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ENGR 250

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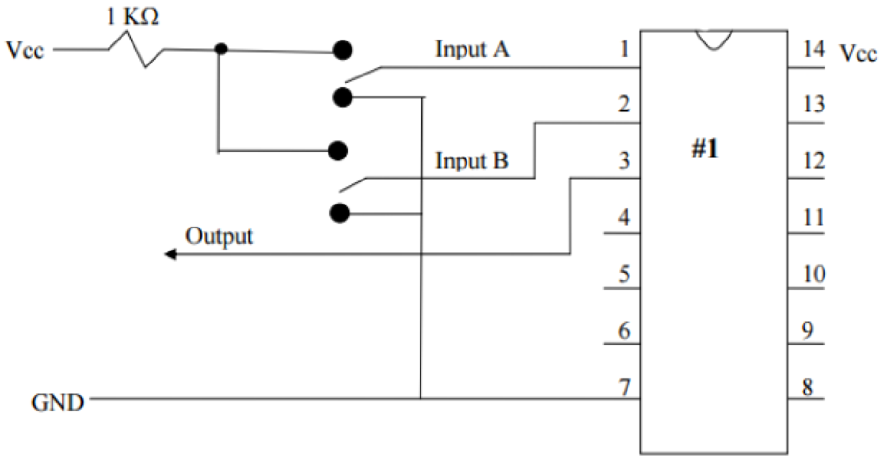
Digital Logic Design Lab #2

Introduction

Actually, before this lab, I learned about most of these experiments in other class. However, by each experiment, I could remind them; also, this lab was a chance to get used to deal with these things: Logic Gates, Truth table, Schematics, and Logic Circuit Design.

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

For the first experiment, our team made the circuit and connected with the unknown logic gate #1. Also, we put the diode on the output; so we confirm the currency, easily, without measuring the current and voltage of each part by the Multimeters.



Bellow chart is the truth table about the above logic gate.

In the insert section, opened switch = 0

(Disconnect with VCC)

closed switch = 1

(Connect with VCC)

In the output section, (Diode is off) = 0

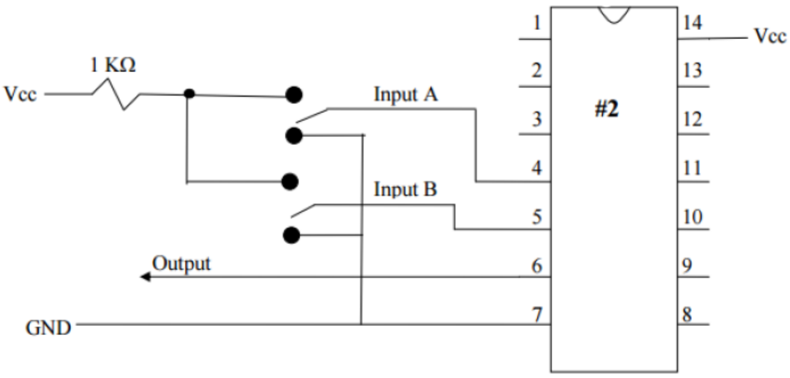
(Diode is on) = 1

Input		Output
Switch 1	Switch 2	Diode
0	0	0
0	1	1
1	0	1
1	1	1

From this result, we could presume this logic gate. We could get some information about the types of gates in www.EngrCS.com. This gate is "OR gate" and it likely to be "74LS32".

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

We experimented the same way with the before thing.



In the insert section, closed switch = 1

(Connect with VCC)

opened switch = 0

(Disconnect with VCC)

In the output section, (Diode is off) = 0

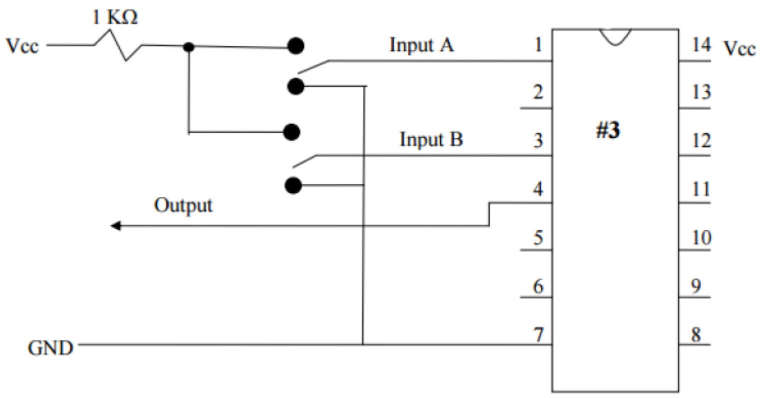
(Diode is on) = 1

Insert		Output
Switch 1	Switch 2	Diode
0	0	0
0	1	0
1	0	0
1	1	1

After examining our truth table, we could compare our result with the specific logic gates in www.EngrCS.com; and we concluded that the unknown gate #2 is “AND” gate, also, it is likely to be 74LS08 gate.

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

We experimented the same way – put the diode on the output line to confirm the flow.



Insert		Output
Switch 1	Switch 2	Diode
0	0	1
0	1	0
1	0	1
1	1	0

In the insert section, closed switch = 1

(Connect with VCC)

opened switch = 0

(Disconnect with VCC)

In the output section, (Diode is off) = 0

(Diode is on) = 1

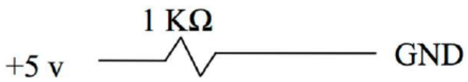
After comparing our result with Digital component section in www.EngrCS.com, we could know that the #3 chip is a Hex Inverter (74LS04).

Experiment 4 - Ohms Law

In this experiment, we used the power supply to set the specific value of voltage.

1) Series Resistors

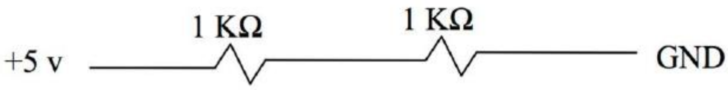
a) Measure voltage across the resistor and calculate the current through the resistor.



We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

5 = I * 1000 I = 5mA (The current is all same in series)

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

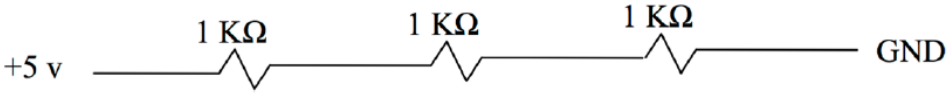


We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

In this part, the sum of the value of the resistors is 2k ohms.

5 = I * 2000 I = 2.5mA (The current is all same in series)

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

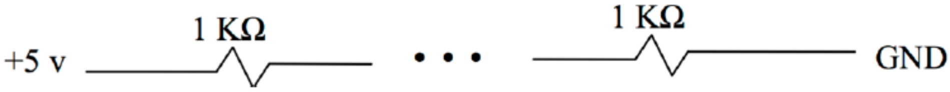


We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

In this part, the sum of the value of the resistors is 3k ohms.

5 = I * 3000 I = 5/3mA = 1.6666666666..mA (The current is all same in series)

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.



In this part, the sum of the value of the resistors is (N)*(1 K ohm) = N k ohms

5 = I * (N * 1000)   I = 5 / (N*1000) <- this unit is “A”.   (The current is all same in series)

2) Parallel Resistors

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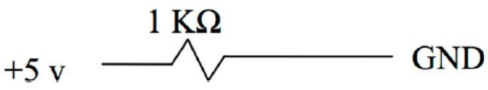
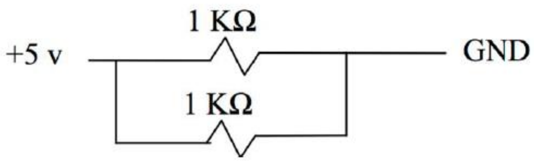
a) Measure voltage across the resistor and calculate the current through the resistor.



We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

5 = I * 1000   I = 5mA

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



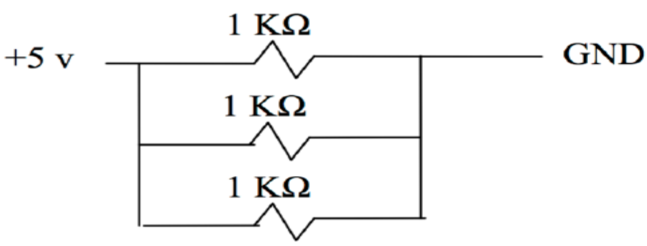
We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

The voltage is all same in parallel so that, in the above circuit, the voltage in the each resistor is 5V.

We found the current of the each resistor by “V = I * R”.

5V = I * 1000 ohms   I=5 mA

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



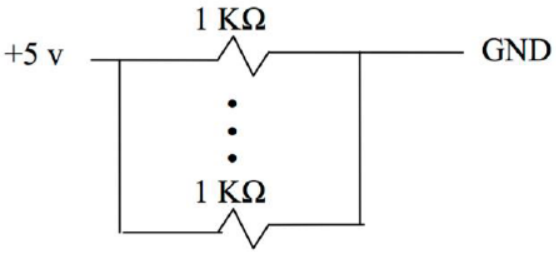
We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

The voltage is all same in parallel so that, in the above circuit, the voltage in the each resistor is 5V.

We found the current of the each resistor by “V = I * R”.

5V = I * 1000 ohms I=5 mA (in each resistor)

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.



We set the voltage as 5 Voltage. For confirming the current, we used the formula V=(I)*(R).

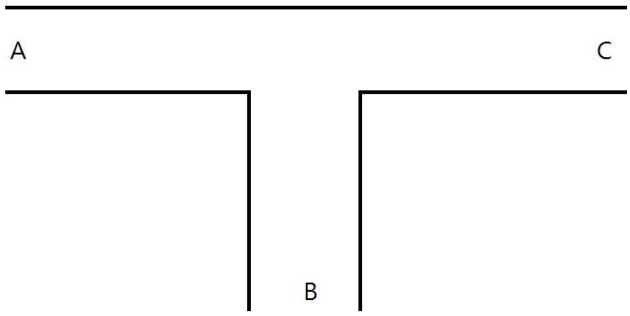
The voltage is all same in parallel so that, in the above circuit, the voltage in the each resistor is 5V.

We found the current of the each resistor by “V = I * R”.

5V = I * 1000 ohms I=5 mA (in each resistor)

Experiment 5 - Traffic Control Signal System

In this Experiment, we put the three diodes to confirm about the currency. Also, we used the different color of diodes so it was easy to differentiate the three different outputs.



Car Position: Car = 1 / No Car = 0

Traffic lights: Green light =1 / Red light = 0

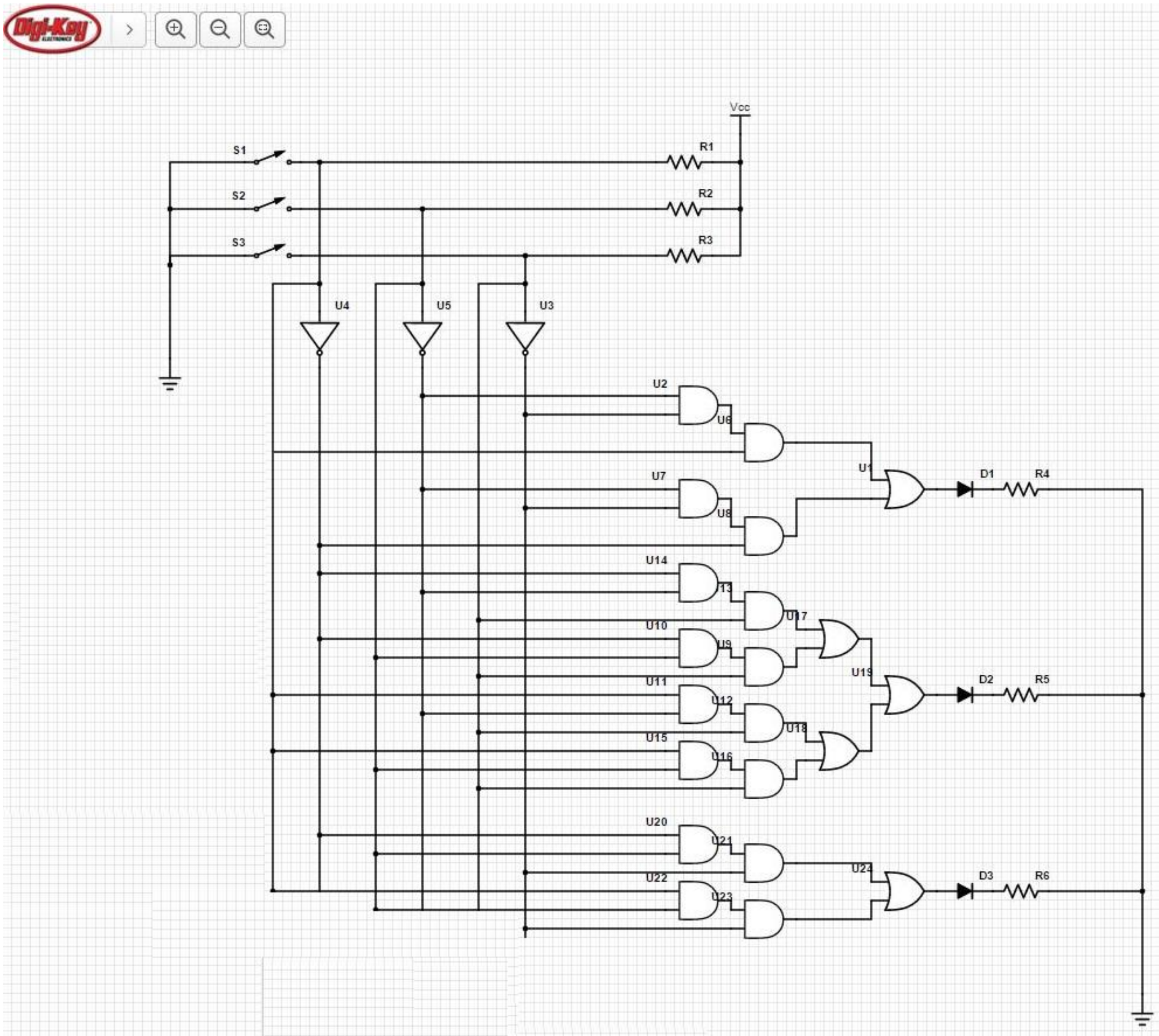
Car Position			Traffic Lights		
A sensor	B sensor	C sensor	L(A)	L(B)	L(C)
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	0	0	1
1	0	0	1	0	0
1	0	1	0	0	1

1	1	0	0	1	0
1	1	1	0	0	1

[R(A) R(B) R(C)] = (0 0 1) = A'B'C + A'BC + AB'C + ABC

[R(A) R(B) R(C)] = (0 1 0) = A'BC' + ABC'

[R(A) R(B) R(C)] = (1 0 0) = A'B'C' + AB'C'



Used logic gates

U2 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23	"AND gate"	74LS08
U 3 U4 U5	"Hex Inverter"	74LS04
U1, U19, U24	"OR gate"	74LS32

Learn from these experiments.

1. The way of identifying the unknown logic gates by the connecting way and truth table.
2. The changes of the voltage and current by connecting ways: series resistors and parallel resistors.

   (By using Ohms Law)
3. Make a truth table and, from this truth table, we made schematics.

Conclusion (New experiment)

Actually, in my case, this lab was not the new experience about logic gate, the difference between series and parallel, and schematics (+truth table). However, in this experiment1, 2, and 3, we had a difficulty about our result. Though we connected wires, logic gate, switches, and so on, correctly, our result was different with other peers. So we tried checked the each wire, resistor, logic gate, and proto board, in our kit box, by the Multi-meters. After that, we did the experiments again and got the result that we expected. Actually, in this lab, we learned about main things but, actually, we got the most important tip for successful experiment. Before experiment, make sure our wire, resistor, proto-board, and transistor whether they work well or not.