DIGITAL ELECTRONICS:

K-MAP

SNS COLLEGE OF ENGINEERING

Kurumbapalayam (PO), Coimbatore – 641 107

An Autonomous Institution

Accredited by NAAC – UGC with 'A' Grade

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

INTRODUCTION TO K-MAP

Dr.G.Arthy
Assistant Professor
Department of EEE
SNS College of Engineering

K-MAP

The complexity of the digital logic gates that implement a Boolean function is directly related to the complexity of the algebraic expression from which the function is implemented.

A map method provides a simple, straight forward procedure for minimizing Boolean functions.

This method may be regarded as a pictorial form of a truth table. The map method is also known as the **Karnaugh map or K-map.**

K-MAP

K-map can take two forms:

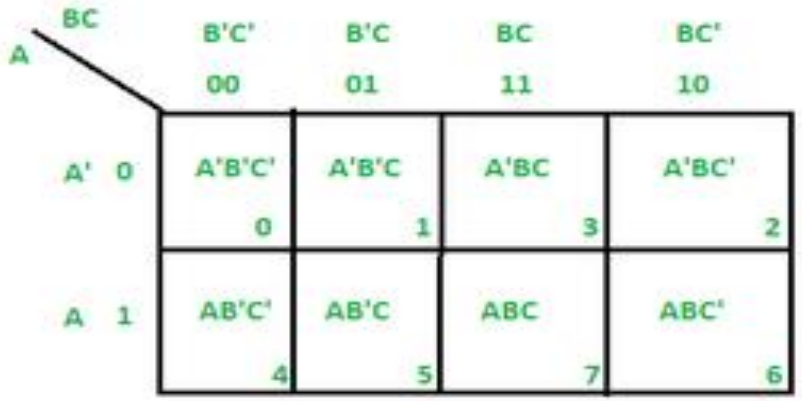
Sum of product (SOP)
Product of Sum (POS)

Steps to Solve Expression using K-map

- Select the K-map according to the number of variables.
- Identify minterms or maxterms as given in the problem.
- For SOP put 1's in blocks of K-map respective to the minterms (0's elsewhere).
- For POS put 0's in blocks of K-map respective to the max terms (1's elsewhere).
- 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.
- From the groups made in step 5 find the product terms and sum them up for SOP form.

SOP FORM K-MAP

1. K-map of 3 variables

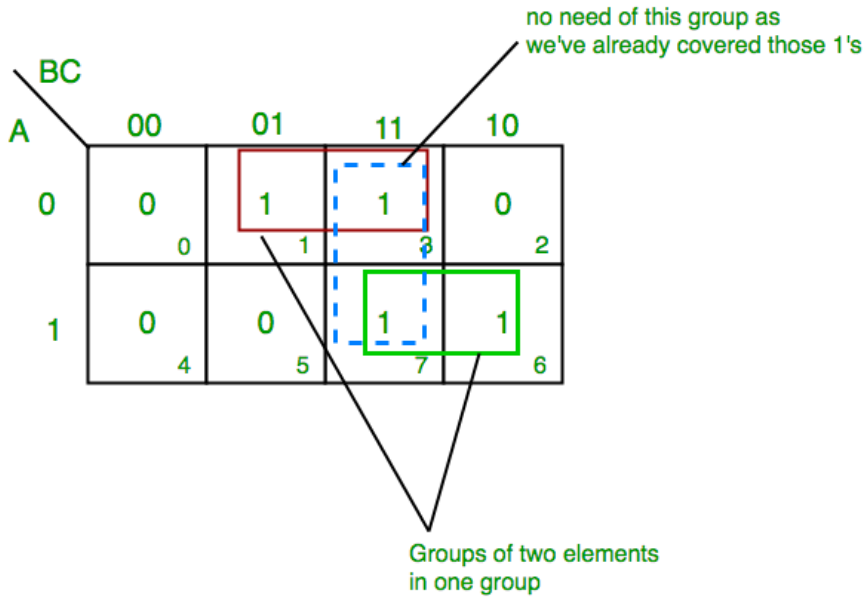


SOP(MINTERMS)

8 Blocks = 1
4 Blocks = 1 variable term
2 Blocks = 2 variable term
1 Block = 3 variable term

K-map of 3 variables

$F(A,B,C)=\Sigma(1,3,6,7)$

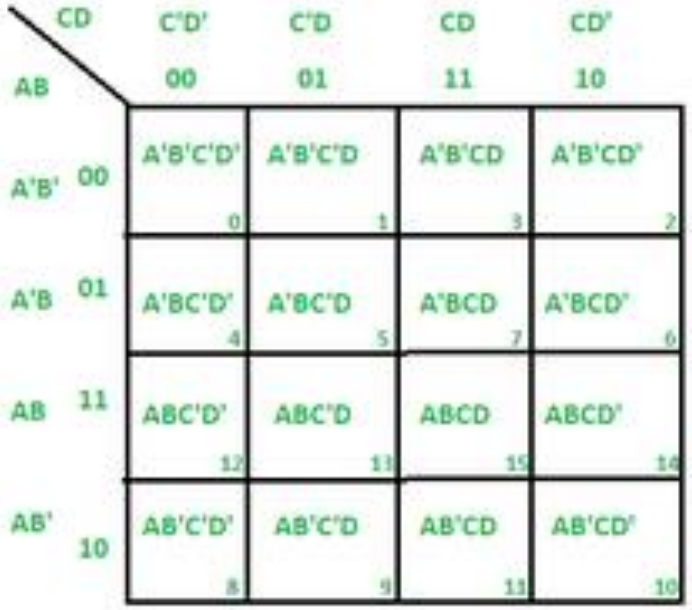


From red group we get product term— A'C
From green group we get product term— AB

Summing these product terms we get- Final expression (A'C+AB)

F= A'C+AB

K-map for 4 variables

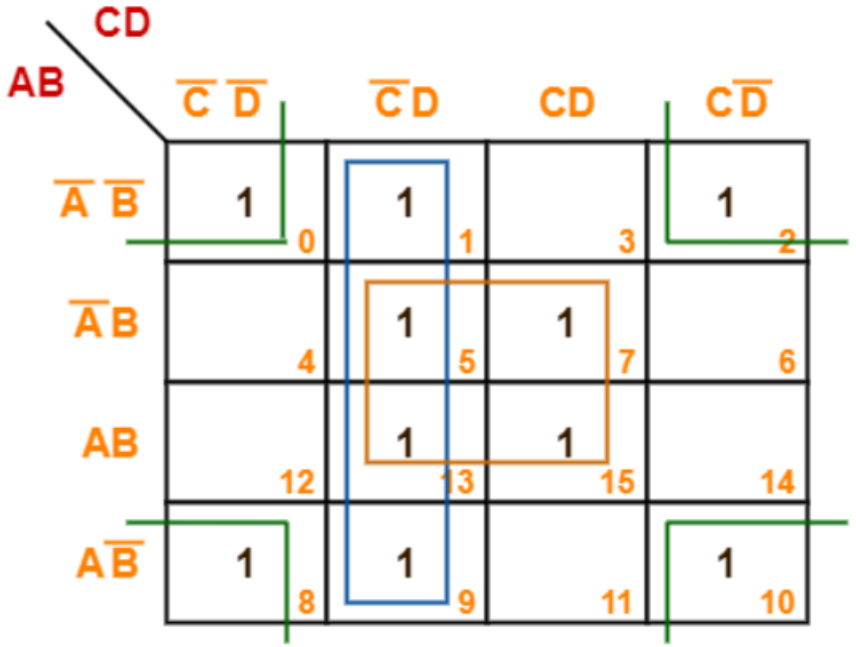


SOP(MINTERMS)

16 Blocks = 1
8 Blocks = 1 variable term
4 Blocks = 2 variable term
2 Blocks = 3 variable term
1 Block = 4 variable term

K-map of 4 variables

$F(A, B, C, D) = \Sigma m(0, 1, 2, 5, 7, 8, 9, 10, 13, 15)$



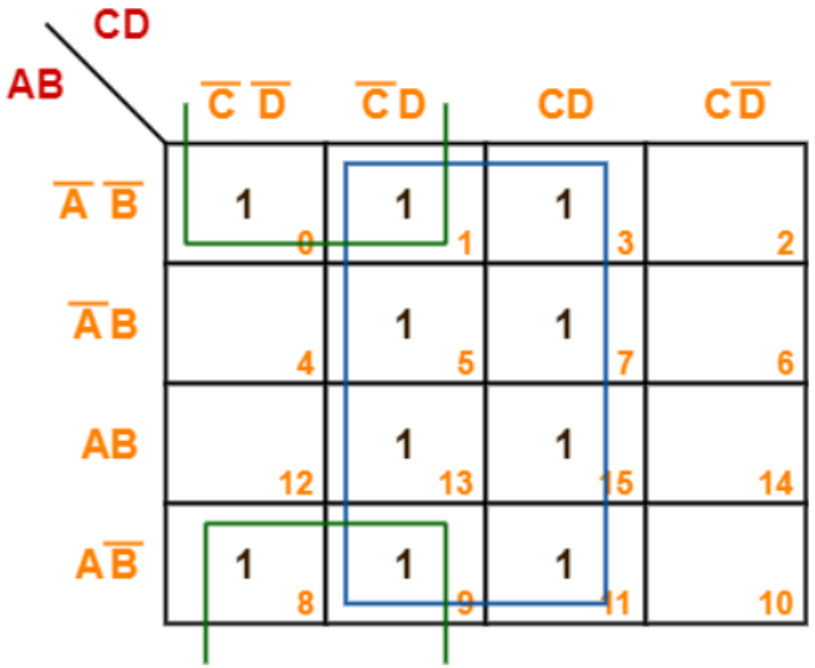
F(A, B, C, D)
= (A'B + AB)(C'D + CD) + (A'B' + A'B + AB + AB')C'D
+ (A'B' + AB')(C'D' + CD')
= BD + C'D + B'D'

Thus, minimized boolean expression is-

F(A, B, C, D) = BD + C'D + B'D'

K-map of 4 variables

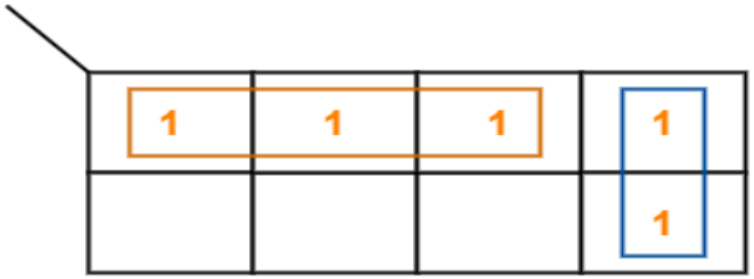
$F(A, B, C, D) = \Sigma m(0, 1, 3, 5, 7, 8, 9, 11, 13, 15)$



Minimized boolean expression is:

F(A, B, C, D) = B'C' + D

WRONG PRACTICES IN GROUPING



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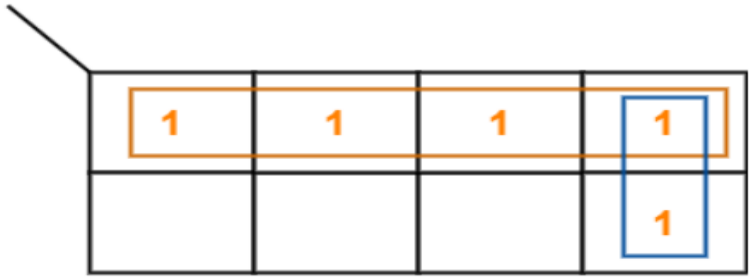

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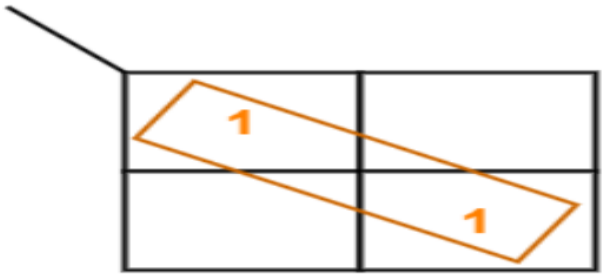

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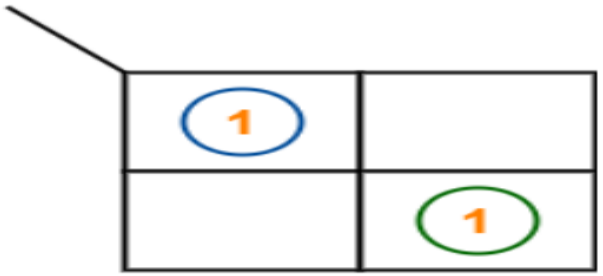

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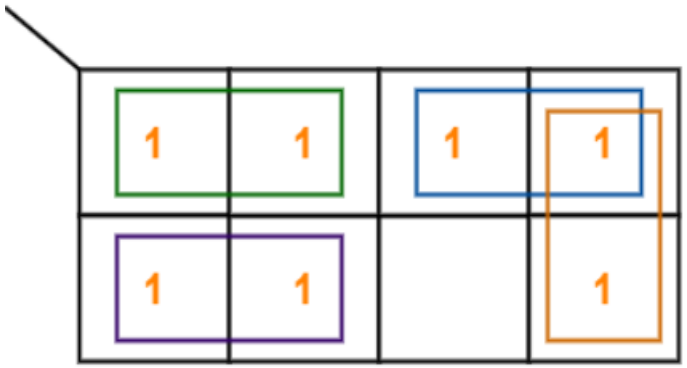

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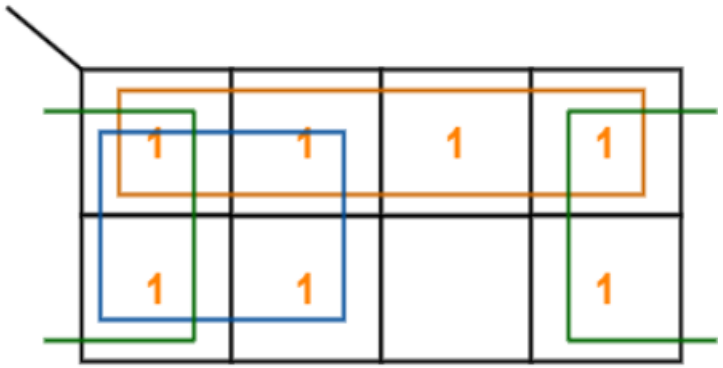

Correct

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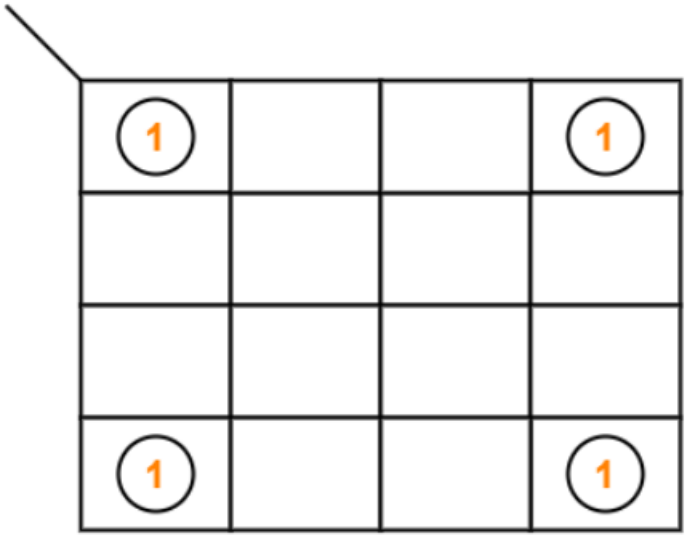

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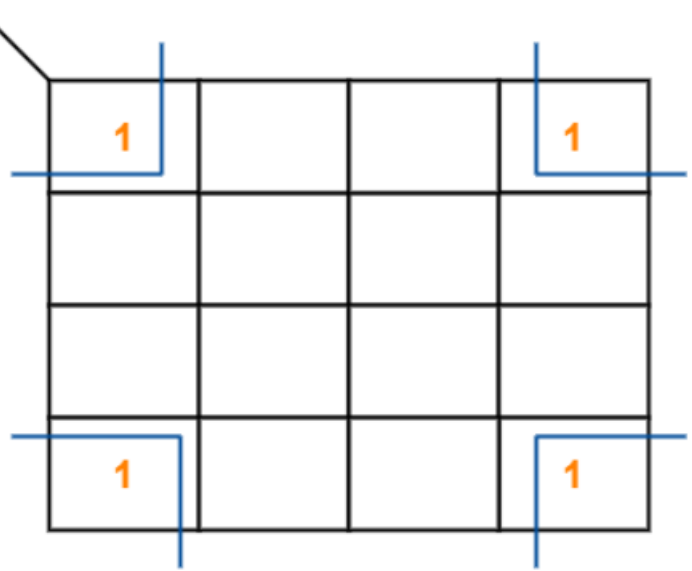

Correct

Assessment

1. What is the necessity of K-Map?

2. Mention few methods used to minimize Boolean Expression?


Thank
you