E-content of MSc Semester II Electronics – Unit 4

KARNAUGH MAP

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Karnaugh Map (K-map) –

The K-map is a graphical representation that provides a systematic method for simplifying the Boolean expression

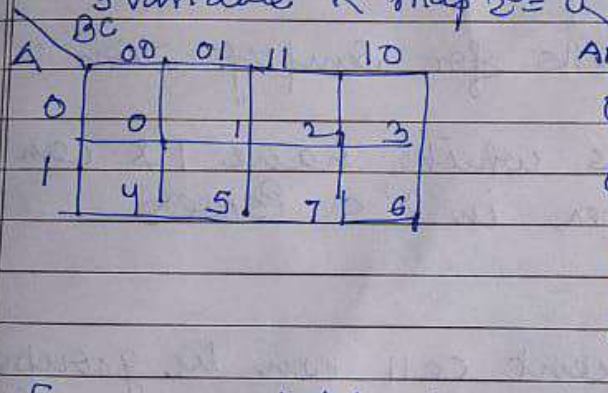
Two variable K-map

For n variable K-map 2^n cells are required. Therefore for 2-variable K-map $2^2 = 4$ cells will be required

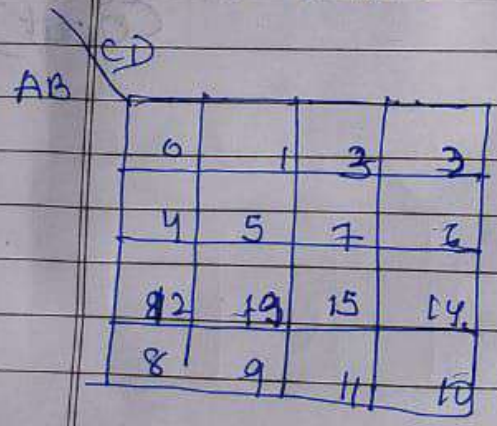
Three variable K-map

cells are required

3 variable K map $2^3 = 8$ cells are required



Four variable K-map – $2^4 = 16$ cells are required

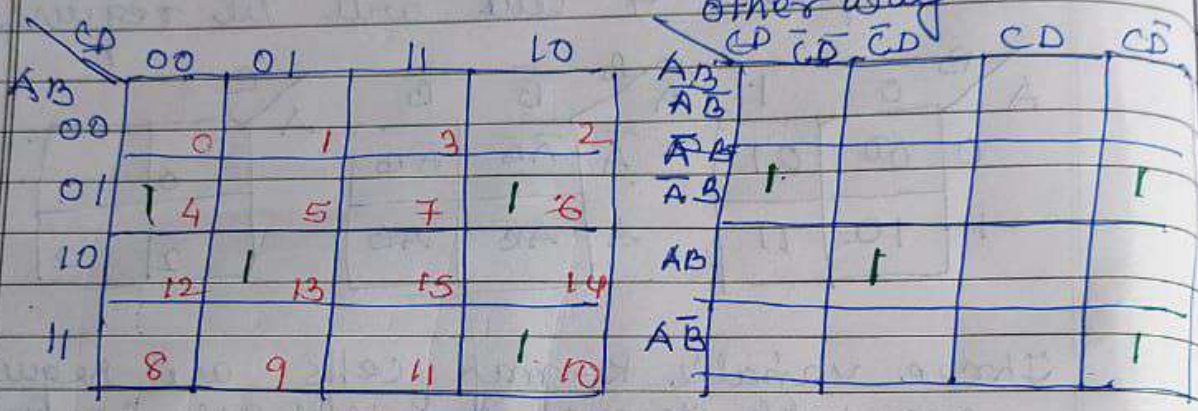


Q Plot the Boolean expression

$Y = \bar{A}B\bar{C}\bar{D} + A\bar{B}CD + \bar{A}BC\bar{D} + AB\bar{C}D$ — SOP form

$Y = \underset{0100}{m_4} \quad \underset{1010}{m_{10}} \quad \underset{0110}{m_6} \quad \underset{1101}{m_{13}}$

$Y = \Sigma m(4, 6, 10, 13)$



Grouping of cells for Simplification

→ Adjacent cells which have 1's can be grouped together in 2's Power.

i.e $2^0 = 1$

$2^1 = 2$ adjacent cell can be grouped (Pair)

$2^2 = 4$ " " " " (Quad)

8 (Octat)

16

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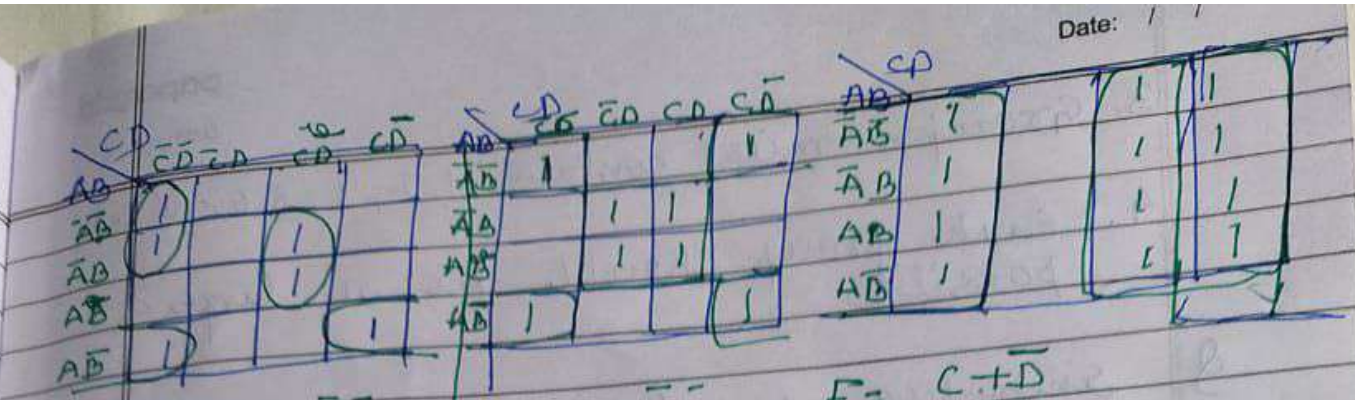


$(\bar{A}\bar{B} + \bar{A}B) \cdot C\bar{D}$

$\bar{A}(\bar{B} + B) \cdot C\bar{D}$

$\bar{A}C\bar{D}$, BCD , $A\bar{B}\bar{D}$

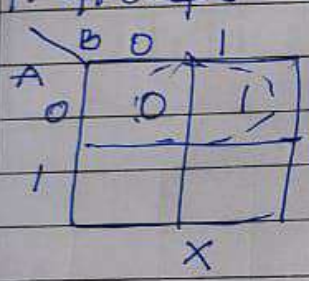
$F = \bar{A}C\bar{D} + BCD + A\bar{B}\bar{D}$

$f = B\bar{D} + \bar{B}\bar{D}$

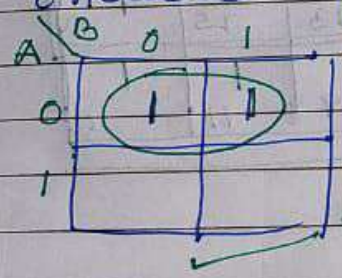
$F = C + \bar{D}$

Rules followed for K-map simplification

1. Groups donot include any cell containing a zero

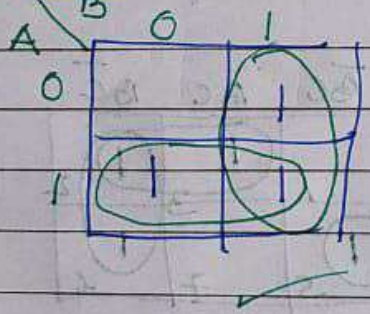


X



2. Groups may be horizontal or vertical but not digonal

X



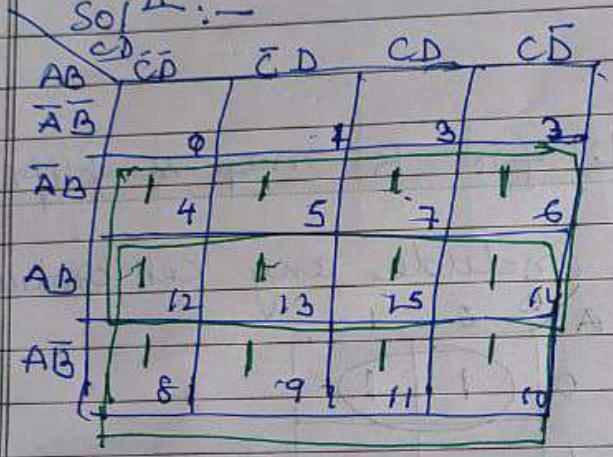
3. Groups must contain 1, 2, 4, 8 or 2^n cells

4. Each group should be as large as possible.

Q Simplify the following expression using K-map

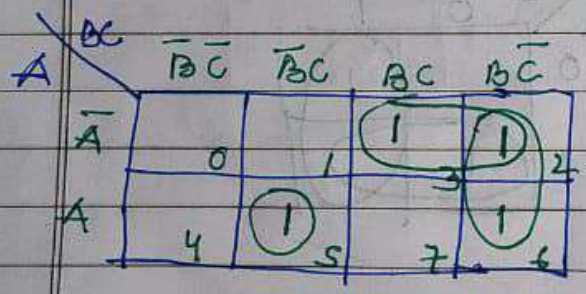
$F(ABCD) = \sum m[4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15)$

Sol^n :-



$F = B + A$

Simplify $F(ABC) = \bar{A}BC + B\bar{C} + AB\bar{C} + A\bar{B}C$ in SOP form and POS form



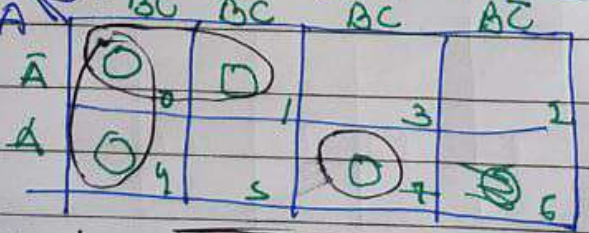
$F = \sum m(2, 3, 5, 6)$

$F = B\bar{C} + \bar{A}B + A\bar{B}C$

SOP form.

POS

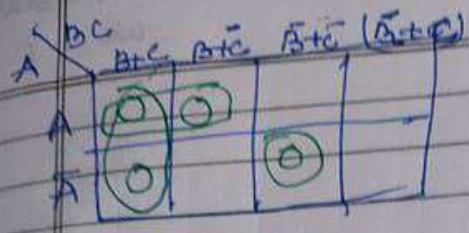
$F = \prod M(0, 1, 4, 7)$



$\bar{F} = \bar{B}\bar{C} + \bar{A}\bar{B} + ABC$

$F = \overline{\bar{B}\bar{C} + \bar{A}\bar{B} + ABC}$

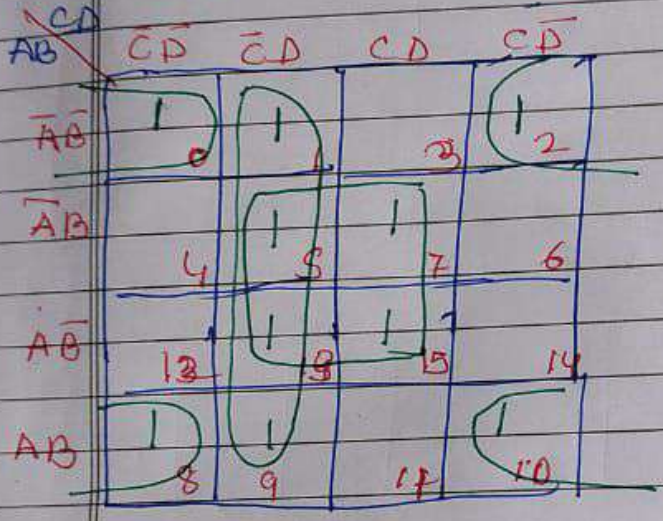
$F = (B+C)\,(A+B)\cdot(\bar{A}\bar{B}\bar{C})$



$F = (B+C).(A+B)(\bar{A}+\bar{B}+\bar{C})$

Q Obtain Reduce Expression for

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



$F = BD + \bar{C}D + \bar{B}\bar{D}$

——— X ———