Ga-wun Kim

ENGR 250

Scott Koss

Lab Partners: Rebecca, Kantas

Digital Logic Design Lab #3

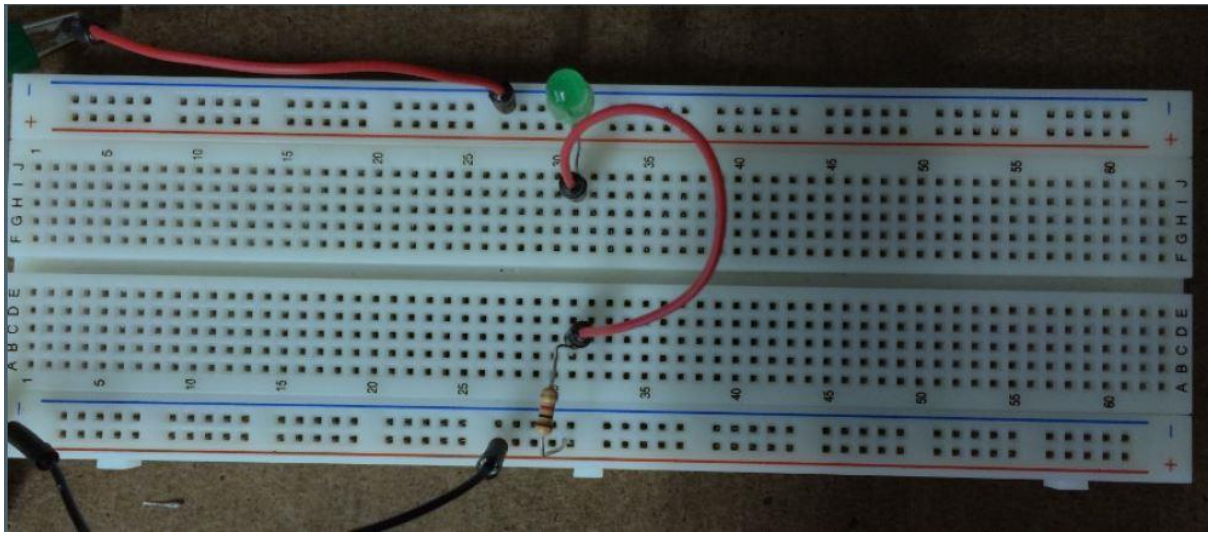
Introduction

Before experiments, by Multimeter, we checked the wires, Proto-board, Diodes, resistors, switch, and transistors whether they worked well or not. Also, before this experiment, we just learned about POS and SOP in the text book. However, by making the circuit, we could use the SOP and POS conceptions in the circuit, practically. By this experiment, we could understand these conceptions deeply.

Experiment 1 – LED Usage

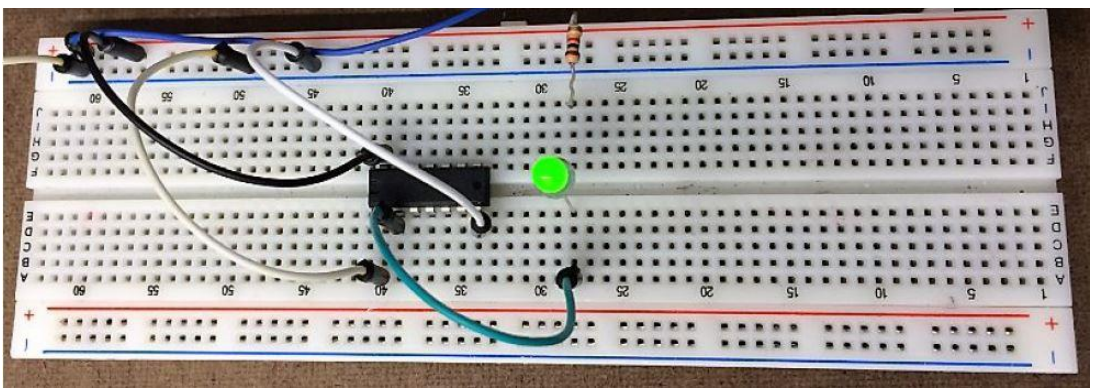
In this experiment, we used “Power Supply”, “Diodes”, “Hex Inverters (74LS04)”, and resistors. When we set up the following three configurations, we paid attention to the direction of the diode. The long foot is for + and we put it on the wire that was connected with VCC. Also, the short foot is for – and we put it on the wire that was connected with GND.

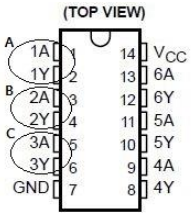
Configuration #1



In this configuration, we set around 5V (4.98V). Also, we built the circuit like the above picture. Before experiment, we expected that the diode would turn on, and the actual result was same with our expectation.

Configuration#2

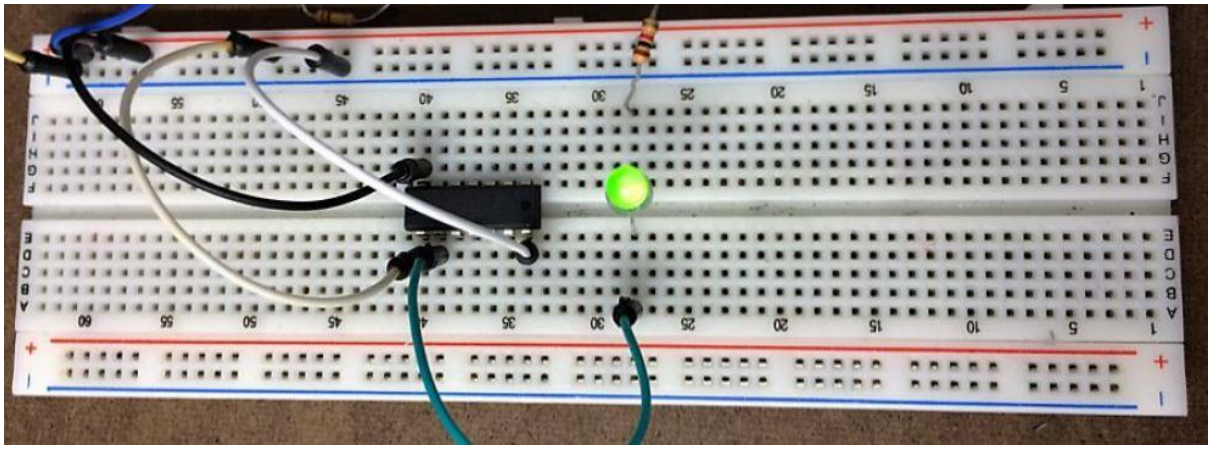




In this configuration, we used Hex inverters (74LS04). We set around 5V (4.99V). Also, we built the circuit like the above picture. In Hex inverters (Left), (1A(input), 1Y(output)) we connected the 1A with GND to make a lower condition than VCC. And then, in the wire was connected with 1Y, the value of voltage was changed to be higher than the value of 1A part; so that the diode turned on.

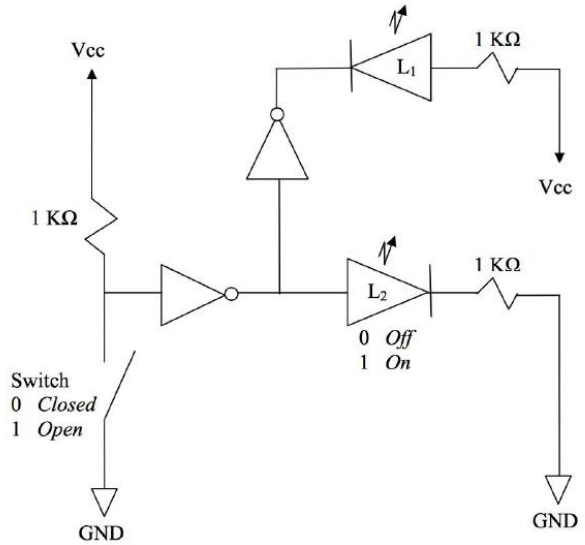
Before the experiment, we expected that the diode would turn on. The actual result was same with our expectation.

Configuration #3

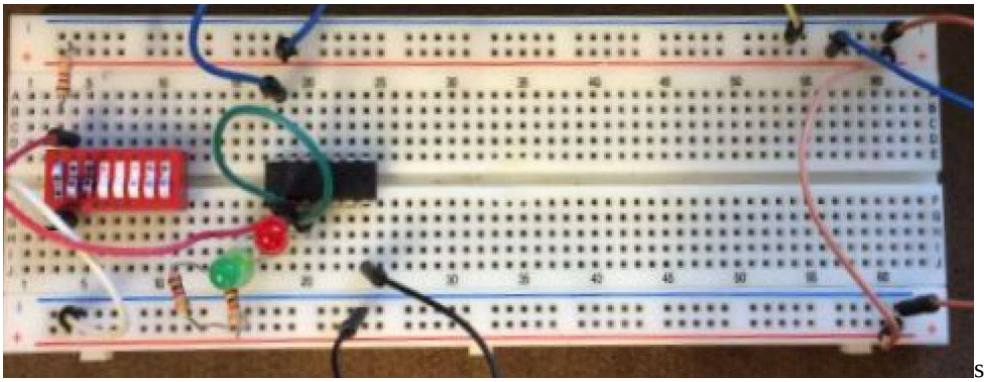


In this configuration, we set around 5V (4.98V). Our circuit was like the above picture. Generally, each tip of circuit was connected with VCC and GND. However, in this circuit, we connected with VCC and other side was with VCC. However, the inverters changed it to be lower condition; so we could see that the diode turned on. This actual result was same with our expectation before the experiment.

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



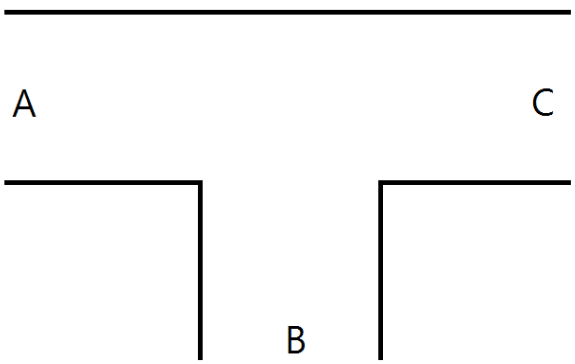
Truth Table		
Input	Output	
Switch	L1	L2
0	1	1
1	0	0

 s

In this experiment, we built the circuit like the above the picture. By changing, the input(changing the combination of the each switch on and off), we could see the difference of output(the each diode). Also, in this experiment, we used the different color of diode so that we could differentiate the output easily.

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

A)



B)

Sensor A	Sensor B	Sensor C	Light A	Light B	Light C
0	0	0	0	0	1
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	0	1	0
1	0	0	1	0	0
1	0	1	1	0	0
1	1	0	1	0	0
1	1	1	1	0	0

Sensor : detected = 1, non-detected = 0.

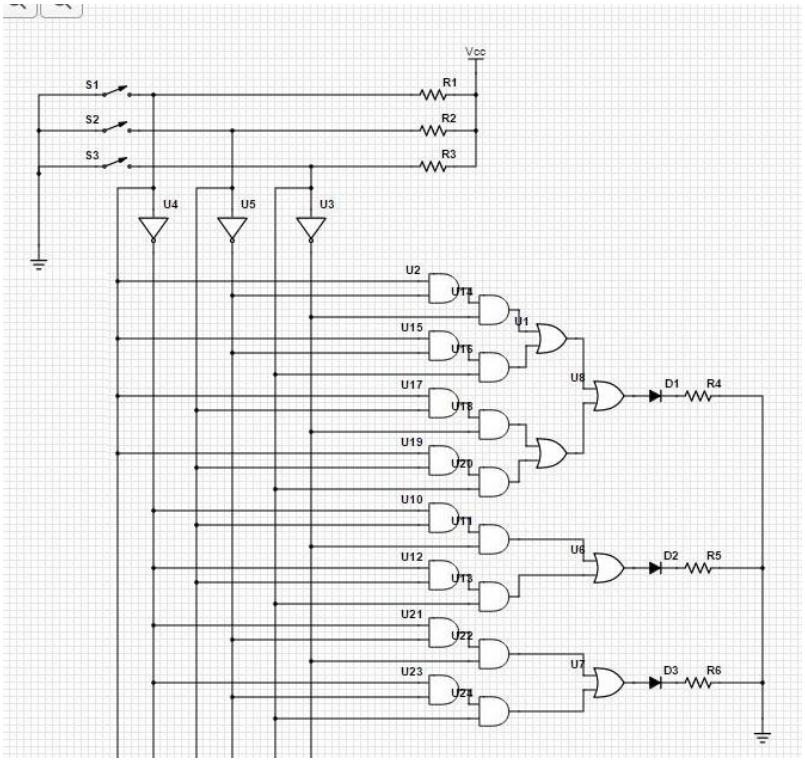
Light : Green = 1, Red = 0

C)

Light A = AB’C’+AB’C+ABC’+ABC

Light B = A’BC’+A’BC

Light C = A’B’C’+A’B’C



U4 : A’

U5 : B’

U3 : C’

AND : 16EA

OR : 5EA

D1 : Light A

D2 : Light B

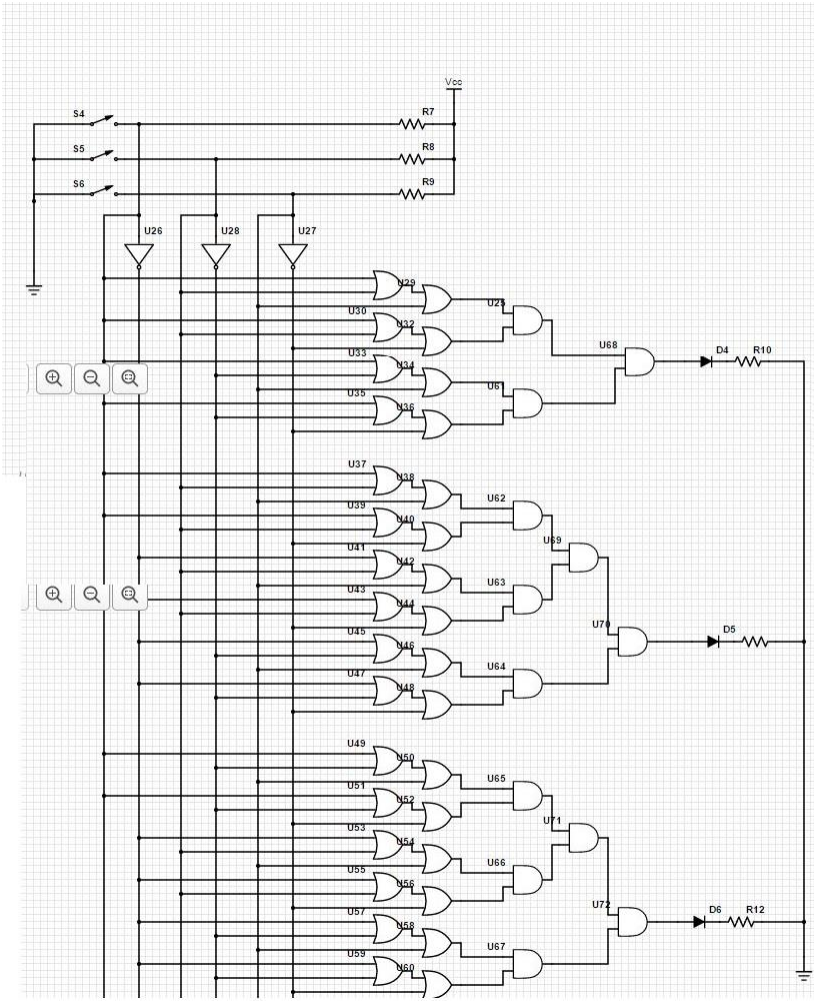
D3 : Light C

D) Product of Sums(POS):

Light A = (A+B+C)(A+B+C’)(A+B’+C)(A+B’+C’)

Light B = (A+B+C)(A+B+C’)(A’+B+C)(A’+B+C’)(A’+B’+C)(A’+B’+C’)

Light C = (A+B’+C)(A+B’+C’)(A’+B+C)(A’+B+C’)(A’+B’+C)(A’+B’+C’)



D4: light A / D5: light B / D6: light C / U26 : A' / U28 : B' / U27 : C'

E)

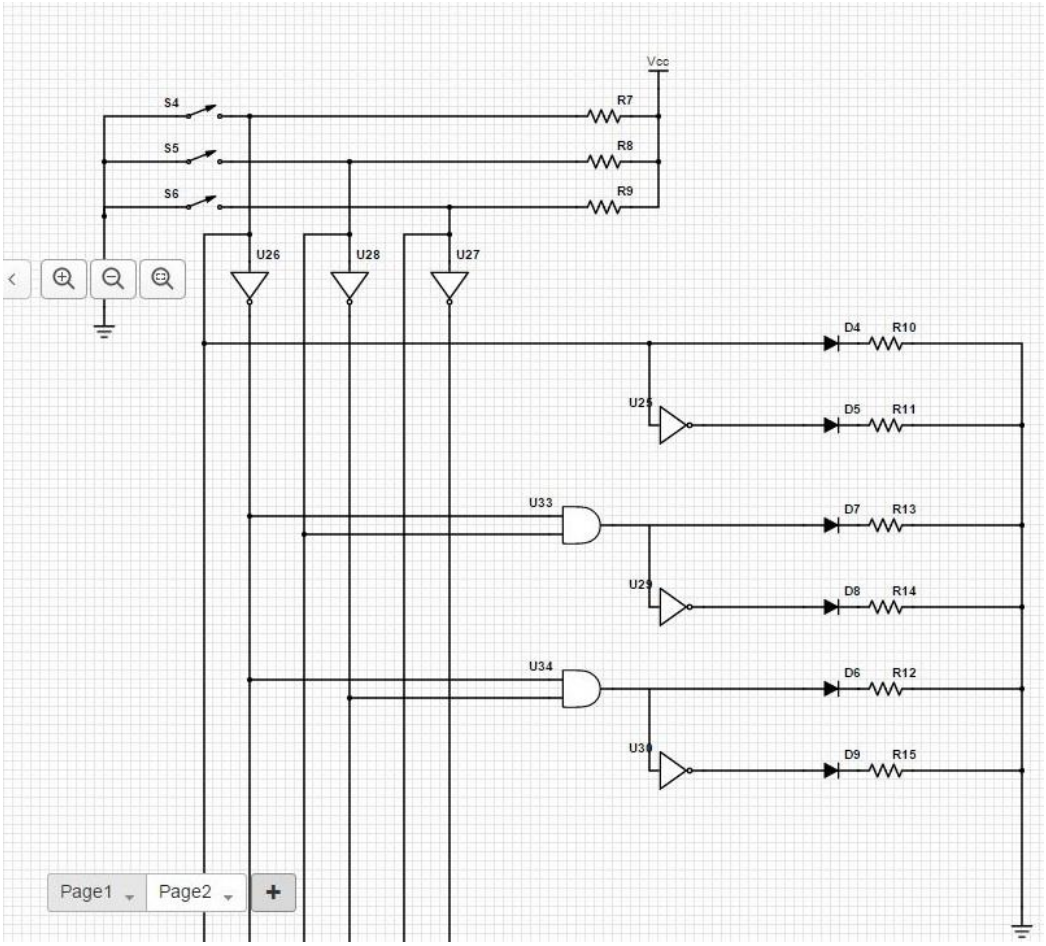
We discussed about this issue. After discussing, we could determine SOP is better to use in this experiment. If we use POS, we had to think more than twice. So, we believe that SOP is more convenient to use.

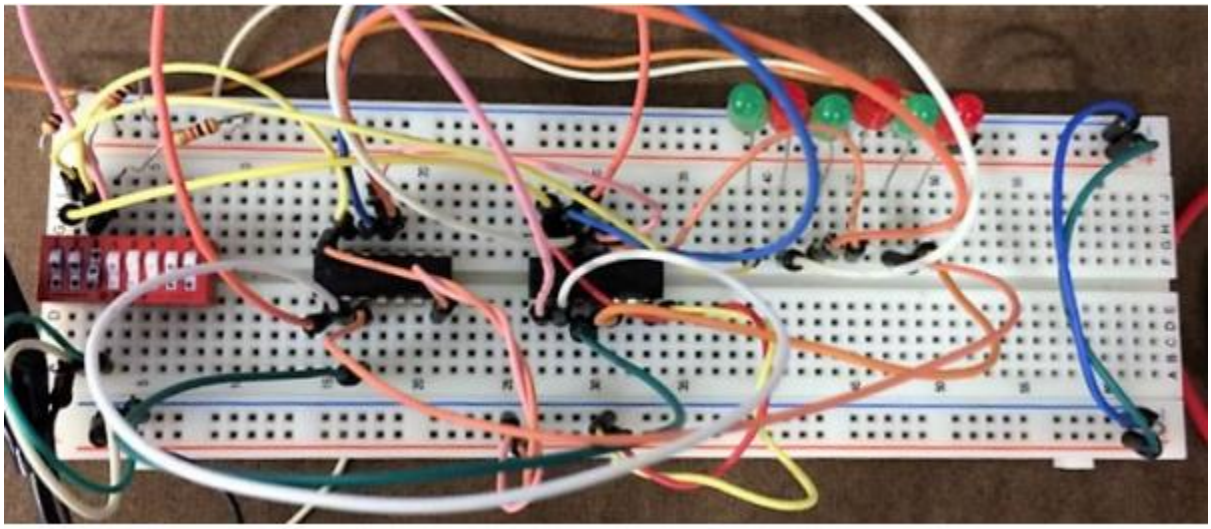
F) SOP minimized:

Light A = AB'+AB = A

Light B = A'B

Light C = A'B'


Vcc
S4
S5
S6
R7
R8
R9
U26
U28
U27
D4
R10
U25
D5
R11
U33
D7
R13
U29
D8
R14
U34
D6
R12
U30
D9
R15
Page1
Page2
+

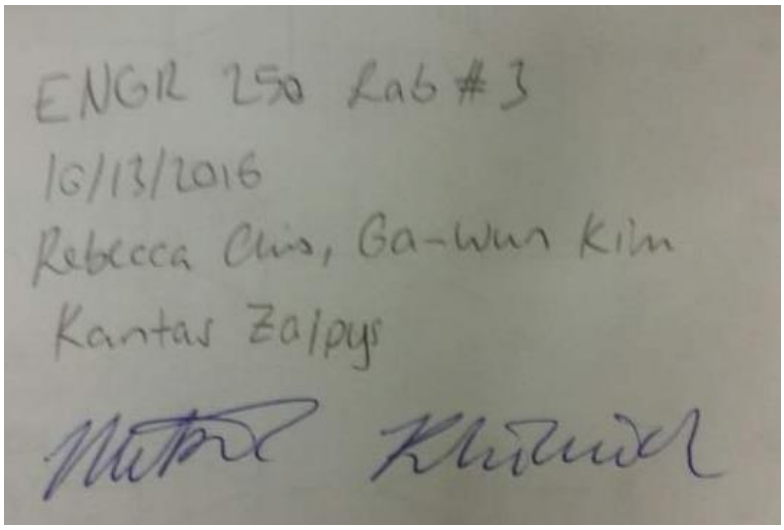


Learn from these experiments.

1. The role of the Hex inverters is to alter the inverse one. High -> Low / Low -> High.
2. The output(result) of the minimized schematic is same with the output of the non-minimized schematics.
3. SOP is convenient rather than POS.
4. The way of drawing POS schematics. And the minimized schematics of SOP

Conclusion (New experiment)

This experiment was very helpful for me. This is because, before the experiment, I knew about the Hex Inverters but I did not have any experience to use in the circuit. However, in this lab, I used the inverter and confirmed this role again. Also, from some parts of the circuit in the lab, I could make sure the practical use of the Hex inverters.

Also, in the experiment C, we draw the three different schematics: SOP, POS, and the minimized SOP. Actually, I did not expect their result would be same.

This was the new experience that I could make the circuit with at least wires and inverters by the minimized way. Also, I believe that it would be much easier to fix the circuit.