

ELEN 21 Lab 2: Design Capture and Simulation Pre-Lab

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II. Pre-Lab

Problem Statement:

- If the manual switch S is on, then the light L is on
 - Motion detector M_1 also can activate the light
 - If motion is detected but light is already on, then alarm A is turned on
 - The disable switch D , disables the motion activated light and alarm, but still allows manual switch S to work
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I. Read the problem statement and identify the inputs and outputs for the circuit.

The inputs of the system are: Manual Switch S , Motion Detector M_1 , and disable switch D .

The outputs of the system are: the Light L and alarm A .

II. Create the truth table for this system; include the light, alarm, switch, disable, and the motion detector.

S	M_1	D	L	A
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	0	0
1	0	0	1	0
1	0	1	1	0
1	1	0	1	1
1	1	1	1	0

Table 1: Truth Table for the problem statement

III. Draw a schematic of this system.

Using the Sum of Products method to synthesize the truth table, we get the boolean algebraic equation to be:

$$\begin{aligned}
 SOP_L &= \sum m_2 + m_4 + m_5 + m_6 + m_7 \\
 &= \bar{S} \cdot M \cdot \bar{D} + S \cdot \bar{M} \cdot \bar{D} + S \cdot \bar{M} \cdot D + S \cdot M \cdot \bar{D} + S \cdot M \cdot D \\
 &= \bar{S} \cdot M \cdot \bar{D} + S \cdot \bar{M} \cdot (\bar{D} + D) + S \cdot M \cdot (\bar{D} + D) \\
 &= \bar{S} \cdot M \cdot \bar{D} + S \cdot \bar{M} + S \cdot M \\
 &= \bar{S} \cdot M \cdot \bar{D} + S \cdot (\bar{M} + M) \\
 &= \bar{S} \cdot M \cdot \bar{D} + S
 \end{aligned}$$

$$\begin{aligned}
 SOP_A &= \sum m_6 \\
 &= S \cdot M \cdot \bar{D}
 \end{aligned}$$

From this, we can determine one of the forms that the circuit can appear as:

