LABORATORY EXERCISE NO. 6: KARNAUGH MAP

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Objective/s:

After performing the exercises, the student should be able to:

1. understand the concepts and rule of K-Mapping; and
2. apply the concepts and rule of K-Map.

Discussion:

Karnaugh Map (K-map) Simplification

- a graphical device used to simplify logic expressions or to convert truth table to its corresponding logic circuits in a simple orderly process.
- provides a simple straight forward method for simplifying Boolean Algebra or functions.
- a diagram made up of squares and each squares represents one minterms or maxterms.
- Although the k-map method can be used for problem solving, it is limited to only six variables.

Format:

2 Literals:

B \ A	0	1
0	m_0	m_1
1	m_2	m_3

3 Literals:

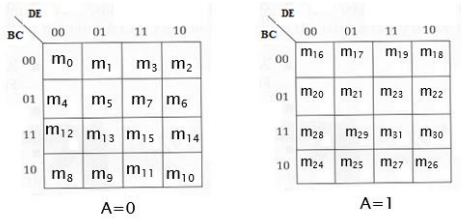
C \ AB	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6

AB \ C	0	1
00	m_0	m_1
01	m_2	m_3
11	m_6	m_7
10	m_4	m_5

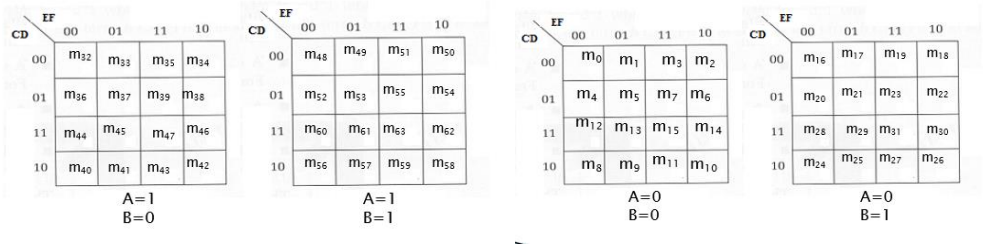
4 Literals:

AB \ CD	00	01	11	10
00	m_0	m_1	m_3	m_2
01	m_4	m_5	m_7	m_6
11	m_{12}	m_{13}	m_{15}	m_{14}
10	m_8	m_9	m_{11}	m_{10}

5 Literals:



6 Literals:



Rules of Simplification

1. No zeros allowed.
2. No diagonals
3. Only power of 2 number of cells in each group.
4. Groups should be as large as possible.
5. Everyone must be in at least one group.
6. Overlapping is allowed
7. Wrap around is allowed
8. Fewest number of groups possible.

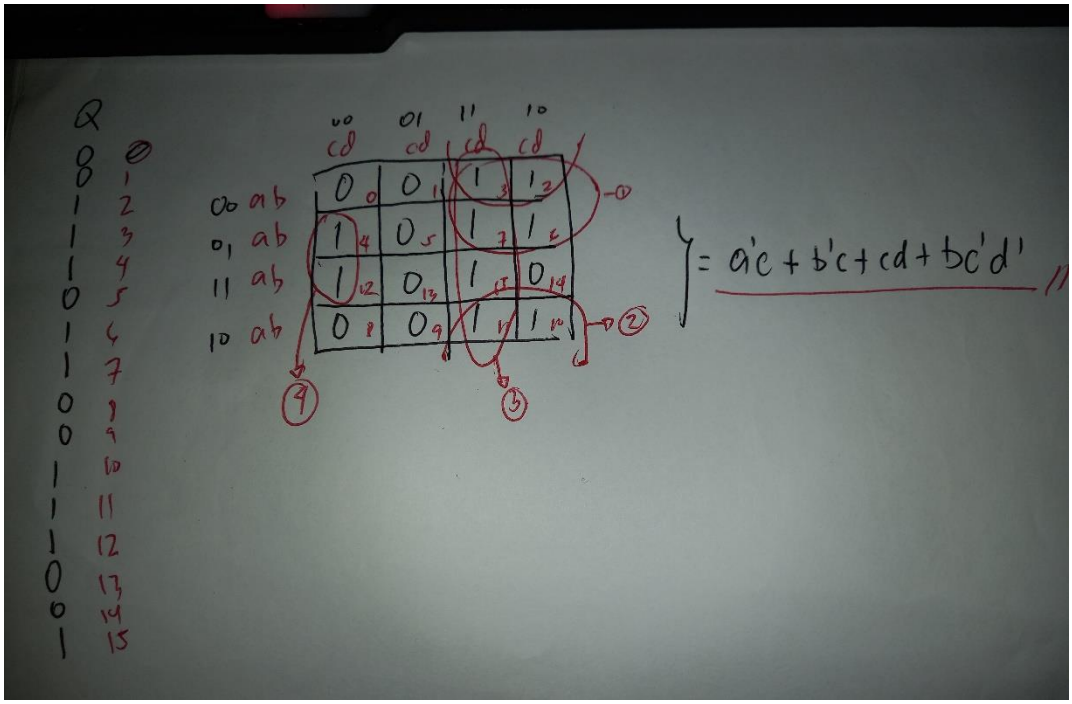
PROCEDURE

1. Get the simplified function using K-Map of the following truth table:

Input				Output
a	b	c	d	Q
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

Table 1. Given Truth Table

Solution:



2. Design the logic circuit of the simplified function.
3. Attach logic circuit diagram you designed.

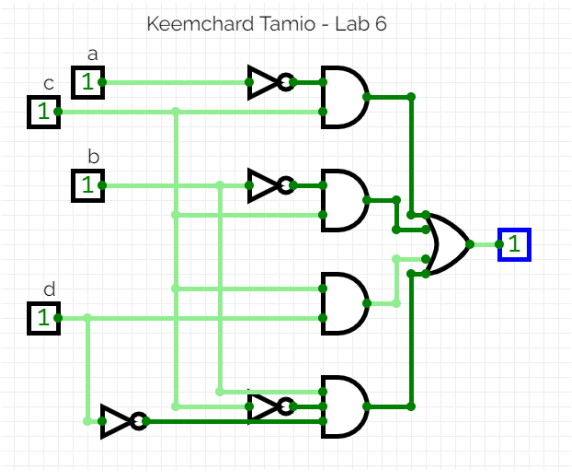


Figure 1. Logic circuit for the given function

4. Construct the circuit on www.tinkercad.com .
5. Attach the screen capture of the logic circuit.

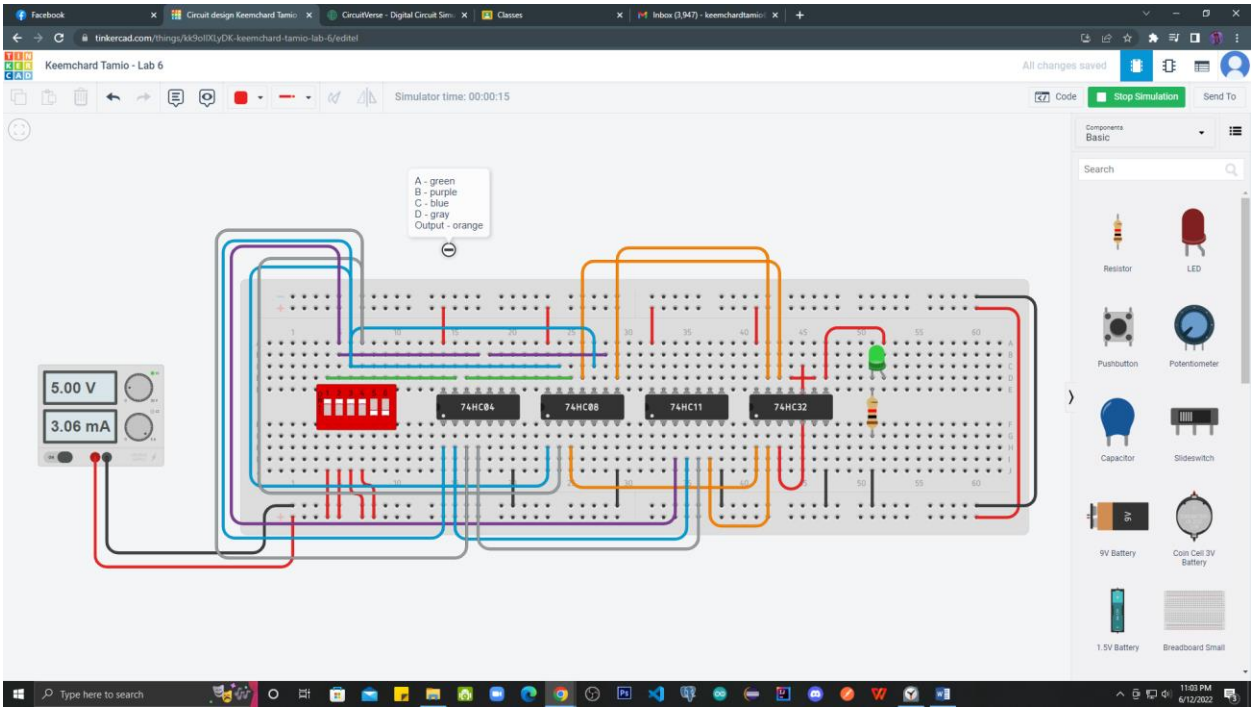


Figure 2. Circuit for the given function

6. Complete the table below by simulating the circuit of the given function:

Input				Output
a	b	c	d	Qs
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**1**
0	0	1	1	**1**
0	1	0	0	**1**
0	1	0	1	**0**
0	1	1	0	**1**
0	1	1	1	**1**
1	0	0	0	**0**
1	0	0	1	**0**
1	0	1	0	**1**
1	0	1	1	**1**
1	1	0	0	**1**
1	1	0	1	**0**

1	1	1	0	**0**
1	1	1	1	**1**

Table 2. Truth Table for the simplified function

CONCLUSION

Make a conclusion of the exercises.

As a conclusion, I was able to satisfy the objectives stated above. I have understood and applied the K mapping concepts in this activity. I was able also to create and simulate a logic circuit based on my simplified function.