数字逻辑

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作业1

1. (1) 若 $A=1$，则 $A+B=A+C=1$ B不一定等于C 则不对.

(2) 若 $A=0$，则 $AB=AC=0$ B不一定等于C 则不对.

(3) 若 $A=1$，则 $AB=AC$ 为0或1取决于B、C

此时 B、C必须保持相同的逻辑变量，即 $B=C$

若 $A=0$，则 $A+B=A+C$ 为0或1取决于B、C

此时，B、C必须保持相同的逻辑变量，即 $B=C$

结论：正确

2. (1) $(A+\bar{B}C)(\bar{A}B+C)$

$=A\bar{A}B+AC+\bar{B}C\bar{A}B+\bar{B}C$

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

(4) $AB+B\bar{C}+ABC+AB\bar{C}$

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

$=AB+B\bar{C}$

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

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

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

4. (2) $F(A,B,C,D)=AB+BC+CD+DA$

$=ABC(C+\bar{C})(D+\bar{D})+(A+\bar{A})BC(\bar{D}+D)+(\bar{A}+A)(B+\bar{B})CD$

$+DA(B+\bar{B})(C+\bar{C})$

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

$\bar{A}BCD + \bar{A}BC\bar{D} + \bar{A}B\bar{C}D + A\bar{B}CD + \bar{A}\bar{B}CD + \bar{A}\bar{B}C\bar{D}$

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

化简 $= ABCD + ABC\bar{D} + AB\bar{C}D + AB\bar{C}\bar{D} + \bar{A}BCD + \bar{A}BC\bar{D}$

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

$= m_{15} + m_{14} + m_{13} + m_{12} + m_7 + m_6 + m_{11} + m_3 + m_9$

$= m_3 + m_6 + m_7 + m_9 + m_{11} + m_{12} + m_{13} + m_{14} + m_{15}$

$= \Sigma(3, 6, 7, 9, 11, 12, 13, 14, 15)$

8.(2). $Z = \Sigma(4, 5, 6, 7)$

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

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

$= \Pi(4, 5, 6, 7)$

(3). $Z = \Pi(0, 2, 4, 6)$

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

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

$= \Sigma(0, 2, 4, 6)$

(6). $Z = \overline{\bar{A}\bar{B} + ABD} + (B + \bar{C}D)$

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

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

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

$= A\bar{B} + A\bar{D} + \bar{A}B + B\bar{D} + B + \bar{C}D$ 其中 $B + A\bar{B} = B + A$.

$= A + B + A\bar{B} + \bar{A}B + B\bar{D} + \bar{C}D$ 其中 $A + A\bar{D} = A$.

$= A + B + \bar{A}B + B\bar{D} + \bar{C}D$ 其中 $A + \bar{A}B = A + B$.

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

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

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9. $F = C\overline{(A\bar{B}+\bar{A}B)} + \bar{C}(A\bar{B}+\bar{A}B)$

$F' = [C + \overline{(A+\bar{B})(\bar{A}+B)}][\bar{C} + (A+\bar{B})(\bar{A}+B)]$

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

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

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

$= F$ 则 F 为自对偶函数.