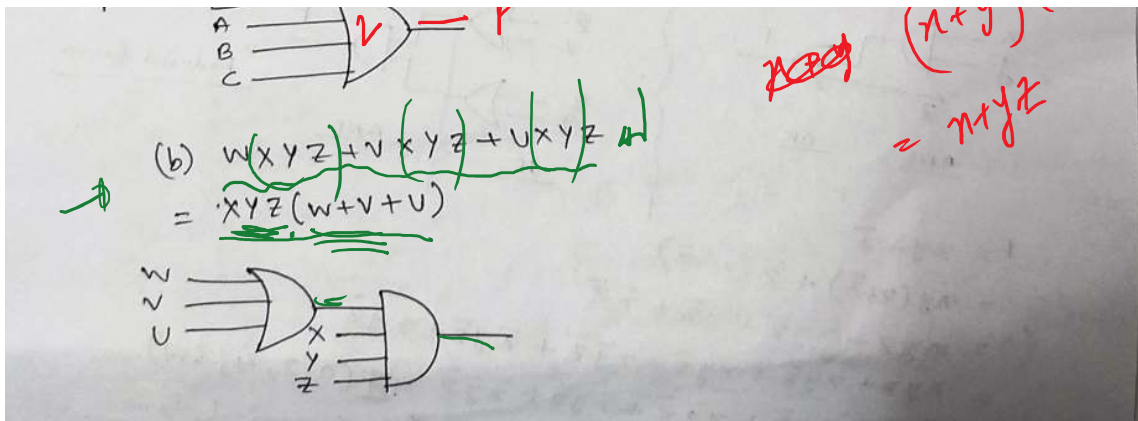


1. Convert the following hexadecimal numbers to their decimal and binary equivalents:
- (a) $(13AF)_{16}$ (b) $(25E6)_{16}$ (c) $(B4.C9)_{16}$ (d) $(45)_{16}$
2. Convert the following octal number to their decimal and binary equivalents:
- (a) $(56.2)_8$ (b) $(16.2)_8$ (c) $(20.45)_8$
3. Draw a combinational logic circuit that uses only one AND gate and one OR gate to realize each of the following functions:
- (a) $(A + B + C + D)(A + B + C + E)(A + B + C + F)$
- (b) $WXYZ + VXYZ + UXYZ$

① ② $(13AF)_{16} \rightarrow (1 \times 16^3 + 3 \times 16^2 + 10 \times 16^1 + 15 \times 16^0)_{10}$
 $= (5039)_{10}$
 ③ $(25E6)_{16} \rightarrow (2 \times 16^3 + 5 \times 16^2 + 14 \times 16^1 + 6 \times 16^0)_{10}$
 $= (9702)_{10}$
 ④ $(B4.C9)_{16} \rightarrow (11 \times 16^1 + 4 \times 16^0 + 12 \times 16^{-1} + 9 \times 16^{-2})_{10}$
 $= (180.7851 \dots)_{10}$
 ⑤ $(13AF)_{16} \rightarrow (\frac{1001}{1} \frac{0011}{3} \frac{1010}{A} \frac{1111}{F})_2 = (\underline{100111010111})_2$
 ⑥ $(25E6)_{16} \rightarrow (\frac{0010}{2} \frac{0101}{5} \frac{1110}{E} \frac{0110}{6})_2 = (\underline{1001011100110})_2$
 ⑦ $(B4.C9)_{16} \rightarrow (\frac{1011}{B} \frac{0100}{4} \cdot \frac{1100}{C} \frac{1001}{9})_2$
 ⑧ $(56.2)_8 \rightarrow (5 \times 8^1 + 6 \times 8^0 + 2 \times 8^{-1})_{10} = (46.25)_{10}$
 $\hookrightarrow (\frac{101}{5} \frac{110}{6} \cdot \frac{010}{2})_2 \rightarrow (\underline{101110.01})_2$
 ⑨ $(16.2)_8 \rightarrow (1 \times 8^1 + 6 \times 8^0 + 2 \times 8^{-1})_{10} = (14.25)_{10}$
 $\hookrightarrow (\frac{001}{1} \frac{110}{6} \cdot \frac{010}{2})_2 = (\underline{1110.01})_2$
 ⑩ $(20.45)_8 \rightarrow (2 \times 8^1 + 0 + 4 \times 8^{-1} + 5 \times 8^{-2})_{10} = (16.578125)_{10}$
 $\hookrightarrow (\frac{010}{2} \frac{000}{0} \cdot \frac{100}{4} \frac{101}{5})_2 = (\underline{10000.100101})_2$
 ⑪ $(A+B+C+D)(A+B+C+E)(A+B+C+F) = F$
 $= (A+B+C) + DEF$
 $\left[\begin{aligned} & \frac{(x+y)(x+z)(x+z)}{(x+yz)(x+z)} ; \text{ as } \frac{(x+y)(x+z)}{x+yz} \\ & = \underline{x+yz} \end{aligned} \right]$




4. Factor each of the following expressions to obtain a product of sums:

(a) $AB + C'D'$

(b) $WX + WY'X + ZYX$

(c) $A'BC + EF + DEF'$

(d) $XYZ + W'Z + XQ'Z$

5. Simplify each of the following expressions by applying one of the theorems.

(a) $(X + Y'Z) + (X + Y'Z)'$

(b) $[W + X'(Y + Z)][W' + X'(Y + Z)]$

(c) $(V'W + UX)'(UX + Y + Z + V'W)$

6. Express the following function in POS (Product of Sums) and SOP (Sum of Products) forms:

$F = xy + z'$

④ (a) $AB + \bar{C}\bar{D}$

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

(b) $WX + WY'X + ZYX$

$= X(W + WY' + ZY)$
 $= X[W(1 + Y') + ZY]$
 $= X[W + ZY]$
 $= X(W + Z)(W + Y)$

(c) $XYZ + \bar{W}\bar{Z} + X\bar{Y}\bar{Z}$

$= Z(XY + \bar{W} + X\bar{Y})$
 $= Z[X(Y + \bar{Y}) + \bar{W}]$
 $= Z(\bar{W} + X)(\bar{W} + Y + \bar{Y})$

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

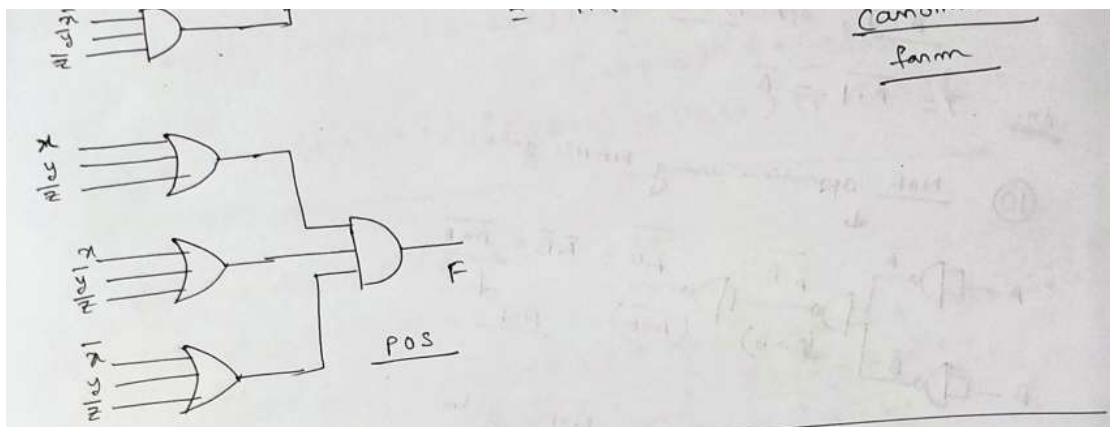
$= \bar{A}BC + E(F + DF)$
 $= \bar{A}BC + E(F + F)(F + D)$
 $= (\bar{A}BC + E)(F + D)$
 $= (\bar{A}BC + E)(\bar{A}BC + F + D)$
 $= (\bar{A} + E)(B + E)(C + E)(F + D + \bar{A})$
 $= (\bar{A} + E)(B + E)(C + E)(F + D)$

⑤ (a) $(x + yz)(x + yz) = 1$

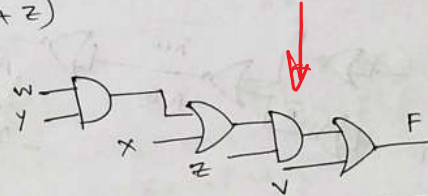
(b) $[W + \bar{X}(Y + Z)][\bar{W} + \bar{X}(Y + Z)]$

$= \bar{X}(Y + Z) + \frac{W \cdot \bar{W}}{0}$
 $= \bar{X}(Y + Z)$

Remember: $x + \bar{x} = 1, x \cdot \bar{x} = 0$



$$\begin{aligned}
 \textcircled{7} F &= (v+w+x)(v+x+y)(v+z) \\
 &= (v+x'+w)(v+x+y)(v+z) \\
 &= (v+x+wy)(v+z) \\
 &= v + z(x+wy)
 \end{aligned}$$



$$\begin{aligned}
 \textcircled{8} \textcircled{a} A\bar{B}C\bar{D} + \bar{A}B\bar{C}D + C\bar{D} \\
 &= C\bar{D}(A\bar{B} + 1) + \bar{A}B\bar{C}D \\
 &= C\bar{D} + \bar{A}B\bar{C}D \\
 &= C(\bar{D} + \bar{A}B\bar{D}) \\
 &= C(\bar{D} + \bar{D})(\bar{D} + \bar{A}B) \\
 &= C(\bar{D} + \bar{A}B) \\
 &= C\bar{D} + \bar{A}B\bar{C}
 \end{aligned}$$

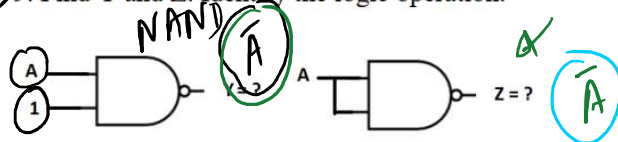
$$\begin{aligned}
 \textcircled{b} A\bar{B}\bar{C} + C\bar{D} + A\bar{B}\bar{C}\bar{D} \\
 &= A\bar{B}\bar{C} + \bar{D}(C + \bar{B}\bar{C}) \\
 &= A\bar{B}\bar{C} + \bar{D}(B + C) \\
 &= A\bar{B}\bar{C} + B\bar{D} + C\bar{D}
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{c} (A+B)(\bar{A}+\bar{B}+D)(\bar{B}+C+\bar{D}) \\
 &= \bar{B} + A(\bar{A}+D)(C+\bar{D}) \\
 &= \bar{B} + AD(C+\bar{D})
 \end{aligned}$$

$$\begin{aligned}
 x + uvw \\
 &= (x+u)(x+v)(x+w) \\
 &= (x+u)(x+v)(x+w)
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{d} (\bar{A}+B+\bar{C}+D)(\bar{A}+\bar{C}+D+E)(\bar{A}+\bar{C}+D+E) \\
 &= [(\bar{A}+\bar{C}+D) + B \cdot E \cdot \bar{E}] AC \\
 &= (\bar{A}+\bar{C}+D) AC \\
 &= ACD ; (\bar{A} \cdot AC = \bar{E} \cdot AC = 0)
 \end{aligned}$$

✓ Find Y and Z. Identify the logic operation.



10. Implement NOR operation using only NAND gates.

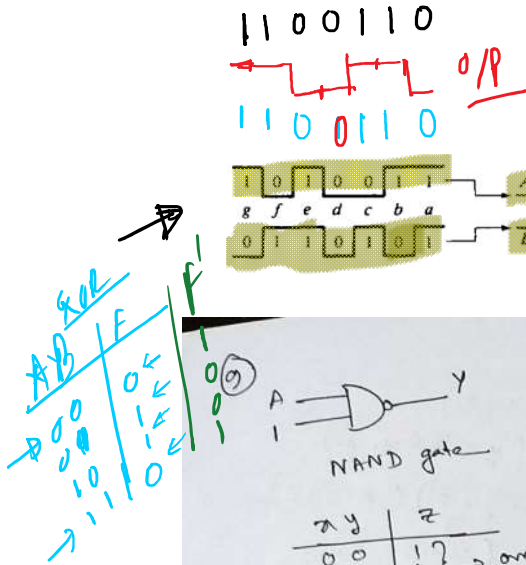
Implement NAND operation using only NOR gates.

11. Draw the output waveform Y.

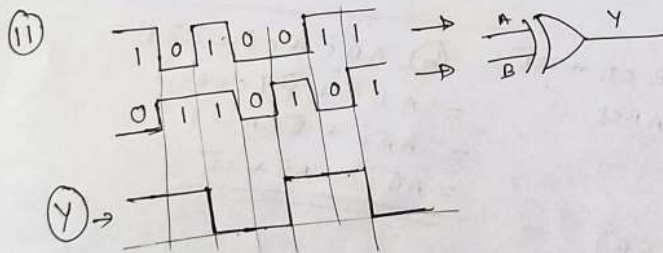
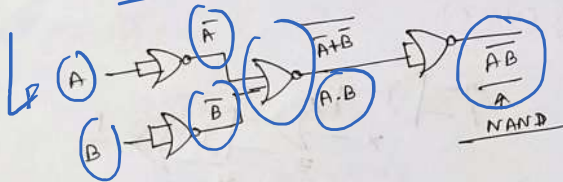
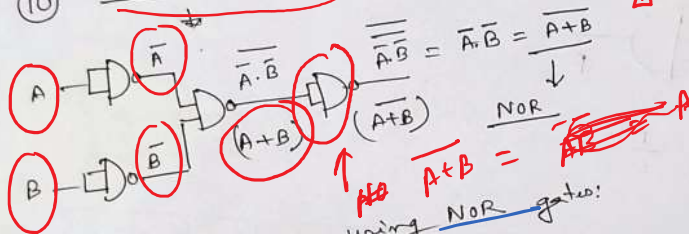
NAND

A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

$\bar{A} \cdot A = \bar{A}$



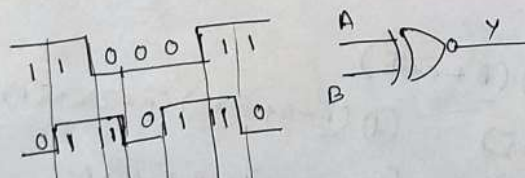
⑩ NOR operation using NAND gates:



XOR

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

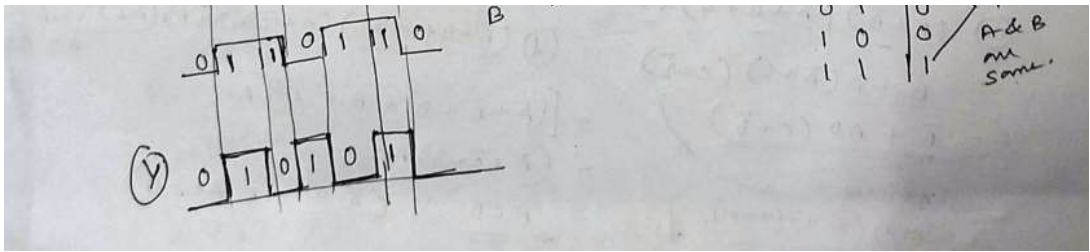
'1' when A & B are different



XNOR

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

'1' when A & B are same



BCD to Excess-3 counter!

Binary coded digit.

Decimal	BCD
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Excess-3 code

W	x	y	z
0	0	1	1
1	0	1	0
2	0	1	0
3	0	1	1
4	0	1	1
5	1	0	0
6	1	0	0
7	1	0	1
8	1	0	1
9	1	1	0
	x	x	x

AB \ C	00	01	11	10
00	0	0	0	0
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x



$$W = f(A, B, C, D)$$

$$x = f'(A, B, C, D)$$



$$y =$$

$$z =$$