2.1, 2.2, 2.7 -> 2.13, 2.18 -> 2.23, 2.33, 2.44, 2.47, 2.48

2.1 Prove $x+yz=(x+y)(x+z)$

RHS: Distribute

$xx+xz+xy+yz$

$x+xz+xy+yz$

$x(1+z)+xy+yz$ ($1+z=1$)

$x+xy+yz$

$x(1+y)+yz$ ($1+y=1$)

$x+yz$ = LHS

2.2 Prove $(x+y)(x+\bar{y})=x$

LHS Distribute

$xx+x\bar{y}+xy+y\bar{y}$ ($y\bar{y}=0$)

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

$x+x$

x = RHS

2.7 Determine whether or not the following expressions are valid, i.e., whether the left- and right-hand sides represent the same function.

(a) $\bar{x}_1x_3+x_1x_2\bar{x}_3+\bar{x}_1x_2+x_1\bar{x}_2=\bar{x}_2x_3+x_1\bar{x}_3+x_2\bar{x}_3+\bar{x}_1x_2x_3$

(b) $x_1\bar{x}_3+x_2x_3+\bar{x}_2\bar{x}_3=(x_1+\bar{x}_2+x_3)(x_1+x_2+\bar{x}_3)(\bar{x}_1+x_2+\bar{x}_3)$

(c) $(x_1+x_3)(\bar{x}_1+\bar{x}_2+\bar{x}_3)(\bar{x}_1+x_2)=(x_1+x_2)(x_2+x_3)(\bar{x}_1+\bar{x}_3)$

(a)

LHS $=\bar{x}_1x_3(x_2+\bar{x}_2)+x_1x_2\bar{x}_3+\bar{x}_1x_2(x_3+\bar{x}_3)+x_1\bar{x}_2(x_3+\bar{x}_3)$

$=\bar{x}_1x_2x_3+\bar{x}_1\bar{x}_2x_3+x_1x_2\bar{x}_3+\bar{x}_1x_2x_3+\bar{x}_1x_2\bar{x}_3+x_1\bar{x}_2x_3+x_1\bar{x}_2\bar{x}_3$

011 001 110 011 010 101 100

3 1 6 3 2 5 4

LHS $=\Sigma m(1,2,3,4,5)$

RHS $=\bar{x}_2x_3(x_1+\bar{x}_1)+x_1\bar{x}_3(x_2+\bar{x}_2)+x_2\bar{x}_3(x_1+\bar{x}_1)+\bar{x}_1x_2x_3$

$=x_1\bar{x}_2x_3+\bar{x}_1\bar{x}_2x_3+x_1x_2\bar{x}_3+x_1\bar{x}_2\bar{x}_3+x_1x_2\bar{x}_3+\bar{x}_1x_2\bar{x}_3+\bar{x}_1x_2x_3$

101 001 110 100 110 010 011

5 1 6 4 6 2 3

RHS $=\Sigma m(1,2,3,4,5)$

LHS = RHS → Valid

(b)

LHS $=x_1\bar{x}_3(x_2+\bar{x}_2)+x_2x_3(x_1+\bar{x}_1)+\bar{x}_2\bar{x}_3(x_1+\bar{x}_1)$

$=x_1x_2\bar{x}_3+x_1\bar{x}_2\bar{x}_3+x_1x_2x_3+\bar{x}_1x_2x_3+x_1\bar{x}_2\bar{x}_3+\bar{x}_1\bar{x}_2\bar{x}_3$

110 100 111 011 100 000

6 4 7 3 4 0

LHS = $\sum m(0,3,4,6,7)$

RHS = $(x_1+\bar{x}_2+x_3)(x_1+x_2+\bar{x}_3)(\bar{x}_1+x_2+\bar{x}_3)$

0 1 0 0 0 1 1 0 1

2 1 5

RHS = $\prod M(1,2,5) = \sum m(0,3,4,6,7)$

LHS = RHS → Valid

(c) LHS = $(x_1+x_3)(\bar{x}_1+\bar{x}_2+\bar{x}_3)(x_1+x_2)$

$= (x_1+x_1x_2+x_1x_3+x_2x_3)(\bar{x}_1+\bar{x}_2+\bar{x}_3)$

$= x_1\bar{x}_2+x_1\bar{x}_3+x_1x_2\bar{x}_3+x_1\bar{x}_2x_3+\bar{x}_1x_2x_3$

$= x_1\bar{x}_2x_3+x_1\bar{x}_2\bar{x}_3+x_1x_2\bar{x}_3+x_1x_2\bar{x}_3+x_1x_2\bar{x}_3+x_1\bar{x}_2x_3+\bar{x}_1x_2x_3$

1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 1 0 1 0 1 1

5 4 6 6 6 5 3

$= \sum m(3,4,5,6)$

RHS = $(x_1+x_2)(x_2+x_3)(\bar{x}_1+\bar{x}_3)$

$= (x_1\bar{x}_3+\bar{x}_1x_2+x_2\bar{x}_3)(x_2+x_3)$

$= x_1x_2x_3+\bar{x}_1x_2+\bar{x}_1x_2x_3+x_2\bar{x}_3$

$= x_1x_2x_3+\bar{x}_1x_2x_3+\bar{x}_1x_2\bar{x}_3+\bar{x}_1x_2x_3+x_1x_2\bar{x}_3+\bar{x}_1x_2\bar{x}_3$

1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 0 1 0 0

7 3 2 3 6 2

$= \sum m(2,3,6,7)$

LHS ≠ RHS → invalid

2.10 Show $\sum m(1,2,3,4,5,6,7) = x_1+x_2+x_3$

$(\bar{x}_1\bar{x}_2x_3)+(\bar{x}_1x_2\bar{x}_3)+(\bar{x}_1x_2x_3)+(x_1\bar{x}_2\bar{x}_3)+(x_1\bar{x}_2x_3)+(x_1x_2\bar{x}_3)+(x_1x_2x_3)$

1 2 3 4 5 6 7

$+(\bar{x}_1x_2x_3)+$

3

$(x_1x_2\bar{x}_3)+(x_1x_2x_3)+(x_1\bar{x}_2\bar{x}_3)+(x_1\bar{x}_2x_3)+(\bar{x}_1x_2x_3)+(\bar{x}_1\bar{x}_2x_3)+(\bar{x}_1x_2\bar{x}_3)$

6 7 4 5 3 1 2

$x_1(x_2\bar{x}_3+x_2x_3+\bar{x}_2\bar{x}_3+\bar{x}_2x_3)+x_2$

2.11 Show $\prod M(0,1,2,3,4,5,6,7) = x_1x_2x_3$

$(x_1+x_2+x_3)(x_1+x_2+\bar{x}_3)(x_1+\bar{x}_2+x_3)(x_1+\bar{x}_2+\bar{x}_3)(\bar{x}_1+x_2+x_3)(\bar{x}_1+x_2+\bar{x}_3)(\bar{x}_1+\bar{x}_2+x_3)(\bar{x}_1+\bar{x}_2+\bar{x}_3)$

$(x_1+x_2)(x_1+\bar{x}_2)(\bar{x}_1x_2)(\bar{x}_1\bar{x}_2)$

2.12 $f = x_1x_3 + x_1\bar{x}_2 + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$ min SOP

$x_1x_3(x_2+\bar{x}_2) + x_1\bar{x}_2(x_3+\bar{x}_3) + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$

$x_1x_2x_3 + x_1\bar{x}_2x_3 + x_1\bar{x}_2x_3 + x_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$

7 5 5 4 3 0

$x_1x_2x_3 + x_1\bar{x}_2x_3 + x_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3$

$(x_2+\bar{x}_2)x_1x_3 + (x_1+\bar{x}_1)\bar{x}_2\bar{x}_3 + (x_1+\bar{x}_1)x_2x_3$

$f = x_1x_3 + x_2x_3 + \bar{x}_2\bar{x}_3$

2.13 $f = x_1\bar{x}_2\bar{x}_3 + x_1x_2x_4 + x_1\bar{x}_2x_3\bar{x}_4$ min SOP

$= x_1\bar{x}_2\bar{x}_3x_4 + x_1\bar{x}_2\bar{x}_3\bar{x}_4 + x_1x_2x_3x_4 + x_1x_2\bar{x}_3x_4 + x_1\bar{x}_2x_3\bar{x}_4$

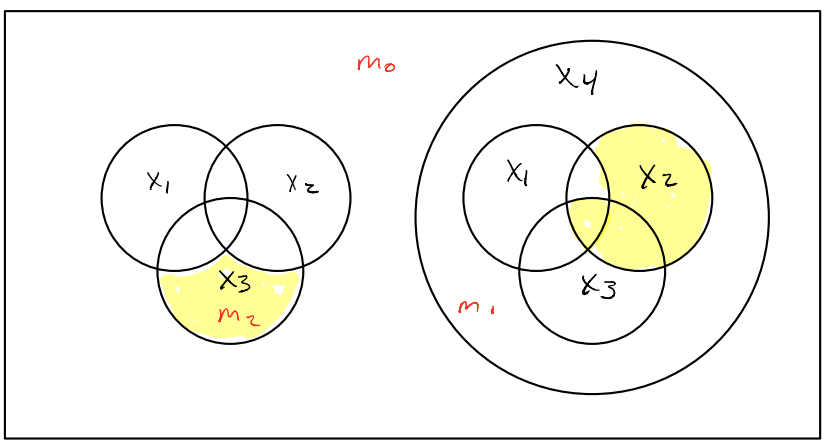
$= x_1\bar{x}_2\bar{x}_3x_4 + x_1\bar{x}_2\bar{x}_3\bar{x}_4 + x_1\bar{x}_2x_3x_4 + x_1\bar{x}_2\bar{x}_3x_4 + x_1x_2x_3x_4 + x_1x_2\bar{x}_3x_4$

$f = x_1\bar{x}_2\bar{x}_3 + x_1\bar{x}_2x_4 + x_1x_2x_4$

2.15 $f = (x_1+x_2+x_3)(x_1+\bar{x}_2+x_3)(\bar{x}_1+\bar{x}_2+x_3)(x_1+x_2+\bar{x}_3)$ min P.O.S

$(x_1+x_2)(\bar{x}_2+x_3)$

2.18 $\bar{x}_1\bar{x}_2x_3\bar{x}_4 + x_1x_2x_3x_4 + \bar{x}_1x_2$



2.20 $f(x_1,x_2,x_3) = \Sigma m(3,4,6,7)$

$(\bar{x}_1x_2x_3) + (x_1\bar{x}_2\bar{x}_3) + (x_1x_2\bar{x}_3) + (x_1x_2x_3)$

$(\bar{x}_1x_2x_3) + (x_1x_2x_3) + (x_1\bar{x}_2\bar{x}_3) + (x_1x_2\bar{x}_3)$

$x_2x_3 + x_1\bar{x}_3$

2.33 SOP

x_1	x_2	x_3	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

$f = \sum m(1,2,3,4,7)$

$= (\bar{x}_1\bar{x}_2x_3) + (\bar{x}_1x_2\bar{x}_3) + (\bar{x}_1x_2x_3) + (x_1\bar{x}_2\bar{x}_3) + (x_1x_2x_3)$

$= (\bar{x}_1\bar{x}_2x_3) + (\bar{x}_1x_2x_3) + (\bar{x}_1x_2\bar{x}_3) + (\bar{x}_1x_2x_3) + (\bar{x}_1x_2x_3) + (x_1x_2x_3) + (x_1\bar{x}_2\bar{x}_3)$

$= \bar{x}_1x_3 + \bar{x}_1x_2 + x_2x_3 + x_1\bar{x}_2\bar{x}_3$

2.44 $f = x_1\bar{x}_3 + x_1x_2 + \bar{x}_1\bar{x}_2 + \bar{x}_2x_3$ SOP

$= x_1x_2\bar{x}_3 + x_1\bar{x}_2x_3 + x_1x_2x_3 + x_1x_2\bar{x}_3 + \bar{x}_1\bar{x}_2x_3 + \bar{x}_1\bar{x}_2\bar{x}_3 + x_1\bar{x}_2x_3 + \bar{x}_1\bar{x}_2x_3$

6 5 7 6 1 0 5 1

$= \bar{x}_1\bar{x}_2\bar{x}_3 + \bar{x}_1\bar{x}_2x_3 + x_1\bar{x}_2x_3 + x_1x_2\bar{x}_3 + x_1x_2x_3$

$= \bar{x}_1\bar{x}_2 + \bar{x}_2x_3 + x_1x_2$

2.47 $f = (x_1 + x_2 + x_3)(x_1 + \bar{x}_2 + x_3)(\bar{x}_1 + x_2 + x_3)(\bar{x}_1 + \bar{x}_2 + x_3)(x_1 + x_2 + \bar{x}_3 + x_4)$

Find min P.O.S

$((x_1 + x_3) + x_2)((x_1 + x_3) + \bar{x}_2)((\bar{x}_1 + x_3) + x_2)((\bar{x}_1 + x_3) + \bar{x}_2)(x_1 + x_2 + \bar{x}_3 + x_4)$

$(x_1 + x_3)(\bar{x}_1 + x_3)(x_1 + x_2 + \bar{x}_3 + x_4)$

$x_3(x_1 + x_2 + \bar{x}_3 + x_4)$

$f = x_1x_3 + x_2x_3 + x_3x_4$ shitty question