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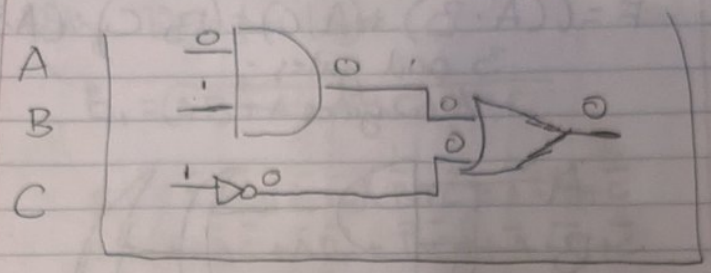
1.



2.

x_2	x_1	x_0	F_1	F_2	F_3	F_4
0	0	0	0	0	1	0
0	0	1	0	1	1	0
0	1	0	0	1	1	0
0	1	1	1	0	1	0
1	0	0	0	1	0	1
1	0	1	1	0	0	1
1	1	0	1	0	0	1
1	1	1	0	1	0	1

$$F_1 = (\bar{x}_2 \cdot x_1 \cdot x_0) + (x_2 \cdot \bar{x}_1 \cdot x_0) + (x_2 \cdot x_1 \cdot \bar{x}_0)$$

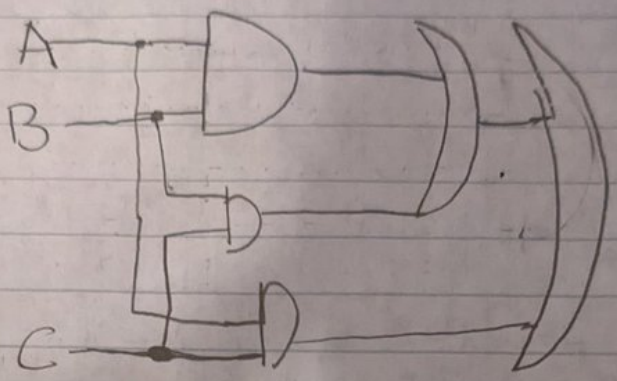
$$F_2 = (\bar{x}_2 \cdot \bar{x}_1 \cdot x_0) + (\bar{x}_2 \cdot x_1 \cdot \bar{x}_0) + (x_1 \cdot \bar{x}_2 \cdot \bar{x}_0) + (\bar{x}_2 \cdot x_1 \cdot \bar{x}$$

$$F_3 = (\bar{x}_2 \cdot \bar{x}_1 \cdot \bar{x}_0) + (\bar{x}_2 \cdot \bar{x}_1 \cdot x_0) + (\bar{x}_2 \cdot x_1 \cdot \bar{x}_0) + (\bar{x}_2 \cdot x_1 \cdot x_0)$$

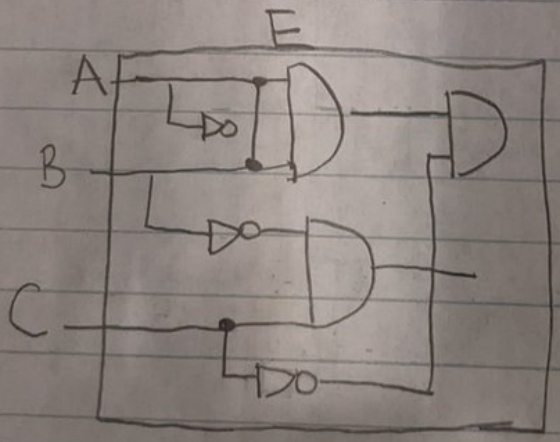
$$F_4 = (x_2 \cdot \bar{x}_1 \cdot \bar{x}_0) + (x_2 \cdot \bar{x}_1 \cdot x_0) + (x_2 \cdot x_1 \cdot \bar{x}_0) + (x_2 \cdot x_1 \cdot x_0)$$

3. $F = ((A \cdot B) + (A \cdot C) + (B \cdot C) \cdot (A \cdot B \cdot C)$

3 and gates ·
2 or gates +



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



Reasoning: When it comes to which gate is much more efficent it would be the first equation. The reason for it is because the first equation only has 5 gates while the second gate has 6

4 Using Demorgans Law:

$$E_1 = \overline{(AB + AC + BC) \cdot ABC}$$

$$E_1 = (\bar{A}+\bar{B})(\bar{A}+\bar{C})(\bar{B}+\bar{C}) + \bar{A}+\bar{B}+\bar{C}$$
$$= (\bar{A} + \bar{A}\bar{C} + \bar{A}\bar{B} + \bar{B}\bar{C}) + \bar{A}+\bar{B}+\bar{C}$$
$$= \bar{A}[1 + \bar{C} + \bar{B}] + \bar{B}\bar{C})(\bar{B}+\bar{C}) + \bar{A}+\bar{B}+\bar{C}$$
$$= (\bar{A} + \bar{B}\bar{C})(\bar{B}+\bar{C}) + \bar{A}+\bar{B}+\bar{C}$$
$$= \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{C} + \bar{B}\bar{C} + \bar{A} + \bar{B} + \bar{C}$$
$$= A[1 + \bar{B} + \bar{C} + \bar{B}[\bar{C} + 1 + \bar{C}] + \bar{C}$$
$$= \bar{A} + \bar{B} + \bar{C}$$
$$E_1 = ABC$$

$$E_2 = \overline{A\bar{B}C + A\bar{B}C + ABC}$$

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

$$\overline{X \cdot X \cdot X} = \bar{X}$$

$$\bar{A} + \bar{B} + \bar{C} = \boxed{ABC = E_2}$$

5.) $X_{or_1} = (A \cdot \bar{B}) + (\bar{A} \cdot B)$

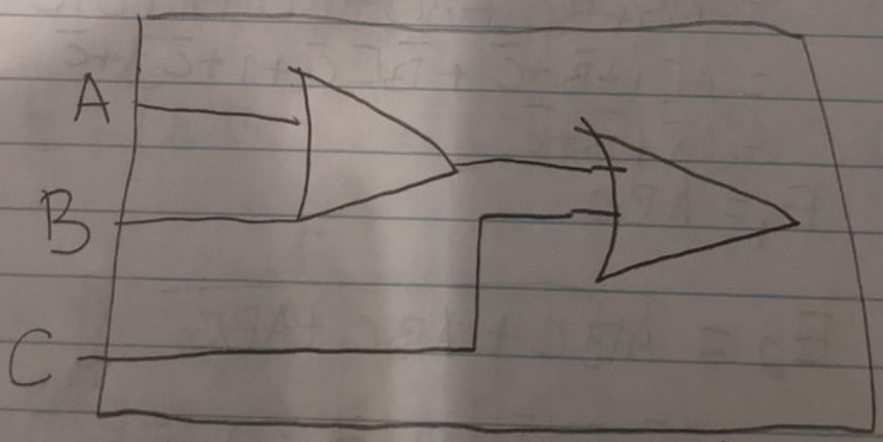
$$(A + \bar{B}) \cdot (\bar{A} + B)$$

$X_{or_2} = (\bar{A} + \bar{B})AB = A \cdot \bar{A} + A\bar{B} + B \cdot \bar{B} + \bar{A}B$

$A \cdot \bar{A} = 0,\ B \cdot \bar{B} = 0 = A\bar{B} + \bar{A}B$

6.)

A	B	C	Xor
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



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