

LAB 3

Question 1.

$$F(X, Y, Z) = \sum m(0, 2, 5, 7)$$

Y
Z
X

	00	01	11	10
0	1 ₀	0 ₁	0 ₃	1 ₂
1	0 ₄	1 ₅	1 ₇	0 ₆

SOP

Ident. $X=1$

comp. $X'=0$

$F(X, Y, Z) = X'Z' + XZ$

$$G(A, B, C, D) = \sum m(1, 3, 4, 6, 9, 11, 12, 14)$$

AB
CD

	00	01	11	10
00	0 ₀	1 ₁	1 ₃	0 ₂
01	1 ₄	0 ₅	0 ₇	1 ₆
11	1 ₁₂	0 ₁₃	0 ₁₅	1 ₁₄
10	0 ₈	1 ₉	1 ₁₁	0 ₁₀

SOP

Ident. $X=1$

comp. $X'=0$

$$G_1 = B' \cdot C'D \cdot CD = B'D$$

$$G_2 = B \cdot C'D' \cdot CD' = BD'$$

$$\underline{G(A, B, C, D) = B'D + BD'}$$

Question 2

$$H(X, Y, Z) = \prod M(0, 2, 6)$$

	00	01	11	10
0	0	1	1	0
1	1	1	1	0

POS

Ident. $X=0$

Compl. $X'=1$

$$G_1 = Y' + Z$$

$$G_2 = X + Z$$

$$\underline{H(X, Y, Z) = (Y' + Z)(X + Z)}$$

$$L(A, B, C, D) = \sum m(4, 6, 7, 15)$$

AB \ CD

	00	01	11	10	
00	0 ₀	0 ₁	0 ₃	0 ₂	G ₁
01	1 ₄	0 ₅	1 ₇	1 ₆	
11	0 ₁₂	0 ₁₃	1 ₁₅	0 ₁₄	G ₂
10	0 ₈	0 ₉	0 ₁₁	0 ₁₀	G ₃

$$G_1 = B$$

$$G_2 = A' + D$$

$$G_3 = C + D'$$

$$\underline{L(A,B,C,D) = B (A' + D)(C + D')}$$

Question 3

$$F(W,X,Y,Z) = \sum m(0,1,2,3,7,8,10)$$

$$\bar{d}_C(W,X,Y,Z) = \sum m(5,6,11,15)$$

1) for SOP form

POS

Ident. $x=0$

Compl. $x'=1$

W X Y Z

	00	01	11	10
00	1 ₀	1 ₁	1 ₃	1 ₂
01	-	1 ₅	1 ₇	-
11	1 ₂	1 ₃	1 ₅	1 ₄
10	1 ₈	1 ₉	-	1 ₁₀

SOP

Ident $x=1$

Comp $x'=0$

$$G_1 = X'Z' \quad G_2 = W'Z$$

$$\underline{F(W, X, Y, Z) = X'Z' + W'Z}$$

2) for POS

W X Y Z

	00	01	11	10
00	1 ₀	1 ₁	1 ₃	1 ₂
01	0 ₄	-	1 ₇	-
11	0 ₂	0 ₃	-	0 ₅
10	1 ₈	0 ₉	-	1 ₁₀

$\Downarrow G_2$

for POS

Ident. $x=0$

Compl. $x'=1$

$$G_1 = X' + Z \quad G_2 = W' + Z'$$

$$\underline{F(W, X, Y, Z) = (X' + Z)(W' + Z')}$$

Question 4

$$F(W, X, Y, Z) = \sum m(0, 1, 2, 4, 7, 8, 10, 12)$$

A Karnaugh map for four variables (W, X, Y, Z) with minterms 0, 1, 2, 4, 7, 8, 10, 12. The map is a 4x4 grid. The columns are labeled W (top) and X (bottom). The rows are labeled Y (left) and Z (right). The minterms are represented by 1s in the grid. Dashed green boxes group the minterms into four groups:

- G1:** Minterms 0, 1, 2, 10. Grouped in a 2x2 square at the top-right.
- G2:** Minterms 0, 1, 4, 5. Grouped in a 2x2 square at the top-left.
- G3:** Minterms 4, 7, 8, 12. Grouped in a 2x2 square at the middle-left.
- G4:** Minterms 7, 8, 10, 12. Grouped in a 2x2 square at the middle-right.

for SOP

Ident. $X=1$

Compl. $X'=0$

Group 1: $X'Z'$

Group 2: $Y'Z'$

Group 3: $W'X'Y'$

Group 4: $W'XYZ$

$$\underline{F(W, X, Y, Z) = X'Z' + Y'Z' + W'X'Y' + W'XYZ}$$

Question 5

$$WX Y' + WX Z' + W X Z + Y Z'$$

$$W X Z' + W X Z = W X (Z + Z') = W X$$

$$W X Y' + W X + Y Z' \quad (\text{Absorpt.})$$

$$W X + Y Z'$$

W	X	Y	Z	Z'	$W X$	$Y Z'$	$W X + Y Z'$
0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	1	0	1	1
0	0	1	1	0	0	0	0
0	1	0	0	1	0	0	0
0	1	0	1	0	0	0	0
0	1	1	0	1	0	1	1
0	1	1	1	0	0	0	0
1	0	0	0	1	0	0	0
1	0	0	1	0	0	0	0
1	0	1	0	1	0	1	1
1	0	1	1	0	0	0	0
1	1	0	0	1	1	0	1
1	1	0	1	0	1	0	1
1	1	1	0	1	1	1	1
1	1	1	1	0	1	0	1

Sum of Minterms

$$\sum m(2, 6, 10, 12, 13, 14, 15)$$

Product of Maxterms

$$\prod m(0, 1, 3, 4, 5, 7, 8, 9, 11)$$