# CSC 347 LAB REPORT

## Lab #2 - Logic Design and Simplification with K-Maps

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Date Performed: 02/21/23

Date Submitted: 03/02/23

I pledge this work to be my own Vitaliy Prymak

## Objective:

*During this lab, the main goal is to design, minimize and implement a 3-bit binary to excess-3 converter circuit using Karnaugh maps.*

## Equipment and Chip used:

- *Elenco Digital/Analog Trainer X-150,*
- *Chips: 74HCT08 (AND gate), 74HCT32 (OR gate), 74HCT04 (inverter gate), 74HCT86 Quad 2-input (XOR gate).*

## Design procedure:

*Derive the truth table for a 3-bit binary to excess-3 code converter. Draw 3 K-maps, one for each output and obtain the simplified Boolean equations for A, B, and C. Draw the logic circuit diagram. Implement the circuit as shown in the circuit diagram on the trainer breadboard and test the circuit*

1. Derive the truth table for a 3-bit binary to excess-3 code converter

| X | Y | Z | A | B | C |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 |

*Table 1 Truth table of 3-bit binary to Excess-3 code*

2. Draw 3 K-maps, one for each output and obtain the simplified Boolean equations for A, B, and C

| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 |

| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |

| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |

*Table 2 3 K-maps for A B C*

$A = X'Z + X'Y + XY'Z'$ $B = X'Y' + XY$ $C = Z'$

3. Draw the logic circuit diagrams

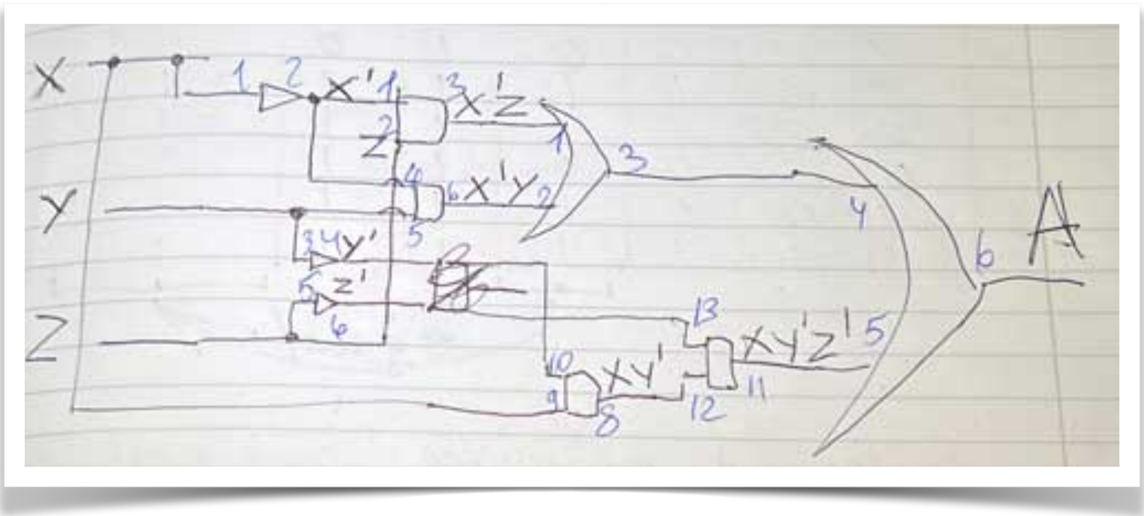



*Figure 1  Logic circuit diagram for A*

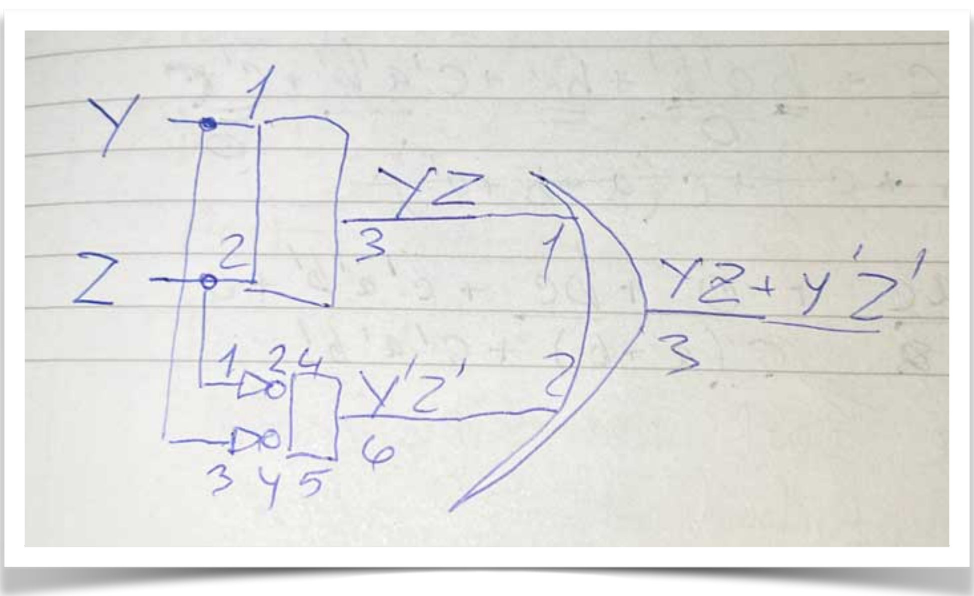



*Figure 2  Logic circuit diagram for B*

4 Implement the circuit as shown in the circuit diagram on the trainer breadboard and test the circuit

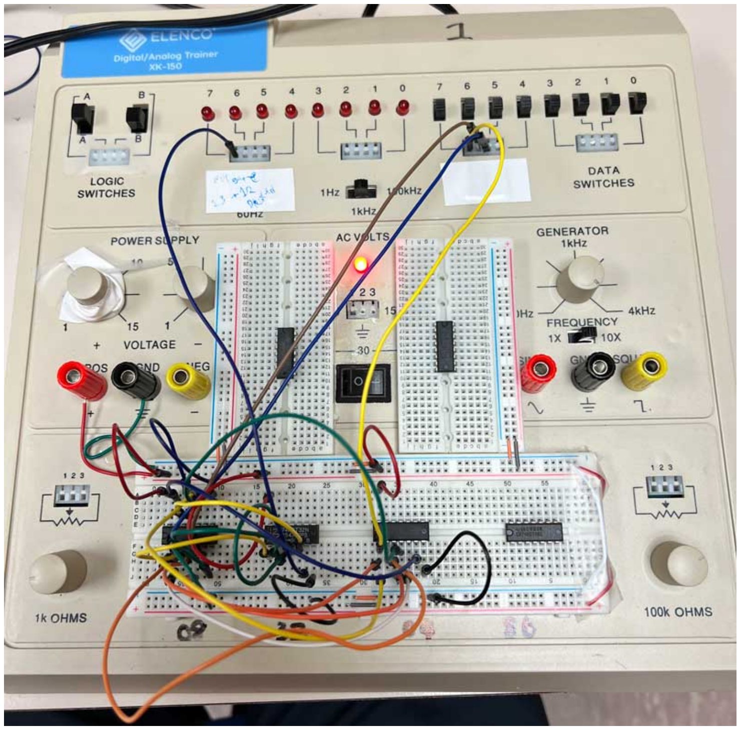



*Figure 3 Circuit diagram for A*

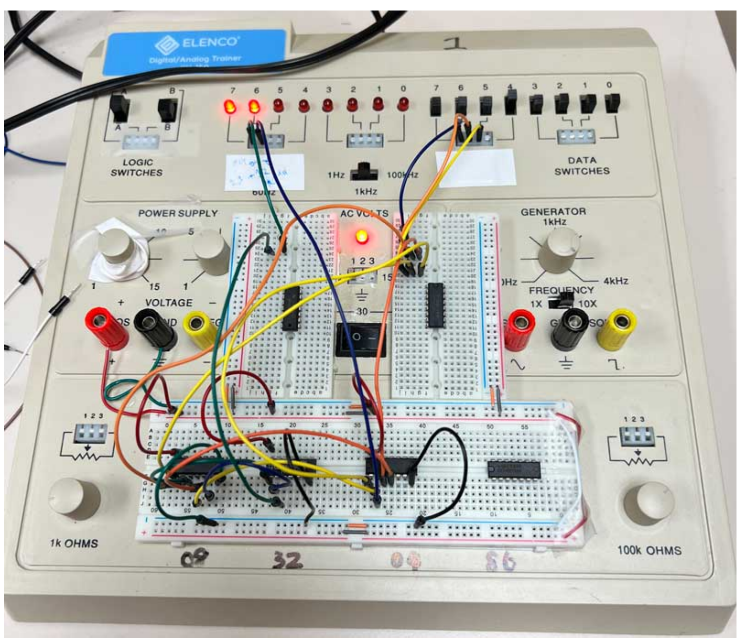



*Figure 4 Circuit diagram for B and C*

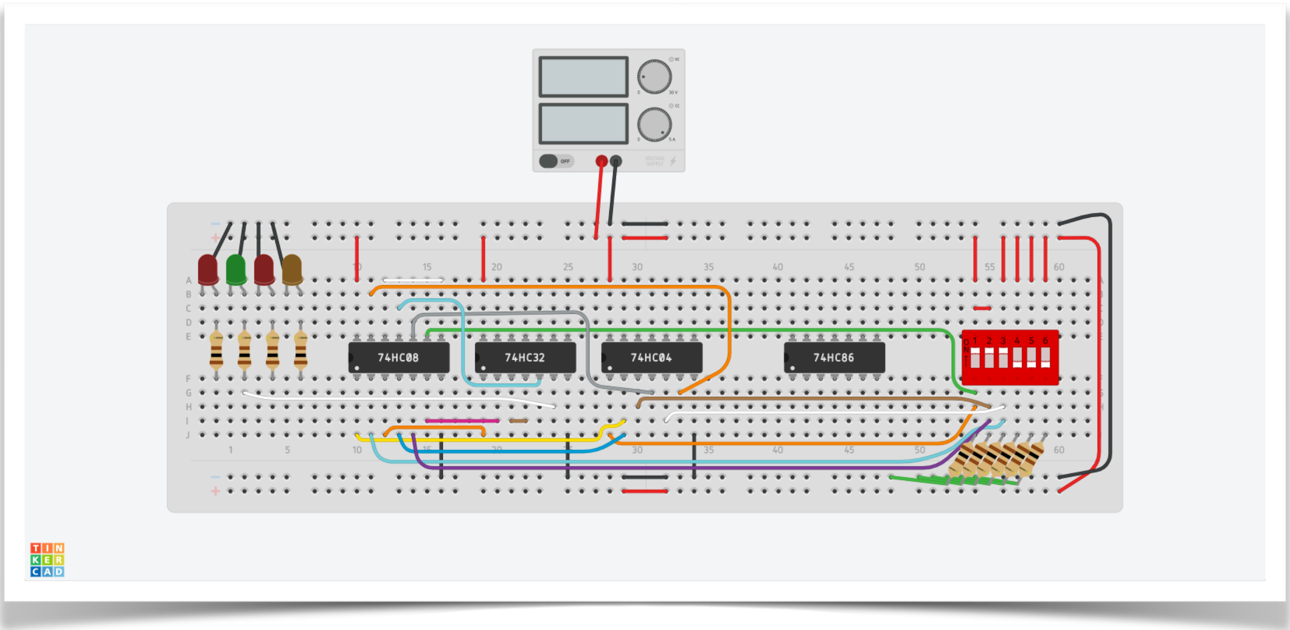



*Figure 5 Circuit diagram for A in TinkerCad*

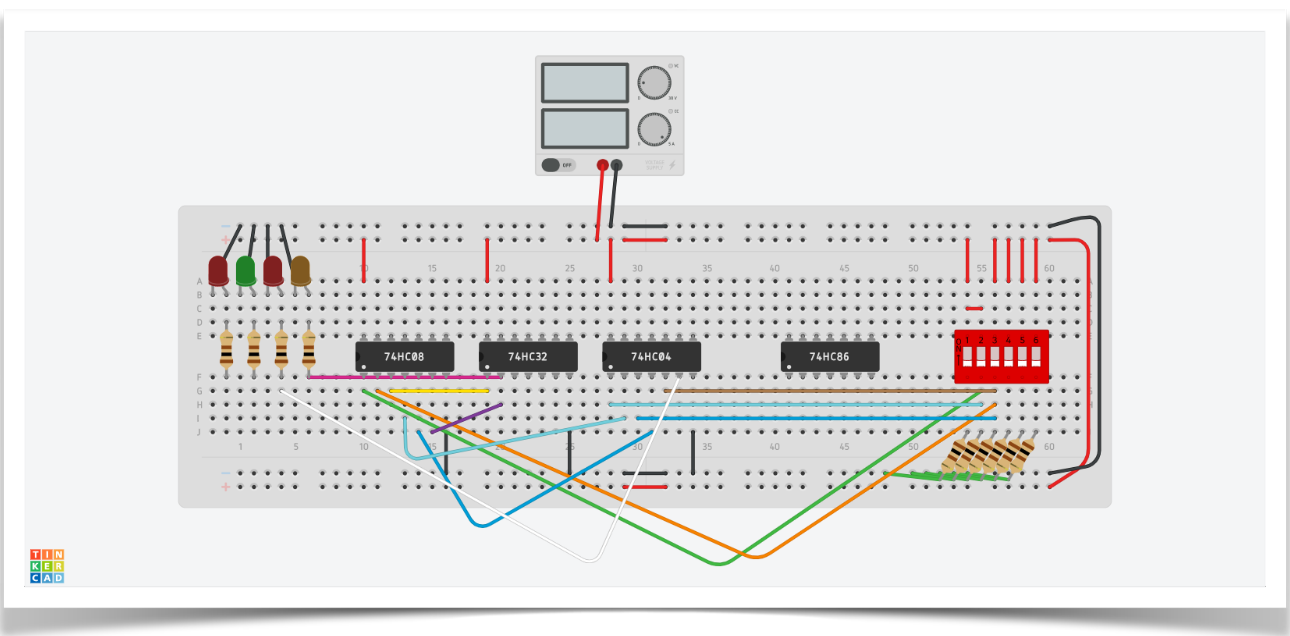



*Figure 6 Circuit diagram for B and C in TinkerCad*

## 4. Result and Conclusions:

During experiment I’ve verified that binary code for 3-bits can be represented with Excess-3 code.


6. Reference: https://www.tinkercad.com/things/aKtlrsoDhCE-copy-of-csc-347-starter-kit/editel?sharecode=xvaTq6lz-iujrkDrlezTBQqH1zYUSsrd027vxzDgZOE

https://www.tinkercad.com/things/9GVfKqX2bx0-copy-of-csc-347-starter-kit/editel?sharecode=zd7EwJ82kk4rDyGwp0FLeFPkE0iH5vysAvrzN2U01pI

# HOMEWORK:

Implement 3-Bit Converter to Gray code

| X Y Z | A B C |
|---|---|
| 0 0 0 | 0 0 0 |
| 0 0 1 | 0 0 1 |
| 0 1 0 | 0 1 1 |
| 0 1 1 | 0 1 0 |
| 1 0 0 | 1 1 0 |
| 1 0 1 | 1 1 1 |
| 1 1 0 | 1 0 1 |
| 1 1 1 | 1 0 0 |

| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |

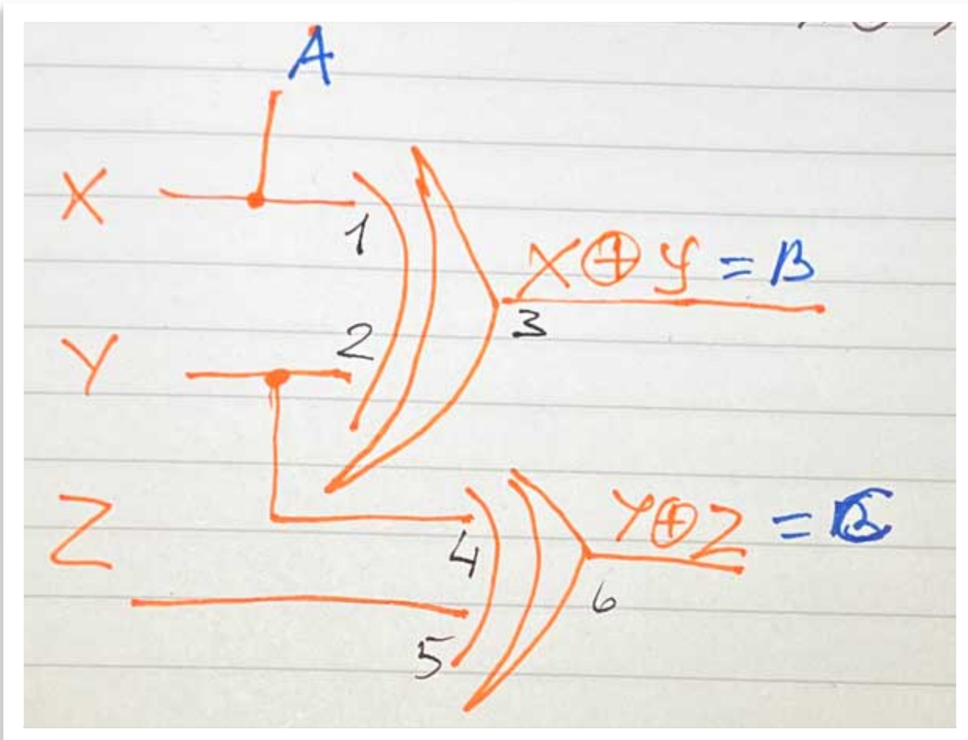
| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 |

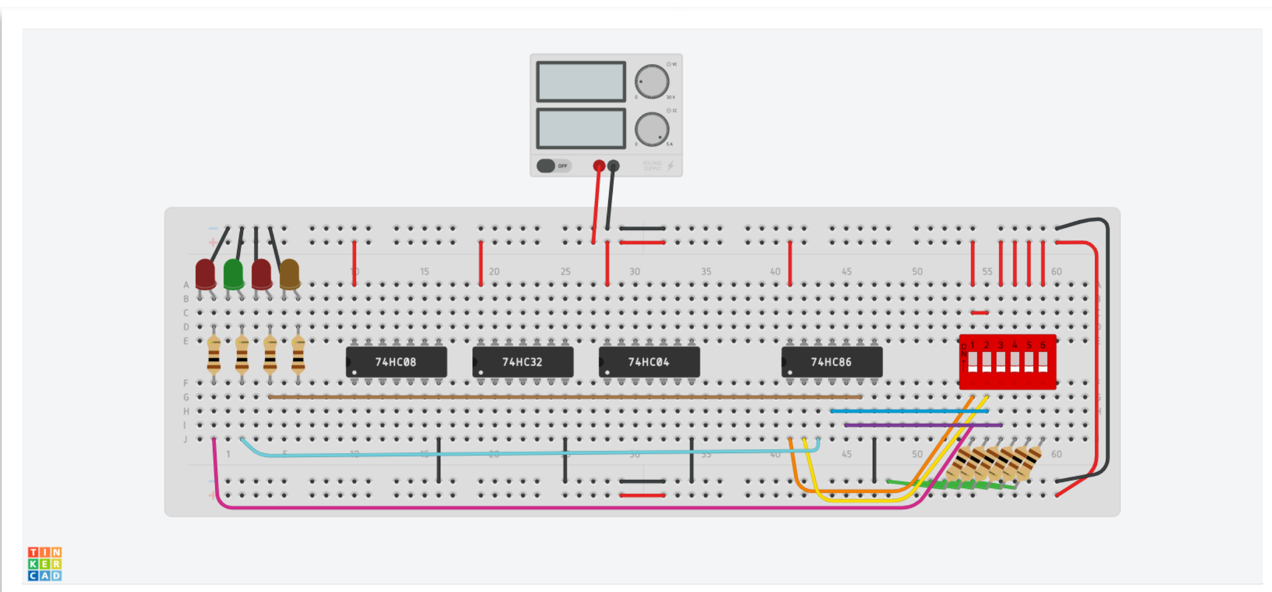
| \YZ X | 0 0 | 0 1 | 1 1 | 1 0 |
|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 |

$A = X$

$B = X'Y' + X'Y = X \oplus Y$

$C = Y'Z + YZ' = Z \oplus Y$




https://www.tinkercad.com/things/c1sg6Mp87Mw-copy-of-csc-347-starter-kit/editel?sharecode=_SNGKPEHinE1-Py5hFHz3rVOarAc7QT-ZDsKzG9V04c