Digital Logic Design Lab #2

Objectives

Understanding of Logic Gates, Truth Table, Schematics and Logic Circuit Design

Material

1. Textbook: Digital Logic Design by Khormaee.
2. Course Website: www.EngrCS.com
3. Instruments: Power Supply, Function Generator and Oscilloscope
4. Supplies:
   - Proto Board
   - Jumper Wire
   - Four 1 KΩ Resistors
   - 14-pin-DIP Unknown #1, #2 and #3

Procedure

Background: 14-pin-DIP Package & Resouces

This package has 7 pins on each side as shown in the diagram. The most optimum placement of the package is on the center of the Prototype board such that the pins are in holes on either side of the center divide

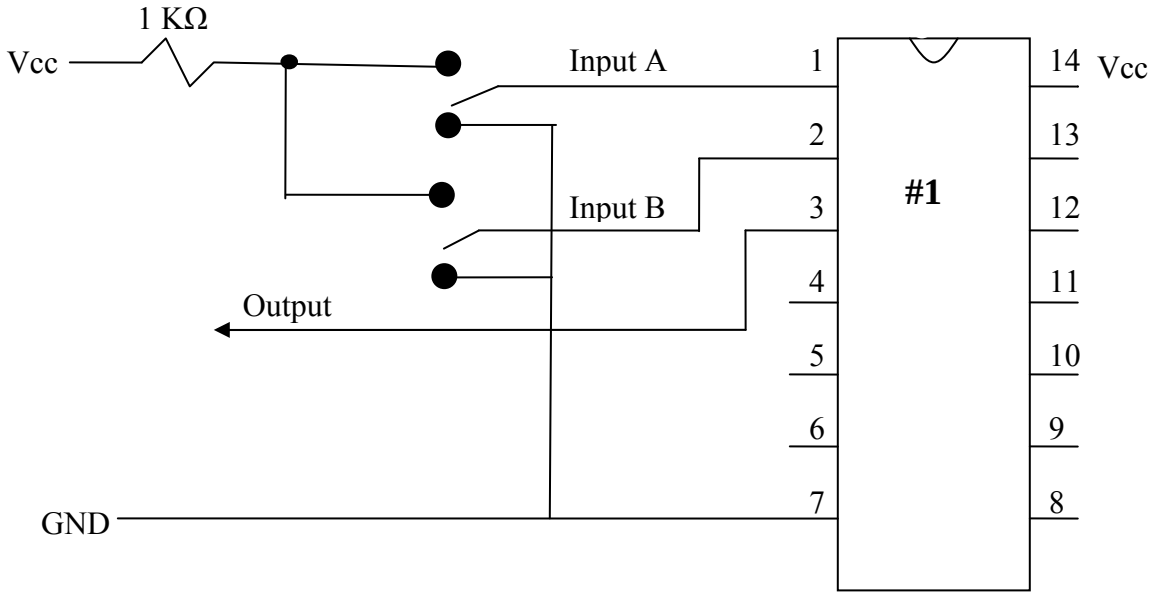
It is important to note that for Logic Components (ICs) used in this experiment Pin #7 should be connected to GND (0 V, Ground) and Pin #14 should be connected to Vcc (+5V).

In order to reduce miss-wiring errors, it is recommended that red color wire be used for Vcc and black color wire be used for GND. Also orienting the ICs so that they are aligned in the same direction on the Prototype board will significantly reduce miss-wiring error.

Further it is important that you review the specifications (Truth Table and Pin configuration) for 74LS xx ICs listed on course website at "http://www.EngrCS.com" component page.

Experiment 1. Identify the unknown 14-pin-DIP IC#1

1) Wire the unknown 14-pin-DIP IC#1 into the prototype board as shown below:



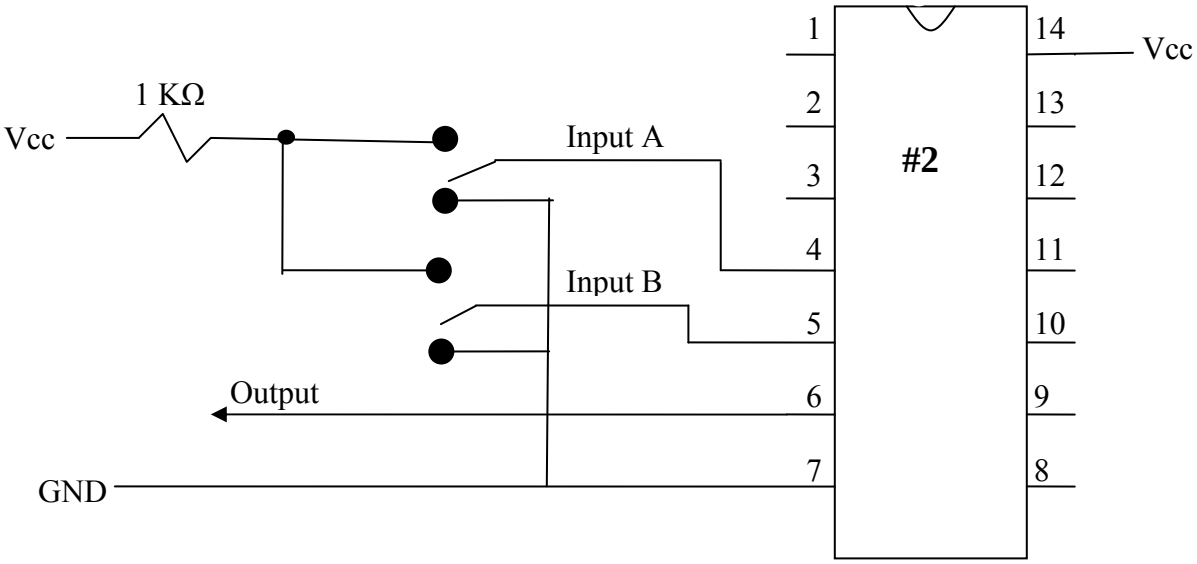
Note: Refer to 14-pin-DIP package section for more information on the packaging and usage of IC's.

2) Using the switches develop a truth table for the Unknown IC #1.

3) Based on the results of this experiment and component specifications for 74LSxxx presented on course website, Identify the component under test and explain your selection process.

Experiment 2. Identify the unknown 14-pin-DIP IC#2

1) Wire the unknown 14-pin-DIP IC#2 into the prototype board as shown below:



Note: Refer to 14-pin-DIP package section for more information on the packaging and usage of IC's.

2) Using the switches develop a truth table for the Unknown IC #2

3) Based on the results of this experiment and component specifications for 74LSxxx presented on course website, Identify the component under test and explain your selection process.

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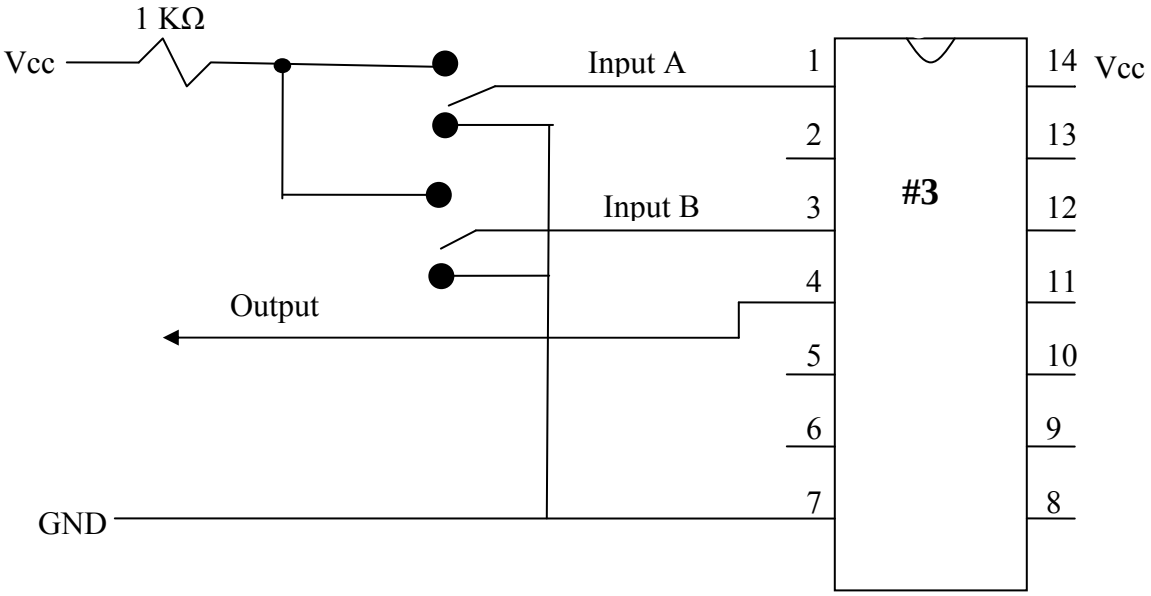
Experiment 3. Identify the unknown 14-pin-DIP IC#3

1) Wire the unknown 14-pin-DIP IC#3 into the prototype board as shown below:



Note: Refer to 14-pin-DIP package section for more information on the packaging and usage of IC's.

2) Using the switches develop a truth table for the Unknown IC #3

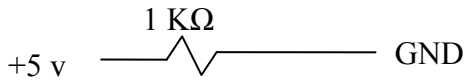
3) Based on this experiment and component specification for 74LSxxx presented on course website, Identify the component under test and explain your selection process.

Experiment 4. Ohms Law

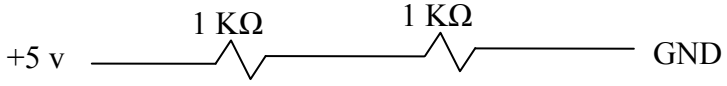
Ohms Law states that voltage (V, Volt) and Current (I, Amp) through a resistor are proportional (R, Ω). The following equation is based on Ohms Law:

$$V = I * R$$

1) Series Resistors
   a) Measure voltage across the resistor and calculate the current through the resistor



   b) Measure voltage across one of the resistors and calculate the current through the resistors.

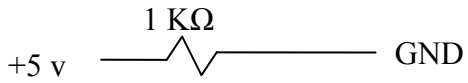


c) Measure voltage across one of the resistors and calculate the current through the resistors.

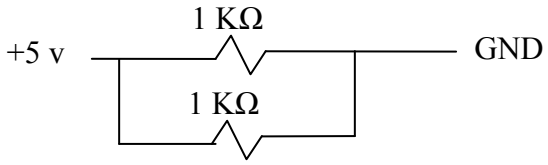
d) In this case, n Resistors (when n is an integer) are connected in series. Derive the equation for average voltage across one of the resistors and current through the resistors in-term of n.

2) Parallel Resistors

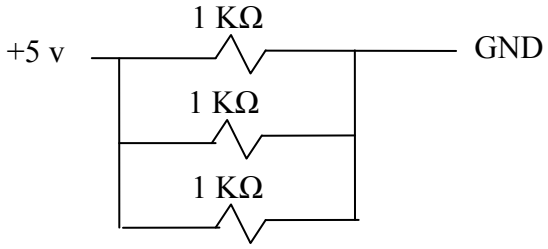
a) Measure voltage across the resistor and calculate current through the resistor



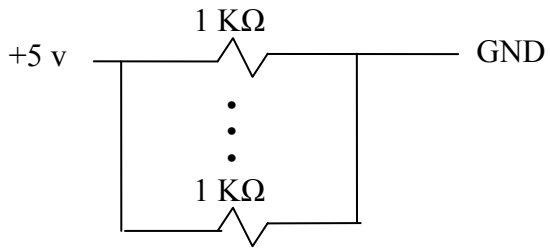
b) Measure voltage across the resistors and calculate current through one of the resistors.



c) Measure voltage across the resistors and calculate current through one of the resistors.



d) In this case, n Resistors (when n is an integer) are connected in parallel. Derive the equation for average voltage across the resistors and current through one of the resistors in-term of n.



Experiment 5. Traffic Control Signal System

A three way intersection is need of a traffic signal control system and you have been assigned the task to design (Do not implement) the system. Each direction has only one lane and one signal control light (green and red) per Lane. Further, you have been asked to give only one lane go or green sign at a time.

Your deliverables should include:

a) Sketch of the intersection with variables identified and respective values defined
b) Truth Table for the Signal Control System based on input/output defined in part a
c) A logic design using only 74LSxx ICs listed on the course website.

Report Requirements

All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum include:

For each Experiment

a) Clear problem statement; specify items given and to be found.
b) Identify the theory or process used.
c) Documents resulting Circuit design, tables, timing diagram, schematic and other results.

For the report as a whole

a) Cover sheet with your name, lab, date of completion and team members' names.
b) Lessons Learned from the experiments.
c) A new experiment and expected results which provide additional opportunity to practice the concepts in this lab.