SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++'(III CYCLE) Grade

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB201 – DIGITAL SYSTEMS DESIGN

II YEAR/ III SEMESTER

UNIT I –BOOLEAN THEOREMS AND LOGIC REDUCTION

TOPIC – TABULATION METHOD

QUINE – MCCLUSKEY METHOD

- The quine-McCluskey method also called the **tabulation method** is a very useful and convenient method for simplification of the Boolean functions for a large number of variables.
- This method is useful over K-Map when the number of variables is larger for which K-map formation is difficult. This method uses prime implicants for simplification.

QUINE – MCCLUSKEY METHOD

- We make a prime implicant table which is used to obtain essential prime implicants which are present in the simplified boolean expression.
- It is a suitable method for a large number of input variables which can be easily solved by this method but the computation complexity is high.
- Majorly, this method includes the use of minterms and prime implicants and obtains essential prime implicants which are further used in the simplified boolean functions.

QUINE MCCLUSKEY METHOD

- Quine Mc-Cluskey method also known as the tabulation method is used to minimize the Boolean functions. It simplifies boolean expression into the simplified form using prime implicants. This method is convenient to simplify boolean expressions with more than 4 input variables.

Terminologies:

Implicant: Implicant is defined as a group of 1's(for minterm).

Prime implicant: It is the largest possible group of 1's(for minterm).

Essential Prime implicant: Essential prime implicants are groups that cover at least one minterm which cannot be covered by other applicants.

STEPS FOR QUINE MCCLUSKEY METHOD

- Arrange the given minterms according to the number of ones present in their binary representation in ascending order.
- Take the minterms from the continuous group if there is only a one-bit change to make their pair.
- Place the '-' symbol where there is a bit change accordingly and keep the remaining bits the same.
- Repeat steps 2 to 3 until we get all prime implicants (when all the bits present in the table are different).

STEPS FOR QUINE MCCLUSKEY METHOD

- Make a prime implicant table that consists of the prime implicants (obtained minterms) as rows and the given minterms (given in problem) as columns.
- Place ‘1’ in the minterms (cell) which are covered by each prime implicant.
- Observe the table, if the minterm is covered by only one prime implicant then it is an essential to prime implicant.
- Add the essential prime implicants to the simplified boolean function.

QUINE MCCLUSKEY METHOD PROBLEMS

Example: Simplify using tabulation method: F(A,B,C,D) =∑ m(0,1,2,4,6,8,9,11,13,15)

Step 1: Convert the given minterms into their binary representation and arrange them according to the number of ones present in the binary representation.

TABLE 1

Group	Minterm	A	B	C	D
0	0	0	0	0	0
1	1	0	0	0	1
	2	0	0	1	0
	4	0	1	0	0
	8	1	0	0	0
2	6	0	1	1	0
	9	1	0	0	1
3	11	1	0	1	1
	13	1	1	0	1
4	15	1	1	1	1

QUINE MCCLUSKEY METHOD PROBLEMS

Step 2: 2 Cell Combinations

TABLE-2

Group	Pair	A	B	C	D
0	(0,1)	0	0	0	–
	(0,2)	0	0	–	0
	(0,4)	0	–	0	0
	(0,8)	–	0	0	0
1	(1,9)	–	0	0	1
	(2,6)	0	–	1	0
	(4,6)	0	1	–	0
	(8,9)	1	0	0	–
2	(9,11)	1	0	–	1
	(9,13)	1	–	0	1
3	(11,15)	1	–	1	1
	(13,15)	1	1	–	1

QUINE MCCLUSKEY METHOD PROBLEMS

Step 3: 4 Cell Combinations

TABLE-3					
Group	Quad	A	B	C	D
0	(0,1,8,9)	–	0	0	–
	(0,2,4,6)	0	–	–	0
1	(9,11,13,15)	1	–	–	1

QUINE MCCLUSKEY METHOD PROBLEMS

Step 4: Prime Implicant Table

PRIME IMPLICANT TABLE										
Minterms →	0	1	2	4	6	8	9	11	13	15
Prime Implicants ↓										
B'C' (0,1,8,9)	1	1				1	1			
A'D'(0,2,4,6)	1		1	1	1					
AD(9,11,13,15)							1	1	1	1
Simplified Boolean function = B'C' + A'D' + AD										

ASSESSMENT

1. The quine-McCluskey method also called the ---------- is a very useful and convenient method for simplification of the Boolean functions for a large number of variables.
2. Tabulation method uses ---------- for simplification.
3. List the terminologies of Quine Mc-Cluskey Method.
4. ---------- is defined as a group of 1's(for minterm).
5. Define Essential Prime Implicant.
6. ---------- is the largest possible group of 1's(for minterm)

THANK YOU