Hw 4

DeMorgan's: $\overline{AB} = \bar{A} + \bar{B}$

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

1. $\underline{f} = x(y + \bar{z}(Q + \bar{R}))$

$\overline{f} = \overline{x(y + \bar{z}(Q + \bar{R}))}$

$A + B$

$\bar{x} + \overline{(y + \bar{z}(Q + \bar{R}))}$

$\bar{x} + \bar{y}(z(Q + \bar{R}))$

$A \quad B$

$\bar{x} + \bar{y}(\bar{z} + \overline{(Q + \bar{R})} \quad \bar{\bar{R}} = R$

$\boxed{\bar{x} + \bar{y}(\bar{z} + \bar{Q}R)}$

2.

x	y	z	f		$\bar{f}$
0	0	0	1	m_0	0
0	0	1	0	m_1	1
0	1	0	1	m_2	0
0	1	1	1	m_3	0
1	0	0	0	m_4	1
1	0	1	1	m_5	0
1	1	0	0	m_6	1
1	1	1	1	m_7	0

$f = \Sigma_m(0,2,3,5,7)$

$f = \Pi M(1,4,6)$

$= \boxed{\bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}z + xyz}$

$= \boxed{(x+y+\bar{z})(\bar{x}+y+z)(\bar{x}+\bar{y}+z)}$

$\bar{f} = \Sigma_m(1,4,6)$

$\bar{f} = \Pi M(0,2,3,5,7)$

$\boxed{\bar{x}\bar{y}z + x\bar{y}\bar{z} + xy\bar{z}}$

$\boxed{(x+y+z)(x+\bar{y}+z)(x+\bar{y}+\bar{z}) \rightarrow (\bar{x}+y+\bar{z})(\bar{x}+\bar{y}+\bar{z})}$

Hw 4

3.i. $f(w,x,y,z) = x + (xyz + \bar{x}yz) + wx + \bar{w}y + \bar{x}z$

$= x + (xyz + \bar{x}yz) + x(w + \bar{w}) + \bar{x}y$

$= (xyz + \bar{x}yz) + x + x + \bar{x}y$

$= (xyz + \bar{x}yz) + x + \bar{x}y$

$= x + xyz + \bar{x}y + \bar{x}yz$

$= \underbrace{x(1 + yz)}_{x \cdot 1} + \bar{x}y + \bar{x}yz$

$= x + \bar{x}y + \bar{x}yz$

$= x + \bar{x}\underbrace{(y + yz)}_{y}$

$= x + \bar{x}y$

$= \boxed{x + y}$

$\begin{cases} A + AB = A \\ A + \bar{A}B = A + B \\ x + \bar{x} = 1 \end{cases}$

$x \cdot 1 = x$

$1 + n = 1$

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

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

ii. $f(x,y,z) = y\bar{z}(\bar{z} + \bar{z}x) + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}y)$

$= y\bar{z}(\bar{z} + \bar{z}x) + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}y$

$= y\bar{z}\bar{z} + y\bar{z}\bar{z}x + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}y)$

$= y\bar{z} + y\bar{z}x + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}y)$

$= y\bar{z}\underbrace{(1 + x)}_{1} + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}y)$

$= y\bar{z} + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}z)$

$= y\bar{z} + (\bar{x} + \bar{z})(\bar{x}(y + z))$

$= y\bar{z} + \underbrace{\bar{x} + \bar{x}\bar{z}}_{\bar{x}}(y + z)$

$= y\bar{z} + \bar{x}(y + z)$

$= yz + \bar{x}y + \bar{x}z = \boxed{y\bar{z} + \bar{x}z}$

$AB + \bar{A}C + BC = AB + \bar{A}C$

Hw 4

4. $f(x,y,z) =$

$xy + x\bar{z}$

$xy(z+\bar{z}) + x\bar{z}(y+\bar{y})$

$= xyz + xy\bar{z} + x\bar{z}y + x\bar{z}\bar{y}$

$f = \sum m(4,5,6)$

$f = \prod M(0,1,2,3,7)$

x	y	z	
0	0	0	m_0
0	0	1	m_1
0	1	0	m_2
0	1	1	m_3
1	0	0	m_4
1	0	1	m_5
1	1	0	m_6
1	1	1	m_7

5. i. $\sum m(1,4,5,6)$

$= \bar{a}\bar{b}c + a\bar{b}\bar{c} + a\bar{b}c + ab\bar{c}$

ii. $g(A,B,C,D) = A(\bar{B} + C\bar{D}) + \bar{A}B\bar{C}D$

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

$A\bar{B} + AC\bar{D}(B+\bar{B})$

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

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

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

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

$A\bar{B}CD + A\bar{B}C\bar{D} + A\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + ABC\bar{D} + A\bar{B}C\bar{D} + \bar{A}BCD$ (cancel)

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