DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603203.

Title of Experiment	:	**11. Reduction of Boolean expression using K-map**
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Register Number	:	RA2111028010094
Date of Experiment	:	16/12/2021

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
Total		**50**	

Staff Signature

PRE LAB QUESTIONS:

1. **How many Cells are in 4 and 5 Variable K- Map.**

   4 variable – 16 cells

   5 variable – 32 cells

2. What do you mean by don’t care condition in K-map or truth table?

While forming groups of cells, we can consider a "Don't Care" cell as 1 or 0 or we can also ignore that cell. Therefore, "Don't Care" condition can help us to form a larger group of cells. A Don't Care cell can be represented by a cross(X) in K-Maps representing an invalid combination.

3. Write the Distributive property of Boolean Algebra.

Distributive Law states that the multiplication of two variables and adding the result with a variable will result in the same value as multiplication of addition of the variable with individual variables.

4. Write down the De Morgan law.

De Morgan's Law states that the complement of the union of two sets is the intersection of their complements and the complement of the intersection of two sets are the union of their complements.

5. State the difference between SOP and POS.

(1) SOP uses minterms while POS uses maxterms.

(2) SOP is sum of minterms while POS is product of maxterms.

(3) SOP is formed by considering all the minterms, whose output is HIGH (1) while POS is formed by considering all the maxterms, whose output is LOW (0).

Experiment No. 11 **Date :**	**Reduction of Logic Expression using Karnaugh map (K- Map)**

Aim: To simply and verify the Boolean expression using K-map.

Apparatus: Logic trainer kit, logic gates / ICs, wires.

Theory:

Karnaugh maps: Karnaugh maps or K-maps for short, provide another means of simplifying and optimizing logical expressions. This is a graphical technique that utilizes a sum of product (SOP) form. SOP forms combine terms that have been ANDed together that then get ORed together. This format lends itself to the use of De Morgan's law which allows the final result to be built with only NAND gates. The K-map is best used with logical functions with four or less input variables. One of the advantages of using K-maps for reduction is that it is easier to see when a circuit has been fully simplified. Another advantage is that using K-maps leads to a more structured process for minimization. In order to use a K-map, the truth table for a logical expression is transferred to a K-map grid. The grid for two, three, and four input expressions are provided in the tables below. Each cell corresponds to one row in a truth table or one given state in the logical expression. The order of the items in the grid is not random at all; they are set so that any adjacent cell differs in value by the change in only one variable. Because of this, items can be grouped together easily in rectangular blocks of two, four, and eight to find the minimal number of groupings that can cover the entire expression. Note that diagonal cells require that the value of more than two inputs change, and that they also do not form rectangles.

	A'B’ 00	A’B 01	AB 11	AB’ 10
C’ 0				
C 1				

Figure 1. Three variables K Map

	A’ 0	A 1
B’ 0		
B 1		

Figure 2. Two variables K- Map

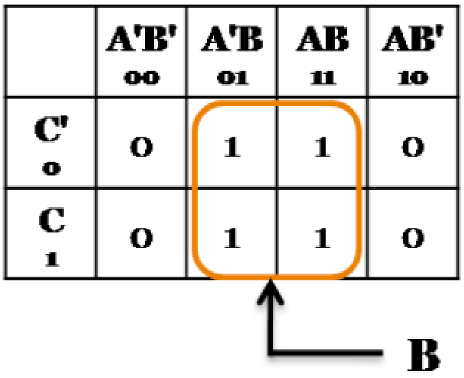
Given expression

F(C,A,B) = CAB + C'AB + CA'B + C'A'B

Simplification Using Boolean Properties

CAB + C'AB + CA'B + C'A'B = AB(C + C') + A'B(C + C') Distributive Property
= AB + A'B C + C' is always true
= (A + A')B Distributive Property
= B A + A' is always true

Simplification using K- Map



	A'B' 00	A'B 01	AB 11	AB' 10
C' 0	0	1	1	0
C 1	0	1	1	0

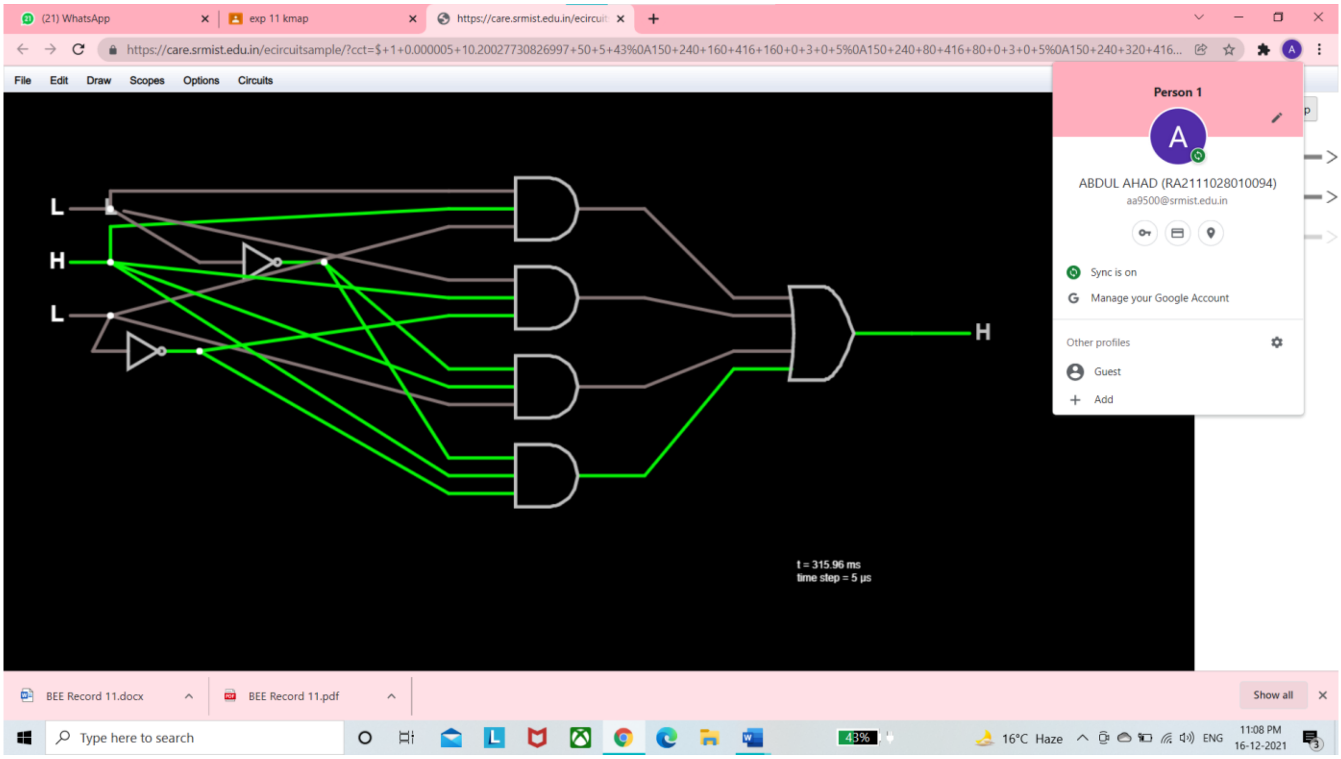
Procedure:

1. Connect the trainer kit to ac power supply.
2. Connect the circuit based on the given logic functions to be simplified.
3. Connect the inputs of first stage to logic sources and output of the last gate to logic indicator.
4. Apply various input combinations and observe output for each one.
5. Verify the output before and after reducing the expression.
6. Switch off the ac power supply.

Truth table:

A	B	C	CAB	C’AB	CA’B	C’A’B	F
0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	1	0	0	0	0	1	1
0	1	1	0	0	1	0	1
1	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0
1	1	0	0	1	0	0	1
1	1	1	1	0	0	0	1

E-circuit


(21) WhatsApp
exp 11 kmap
https://care.srmist.edu.in/ecircuit
https://care.srmist.edu.in/ecircuitsample/?cct=$+1+0.000005+10.20027730826997+50+5+43%0A150+240+160+416+160+0+3+0+5%0A150+240+80+416+80+0+3+0+5%0A150+240+320+416...
File
Edit
Draw
Scopes
Options
Circuits
L
H
L
H
t = 315.96 ms
time step = 5 µs
Person 1
A
ABDUL AHAD (RA2111028010094)
aa9500@srmist.edu.in
Sync is on
Manage your Google Account
Other profiles
Guest
Add
BEE Record 11.docx
BEE Record 11.pdf
Show all
Type here to search
43%
16°C Haze
ENG
11:08 PM
16-12-2021

Result: The Boolean expression using k Map is verified.

Post-lab questions

1. Simply the expression F=AB+AB’

Using Distributive property in reverse:

F = A (B+B')

= A (1)

= A

2. Name the different reduction techniques

(1) Using Boolean algebra

(2) Using K- Map

3. Give the merits and demerits of K-map

Merits:

Minimizes Boolean expressions without the need using various Boolean theorems computations. Minimizes number of Logical gates used.

Demerits:

It is not suitable for computer reduction. It is not suitable when the number of variables involved exceed four.

4. What are differences between K-map and Quine McCluskey?

Karnaugh map (K-map) and Quine-McCluskey (QM) methods are well known methods to simplify Boolean expression. K-map method becomes complex beyond five variable Boolean expression. Quine-McCluskey method is computer-based technique for minimization of Boolean function and it is raster than K-map method.

5. Give steps for reducing two variable expression using K-map?

(1) Firstly, we define the given expression in its canonical form.

(2) Next, we create the K-map by entering / to each product-term into the K-map cell and fill the remaining cells with zeros.

(3) Next, we form the groups by considering each one in the K-map.

(4) In the next step, we find the Boolean expression for each group.

(5) Lastly, we find the Boolean expression for the Output.