Assignment 2 Shefali E.

(#1) Verify the $\underbrace{\text{absorption 2}}$ relations.

$$x + \bar{x}y = x + y \quad ; \quad 3 \quad x(\bar{x} + y) = xy$$

rule 3

Rule 3

$$\underbrace{(x+\bar{x})}_{1}(x+y) \quad \therefore x+y$$

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

rule 5

$$x \cdot \bar{x} = 0 \qquad \therefore xy$$

(#2)

$$\begin{aligned} x &= \bar{\bar{x}} \\ &= \bar{\bar{x}} \cdot 1 \\ &= \bar{\bar{x}}(x + \bar{x}) \\ &= \bar{\bar{x}} \cdot x + \underbrace{(\bar{\bar{x}} \cdot \bar{x})}_{\emptyset} \\ &= \bar{\bar{x}} \cdot x \end{aligned}$$

$$\begin{aligned} x &= x \cdot 1 \\ &= x(\bar{x} + \bar{\bar{x}}) \\ &= \underbrace{x \cdot \bar{x}}_{\emptyset} + (x \cdot \bar{\bar{x}}) \\ &= \bar{\bar{x}} \cdot x \end{aligned}$$

Let's say that x is in Set N. By the definition of $\bar{x}$, $\bar{x}$ will be comprised of all the elements that are not in subset x. When you negate $\bar{x}$ to $\bar{\bar{x}}$ you end up with all the elements that are in subset X. This proves that x and $\bar{\bar{x}}$ are equivelent.

#3

$\overset{T}{A} + \overset{F}{C} = 1$

$\overset{T}{A} \cdot \overset{F}{C} = 0$

$\overset{T}{B} + \overset{F}{C} = 1$

$\overset{T}{B} \cdot \overset{F}{C} = 0$

$\therefore A = B$

3 Variable Input

$\overline{ABC} = \overline{A} + \overline{B} + \overline{C}$

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

2

* No cancelation

BCD
Clock

$A + C = B + C$

$T + F = T + F$

$T = T$

$A \cdot C = B \cdot C$

$T \cdot F = T \cdot F$

$F = F$

Rule 4

$A + 0 = B + 0$

$A = B$

$A \cdot 1 = B \cdot 1$

$A = B$

$$\begin{aligned} A = A \cdot 1 &= A \cdot (B + C) \\ &= AB + AC \\ &= AB + 0 \\ &= AB \end{aligned}$$

$$\begin{aligned} B = B \cdot 1 &= B(A + C) \\ &= BA + BC \\ &= AB + 0 \\ &= AB \end{aligned}$$

#4 DeMorgan's Law

$\overline{X+y} = \overline{X} \cdot \overline{y}$; $\overline{X \cdot y} = \overline{X} + \overline{y}$

then do this 2ndly

$A + C = 1$
$A \cdot C = 0$
$B + C = 1$
$B \cdot C = 0$

✓ $\overline{X+Y} + C = 1$
✓ $\overline{X+y} \cdot C = 0$
✓ $\overline{X} \cdot \overline{Y} + C = 1$
✓ $\overline{x} \cdot \overline{y} \cdot C = 0$

$C = x+y$

$C = x \cdot y$

✓ $\overline{X \cdot y} + C = 1$
✓ $\overline{X \cdot y} \cdot C = 0$
$\overline{X} + \overline{y} + C = 1$
$\overline{X} + \overline{y} \cdot C = 0$

$$
\begin{aligned}
1 &= \overline{X} \cdot \overline{y} + (X+y) \\
&= (\overline{X}\,\overline{y} + x) + y \\
&= \underbrace{(X + \overline{X})}_{1} \cdot (X + \overline{y}) + y \\
&= (x+\overline{y}) + y \\
&= x + \underbrace{(\overline{y} + y)}_{1} \\
&= X + 1 \\
&= 1
\end{aligned}
$$

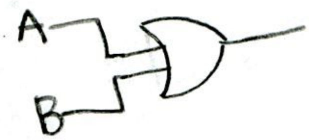
$$
\begin{aligned}
\emptyset &= \overline{X} \cdot \overline{y} \cdot (X+y) \\
&= \underbrace{\overline{X}X}_{\emptyset}\overline{y} + \overline{X}\underbrace{\overline{y}y}_{\emptyset} \\
&= (\emptyset)\overline{y} + \overline{x}(\emptyset) \\
&= \emptyset + \emptyset \\
&= \emptyset
\end{aligned}
$$

$$
\begin{aligned}
1 &= \overline{X} + \overline{y} + (X \cdot y) \\
&= \overline{X} + (\overline{y} + X)\underbrace{(\overline{y} + y)}_{1} \\
&= \overline{y} + \underbrace{(\overline{x} + x)}_{1} \\
&= 1
\end{aligned}
$$

$$
\begin{aligned}
\emptyset &= \overline{X} + \overline{y} \cdot (x \cdot y) \\
&= \underbrace{\overline{X}x}_{\emptyset}y + \underbrace{\overline{y}\,y}_{\emptyset}x \\
&= y(\emptyset) + x(\emptyset) \\
&= \emptyset + \emptyset \\
&= \emptyset
\end{aligned}
$$

#5

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



* absorption 2

$a + b$

(b) $ab + a\bar{b}$

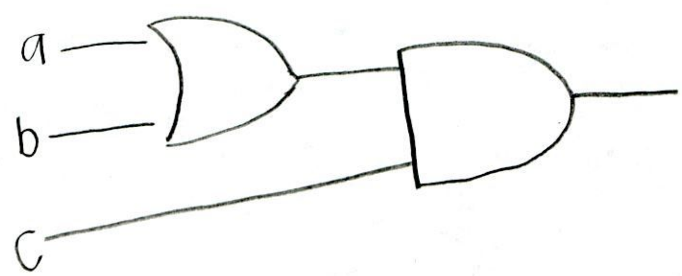
$a\underbrace{(b + \bar{b})}$

* rule 5

$a(1)$

a

(c) $\bar{a}bc + ac$



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

$c(a + b)$

(d) $\bar{X}N + (XN\bar{C} + XNC)$

$\bar{X}N + XN\underbrace{(\bar{C} + C)}_{1}$

$N\underbrace{(\bar{X} + X)}_{1}$

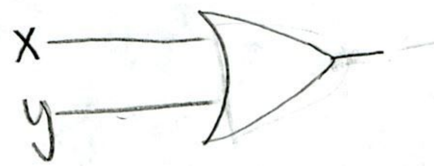
N

(e) $\overline{\overline{X+Y} + \overline{X+Y}}$

$\overline{\overline{x+y}} \cdot \overline{\overline{x+y}}$

$(x+y) \cdot (x+y)$

$x+y$



(f) $\overline{\overline{AA} + \overline{BB}}$

$\overline{\overline{AA}} \cdot \overline{\overline{BB}}$

$AA \cdot BB$

$A \cdot B$