

$$\begin{aligned}\bar{A} &\Rightarrow \text{NOT } A \\ A \cdot B &\Rightarrow A \text{ AND } B \\ A + B &\Rightarrow A \text{ OR } B\end{aligned}$$

Laws:

1. Commutative: $A + B = B + A$, $A \cdot B = B \cdot A$
2. Associative: $A + (B + C) = (A + B) + C$, $A \cdot (B \cdot C) = (A \cdot B) \cdot C$
3. Distributive: $A \cdot (B + C) = (A \cdot B) + (A \cdot C)$
 $A + (B \cdot C) = (A + B) \cdot (A + C)$
4. Idempotent: $A \cdot A \cdot A \dots A = A$, $X + X + X + \dots + X = X$
5. Identity: $1 \cdot A = A$, $0 + A = A$
6. Null: $0 \cdot A = 0$, $1 + A = 1$
7. Inverse: $A \cdot \bar{A} = 0$, $A + \bar{A} = 1$
8. Absorption: $A \cdot (A + B) = A$, $A + (A \cdot B) = A$, $A \cdot (\bar{A} \cdot B) = A + B$
9. Double Complement: $\bar{\bar{A}} = A$, $\overline{AB} = \bar{A}\bar{B}$, $\overline{A+B} = \bar{A} \cdot \bar{B}$
10. De Morgan's Theorem: $\overline{A \cdot B} = \bar{A} + \bar{B}$, $\overline{A + B} = \bar{A} \cdot \bar{B}$

Practice:

$$\begin{aligned}\text{Q. } A + B + \bar{A} + \bar{B} &\Rightarrow A + B + \bar{A} + \bar{B} \quad \text{Associative law} \\ &\Rightarrow (A + \bar{A}) + (B + \bar{B}) \quad \text{Inverse law} \\ &\Rightarrow 1 + 1 \\ &\Rightarrow 1 \\ \therefore A + B + \bar{A} + \bar{B} &= 1\end{aligned}$$

$$\begin{aligned}\text{Q. } A \cdot B \cdot C + \bar{A} \cdot B \cdot C + A \cdot \bar{B} \cdot C + A \cdot B \cdot \bar{C} &\quad \text{Distributive law} \\ \Rightarrow B \cdot C \cdot (A + \bar{A}) + A \cdot (\bar{B}C + B\bar{C}) \\ \checkmark \Rightarrow B \cdot C + A \cdot (\bar{B}C + B\bar{C})\end{aligned}$$

$$\begin{aligned}ABC + \bar{A}BC + A\bar{B}C + AB\bar{C} &\quad \text{Associative law} \\ \Rightarrow ABC + (\bar{A}BC + A\bar{B}C + AB\bar{C}) &\quad \text{Distributive law} \\ \Rightarrow (ABC + \bar{A}BC) + (A\bar{B}C + AB\bar{C}) &\quad \text{Distributive law} \\ \Rightarrow BC(A + \bar{A}) + AC(B + \bar{B}) + AB(C + \bar{C}) &\quad \text{Inverse law} \\ \checkmark \Rightarrow BC + AC + AB\end{aligned}$$

$$\begin{aligned}\text{Q. } \bar{A}A + \bar{A}B + AB + B\bar{B} + AAA + AAB &\quad \text{Inverse law} \\ \Rightarrow 0 + \bar{A}B + AB + 0 + AAA + AAB &\quad \text{Idempotent law / Identity law} \\ \Rightarrow \bar{A}B + AB + A + AB &\quad \text{Distributive law} \\ \Rightarrow B \cdot (\bar{A} + A) + A \cdot (1 + B) \\ &\quad \text{Inverse Null} \\ \Rightarrow B \cdot 1 + A \cdot 1 &\quad \text{Identity law} \\ \Rightarrow B + A &\quad \text{Commutative law} \\ \Rightarrow A + B\end{aligned}$$

Homework:

① O/N 18, P32, Q.3 (9608)
 Q. $A\bar{B}\bar{C} + AB\bar{C} + ABC$

② M/J 19, P33, Q.3(c), 9608
 Q. $\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D$