

**EE/CompE 243**  
**Quine-McCluskey Examples**

1.  $f(a,b,c,d) = \sum m(0,3,4,5,7,9,11,13)$

$m_0$ 0000	<u>0</u> 0000	<u>(0,4)</u> 0 _ 00 PI	
$m_3$ 0011	<u>4</u> 0100	<u>(4,5)</u> 010 _ PI	
$m_4$ 0100	3 0011	<u>(3,7)</u> 0 _ 11 PI	
$m_5$ 0101	5 0101	(3,11) _ 011 PI	
$m_7$ 0111	<u>9</u> 1001	<u>(5,13)</u> _ 101 PI	
$m_9$ 1001	7 0111	<u>(5,7)</u> 01 _ 1 PI	
$m_{11}$ 1011	11 1011	(9,11) 10 _ 1 PI	
$m_{13}$ 1101	13 1101	<u>(9,13)</u> 1 _ 01 PI	

The Prime Implicants are :

$$a'c'd' \quad a'bc' \quad a'cd \quad b'cd \quad bc'd \quad a'bd \quad ab'd \quad ac'd$$

2.  $f(a,b,c,d) = \sum m(2,4,5,6,9,10,11,12,13,15)$

$m_2$ 0010	2 0010	(2,6) 0 _ 10 PI	(4,5,12,13) _ 10 _ PI
$m_4$ 0100	<u>4</u> 0100	(2,10) 010 _ PI	(4,12,5,13) _ 10 _
$m_5$ 0101	5 0101	(4,5) 010 _	(9,11,13,15) 1 _ _ 1 PI
$m_6$ 0110	6 0110	(4,6) 01 _ 0 PI	(9,13,11,15) 1 _ _ 1
$m_9$ 1001	9 1001	<u>(4,12)</u> _ 100	
$m_{10}$ 1010	10 1010	(5,13) _ 101	
$m_{11}$ 1011	<u>12</u> 1100	(9,11) 10 _ 1	
$m_{12}$ 1100	11 1011	(9,13) 1 _ 01	
$m_{13}$ 1101	<u>13</u> 1101	(10,11) 101 _ PI	
$m_{15}$ 1111	15 1111	<u>(12,13)</u> 110 _	
		(11,15) 1 _ 11	
		(13,15) 11 _ 1	

The Prime Implicants are :

$$a'cd' \quad b'cd' \quad a'bd' \quad ab'c \quad bc' \quad ad$$

3.  $f(a, b, c, d) = \sum m(0, 3, 4, 5, 7, 9, 11, 13)$   
Use the Prime Implicants from problem 1.

Prime Implicants	0	3	4	5	7	9	11	13	Essential
(0,4) $a'c'd'$	X		X						Yes
(4,5) $a'bc'$			X	X					No
(3,7) $a'cd$		X			X				No
(3,11) $b'cd$		X					X		No
(5,13) $bc'd$				X				X	No
(5,7) $a'bd$				X	X				No
(9,11) $ab'd$						X	X		No
(9,13) $ac'd$						X		X	No

$$f = a'c'd' + a'cd + ab'd + bc'd$$

OR

$$f = a'c'd' + ac'd + a'bd + b'cd$$

4.  $f(a, b, c, d) = \sum m(2, 4, 5, 6, 9, 10, 11, 12, 13, 15)$   
Use the Prime Implicants from problem 2

Prime Implicants	2	4	5	6	9	10	11	12	13	15	Essential
(2,6) $a'cd'$	X			X							No
(2,10) $b'cd'$	X					X					No
(4,6) $a'bd'$		X		X							No
(10,11) $ab'c$						X	X				No
(4,5,12,13) $bc'$		X	X					X	X		Yes
(9,11,13,15) $ad$					X		X		X	X	Yes

$$f = bc' + ad + a'cd' + b'cd'$$

OR

$$f = bc' + ad + a'cd' + ab'c$$

OR

$$f = bc' + ad + a'bd' + b'cd'$$

$$5. G(A, B, C, D, E, F) = \sum m(1, 2, 3, 16, 17, 18, 19, 26, 32, 39, 48, 63) + \sum d(15, 28, 29, 30)$$

1	000001	(1,3)	0000-1	(1,3,17,19)	0-00-1	PI
2	000010	(1,17)	0-0001	(1,17,3,19)	0-00-1	
16	010000	(2,3)	00001-	(2,3,18,19)	0-001-	PI
32	100000	(2,18)	0-0010	(2,18,3,19)	0-001-	
	-----	(16,17)	01000-	(16,17,18,19)	0100-	PI
3	000011	(16,18)	0100-0	(16,18,17,19)	0100-	
17	010001	(16,48)	-10000			PI
18	010010	(32,48)	100000			PI
48	110000	-----				
		(3,19)	0-0011			
19	010011	(17,19)	0100-1			
26	011010	(18,19)	01001-			
28	011100	(18,26)	01-010			PI
	-----					
29	011101	(26,30)	011-10			PI
30	011110	(28,29)	01110-			PI
39	100111	PI	(28,30)	0111-0		PI
	-----					
63	111111	PI				

Prime Implicants	1	2	3	16	17	18	19	26	32	39	48	63	Essential
(63) ABCDEF												X	YES
(39) AB'C'DEF										X			YES
(16,48) BC'D'E'F'				X							X		NO
(32,48) AC'D'E'F'									X		X		YES
(18,26) A'BD'EF						X		X					NO
(26,30) A'BCEF'								X					NO
(28,29) A'BCDE'													NO
(28,30) A'BCDF'													NO
(1,3,17,19) A'C'D'F	X		X		X		X						YES
(2,3,18,19) A'C'D'E		X	X			X	X						YES
(16,17,18,19) A'BC'D'				X	X	X	X						NO

(a)  $G = \underline{ABCDEF} + \underline{AB'C'DEF} + \underline{AC'D'E'F'} + \underline{A'C'D'F}$   
 $+ \underline{A'C'D'E} + A'BC'D' + (A'BD'EF' \text{ (or) } A'BCEF')$