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Simplify Boolean Expressions

① $[A\bar{B}(C+BD)+\bar{A}\bar{B}]C$

$=[A\bar{B}C+A\bar{B}BD+\bar{A}\bar{B}]C$ (Using distributive law)

$=[A\bar{B}C+\bar{A}\bar{B}]C$ (As $\bar{B}B=0$)

$=A\bar{B}CC+\bar{A}\bar{B}C$ (Using distributive law)

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

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

$=\boxed{\bar{B}C}$ (As $A+\bar{A}=1$)

② $[AB(C+\overline{BD})+\overline{AB}]CD$

$=[ABC+AB\overline{BD}+\overline{AB}]CD$ (Using distributive law)

$=[ABC+AB(\bar{B}+\bar{D})+\overline{AB}]CD$

(Using demorgan's second law)

$=[ABC+AB\bar{B}+AB\bar{D}+\overline{AB}]CD$

(using distributive law)

$=[ABC+AB\bar{D}+\overline{AB}]CD$ (as $B\bar{B}=0$)

$=ABC\,CD+AB\bar{D}C.D+\overline{AB}CD$ (distributive law)

$=ABCD+\overline{AB}CD$ (as $\bar{D}.D=0$ & $C.C=C$)

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

$=\boxed{CD}$ ($AB+\overline{AB}=1$)

(3) $\bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$

$= A+\bar{A}(BC) + A\bar{B}(C+\bar{C}) + \bar{A}\bar{B}\bar{C}$ (taking BC & $A\bar{B}$ common)

$= BC + A\bar{B} + \bar{A}\bar{B}\bar{C}$ ($A+\bar{A} = 1$ & $C+\bar{C} = 1$)

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

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

$= \boxed{BC + A\bar{B} + \bar{B}\bar{C}}$ (distributive law)

(4) $\overline{A\bar{B} + AC} + \bar{A}\bar{B}C$

$= \overline{A\bar{B}} \cdot \overline{AC} + \bar{A}\bar{B}C$ (using demorgan's law)

$= (\bar{A}+\bar{B})(\bar{A}+\bar{C}) + \bar{A}\bar{B}C$ (using demorgan's law)

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

$= \bar{A} + \bar{A}\bar{C} + \bar{B}\bar{C} + \bar{A}\bar{B}(1+C)$ (taking $\bar{A}\bar{B}$ common)

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

$= \bar{A}(1+\bar{C}+\bar{B}) + \bar{B}\bar{C}$ (taking $\bar{A}$ common)

$= \boxed{\bar{A} + \bar{B}\bar{C}}$ (as $1+\bar{C}+\bar{B} = 1$)

Date / /
Page No.

(5) $\overline{AB} + \overline{AC} + \bar{A}\bar{B}\bar{C}$

$= \bar{A} + \bar{B} + \bar{A} + \bar{C} + \bar{A}\bar{B}\bar{C}$ (Using demorgan Second law)

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

$= \bar{A} + \bar{B} + \bar{C}(1 + \bar{A}\bar{B})$ (taking C common)

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

$= \boxed{\overline{ABC}}$ (Using demorgan's first law)

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

$= A(1 + B + \bar{B}C)$ (taking A common)

$= \boxed{A}$ (as $1 + B + \bar{B}C = 1$)

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

$= \bar{A}C + BC + ABC$ (distributive law)

$= \bar{A}C + BC(1 + A)$ (BC common)

$= \bar{A}C + \bar{A}C + BC$ (as $1 + A = 1$)

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

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(8) $A\bar{B}C(BD + CDE) + \bar{A}C$

$= A\bar{B}C\,BD + A\bar{B}C\,\bar{C}DE + A\bar{C}$ (distribute)

$= A\bar{B}CDE + A\bar{C}$ (as $B\bar{B} = 0$

$= \boxed{A(\bar{B}CDE + \bar{C})}$ taking A common