SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB231 – DIGITAL ELECTRONICS

II YEAR/ III SEMESTER

UNIT 1 – MINIMIZATION TECHNIQUES AND LOGIC GATES

TOPIC 7- QUINE- MC CLUSKEY METHOD OF MINIMIZATION

➢ k map is difficult to simplify the Boolean functions having more than 5 variables.

➢ Quine-Mc Cluskey tabular method is a tabular method based on the concept of prime implicants.

Prime Implicants(PI)

➢Group of minterms which cannot be combined with any other minterms or groups**.**

Essential Prime implicants (EPI)

➢The essential prime implicant is a prime implicant in which one or more minterms are unique.

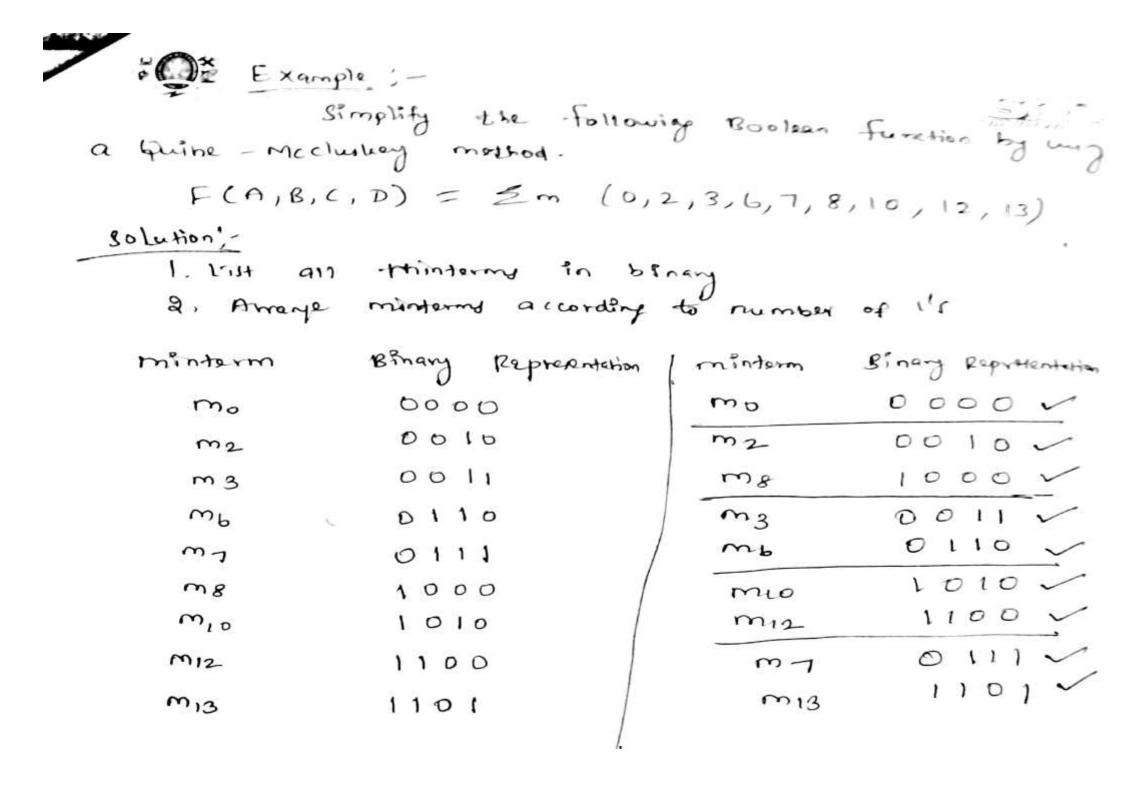➢Contains atleast one minterm which is not contained in any other.

PROCEDURE:

1. List all minterms in the binary form.

2. Arrange all the minterms accordingly to number of one's contained and from the groups having no one's, one 1's, two 1's, three 1's and so on.

3. Compare each binary numbers with every group in the adjacent next higher category group and they differ only one bit position.

4. Apply the same process described in step 3 for the resultant coulmn and continue the cycles until a single pass through cycle yields further elimination of literals.

5. List all prime Implicants.

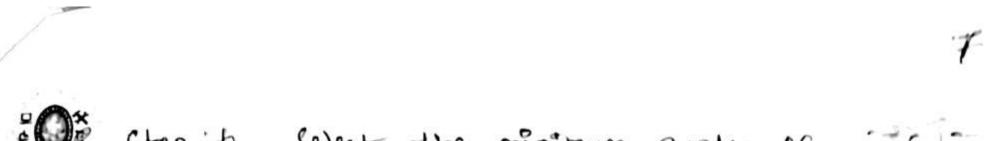6. Select the minimum number of prime implicants which must cover all the minterms.

Example :—

Simplify the following Boolean function by using a Quine – McCluskey method.

$$F(A, B, C, D) = \Sigma m \ (0, 2, 3, 6, 7, 8, 10, 12, 13)$$

Solution :—

1. List all minterms in binary
2. Arrange minterms according to number of 1's

minterm	Binary Representation		minterm	Binary Representation
m_0	0 0 0 0		m_0	0 0 0 0 ✓
m_2	0 0 1 0		m_2	0 0 1 0 ✓
m_3	0 0 1 1		m_8	1 0 0 0 ✓
m_6	0 1 1 0		m_3	0 0 1 1 ✓
m_7	0 1 1 1		m_6	0 1 1 0 ✓
m_8	1 0 0 0		m_{10}	1 0 1 0 ✓
m_{10}	1 0 1 0		m_{12}	1 1 0 0 ✓
m_{12}	1 1 0 0		m_7	0 1 1 1 ✓
m_{13}	1 1 0 1		m_{13}	1 1 0 1 ✓

Step 3 & 4

Column (C)

Mintorm	Binary Representation
0, 2	00 _ 0 ✓
0, 8	_ 000 ✓
2, 3	001 _ ✓
2, 6	0 _ 10 ✓
2, 10	_ 010 ✓
8, 10	10 _ 0 ✓
8, 12	1 _ 00
3, 7	0 _ 11 ✓
6, 7	011 _ ✓
12, 13	110 _

Column (D)

minterms	Binary Repres
0, 2, 8, 10	← 0 _ 0
2, 3, 6, 7	0 _ 1 _

Step 5 List the prime Implicants

prime Implicants		Binary Representation
$A\bar{C}\bar{D}$	8, 12	1 — 0 0
$AB\bar{C}$	12, 13	1 1 0 —
$B\bar{D}$	0, 2, 8, 10	— 0 — 0
AC	2, 3, 6, 7	0 — 1 —

Step:6 Select the minimum number of prime implicants which must cover all the minterms

Prime Implicants		m_0	m_2	m_3	m_6	m_7	m_8	m_{10}	m_{12}	m_{13}
$A\bar{C}\bar{D}$	8, 12						⊙		⊙	
$AB\bar{C}$	12, 13 ✓								⊙	⊙
$\bar{B}\bar{D}$	✓ 0, 2, 8, 10	⊙	⊙				⊙	⊙		
$\bar{A}C$	✓ 2, 3, 6, 7		⊙	⊙	⊙	⊙				

$$f(A, B, C, D) = (110\_) + (\_0\_0) + (0\_1\_)$$

$$= AB\bar{C} + \bar{B}\bar{D} + \bar{A}C$$

- It is more efficient for use in computer algorithms
- It also gives a deterministic way to check that the minimal form of a boolean function has been reached

1. What is the another name for Quine Mc Cluskey method?

2. The starting point of the tabulation method that specifies the function is the----

3. Unchecked terms in the table forms are----------

4. What is the first tabulation method?

5. State Prime Implicants.

THANK YOU