Quine-McCluskey/ Tabulation Method

Two parts of Tabulation Method

1. Determination of prime implicants
2. Selection of prime implicants

Example: Simplify the following Boolean function by using the tabulation method:

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

Solution:

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

$= \sum (0000,0001,0010,0101,0110,0111,$

$1000,1001,1010,1110)$

Implicant Chart

	Column I		Column II	Column III
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		

Solution:
Step 1:Determination of prime implicants:

	Column I			Column II		Column III
Group 0	0	0000	✓	0,1 0,2 0,8	000- 00-0 -000	
Group 1	1 2 8	0001 0010 1000	✓ ✓ ✓			
Group 2	5 6 9 10	0101 0110 1001 1010				
Group 3	7 14	0111 1110				

Step 1:Determination of prime implicants:

	Column I			Column II		Column III
Group 0	0	0000	✓	0,1 0,2 0,8	000- 00-0 -000	
Group 1	1 2 8	0001 0010 1000	✓ ✓ ✓	1,5 1,9 2,6 2,10 8,9 8,10	0-01 -001 0-10 -010 100- 10-0	
Group 2	5 6 9 10	0101 0110 1001 1010	✓ ✓ ✓ ✓			
Group 3	7 14	0111 1110				

Step 1:Determination of prime implicants:

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

Step 1:Determination of prime implicants:

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

Step 1:Determination of prime implicants:

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

- Prime implicants:

b'c' + b'd' + cd' + a'c'd + a'bd + a'bc

Step2: Selection of Prime Implicants:

PIs	abcd		Minterms									
			0	1	2	5	6	7	8	9	10	14
(0,1,8,9)	-00-	b'c'										
(0,2,8,10)	-0-0	b'd'										
(2,6,10,14)	--10	cd'										
(1,5)	0-01	a'c'd										
(5,7)	01-1	a'bd										
(6,7)	011-	a'bc										

Step2: Selection of Prime Implicants:

			Minterms									
PIs	abcd		0	1	2	5	6	7	8	9	10	14
(0,1,8,9)	-00-	b'c'	x	x					x	x		
(0,2,8,10)	-0-0	b'd'	x		x				x		x	
(2,6,10,14)	--10	cd'			x		x				x	x
(1,5)	0-01	a'c'd		x		x						
(5,7)	01-1	a'bd				x		x				
(6,7)	011-	a'bc					x	x				

Step2: Selection of Prime Implicants:

	PIs	abcd		Minterms 0	1	2	5	6	7	8	9	10	14
✓	(0,1,8,9)	-00-	b'c'	x	x					x	⊗		
	(0,2,8,10)	-0-0	b'd'	x		x				x		x	
✓	(2,6,10,14)	--10	cd'			x		x				x	⊗
	(1,5)	0-01	a'c'd		x		x						
	(5,7)	01-1	a'bd				x		x				
	(6,7)	011-	a'bc					x	x				

⊗ Essential Prime Implicant

Step2: Selection of Prime Implicants:

				✓ 0	✓ 1	✓ 2	5	✓ 6	7	✓ 8	✓ 9	✓ 10	✓ 14
	PIs	abcd		0	1	2	5	6	7	8	9	10	14
✓	(0,1,8,9)	-00-	b'c'	x	x					x	⊗		
	(0,2,8,10)	-0-0	b'd'	x		x				x		x	
✓	(2,6,10,14)	--10	cd'			x		x				x	⊗
	(1,5)	0-01	a'c'd		x		x						
	(5,7)	01-1	a'bd				x		x				
	(6,7)	011-	a'bc					x	x				

Step2: Selection of Prime Implicants:

				✓ 0	✓ 1	✓ 2	✓ 5	✓ 6	✓ 7	✓ 8	✓ 9	✓ 10	✓ 14
	PIs	abcd		0	1	2	5	6	7	8	9	10	14
✓	(0,1,8,9)	-00-	b'c'	x	x					x	⊗		
	(0,2,8,10)	-0-0	b'd'	x		x				x		x	
✓	(2,6,10,14)	--10	cd'			x		x				x	⊗
	(1,5)	0-01	a'c'd		x		x						
✓✓	(5,7)	01-1	a'bd				x		x				
	(6,7)	011-	a'bc					x	x				

f = b'c' + cd' + a'bd (Ans)