

CE2120

Lab 6

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Question 1

a.

$$F(x,y,z) = EPI_1 + EPI_2 + EPI_3$$

$$F(x,y,z) = Y'Z' + X'Y' + X.Y.Z$$

A Karnaugh map for the function F(x,y,z) with variables x, y, and z. The map is a 2x4 grid. The top row is labeled with yz values 00, 01, 11, 10. The bottom row is labeled with yz values 00, 01, 11, 10. The left column is labeled with x values 0, 1. The right column is labeled with x values 0, 1. The map contains the following values: (0,00)=1, (0,01)=1, (0,11)=0, (0,10)=0, (1,00)=1, (1,01)=0, (1,11)=1, (1,10)=0. Three prime implicants are highlighted with red boxes: EPI1 is a 2x2 square covering (0,00), (0,01), (1,00), and (1,01); EPI2 is a 2x2 square covering (0,00), (0,01), (0,11), and (0,10); EPI3 is a 2x2 square covering (1,00), (1,01), (1,11), and (1,10). Arrows point from the labels EPI1, EPI2, and EPI3 to their respective boxes.

x \ yz	00	01	11	10
0	1	1	0	0
1	1	0	1	0

b.

$$G(x,y,z,w) = EPI + EPI + EPI$$

$$G(x,y,z,w) = x'y' + xyw + yz'w$$

A Karnaugh map for the function G(x,y,z,w) with variables x, y, z, and w. The map is a 4x4 grid. The top row is labeled with xy values 00, 01, 11, 10. The bottom row is labeled with xy values 00, 01, 11, 10. The left column is labeled with zw values 00, 01, 11, 10. The right column is labeled with zw values 00, 01, 11, 10. The map contains the following values: (00,00)=1, (00,01)=1, (00,11)=1, (00,10)=1, (01,00)=1, (01,01)=1, (01,11)=1, (01,10)=1, (11,00)=1, (11,01)=1, (11,11)=1, (11,10)=1, (10,00)=1, (10,01)=1, (10,11)=1, (10,10)=1. Three prime implicants are highlighted with red boxes: EPI1 is a 2x2 square covering (00,00), (00,01), (01,00), and (01,01); EPI2 is a 2x2 square covering (00,00), (00,01), (00,11), and (00,10); EPI3 is a 2x2 square covering (01,00), (01,01), (01,11), and (01,10). Arrows point from the labels EPI1, EPI2, and EPI3 to their respective boxes.

zw \ xy	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

Question 2

a.

X	Y	Z	A	B	C
0	0	0	0	1	0
0	0	1	0	1	1
0	1	0	1	0	0
0	1	1	0	1	0
1	0	0	0	1	1
1	0	1	1	0	0
1	1	0	1	0	1
1	1	1	1	1	0

b.

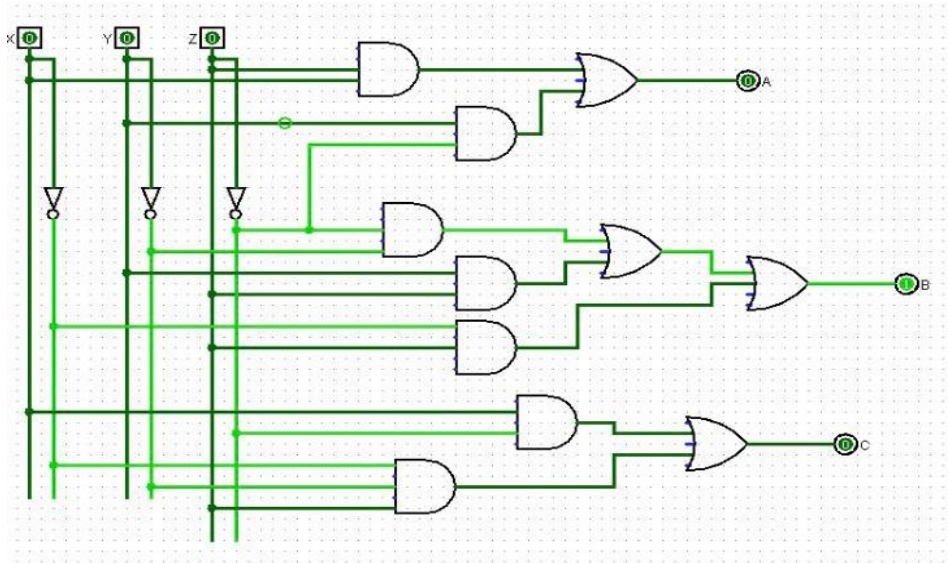
$A = \sum_m (2, 5, 6, 7)$
 $A(x, y, z) = \bar{E}D\bar{I} + E\bar{D}I_2$
 $A = xz + y\bar{z}$
 $A(x, y, z) = xz + y\bar{z}$

$B = \sum_m (0, 1, 3, 4, 7)$
 $B = E\bar{D}\bar{I} + E\bar{D}I_2 + E\bar{D}I_3$
 $B = y\bar{z} + \bar{x}z + yz$
 or
 $B = y\bar{z} + yz + \bar{x}y$

$C = \sum_m (1, 4, 6)$
 $C = \bar{E}D\bar{I} + E\bar{D}I_2$
 $C = \bar{x}y\bar{z} + x\bar{z}$

The image shows three Karnaugh maps for functions A, B, and C. Each map is a 2x4 grid with columns labeled by yz (00, 01, 11, 10) and rows labeled by x (0, 1).
 - Map A: 1s are at (0,01), (0,11), (1,00), and (1,10). Prime implicants are EDI1 (covering (0,01), (0,11), (1,00), (1,10)) and EDI2 (covering (0,01), (1,00)).
 - Map B: 1s are at (0,00), (0,01), (0,11), (1,00), and (1,10). Prime implicants are EDI1 (covering (0,00), (0,01), (1,00), (1,10)), EDI2 (covering (0,01), (1,00)), and EDI3 (covering (0,11), (1,10)).
 - Map C: 1s are at (0,01), (1,00), and (1,10). Prime implicants are EDI1 (covering (0,01), (1,00), (1,10)) and EDI2 (covering (0,01), (1,00)).

c.

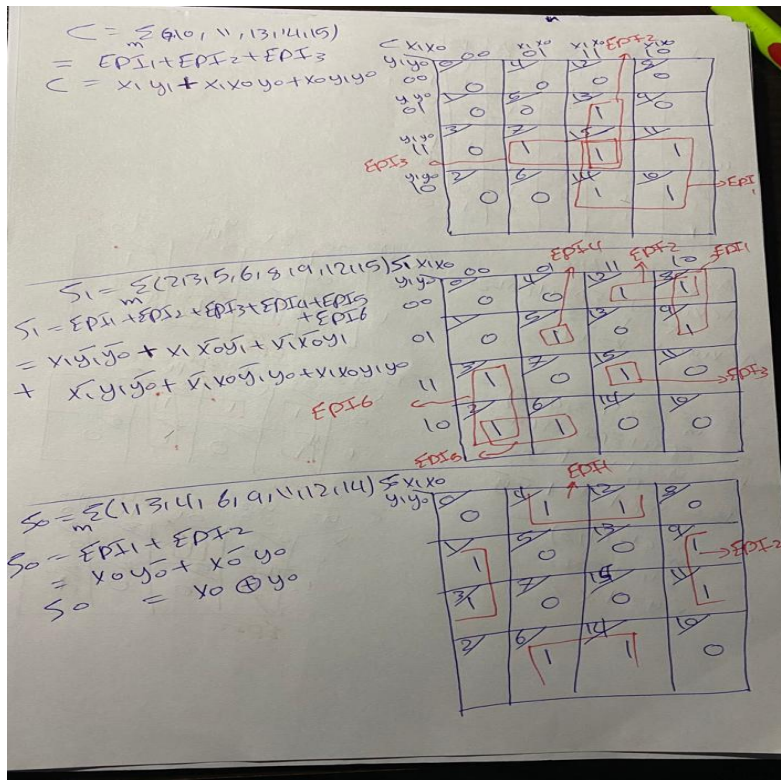


Question 3

a.

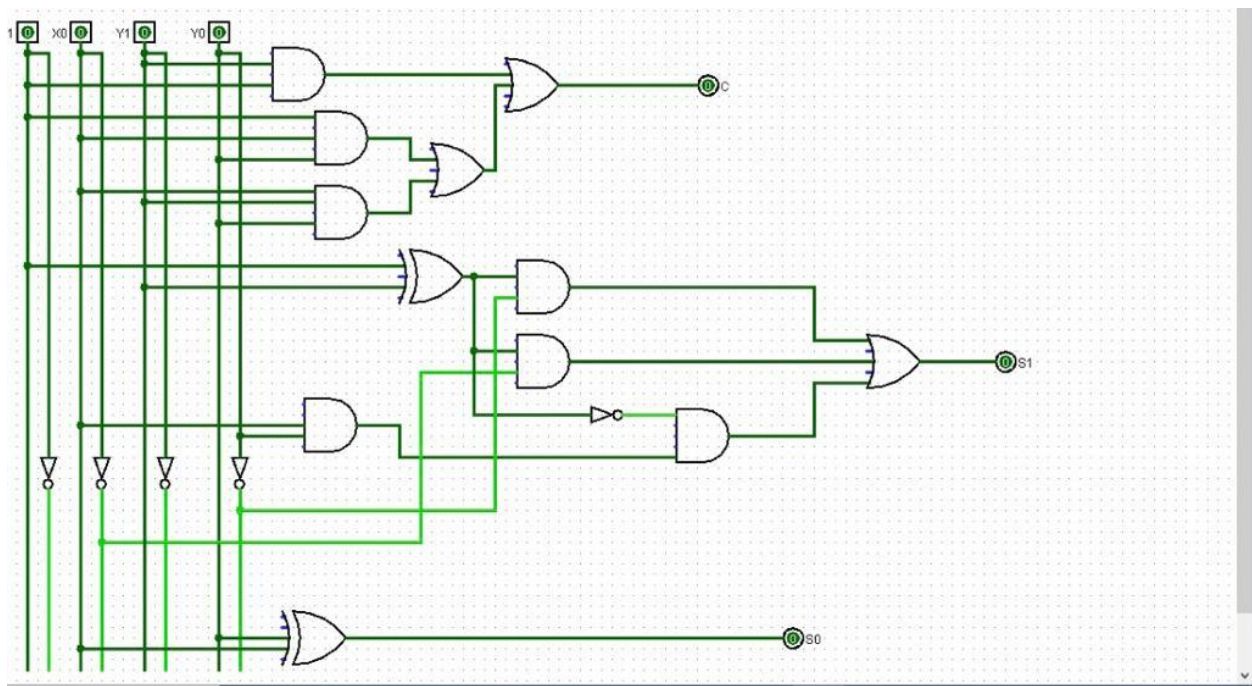
X1	X0	Y1	Y0	C	S1	S0
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	1	0
0	0	1	1	0	1	1
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	0	1	1
0	1	1	1	1	0	0
1	0	0	0	0	1	0
1	0	0	1	0	1	1
1	0	1	0	1	0	0
1	0	1	1	1	0	1
1	1	0	0	0	1	1
1	1	0	1	1	0	0
1	1	1	0	1	0	1
1	1	1	1	1	1	0

b.



$$\begin{aligned}
 S1 = & \\
 & x_1' y_1' y_0' + x_1' y_1 y_0' + x_1 x_0' y_1' + x_1' x_0' y_1 + \\
 & x_1' x_0 y_1' y_0 + x_1 x_0 y_1 y_0 = \\
 & y_0' (x_1 y_1' + x_1' y_1) + x_0' (x_1 y_1' + x_1' y_1) + \\
 & x_0 y_0 (x_1' y_1' + x_1 y_1) \\
 & y_0' \cdot (x_1 \oplus y_1) + x_0' (x_1 \oplus y_1) + x_0 y_0 (x_1 \oplus y_1)'
 \end{aligned}$$

c.



Question 4

a.

A	B	C	D	W	X	Y	Z
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	0
1	0	1	1	0	1	0	1
1	1	0	0	0	1	1	0
1	1	0	1	0	1	1	1
1	1	1	0	1	0	0	0
1	1	1	1	1	0	0	1
0	1	0	1	X	X	X	X
0	1	1	0	X	X	X	X
0	1	1	1	X	X	X	X
1	0	0	0	X	X	X	X
1	0	0	1	X	X	X	X
1	0	1	0	X	X	X	X

B.

W	AB	00	01	11	10
CD	00	0	0	0	X
01	0	X	0	X	
11	0	X	1	0	
10	0	X	1	X	

$\Sigma(10, 11, 12, 13, 14, 15)$

X

	AB	00	01	11	10
CD	00	0	1	1	X
01	0	X	1	X	
11	0	X	0	1	
10	0	X	0	X	

Y

	AB	00	01	11	10
CD	00	0	0	1	X
01	0	X	1	X	
11	1	X	0	0	
10	1	X	0	X	

Z

	AB	00	01	11	10
CD	00	0	0	0	X
01	1	X	X	1	X
11	1	X	X	1	1
10	0	X	0		X

$$W = BC$$

$$X = AB' + BC'$$

$$Y = AC' + A'C = A \text{ XOR } C$$

$$Z = D$$

