디지털논리 과제

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1. $\bar{X}\bar{Y}+\bar{X}Y+XY=\bar{X}+Y$

$\bar{X}\bar{Y}+\bar{X}Y+XY$

$=\bar{X}(\bar{Y}+Y)+XY$

$=\bar{X}+XY$

$=(\bar{X}+X)(\bar{X}+Y)$

$=\bar{X}+Y$

2. $Y+\bar{X}Z+X\bar{Y}=X+Y+Z$

$Y+\bar{X}Z+X\bar{Y}$

$=Y\cdot 1+\bar{X}Z+X\bar{Y}$

$=Y(\bar{X}+X)+\bar{X}Z+X\bar{Y}$

$=\bar{X}Y+XY+\bar{X}Z+X\bar{Y}$

$=\bar{X}(Y+Z)+X(Y+\bar{Y})$

$=X+\bar{X}(Y+Z)$

$=(X+\bar{X})(X+Y+Z)$

$=X+Y+Z$

3. $\bar{X}\bar{Y}+\bar{Y}Z+XZ+XY+Y\bar{Z}=\bar{X}\bar{Y}+XZ+Y\bar{Z}$

$\bar{X}\bar{Y}+\bar{Y}Z+XZ+XY+Y\bar{Z}$

$=\bar{X}\bar{Y}+\bar{Y}Z+XZ+Y\bar{Z}$

$=\bar{X}\bar{Y}+XZ+Y\bar{Z}$

4. $AB\bar{C}+B\bar{C}\bar{D}+BC+\bar{C}D=B+\bar{C}D$

$AB\bar{C}+B\bar{C}\bar{D}+BC+\bar{C}D$

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

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

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

$=BC+AB+\bar{C}D+B\bar{C}$

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

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

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

$=B+\bar{C}D$

5. $\bar{A}\bar{C}+\bar{A}BC+\bar{B}C$

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

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

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

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

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

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

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

6. $AB\bar{C}+AC$

$AB\bar{C}+AC$

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

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

$=A(C+B)$

7. $\bar{A}\bar{B}D + \bar{A}\bar{C}D + BD$

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

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

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

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

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

$= BD + \bar{A}D(1+\bar{C})$

$= BD + \bar{A}D$

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

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

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

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

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

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

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

9. $\bar{X}\bar{Y} + XYZ + \bar{X}Y$ to three literals

$\bar{X}\bar{Y} + XYZ + \bar{X}Y$

$= Y(\bar{X}+XZ) + \bar{X}\bar{Y}$

$= Y(\bar{X}+Z)(\bar{X}+X) + \bar{X}\bar{Y}$

$= Y(\bar{X}+Z) + \bar{X}\bar{Y}$

$= \bar{X}Y + YZ + \bar{X}\bar{Y}$

$= \bar{X}(Y+\bar{Y}) + YZ$

$= \bar{X} + YZ$

10. $X + Y(Z + \overline{X+Z})$ to two literals

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

$= X + Y(Z + \bar{X}\cdot\bar{Z})$

$= X + Y(Z+\bar{X})(Z+\bar{Z})$

$= X + Y(Z+\bar{X})$

$= X\cdot 1 + YZ + \bar{X}Y$

$= X(1+Y) + YZ + \bar{X}Y$

$= X + XY + YZ + \bar{X}Y$

$= X + YZ + Y(X+\bar{X})$

$= X + Y + YZ$

$= X + Y(1+Z)$

$= X + Y$

11. $\bar{W}X(\bar{Z}+\bar{Y}Z) + X(W+\bar{W}YZ)$ to one literal

$\bar{W}X(\bar{Z}+\bar{Y}Z) + X(W+\bar{W}YZ)$

$= \bar{W}X\bar{Z} + \bar{W}X\bar{Y}Z + WX + \bar{W}XYZ$

$= \bar{W}X(\bar{Z}+YZ) + X(W+\bar{W}\bar{Y}Z)$

$= \bar{W}X(\bar{Z}+Y)(\bar{Z}+Z) + X(W+\bar{Y}Z)(W+\bar{W})$

$= \bar{W}X(\bar{Z}+Y) + X(W+\bar{Y}Z)$

$= \bar{W}X\bar{Z} + \bar{W}XY + WX + X\bar{Y}Z$

$= \bar{W}X\bar{Z} + X(W+\bar{W}Y) + X\bar{Y}Z$

$= \bar{W}X\bar{Z} + X(W+Y) + X\bar{Y}Z$

$= \bar{W}X\bar{Z} + XW + XY + X\bar{Y}Z$

$= X(W+W\bar{Z}) + X(Y+\bar{Y}Z)$

$= X(W+\bar{Z}) + X(Y+Z)$

$= XW + X\bar{Z} + XY + XZ$

$= XW + X(Z+\bar{Z}) + XY$

$= XW + X + XY$

$= X(W+1) + XY = X + XY$

$= X(1+Y) = X$

12. $(\bar{X}+\bar{Y})Z$

$F=(\bar{X}+\bar{Y})Z$

$\bar{F}=XY+\bar{Z}$

13. $W+(Y+\bar{Z}+YZ)+\bar{W}X+(\bar{Y}+Z)(Y+\bar{Z})$

$W+(Y+\bar{Z}+YZ)+\bar{W}X+(\bar{Y}+Z)(Y+\bar{Z})$

$=W+(Y+\bar{Z})+\bar{W}X+(\bar{Y}\bar{Z}+YZ)$

$=(W+\bar{W}X)+(Y+\bar{Y}\bar{Z})+(\bar{Z}+YZ)$

$=W+X+Y+\bar{Z}+\bar{Z}+Y$

$=W+X+Y+\bar{Z}=F,\ \bar{F}=\bar{W}\bar{X}\bar{Y}Z$

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

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

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

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

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

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

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

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

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

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

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