

Q-M (Quine-Mc Clusky method) or Tabular Method:

Kmaps limited upto 6-var.

VEM " " 8-var

QM \rightarrow can be used for larger no. of var's

\rightarrow more systematic

\rightarrow suitable for hand computation & computation by machines i.e. it is programmable.

Steps:-

- ① List all minterms and arrange them accordingly in groups of same no. of 1's in binary representation in ascending order.

No. of 1's in a term is called Index/Weight.

eg: $(4)_{10} = (0100)_2 \Rightarrow \text{Index} = 1$

$(5)_{10} = (0101)_2 \Rightarrow \text{Index} = 2$ & so on...

- ② compare each term in lower index group with succeeding term in higher index group & check if they are adjacent or not (i.e. when terms differ in only 1 bit in same position) Replace that var by a dash (-).

- ③ Place a check (✓) or tick mark to every term which has been combined & move to make larger groups, i.e. first making pairs, then quads, octet ... until no further combination is possible.

eg:

Decimal	Binary	Index		Pair	Binary	Index
0	✓ 0000	0	\Rightarrow	(0,1)	000-	0
1	✓ 0001	1		(0,2)	00-0	
2	✓ 0010			(1,2)	00-1	1
3	✓ 0011	2		(1,3)	001-	
					↓	
					so on...	

- ④ List of all unchecked terms are Set of PI and make a PI chart (Don't cares are not considered).
- ⑤ obtain Essential PI by identifying PI which have atleast one unique minterm.
- ⑥ Write the reduced expression.

Obtain set of PI for boolean fn as :

$f = \sum m(0, 1, 6, 7, 8, 9, 13, 14, 15)$ using tabular method.

⇒ Arrange all minterms in ascending order of index
i.e. no. of 1's in binary form.

Index	Minterm	Binary	Pair	Var's A B C D	Quad A B C D
0	✓0	0000	(0,1)✓	000-	(0,1,8,9)✓-00-
1	✓1	0001	(0,1)✓	-000	
	✓8	1000	(1,9)✓	0000	
2	✓6	0110	(8,9)✓	100-	⇒ (6,7,14,15)✓-11-
	✓9	1001	(6,7)✓	011-	
3	✓7	0111	(6,14)✓	-110	
	✓13	1101	(9,13)Ⓢ	1-01	
	✓14	1110	(7,15)✓	-111	
4	✓15	1111	(13,15)Ⓡ	11-1	
			(14,15)✓	111-	

4 PI → P, Q, R, S

PI chart

Set of PI	0	1	6	7	8	9	13	14	15
✓ P(0,1,8,9)	ⓧ	ⓧ			ⓧ	X			
✓ Q(6,7,14,15)			ⓧ	ⓧ				ⓧ	X
R(13,15)							X		X
S(9,13)						X	X		

Identify columns which have single 'X' and mark those PI as Essential PI.

P(0,1,8,9) & Q(6,7,14,15) are Essential PI
minterm '13' ~~is covered~~ can be covered by either R or S

∴ R(13,15) & S(9,13) are selective PI

∴ It has 2 possible answers:

$f = P + Q + R$

or $f = P + Q + S$

$f = \overline{B}\overline{C} + BC + ABD$

or $f = \overline{B}\overline{C} + BC + A\overline{C}D$

(3)

obtain minimal expression for:

$$f = \sum m(6, 7, 8, 9) + d(10, 11, 12, 13, 14, 15)$$

Index	Minterms	Pairs	Quads
0		✓ (8, 9) (1)	✓ (8, 9, 10, 11) (2, 1)
1	✓ 8	✓ (8, 10) (2)	✓ (8, 9, 12, 13) (4, 1)
2	✓ 6 ✓ 9 ✓ *10 ✓ *12	✓ (8, 12) (4) ✓ (6, 7) (1) ✓ (6, 14) (8) ✓ (9, 11) (2)	✓ (8, 10, 12, 14) (4, 2) <u>Q</u> (6, 7, 14, 15) (8, 1)
3	✓ 7 ✓ *11 ✓ *13 ✓ *14	✓ (9, 13) (4) ✓ (*10, *11) (1) ✓ (*10, *14) (4) ✓ (*12, *13) (1)	✓ (9, 11, 13, 15) (4, 2) ✓ (10, 11, 14, 15) (4, 1)
4	✓ *15	✓ (*12, *14) (2) ✓ (*12, *15) (8) ✓ (*11, *15) (4) ✓ (*13, *15) (2) ✓ (*14, *15) (1)	✓ (12, 13, 14, 15) (2, 1)

$$P = \overbrace{(8, 9, 10, 11, 12, 13, 14, 15)}^{(4, 2, 1)} \Rightarrow A - - -$$

$$PI \rightarrow P \& Q$$

$$Q(6, 7, 14, 15) (8, 1)$$

$$\begin{array}{cccc} 8 & 4 & 2 & 1 \\ - & 1 & 1 & - \end{array}$$

PI Chart

	6	7	8	9
$P(8, 9, 10, 11, 12, 13, 14, 15)$			X	X
$Q(6, 7, 14, 15)$	X	X		

Both are Essential PI.

$$\therefore f = P + Q$$

$$\boxed{f = A + BC} \quad \text{Ans}$$