Assignment Questions

1. Make a table relating control input, signal input, and output for all gates (e.g., for an AND gate, $Y = 0$ when $A = 0$; $Y = B$ when $A = 1$).
2. Hand in the results for this lab on a separate sheet. Draw a timing diagram for each gate, showing the relationship between control input, signal input, and gate output. When drawing the waveforms, use a ruler or drafting software.

Lab 6

Boolean Algebra: SOP Forms

Name _____ Class _____ Date _____

Objectives Upon completion of this laboratory exercise, you should be able to:

- Draw the logic diagram of a combinational circuit from a Boolean expression.
- Take a truth table from a logic gate network and use it to derive a sum-of-products (SOP) Boolean expression for the network.
- Use Boolean algebra to simplify a logic gate network and to prove that two gate networks are equivalent.
- Use DeMorgan equivalent forms of logic gates to simplify the Boolean expression of a logic gate network.

Reference Ken Reid and Robert Dueck, *Introduction to Digital Electronics*
Chapter 2: Logic Functions and Gates
Chapter 3: Boolean Algebra and Combinational Logic

Equipment Required Digital trainer
Wire strippers
#22 solid-core wire, as required
Components as follows:

Part No.	Qty.	Description
74LS00 or 74HC00	1	Quad 2-input NAND gate
74LS02 or 74HC02	1	Quad 2-input NOR gate
74LS04 or 74HC04	1	Hex inverter
74LS08 or 74HC08	1	Quad 2-input AND gate
74LS10 or 74HC10	2	Triple 3-input NAND gate

Experimental Notes

Any combinational logic circuit can be described by a Boolean expression written in sum-of-products (SOP) form. This form can be derived from a truth table by noting the lines on the truth table where the output has a value of 1 and writing a **product term** for each such line. Each product term consists of all input variables in either true or complement form. If an input is 0, it is written in complement form (with a bar); if the input is 1, it is written in true form (no bar).

For example, in Table 6.1 there are three product terms. These three terms are combined in an OR function to make a sum-of-products Boolean expression:

$$Y = \bar{A}\bar{B}\bar{C} + \bar{A}BC + AB\bar{C}$$