

Quine-McCluskey minimization Technique

(Tabular Method)

- ↳ Solving large input where (6 variables) where K-map, Boolean Algebra
- ↳ very complex digital electronics solved here
- ↳ Prime Implicant :- largest possible no. of 1's
- ↳ Essential Prime Implicant.

Ex:- $Y(A, B, C, D) = \sum m(0, 1, 3, 7, 8, 9, 11, 15)$

Make binary equivalent of all minterms $0 \rightarrow$

A	B	C	D
0	0	0	0

Step 1:- Make a table with same no. of 1's

$0 \rightarrow 0000$ $8 \rightarrow 1000$
 $1 \rightarrow 0001$ $9 \rightarrow 1001$
 $3 \rightarrow 0011$ $11 \rightarrow 1011$
 $7 \rightarrow 0111$ $15 \rightarrow 1111$

Step 1:- Group		Min term	Binary Representati A B C D
✓ 0		m_0 ✓	0 0 0 0 ✓
✓ 1		m_1 ✓ m_8 ✓	0 0 0 1 ✓ 1 0 0 0 ✓
2		m_3 ✓ m_9 ✓	0 0 1 1 ✓ 1 0 0 1 ✓
3		m_7 ✓ m_{11} ✓	0 1 1 1 ✓ 1 0 1 1 ✓
4		m_{15} ✓	1 1 1 1 ✓

Step II:- Make another table

Group	(diff of only variable Matched Pair (compare nonti))	Binary Rep A B C D	
0	$m_0 - m_1$ $m_0 - m_8$	0 0 0 - - 0 0 0	✓ ✓
1	$m_1 - m_3$ $m_1 - m_9$ $m_8 - m_9$	0 0 - 1 - 0 0 1 1 0 0 -	✓ ✓ ✓
2	$m_3 - m_7$ $m_3 - m_{11}$ $m_9 - m_{11}$	0 - 1 1 - 0 1 1 1 0 - 1	✓ ✓ ✓
3	$m_7 - m_{15}$ $m_{11} - m_{15}$	- 1 1 1 1 - 1 1	✓ ✓

Step III

Group	Matched Pairs	Binary Rep A B C D	
0	$m_0 - m_1, m_8 - m_9$ $m_0 - m_8 - m_1 - m_9$	- 0 0 - - 0 0 -	$\bar{B}\bar{C}$
1	$m_1 - m_3, m_9 - m_{11}$ $m_1 - m_9 - m_3 - m_{11}$	- 0 - 1 - 0 - 1	$\bar{B}D$
2	$m_3 - m_7 - m_{11} - m_{15}$ $m_3 - m_{11} - m_7 - m_{15}$	- - 1 1 - - 1 1	CD

PI

Step IV

Prime Implicant Table :- which help to get essential P.I

P. I	Minterm involved	0	1	3	7	8	9	11	15
$\overline{B}\overline{C}$	m_0, m_1, m_8, m_9	(X)	X			(X)	X		
$\overline{B}D$	m_1, m_3, m_9, m_{11}		X	X			X	X	
CD	m_3, m_7, m_{11}, m_{15}			X	(X)			X	(X)

$$\overline{B}\overline{C} + CD$$

	CD	00	01	11	10
AB	00	1	1	1	1
	01	1	1	1	1
	11	1	1	1	1
	10	1	1	1	1

$$Y = CD + \overline{B}\overline{C}$$

Q $F(a, b, c, d) = \sum(0, 5, 8, 9, 10, 11, 14, 15)$

Soln:-

$0 \rightarrow 0000$

$10 \rightarrow 1010$

$5 \rightarrow 0101$

$11 \rightarrow 1011$

$8 \rightarrow 1000$

$14 \rightarrow 1100$

$9 \rightarrow 1001$

$15 \rightarrow 1111$

Step 1:-

Group	Minterm	Binary Representation A B C D
0	m_0	0 0 0 0 ✓
1	m_8	1 0 0 0 ✓
2	m_5 m_9 m_{10}	0 1 0 1 ✗ 1 0 0 1 ✓ 1 0 1 0 ✓
3	m_{11} m_{14}	1 0 1 1 ✓ 1 1 1 0 ✓
4	m_{15}	1 1 1 1 ✓

Step II

Group	Matched Minterm	Binary Rep A B C D
0	m_0, m_8	- 0 0 0 \otimes
1	m_8, m_9 m_8, m_{10}	1 0 0 - ✓ 1 0 - 0 ✓
2	m_9, m_{11} m_{10}, m_{11} m_{10}, m_{14}	1 0 - 1 ✓ 1 0 1 - ✓ 1 - 1 0 ✓
3	m_{11}, m_{15} m_{14}, m_{15}	1 - 1 1 ✓ 1 1 1 - ✓

Step III

Group	Matched Minterm	Binary Rep A B C D
0	m_8, m_9, m_{10}, m_{11} m_8, m_{10}, m_9, m_{11}	1 0 - - $\overline{A}\overline{B}$ 1 0 - - $\overline{A}\overline{B}$
1	$m_{10}, m_{11}, m_{14}, m_{15}$ $m_{10}, m_{14}, m_{11}, m_{15}$	1 - 1 - $\overline{A}C$ 1 - 1 - $\overline{A}C$
	m_8, m_9 m_{15}	- 0 0 0 $\overline{B}\overline{C}\overline{D}$ 0 1 0 1 $\overline{A}B\overline{C}D$

PI

Essential PI

PI	Minterm Involved	0	5	8	9	10	11	14	15
8, 9, 10, 11				X	(X)	X	X		
10, 11, 14, 15						X	X	(X)	(X)
0, 8		(X)		X					
5			(X)						

$$= AB' + AC + \overline{B}\overline{C}\overline{D} + \overline{A}B\overline{C}\overline{D}$$