



**SNS COLLEGE OF ENGINEERING**  
**(Autonomous)**  
**DEPARTMENT OF CSE - IoT**



**COURSE NAME:19EC306 / DIGITAL CIRCUITS**  
**II YEAR/III SEMESTER**

**UNIT:1- MINIMIZATION TECHNIQUES AND LOGIC GATES**

**TOPIC: TABULATION METHOD USING QUINE MCKLUSKEY METHOD**



# Outline

- ❑ K-Map is systemic
- ❑ Require the ability to identify and visualize the prime implicants in order to cover all minterms
- ❑ But effective only up to 5-6 input variables!

## Quine-McCluskey Algorithm

- ❑ Tabular Method
  - Compute all prime implicants
  - Find a minimum expression for Boolean functions
- ❑ No visualization of prime implicants
- ❑ Can be programmed and implemented in a computer



# Example

$$F(W, X, Y, Z) = \sum m(0,3,5,6,7,10,12,13) + \sum d(2,9,15)$$

- Step 1 : Divide all the minterms (and don't cares) of a function into groups

**For Minterms:**

Minterm ID	W	X	Y	Z
0	0	0	0	0
3	0	0	1	1
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
10	1	0	1	0
12	1	1	0	0
13	1	1	0	1

**For don't cares:**

Minterm ID	W	X	Y	Z
2	0	0	1	0
9	1	0	0	1
15	1	1	1	1



- Step 1 : Divide all the minterms (and don't cares) of a function into groups

Groups	Minterm ID	W	X	Y	Z	Merge Mark
G0	0	0	0	0	0	
G1	2	0	0	1	0	
G2	3	0	0	1	1	
	5	0	1	0	1	
	6	0	1	1	0	
	9	1	0	0	1	
	10	1	0	1	0	
G3	12	1	1	0	0	
	7	0	1	1	1	
	13	1	1	0	1	
G4	15	1	1	1	1	



□ Step 3: Repeat step 2 until no more merging is possible

Groups	Minterm ID	W	X	Y	Z	Merge Mark
G0'	0, 2	0	0	d	0	
G1'	2, 3	0	0	1	d	<input checked="" type="checkbox"/>
	2, 6	0	d	1	0	<input checked="" type="checkbox"/>
	2, 10	d	0	1	0	
G2'	3, 7	0	d	1	1	<input checked="" type="checkbox"/>
	5, 7	0	1	d	1	<input checked="" type="checkbox"/>
	6, 7	0	1	1	d	<input checked="" type="checkbox"/>
	5, 13	d	1	0	1	<input checked="" type="checkbox"/>
	9, 13	1	d	0	1	
G3'	12, 13	1	1	0	d	
	7, 15	d	1	1	1	<input checked="" type="checkbox"/>
	13, 15	1	1	d	1	<input checked="" type="checkbox"/>

Groups	Minterm ID	W	X	Y	Z
G1''	2, 3, 6, 7	0	d	1	d
	2, 6, 3, 7	0	d	1	d
G2''	5, 7, 13, 15	d	1	d	1
	5, 7, 13, 15	d	1	d	1



- Step 3: Repeat step 2 until no more merging is possible

Groups	Minterm ID	W	X	Y	Z	Merge Mark
G0''	0, 2	0	0	d	0	
G1''	2, 3, 6, 7	0	d	1	d	
	2, 10	d	0	1	0	
G2''	5, 7, 13, 15	d	1	d	1	
	9, 13	1	d	0	1	
	12, 13	1	1	0	d	

**• No more merging possible!**



□ Step 4: Put all prime implicants in a cover table (don't cares excluded)

Minterm ID	$\bar{W} \bar{X} \bar{Z}$	$\bar{W} Y$	$\bar{X} Y \bar{Z}$	$X Z$	$W X \bar{Y}$	$W \bar{Y} Z$
0	1					
3		1				
5				1		
6		1				
7		1		1		
10			1			
12					1	
13				1	1	1

Need not include don't cares



- ❖ Step 5: Identify essential minterms, and hence essential prime implicants

Minterm ID	$\bar{W} \bar{X} \bar{Z}$	$\bar{W} Y$	$\bar{X} Y \bar{Z}$	$X Z$	$W X \bar{Y}$	$W \bar{Y} Z$
0	1					
3		1				
5				1		
6		1				
7		1		1		
10			1			
12					1	
13				1	1	1





# Outline

- ❖ Step 6: Add prime implicants to the minimum expression of  $F$  until all minterms of  $F$  are covered

Minterm ID	$\bar{W} \bar{X} \bar{Z}$	$\bar{W} Y$	$\bar{X} Y \bar{Z}$	$X Z$	$W X \bar{Y}$	$W \bar{Y} Z$
0	1					
3		1				
5				1		
6		1				
7		1		1		
10			1			
12					1	
13				1	1	1

**Already cover all minterms!**



$$F(W, X, Y, Z) = \sum m(0,3,5,6,7,10,12,13) + \sum d(2,9,15)$$

- So after simplification through QM method, a minimum expression for  $F(W, X, Y, Z)$  is:

$$F(W, X, Y, Z) = \overline{W}\overline{X}\overline{Z} + \overline{W}Y + \overline{X}Y\overline{Z} + XZ + WX\overline{Y}$$



*Thank  
you*