

Homework 1

The pdf you submit must look exactly like this with the answers and all supporting works shown on the the page with the question.

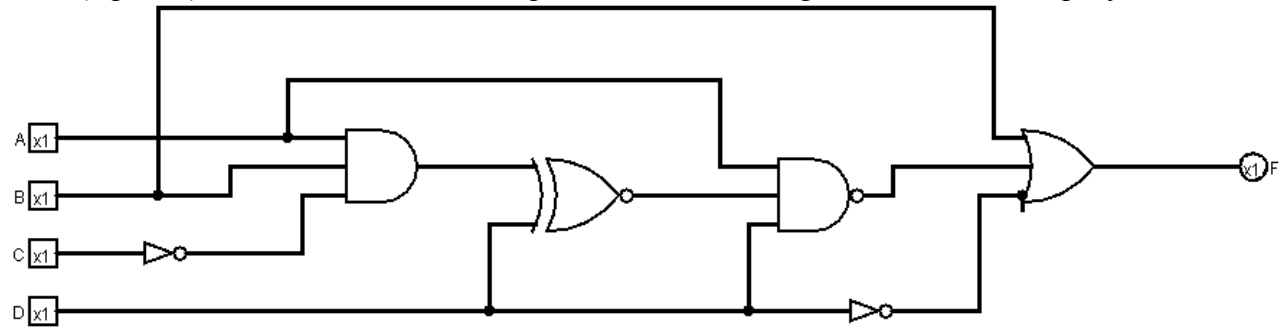
| Last Name | First Name | Student ID |
|-------------------|--------------------|--------------------|
| | | |
| Partner Last Name | Partner First Name | Partner Student ID |
| | | |

1. (5 points) Use Boolean Algebra to prove that

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

2. (3 points) Prove that $A \text{ XOR } B = A * \bar{B} + \bar{A} * B$

3. (3 points) Write the function that represents the following circuit. Do not simplify.



4. Given the following truth table

| A | B | C | Output |
|---|---|---|--------|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

1. (3 points) Write a function in SOP form that behaves according to the truth table. Do not simplify.
2. (3 points) Write a function in POS form that behaves according to the truth table. Do not simplify.

5. (3 points each) For each of the following problems assume that the variables are $x_0 - x_{N-1}$, with x_0 representing the least significant bit and x_{N-1} the most significant. For example if we had an equation of 3 variables, $m_1 = \bar{x}_2 * \bar{x}_1 * x_0$ and $m_6 = x_2 * x_1 * \bar{x}_0$. For each of the following problems write each function in **both** its most simplified SOP and POS form. There are a total of **5** subquestions

1. $m_0 + m_1 + m_2$

$$2. \quad M_0 * M_3 * M_4 * M_7$$

$$3. \quad m_4 + m_5 + m_7 + m_{12} + m_{13} + m_{15}$$

$$4. \quad m_0 + m_3 + m_4 + m_8 + D_2 + D_5 + D_7 + D_{10} + D_{13} + D_{15}$$

$$\begin{aligned}
5. \quad & m_1 + m_3 + m_7 + m_9 + m_{11} + m_{15} + m_{17} + m_{19} + m_{25} + m_{27} + D_4 + D_6 + D_{12} \\
& + D_{14} + D_{16} + D_{18} + D_{20} + D_{22} + D_{24} + D_{26} + D_{28} + D_{30}
\end{aligned}$$