

# Quine McCluskey Tabular Method

Based on complementation theorem

$$X.Y + X.\overline{Y} = X$$

**X** represents either a **variable** or a **term** or an **expression** and **Y** is a **variable**

## Method

- Group and arrange the minterms in ascending order based on the number of 1's in them
- Compare every pair of minterm (minterms from consecutive groups should be compared)
  - combine a pair only if one variable differ
  - reduce comparison by grouping
  - remove redundant pair, if any
- Repeat the process for the new stage till no more stage can be created

# Quine McCluskey Method - Example

**Example:**  $F(a,b,c,d) = \sum(0,1,2,5,6,7,8,9,10,14)$

- Group 0

- 0          0000

- Group 1

- 1          0001
- 2          0010
- 8          1000

- Group 2

- 5          0101
- 6          0110
- 9          1001
- 10         1010

- Group 3

- 7          0111
- 14         1110

# Quine McCluskey Method - Example

## Prime Implicant Table:

Stage 1		Stage 2		Stage 3	
0	0000	0,1	000-	0,1,8,9	-00-
1	0001	0,2	00-0	0,2,8,10	-0-0
2	0010	0,8	-000	0,8,1,9	-00-
8	1000	1,5	0-01	0,8,2,10	-0-0
5	0101	1,9	-001	2,6,10,14	--10
6	0110	2,6	0-10	2,10,6,14	--10
9	1001	2,10	-010		
10	1010	8,9	100-		
7	0111	8,10	10-0		
14	1110	5,7	01-1		
		6,7	011-		
		6,14	-110		
		10,14	1-10		

# Quine McCluskey Method - Example

## Prime Implicant Chart: Covering phase

Prime Implicant		0	1	2	5	6	7	8	9	10	14
0,1,8,9	b'c'	X	X					X	X		
0,2,8,10	b'd'	X		X				X		X	
2,6,10,14	cd'			X		X				X	X
1,5	a'c'd		X		X						
5,7	a'bd				X		X				
6,7	a'bc					X	X				

$$F = b'c' + cd' + a'bd$$

# Cyclic dependencies

$$F(a,b,c) = \sum m(0,1,2,5,6,7)$$

			0	1	2	5	6	7
$P_1$	(0,1)	$a'b'$	x	x				
$P_2$	(0,2)	$a'c'$	x		x			
$P_3$	(1,5)	$b'c$		x		x		
$P_4$	(2,6)	$bc'$			x		x	
$P_5$	(5,7)	$ac$				x		x
$P_6$	(6,7)	$ab$					x	x

$$F = a'b' + bc' + ac$$

# Functions with don't cares

$$F(a, b, c, d) = \Sigma m(0, 1, 2, 8, 9, 20, 14) + \Sigma d(5, 6, 7)$$

[illegible]

## Practice:

1.  $f(a, b, c, d) = \Sigma m(1, 5, 7, 9, 11, 12, 14, 15)$
2.  $f(a, b, c, d) = \Sigma m(0, 1, 3, 5, 6, 7, 8, 10, 14, 15)$
3.  $f(a, b, c, d) = \Sigma m(1, 3, 4, 5, 6, 7, 10, 12, 13) + \Sigma d(2, 9, 15)$
4.  $f(a, b, c, d) = \Sigma m(9, 12, 13, 15) + \Sigma d(1, 4, 5, 7, 8, 11, 14)$