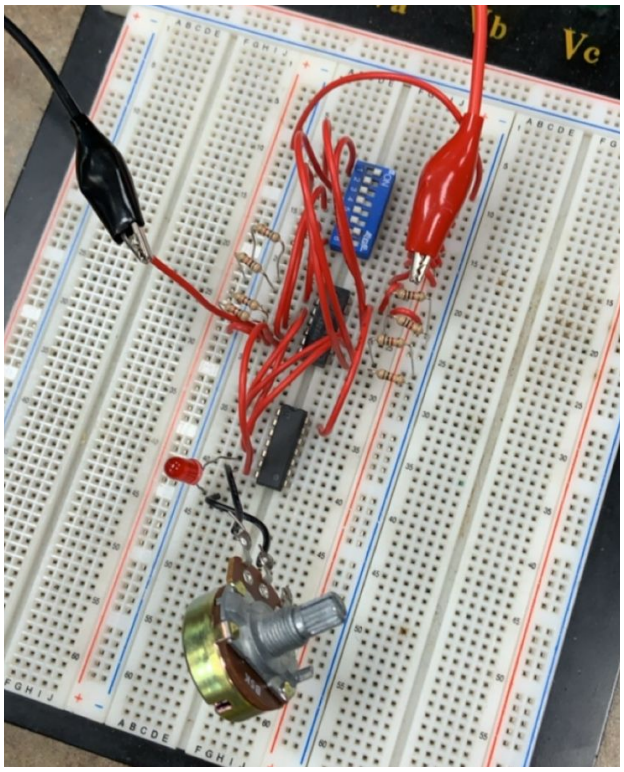
Digital Lock



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10/26-10/30

Objectives:

During this lab, you will be able to:

- Construct a digital lock with a 4 bit code input

Procedure:

During this lab, we used the following materials:

- 7421 IC (4 input AND Gates)
- 74266 IC (Exclusive NOR Gates)
- 1kΩ resistors (8)
- LED
- Multisim

To begin, we used a 74266 IC chip that contains four Ex-NOR gates (as shown in figure 1-1). An Ex-NOR gate is the inverse of an exclusive OR gate and output high whenever both values match. This was used to compare the configured bit for the lock with the input to see whether the bits matched.

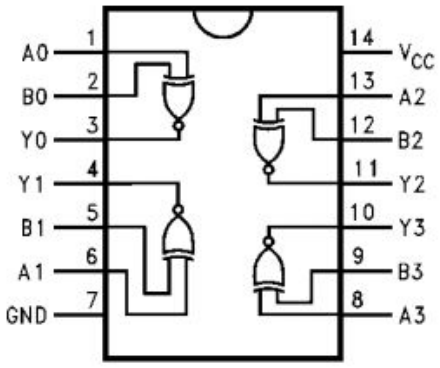


Figure 1-1 (74266 pinout)

Table 1-1 represents the truth table for a nor gate, being high whenever both inputs are the same as mentioned previously.

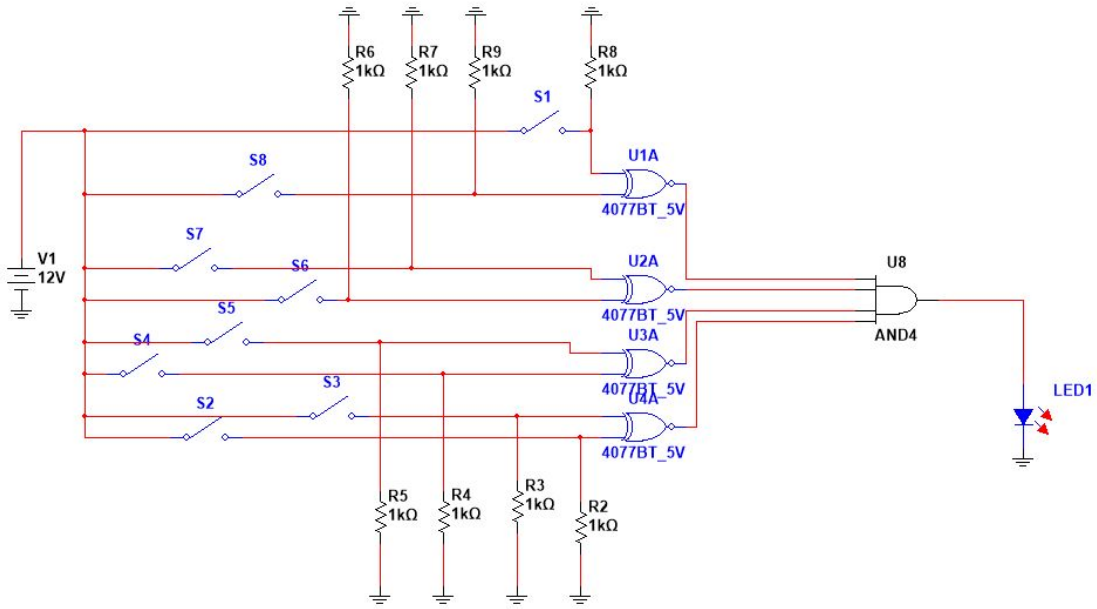
Inputs		Outputs
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	H

Table 1-1 (Ex-NOR truth table)

$(A \oplus B)' = Z$ Equation 1-1

$A'B' + AB = Z$ Equation 1-2

Since an Ex-NOR gate only turns on when both inputs match, the lock configuration was put into one input or an Ex-NOR and the input value for that pin was connected to the other input. If the input bit matches the configured bit, the output is high. Since this is a 4 bit lock, there were four Ex-NOR gates with their outputs connected to an and gate so if each bit matches, the lock is opened which is indicated by LED1 as shown in Circuit 1-1. Pulldown resistors and SPST switches were placed on each input to be able to adjust the configuration and input to test the lock.



Circuit 1-1

Discussion:

There were no issues involving the physical and multisim components of this lab.

Conclusion:

An Ex-NOR gate is a gate that only turns on when both inputs are equal to each other as shown in Table 1-1. Since the output will only be high if both inputs match, this can be used to compare the two inputs to create a lock. Each bit in the lock was compared with an Ex-Nor gate. If the configured input matched the set input, then the output would be high, as shown in Circuit 1-1. To create a 4-bit digital locking mechanism, the circuit's four Ex-NOR gates must be in-line with the code set by the AND gate. Say, for example, the code the input must receive is 0110. The Ex-NOR gates must read: low-high-high-low sequentially in order for the AND gate to activate. The Ex-NORs are activated by the SPST switches connected to them and the power source. For them to activate a gate, both switches would close and the connected Ex-NOR would

read high. That set of actions would be repeated for any gate that the AND requires a high output from.