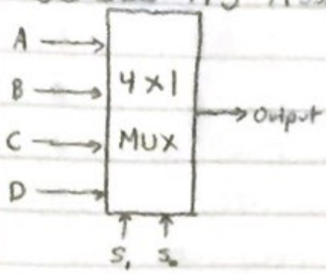
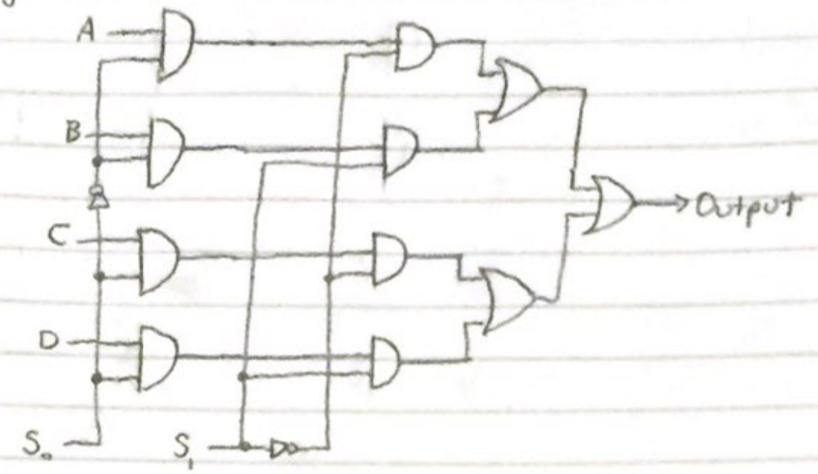
Derek Chan

CSCI 113 Assignment 1

8/30/21

#1.





#2. $F1 = (\bar{x}_0 \cdot x_1 \cdot x_2) + (x_0 \cdot \bar{x}_1 \cdot x_2) + (x_0 \cdot x_1 \cdot \bar{x}_2)$

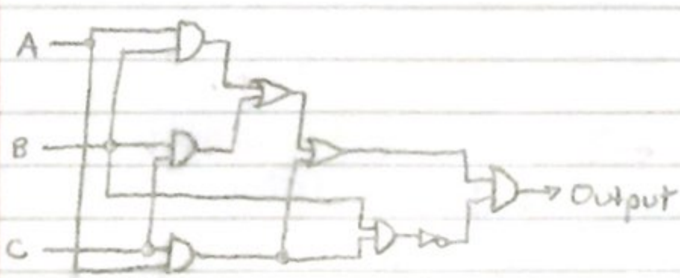
$F2 = (\bar{x}_0 \cdot \bar{x}_1 \cdot x_2) + (\bar{x}_0 \cdot x_1 \cdot \bar{x}_2) + (x_0 \cdot \bar{x}_1 \cdot \bar{x}_2) + (x_0 \cdot x_1 \cdot x_2)$

$F3 = (\bar{x}_0 \cdot \bar{x}_1 \cdot \bar{x}_2) + (\bar{x}_0 \cdot \bar{x}_1 \cdot x_2) + (\bar{x}_0 \cdot x_1 \cdot \bar{x}_2) + (\bar{x}_0 \cdot x_1 \cdot x_2)$

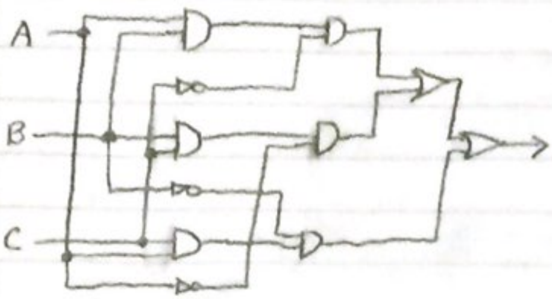
$F4 = (x_0 \cdot \bar{x}_1 \cdot \bar{x}_2) + (x_0 \cdot \bar{x}_1 \cdot x_2) + (x_0 \cdot x_1 \cdot \bar{x}_2) + (x_0 \cdot x_1 \cdot x_2)$

$F2 = x_0 \oplus x_1 \oplus x_2$

#3. $E = ((A \cdot B) + (A \cdot C) + (B \cdot C)) \cdot (\overline{A \cdot B \cdot C})$



$E = (A \cdot B \cdot \overline{C}) + (A \cdot \overline{B} \cdot C) + (\overline{A} \cdot B \cdot C)$



The first logic equation for E is more efficient in terms of the number of 2-input gates. The first logic equation can be made using only seven 2-input gates while the second logic equation needs eight.

#4 $E = ((A \cdot B) + (A \cdot C) + (B \cdot C)) \cdot \overline{(A \cdot B \cdot C)} \rightarrow (A \cdot B \cdot \overline{C}) + (A \cdot \overline{B} \cdot C) + (\overline{A} \cdot B \cdot C)$

$\equiv ((A \cdot B) + (A \cdot C) + (B \cdot C)) \cdot (\overline{A} + \overline{B} + \overline{C})$ DeMorgan's Laws

$\equiv (((A \cdot B) \cdot (\overline{A} + \overline{B} + \overline{C})) + ((A \cdot C) \cdot (\overline{A} + \overline{B} + \overline{C})) + ((B \cdot C) \cdot (\overline{A} + \overline{B} + \overline{C})))$ Distribution Laws

$\equiv (((A \cdot B \cdot \overline{A}) + (A \cdot B \cdot \overline{B}) + (A \cdot B \cdot \overline{C})) + ((A \cdot C \cdot \overline{A}) + (A \cdot C \cdot \overline{B}) + (A \cdot C \cdot \overline{C}))$
$+ ((B \cdot C \cdot \overline{A}) + (B \cdot C \cdot \overline{B}) + (B \cdot C \cdot \overline{C})))$ Distribution Laws

$\equiv ((0 + 0 + (A \cdot B \cdot \overline{C})) + ((0 + (A \cdot C \cdot \overline{B}) + 0) + ((B \cdot C \cdot \overline{A}) + 0 + 0))$ Negation Laws

$\equiv (A \cdot B \cdot \overline{C}) + (A \cdot C \cdot \overline{B}) + (B \cdot C \cdot \overline{A})$ Identity Law

$\equiv (A \cdot B \cdot \overline{C}) + (A \cdot \overline{B} \cdot C) + (\overline{A} \cdot B \cdot C)$ Commutative Laws

#5 $XOR = (A \cdot \overline{B}) + (\overline{A} \cdot B) \rightarrow (A + B) \cdot \overline{(A \cdot B)}$

$\equiv ((A \cdot \overline{B}) + \overline{A}) \cdot ((A \cdot \overline{B}) + B)$ Distribution Laws

$\equiv ((A + \overline{A}) \cdot (\overline{B} + \overline{A})) \cdot ((A + B) \cdot (\overline{B} + B))$ Distribution Laws

$\equiv (1 \cdot (\overline{B} + \overline{A})) \cdot ((A + B) \cdot 1)$ Negation Laws

$\equiv (\overline{B} + \overline{A}) \cdot (A + B)$ Identity Laws

$\equiv (A + B) \cdot (\overline{B} + \overline{A})$ Commutative Laws

$\equiv (A + B) \cdot (\overline{A} + \overline{B})$ Commutative Laws

$\equiv (A + B) \cdot \overline{(A \cdot B)}$ DeMorgan's Laws

#6 XOR $= x \oplus y \oplus z$

X	y	z	Output
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

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