Minimization of Boolean Expressions

Problems

1) $A + AB = A$

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

$$A + AB = A(1+B)$$
$$= A(1)$$
$$= A$$

2) $A + \bar{A}B + A + B$

$$A + \bar{A}B = A + AB + \bar{A}B$$
$$= A + B(A + \bar{A})$$
$$= A + B(1)$$
$$= A + B$$

$A = A + AB$
$A + \bar{A} = 1$

3) $(A+B)(A+C) = A + BC$

$$(A+B)(A+C)$$
$$= AA + AC + BA + BC \quad \ldots \text{Dis. Law}$$
$$= A + AC + BA + BC$$
$$= A(1+C) + AB + BC$$
$$= A + AB + BC$$
$$= A(1+B) + BC$$
$$= A + BC$$

$AA = A$
$1 + C = 1$
$1 + B = 1$

4) $A + \bar{A}B + AB = A + B$

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

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

$= A + B(1)$

$A + \bar{A} = 1$

5) $A\bar{B} + \bar{A}B + AB + \bar{A}\bar{B} = 1$

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

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

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

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

Same

6) Simplify $\rightarrow A\bar{B} + \bar{A}B + AB + \bar{A}\bar{B}$

$Y = A\bar{B} + \bar{A}B + AB + \bar{A}.\bar{B}$

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

$= \bar{B} + B$

$Y = 1$

$\bar{A} + A = 1$

$\bar{B} + B = 1$

b) $Y = A\bar{B}C + ABC + \bar{A}BC$

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

$= AC + \bar{A}BC$ $\quad\quad \bar{B}+B = 1$

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

$\therefore Y = C(A+B)$

<u>Problems</u>. [Minimization of Boolean expressions]

1) $\bar{A}\cdot B + A\cdot B + \bar{A}\cdot\bar{B}$ Ans $\rightarrow B+\bar{A}$

2) $A + A\bar{B} + \bar{A}B$ Ans $\rightarrow A+B$

3) Complement the expression

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

4) $AB + \bar{A}C + A\bar{B}C(AB+C)$ Ans $=1$

5) $Y = (\bar{A}+B)(A+B)$ Ans $= B$

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

Ans $= \bar{C}$

Problems

1) $A(A+B) = A \rightarrow$ Prove

$A \cdot A = A$
$1 + A = 1$
$A \cdot 1 = A$

$$A(A+B) = AA + AB$$
$$= A + AB$$
$$= A \cdot 1 + AB$$
$$= A(1+B)$$
$$= A \cdot 1$$
$$= A$$

2) Prove $A + B + C + D + \overline{ABCD} = 1$

$$A + B + C + D + \overline{ABCD}$$
$$= A + B + C + D + \bar{A} + \bar{B} + \bar{C} + \bar{D}$$
$$= A + \bar{A} + B + \bar{B} + C + \bar{C} + D + \bar{D}$$
$$= 1 + 1 + 1 + 1$$
$$= 1$$

3) Simplify the logic expression

$$(AB(C + \overline{\bar{B}\bar{D}}) + \overline{AB})CD$$
$$= (AB(C + B + D) + \bar{A} + \bar{B})CD$$
$$= (ABC + AB\bar{B} + AB\bar{D} + \bar{A} + \bar{B})CD$$
$$= (ABC + AB\bar{D} + \bar{A} + \bar{B})CD$$
$$= ABCD + AB\bar{D}CD + \bar{A}CD + \bar{B}CD$$

$= ABCD + \bar{A}CD + BCD$

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

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

$= CD$