Friday, 28 February 2020 9:44 pm

1. a)

X	Y	Z	XY	XY+Z	XZ	Y+XZ	(XY+Z)(Y+XZ)
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	0	0	0	1	0
0	1	1	0	1	0	1	1
1	0	0	0	0	0	0	0
1	0	1	0	1	1	1	1
1	1	0	1	1	0	1	1
1	1	1	1	1	1	1	1

$SOM = \bar{X}YZ + X\bar{Y}Z + XY\bar{Z} + XYZ$

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

b)

A	B	C	$(\bar{A}+B)$	$(\bar{B}+C)$	$(\bar{A}+B)(\bar{B}+C)$
0	0	0	1	1	1
0	0	1	1	1	1
0	1	0	1	0	0
0	1	1	1	1	1
1	0	0	0	1	0
1	0	1	0	1	0
1	1	0	1	0	0
1	1	1	1	1	1

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

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

c)

W	X	Y	Z	$WX\bar{Y}$	$WX\bar{Z}$	WXZ	$Y\bar{Z}$	$WX\bar{Y}+WX\bar{Z}+WXZ+Y\bar{Z}$
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	1	0	0	0	0	1	1
0	0	1	1	0	0	0	0	0
0	1	0	0	0	0	0	0	0
0	1	0	1	0	0	0	0	0
0	1	1	0	0	0	0	1	1
0	1	1	1	0	0	00	0	0
1	0	0	0	0	00	0	0	0
1	0	0	1	0	0	0	0	0
1	0	1	0	0	0	0	1	1
1	0	1	1	0	0	0	0	0
1	1	0	0	1	1	0	0	1
1	1	0	1	1	0	1	0	1
1	1	1	0	0	1	0	1	1
1	1	1	1	1	0	1	0	1

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

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

Friday, February 28, 2020 10:41 PM

a) $E = \Sigma m(1,3,6,7) = \Pi M(0,2,4,5)$

$F = \Sigma m(3,4,5,6,7) = \Pi M(0,1,2)$

b) $\bar{E} = \Sigma m(0,2,4,5)$

$\bar{F} = \Sigma m(0,1,2)$

c) $E+F = \Sigma m(1,3,4,5,6,7)$

$E \cdot F = \Sigma m(3,6,7)$

d) $E = \bar{X}\bar{Y}Z + \bar{X}YZ + X\bar{Y}\bar{Z} + XYZ$

$F = XYZ$

3

Friday, February 28, 2020 10:41 PM

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

$= AB\cancel{B} + AB\bar{C}D + BC + C\bar{C}D$ ($C\bar{C} = 0$)

$= AB(1+\bar{C}D) + BC$

$= AB + BC$ SOP

$= B(A+C)$ POS

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

$= \bar{X} + \cancel{X}XY + \cancel{X}X\bar{Z} + X\cancel{\bar{Y}}Y + X\bar{Y}\bar{Z}$ ($X\bar{Y}Y = 0$)

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

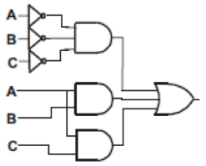
$= \bar{X} + XY + XZ(1+\bar{Y})$

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

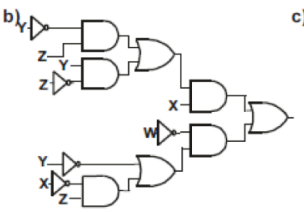
4

Friday, February 28, 2020 10:41 PM

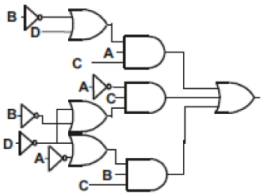
a)



b)



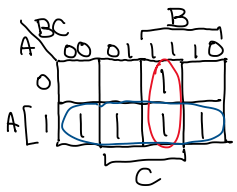
c)



5

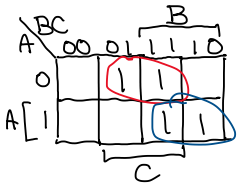
Friday, February 28, 2020 10:41 PM

a)



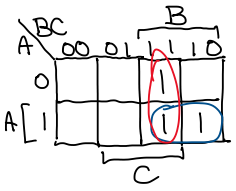
$F = A + BC$

b)



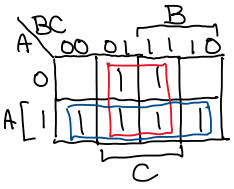
$F = AB + \bar{A}C$

c)



$F = AB + BC$

d)

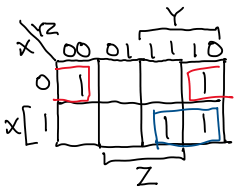


$F = A + C$

6

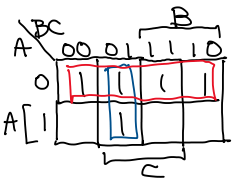
Friday, February 28, 2020 10:41 PM

a)



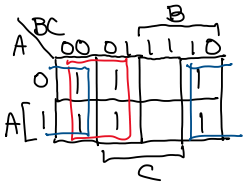
$\bar{X}\bar{Z} + XY$

b)



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

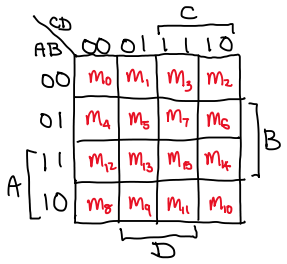
c)



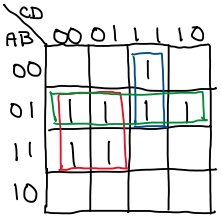
$\bar{B} + \bar{C}$

7

Friday, February 28, 2020 10:41 PM

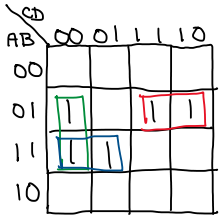


a)



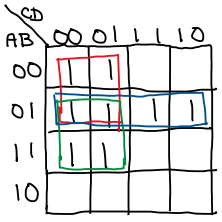
$\bar{A}B + B\bar{C} + \bar{A}CD$

b)



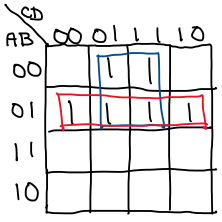
$AB\bar{C} + \bar{A}BC + B\bar{C}\bar{D}$

c)



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

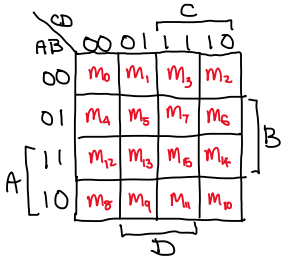
d)



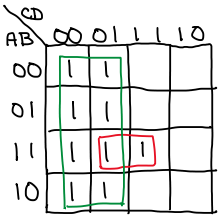
$\bar{A}B + \bar{A}D$

8

Friday, February 28, 2020 10:41 PM

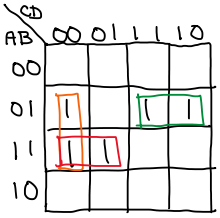


a)



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

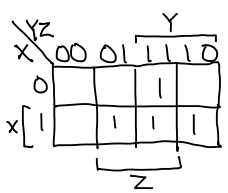
b)



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

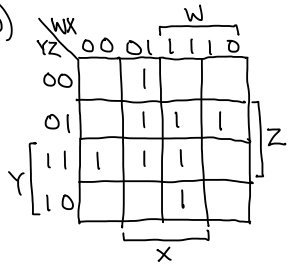
Friday, February 28, 2020 10:41 PM

a)



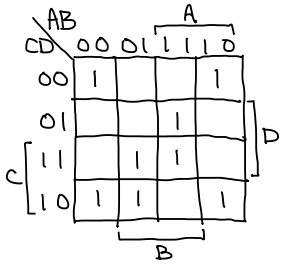
$\Sigma m(3,5,6,7)$

b)



$\Sigma m(3,4,5,7,9,13,14,15)$

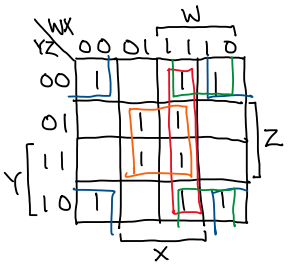
c)

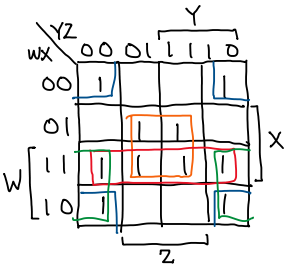


$\Sigma m(0,2,6,7,8,10,13,15)$

Friday, February 28, 2020 10:41 PM

a)

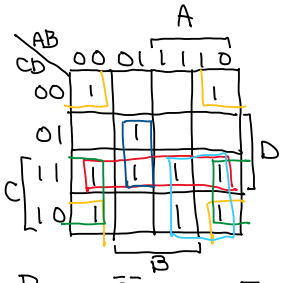


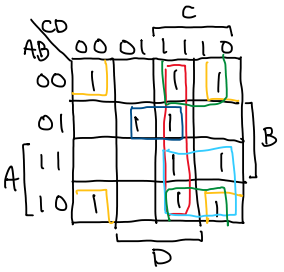


Prime: $\bar{x}\bar{z}$, xz, $w\bar{z}$, wx

Essential: $\bar{x}\bar{z}$, xz

b)

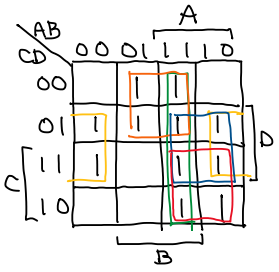


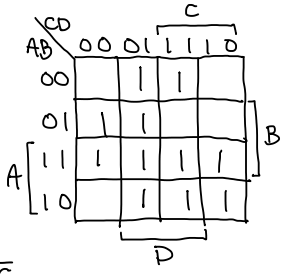


Prime: $\bar{B}\bar{D}$, CD, AC, $\bar{B}C$, $\bar{A}BD$

Essential: $\bar{B}\bar{D}$, AC, $\bar{A}BD$

c)

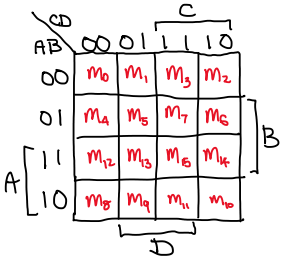




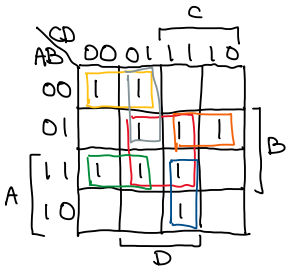
Prime: AB, $\bar{C}D$, $\bar{B}\bar{D}$, AD, AC, $B\bar{C}$

Essential: $\bar{B}\bar{D}$, $B\bar{C}$, AC

Friday, February 28, 2020 10:41 PM



a)



Prime:

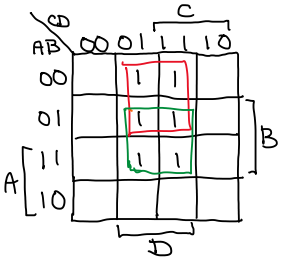
$\bar{A}\bar{B}\bar{C}$, BD, $AB\bar{C}$, $\bar{A}BC$, ACD, $\bar{A}\bar{C}D$

Essential:

$\bar{A}\bar{B}\bar{C}$, BD, $AB\bar{C}$, $\bar{A}BC$, ACD

$F = \bar{A}\bar{B}\bar{C} + BD + AB\bar{C} + \bar{A}BC + ACD$

b)



Prime:

$\bar{A}D$, BD

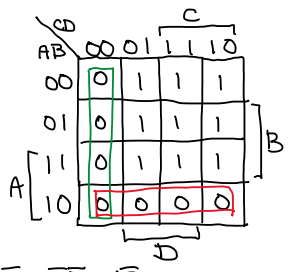
Essential:

$\bar{A}D$, BD

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

Friday, February 28, 2020 10:41 PM

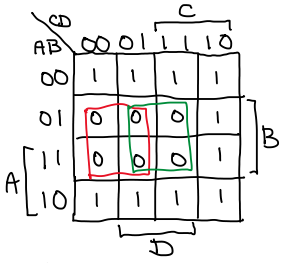
a)



$\overline{F} = \overline{C}\overline{D} + A\overline{B}$

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

b)

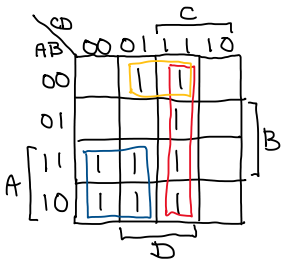


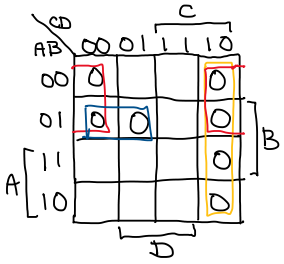
$\overline{F} = B\overline{C} + BD$

$F = (\overline{B}+C)(\overline{B}+\overline{D})$

Friday, February 28, 2020 10:41 PM

a)



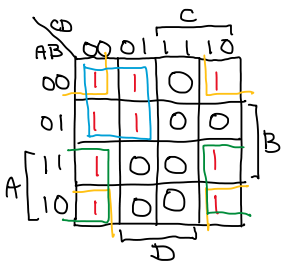


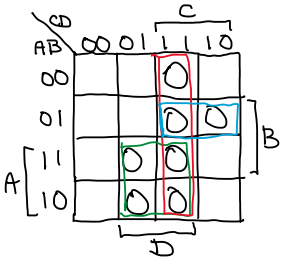
$\overline{\bar{A}B\bar{C}+\bar{A}\bar{D}+C\bar{D}}$

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

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

b) Fill in the 0s first from the POS expression, then fill the 1's on the K-map. Group the 1's to get SOP expression

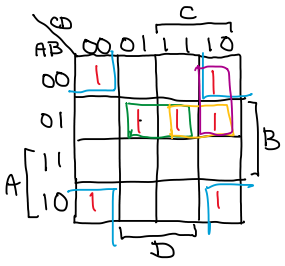


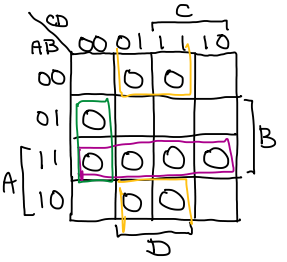


SOP: $A\bar{D}+\bar{B}\bar{D}+\bar{A}\bar{C}$

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

c)





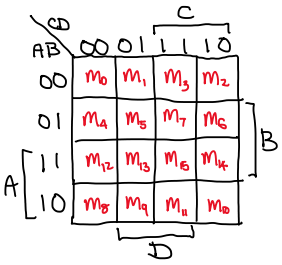
SOP: $\bar{B}\bar{D}+\bar{A}BD+\bar{A}BC$

or

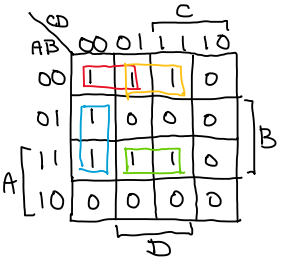
$\bar{B}\bar{D}+\bar{A}BD+\bar{A}C\bar{D}$

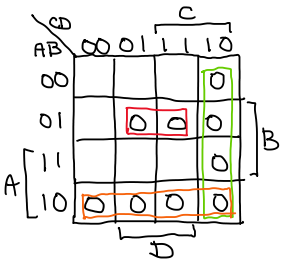
POS: $(\bar{A}+\bar{B})(B+\bar{D})(\bar{B}+C+D)$

Friday, February 28, 2020 10:42 PM



a)

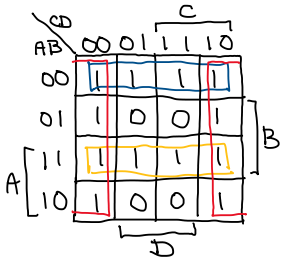


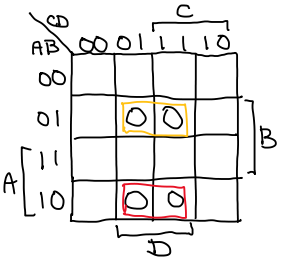


SOP: $\bar{A}\bar{B}\bar{C} + A\bar{B}D + B\bar{C}\bar{D} + AB\bar{D}$

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

b)

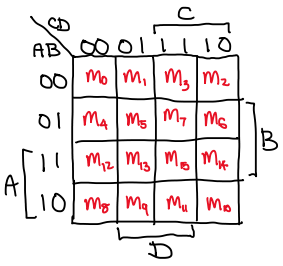




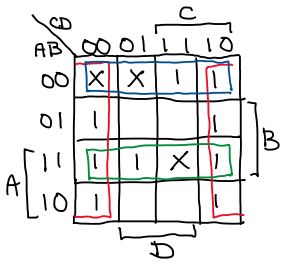
SOP: $\bar{D} + \bar{A}\bar{B} + AB$

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

Friday, February 28, 2020 10:42 PM

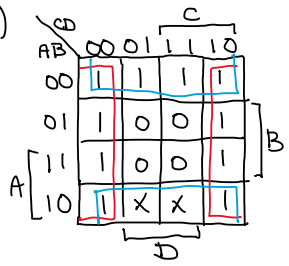


a)



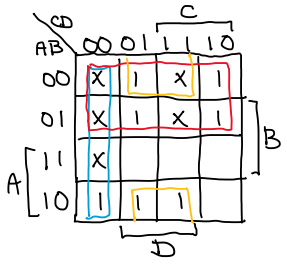
$F = \bar{D} + \bar{A}B + AB$

b)



$F = \bar{D} + \bar{B}$

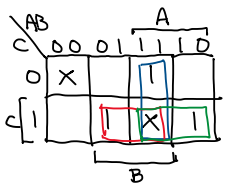
c)



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

Friday, February 28, 2020 10:42 PM

a)

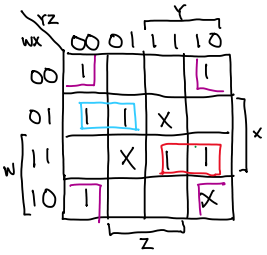


$F = AB + BC + AC$

Essential

AB, BC, AC

b)

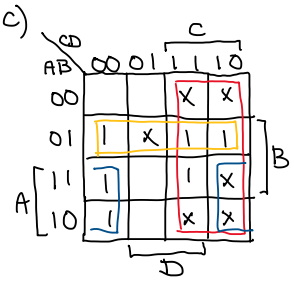


$F = \bar{X}\bar{Z} + \bar{W}X\bar{Y} + WXY$

Essential : $\bar{X}\bar{Z}$

Prime : $\bar{W}X\bar{Y}$, WXY, $\bar{X}\bar{Z}$

c)



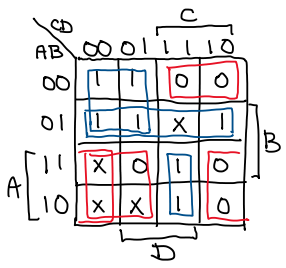
$F = C + A\bar{D} + \bar{A}B$

Essential : C, $A\bar{D}$

Prime : $\bar{A}B$, C, $A\bar{D}$

Friday, February 28, 2020 10:42 PM

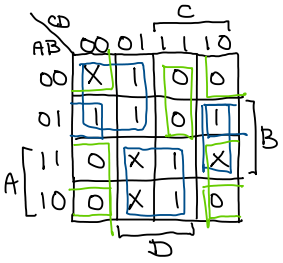
a)



SOP: $\bar{A}\bar{C} + \bar{A}B + ACD$

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

b)



SOP: $\bar{A}\bar{C} + AD + \bar{A}B\bar{D}$

or

$\bar{A}\bar{C} + AD + BC\bar{D}$

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

Friday, February 28, 2020 10:42 PM

a) $F = A\bar{B}C + \bar{A}BC + A\bar{B}D + \bar{A}BD$ → literals = 12, terms = 4, complement = 2, GIC = 18

Define

$X_1 = A\bar{B}$ GIC = 3

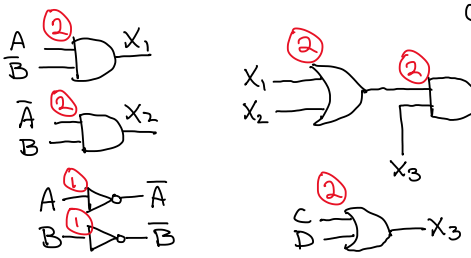
$X_2 = \bar{A}B$ GIC = 3

$\Rightarrow F = X_1C + X_2C + X_1D + X_2D$

$= (X_1 + X_2)(C + D)$

Define $X_3 = C + D$ GIC = 2

$\Rightarrow F = (X_1 + X_2)X_3$ → literals = 3, terms = 1, complement = 0 } Total GIC = 3+3+2 = 3+1 = 12



b) $F = WY + XY + \bar{W}XZ + W\bar{X}Z$ → literals = 10, terms = 4, complements = 2, GIC = 16

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

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

Define

$T = W + X$ GIC = 2

$S = \bar{W} + \bar{X}$ GIC = 4

$F = YT + ZST$ → literals = 5, terms = 2, complement = 0 } Total GIC = 5+2+2+4 = 13