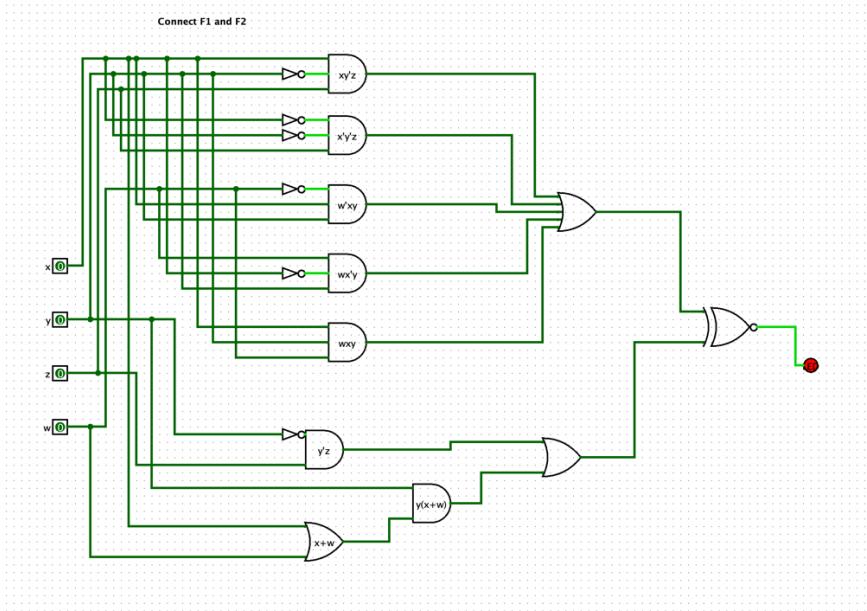


LAB #3 - SYSC 2310 L2E  
Riya Arora (101190033)  
November 5<sup>th</sup>, 2021

### Screenshot 1: Connect F1 and F2



### Screenshot 2: Connect F1 and F2 LOGGING

LED      w      x      y      z

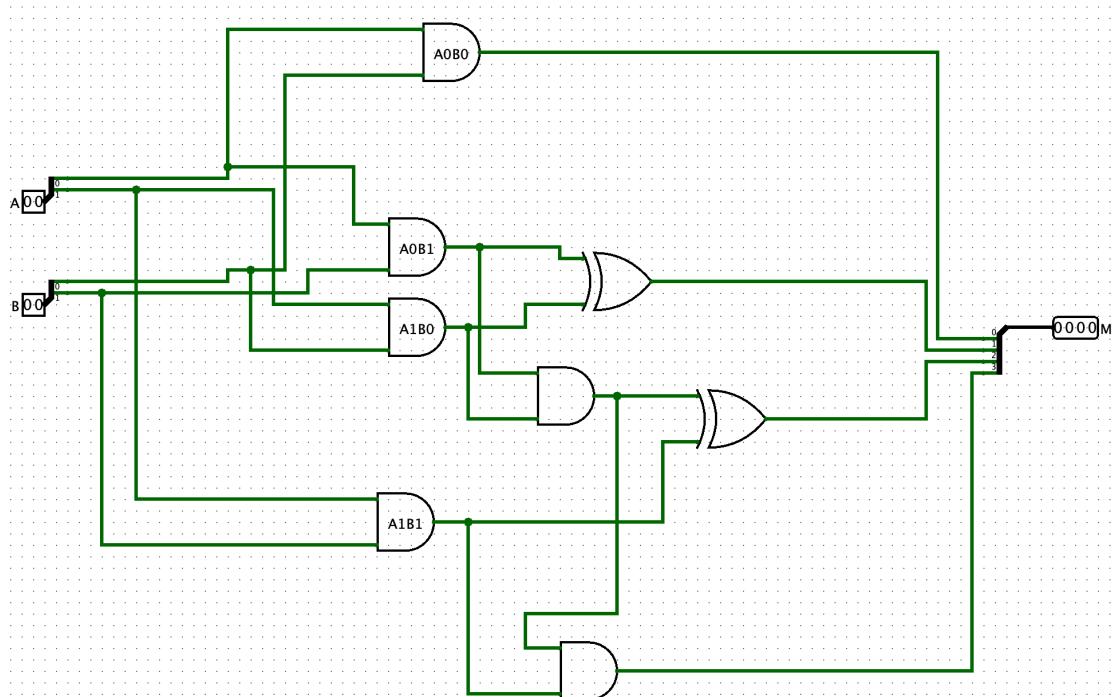
| LED | w | x | y | z |
|-----|---|---|---|---|
| 1   | 0 | 1 | 1 | 1 |
| 1   | 0 | 0 | 1 | 1 |
| 1   | 0 | 0 | 0 | 1 |
| 1   | 0 | 0 | 0 | 0 |
| 1   | 1 | 0 | 0 | 0 |
| 1   | 0 | 0 | 0 | 0 |
| 1   | 1 | 0 | 0 | 0 |
| 1   | 1 | 0 | 0 | 1 |
| 1   | 1 | 0 | 1 | 1 |
| 1   | 1 | 1 | 1 | 1 |
| 1   | 1 | 0 | 1 | 1 |
| 1   | 1 | 0 | 1 | 0 |
| 1   | 1 | 0 | 0 | 0 |
| 1   | 0 | 0 | 0 | 0 |
| 1   | 0 | 0 | 0 | 1 |
| 1   | 0 | 0 | 1 | 1 |
| 1   | 0 | 1 | 1 | 1 |
| 1   | 1 | 1 | 1 | 1 |
| 1   | 1 | 1 | 1 | 0 |
| 1   | 1 | 1 | 0 | 0 |
| 1   | 0 | 0 | 0 | 0 |
| 1   | 0 | 0 | 0 | 1 |

### Screenshot 3: MATH for part 1

① 
$$\begin{aligned} F_1 &= xy'z + x'y'z + w'xy + wx'y + wxy + wxyz \\ &= y'z(x+x') + xy(w'+w) + wy(x'+x) \end{aligned}$$

$$\begin{aligned} F_2 &= y'z + xy + wy \\ &= y'z + y(x+w) \end{aligned}$$

### Screenshot 4: Multiplier



Example 2– Multiplier

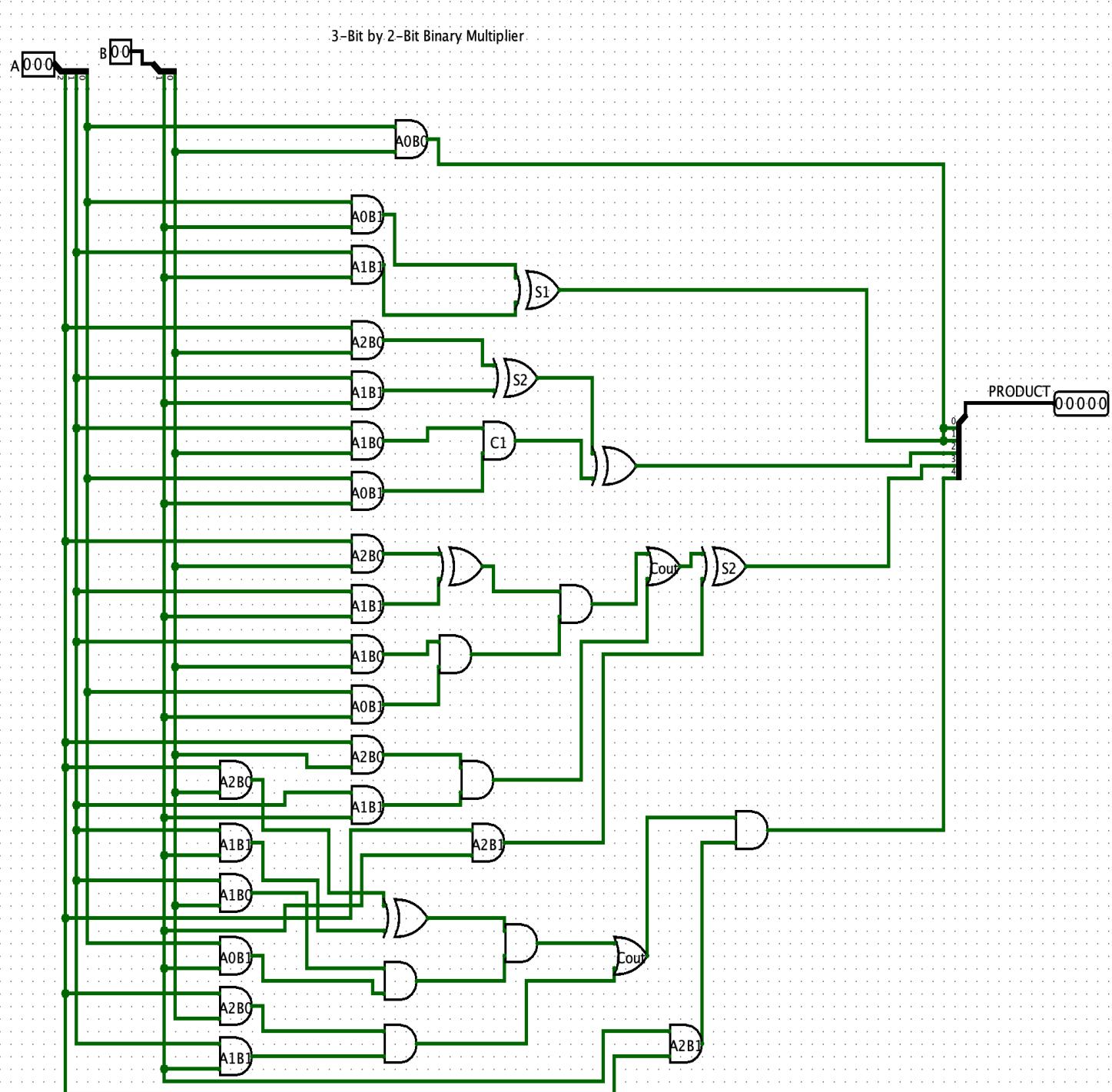
**Screenshot 5: Multiplier LOGGING**

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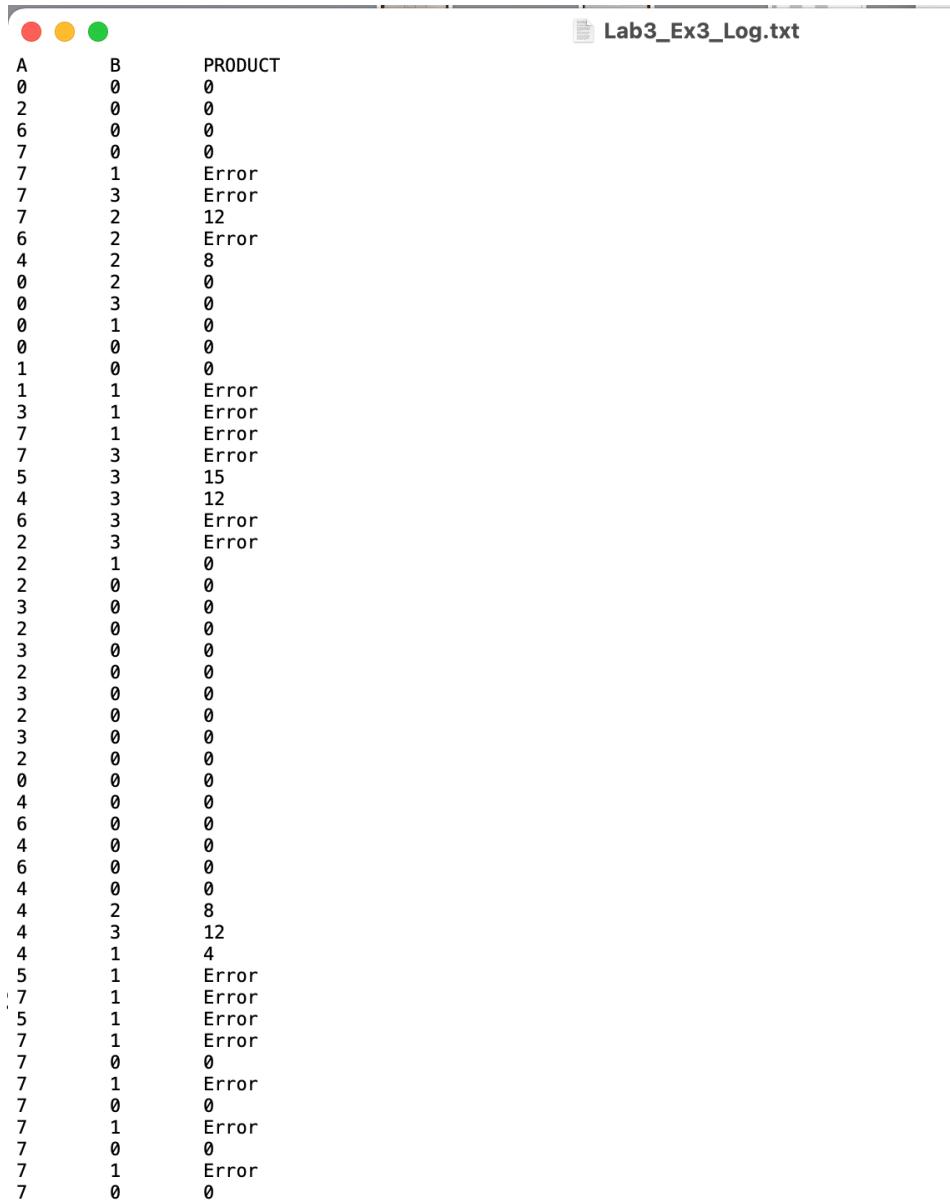
| A | B | M |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 2 | 0 |
| 0 | 3 | 0 |
| 1 | 3 | 3 |
| 3 | 3 | 9 |
| 1 | 3 | 3 |
| 0 | 3 | 0 |
| 0 | 2 | 0 |
| 2 | 2 | 4 |
| 2 | 0 | 0 |
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |
| 0 | 1 | 0 |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 2 | 1 | 2 |
| 0 | 1 | 0 |
| 0 | 0 | 0 |
| 0 | 2 | 0 |
| 1 | 2 | 2 |
| 0 | 2 | 0 |
| 0 | 0 | 0 |

---

Screenshot 6: 3-Bit by 2-Bit Binary Multiplier



### Screenshot 7: 3-Bit by 2-Bit Binary Multiplier LOGGING



| A | B | PRODUCT |
|---|---|---------|
| 0 | 0 | 0       |
| 2 | 0 | 0       |
| 6 | 0 | 0       |
| 7 | 0 | 0       |
| 7 | 1 | Error   |
| 7 | 3 | Error   |
| 7 | 2 | 12      |
| 6 | 2 | Error   |
| 4 | 2 | 8       |
| 0 | 2 | 0       |
| 0 | 3 | 0       |
| 0 | 1 | 0       |
| 0 | 0 | 0       |
| 1 | 0 | 0       |
| 1 | 1 | Error   |
| 3 | 1 | Error   |
| 7 | 1 | Error   |
| 7 | 3 | Error   |
| 5 | 3 | 15      |
| 4 | 3 | 12      |
| 6 | 3 | Error   |
| 2 | 3 | Error   |
| 2 | 1 | 0       |
| 2 | 0 | 0       |
| 3 | 0 | 0       |
| 2 | 0 | 0       |
| 2 | 0 | 0       |
| 3 | 0 | 0       |
| 2 | 0 | 0       |
| 3 | 0 | 0       |
| 2 | 0 | 0       |
| 0 | 0 | 0       |
| 4 | 0 | 0       |
| 6 | 0 | 0       |
| 4 | 0 | 0       |
| 6 | 0 | 0       |
| 4 | 0 | 0       |
| 4 | 2 | 8       |
| 4 | 3 | 12      |
| 4 | 1 | 4       |
| 5 | 1 | Error   |
| 7 | 1 | Error   |
| 5 | 1 | Error   |
| 7 | 1 | Error   |
| 7 | 0 | 0       |
| 7 | 1 | Error   |
| 7 | 0 | 0       |
| 7 | 1 | Error   |
| 7 | 0 | 0       |
| 7 | 1 | Error   |
| 7 | 0 | 0       |

Screenshot 8 – MATH FOR part 3

example 3

(3) 
$$\begin{array}{r}
 A_1 \ A_0 \\
 \times B_1 \ B_0 \\
 \hline
 A_1B_0 \ A_0B_0 \\
 + A_1B_1 \ A_0B_1 \\
 \hline
 M_3 \quad M_2 \quad M_1 \quad M_0
 \end{array}$$
} 2x2 multiplier

~~$M_0 = A_0 \cdot B_0$~~

$M_1 = A_0B_1 \oplus A_1B_0$        $C = (A_1B_0 \cdot B_1A_0)$

$M_2 = (A_2 \cdot B_0) \oplus (A_1B_1) \oplus C$   
 $= (A_2 \cdot B_0) \oplus (A_1B_1) \oplus (A_1B_0 \cdot B_1A_0)$

$M_3 = (A_2B_1) \oplus C$   
 $= (A_2B_1) \oplus [(A_1B_0 \cdot A_1B_1) + ((A_2B_0 \oplus A_1B_1) \cdot (A_0B_1 \cdot A_1B_0))]$

$M_4 = A_2B_1 \cdot [(A_2B_0 \cdot A_1B_1) + ((A_2B_0 \oplus A_1B_1) \cdot (A_0B_1 \cdot A_1B_0))]$