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Karnaugh Maps

The process of simplifying the algebraic expression of a boolean function is called minimization. Minimization is important since it reduces the cost and complexity of the associated circuit.The minimization of the algebraic expressions can be done in two ways:
1.Mimization using algebraic manipulation
2.Minimization using K-map

- We can minimize Boolean expressions of 3, 4 variables very easily using K-map without using any Boolean algebra theorems.
- K-map can take two forms Sum of Product (SOP) and Product of Sum (POS) according to the need of problem.
- K-map is table like representation but it gives more information than TRUTH TABLE.
- We fill grid of K-map with $0's$and $1's$ then solve it by making groups.

Problem Statement:

Reduce the following boolean expression to it's simplest form using K-Map:

$$F(X,Y,Z,W) = \sum(0,1,2,3,4,5,10,11,14)$$

SOLUTION: Steps to solve expression using K-map:

1.Select K-map according to the number of variables.
2.Identify minterms or maxterms as given in problem.
3.For SOP put $1's$ in blocks of K-map respective to the minterms.
4.For POS put $0's$ in blocks of K-map respective to the maxterms.
5.Make rectangular groups containing total terms in power of two like 2,4,8 ..(except 1) and try to cover as many elements as you can in one group.
6.From the groups made in step 5 find the product terms and sum them up for SOP form.

XY \ ZW	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	1
10	0	0	1	1

XY \ ZW	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	1
10	0	0	1	1

Minterm-1: $\overline{XZ}$

XY \ ZW	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	1
10	0	0	1	1

Minterm-2: $\overline{Y}$Z

XY \ ZW	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	1
10	0	0	1	1

Minterm-3: XZ$\overline{W}$

XY \ ZW	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	1
10	0	0	1	1

Expression: $\overline{XZ}$+$\overline{Y}$Z+XZ$\overline{W}$

Truth table for the boolean expression $\overline{XZ}$+$\overline{Y}$Z+XZ$\overline{W}$ is given below:

X	Y	Z	W	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

The above truth table can be verified in arm.
1.consider any 4 digital pins as inputs and take different combinations of 4 bit input.
2.Make one of the digitalpins of the arm as output.
3. Connect LED to the output pin
4. The connections are given in the table below:

Arm pins	Input	output
2	+vcc/gnd	-
3	+vcc/gnd	-
4	+vcc/gnd	-
5	+vcc/gnd	-
8	-	LED

5. download the code from the link below and upload into the arm
Github link: Arm.