V.V compu

TABULATION METHOD (OR) QUINE Mc-CLUSKEY METHOD

1o) Simplify the following boolean expression using tabulation method.

$$F(A, B, C, D) = \Sigma_m (0, 2, 5, 6, 7, 8, 10, 12, 13, 14, 15)$$

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	Column	Step - I	column - II	Step II
0 -	0000 ✓	0 - 0000	(0,2) ✓	00-0
2 -	0010 ✓	2 - 0010	(0,8) ✓	-000
5 -	0101 ✓	8 - 1000	(2,6) ✓	0-10
6 -	0110 ✓	5 - 0101	(2,10) ✓	-010
7 -	0111 ✓	6 - 0110	(8,10) ✓	10-0 -
8 -	1000 ✓	10 - 1010	(8,12)	1-00
10 -	1010 ✓	12 - 1100	(5,7)	01-1
12 -	1100 ✓	7 - 0111	(5,13)	-101
13 -	1101 ✓	13 - 1101	(6,7)	011-
14 -	1110 ✓	14 - 1110	(6,14) ✓	-110
15 -	1111 ✓	15 - 1111	(10,14) ✓	a 1-10
			(12,13)	110-
			(12,14)	11-0

Step 1: Divide the minterms into diffuent sections depending upon the no. of ones in minterms

Step 2: Compare the minterms in the adjacent sections. The two minterms are said to be compared if only one variable changes put a dash in the position where the variable is changing.

Step 3: In the second table minterm can be compared with the adjacent table. If dash is in the same position & single variable changes; Continue the process.

(7,15)	-111
(13,15)	11-1
(14,15)	111-

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Column III

(0,2) 00 – 0 }
(8,10) 10 – 0 } (0,2,8,10) – 0 – 0

(0,8) – 000 }
(2,10) – 010 } (0,8,2,10) – 0 – 0

(2,6) 0 – 10 }
(10,14) 1 – 10 } (2,6,10,14) – – 10

(2,10) – 010 }
(6,14) – 110 } (2,10,6,14) – – 10

(8,12) 1 – 00 }
(10,14) 1 – 10 } (8,12,10,14) 1 – – 0

(8,10) 10 – 0 }
(12,14) 11 – 0 } (8,10,12,14) 1 – – 0

(5,7) 01 – 1 }
(13,15) 1 – 1 } (5,7,13,15) – 1 – 1

(5,13) – 101 }
(7,15) – 111 } (5,13,7,15) – 1 – 1

(6,7) 011 – }
(14,15) 111 – } (6,7,14,15) – 11 –

(6,14) – 110 }
(7,15) – 111 } (6,14,7,15) – 11 –

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(12,13) 110 – } (12,13,14,15) 11 – –

(14,15) 111 –

(12,14) 11 – 0 } (12,14,13,15) 11 – –

(13,15) 11 – 1.

Step 3 contains no. of duplicate entries, duplicate terms can be crossed out.

Step 4: Select the prime implicants which remains & compared, remaining unchecked products cannot be combined with other products

Column IV (Prime Implicant Table)

(0,2,8,10) – 0 – 0
B'D'

(2,6,10,14) – – 10
CD'

(8,12,10,14) 1 – – 0
AD'

(5,7,13,15) – 1 – 1 (BD)

(6,7,14,15) – 11 – (BC)

(12,13,14,15) 11 – – (AB).

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- Step 5: Select the column which has single 'X' & take corresponding implicant as essential prime implicant & verify whether essential prime implicant covers the min term in the given function.

	0	2	5	6	7	8	10	12	13	14
B'D' (0,2,8,10)	X	X				X	X			
CD' (2,6,10,14)		X		X			X			X
AD' (8,12,10,14)						X	X	X	X	
BD (5,7,13,15)			X		X				X	X
BC (6,7,14,15)				X	X					X X
AB (12,13,14,15)								X	X	X X

$F = \underbrace{B'D' + BD}_{\text{compulsory} \Rightarrow \text{single complem state}} + (CD' + AD')$ or $(BC + AB)$ or $(BC + AD')$ or $(CD' + AB)$

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2.) $F = \Sigma(1, 2, 3, 7, 8, 9, 10, 11, 14, 15)$

1	0001 ✓	0001 - 1 0010 - 2 1000 - 8	(1,3) 00-1 (1,9) -001 (2,3) 001- (2,10) -010 (8,9) 100- (8,10) 10-0	(1,9)(3,11) -0-1 (1,3)(9,11) -0-1 (2,10)(3,11) -01- (2,3)(10,11) -01- (8,9)(10,11) 10-- (8,10)(9,11) 10--
2	0010 ✓			
3	0011 ✓	0011 - 3 1001 - 9 1010 - 10		
7	0111 ✓			
8	1000 ✓	0111 - 7 1011 - 11 1110 - 14	(3,7) 0-11 (3,11) -011 (9,11) 10-1 (10,11) 101- (10,14) 1-10	(3,7)(11,15) --11 (3,11)(7,15) --11 (10,11)(14,15) 1-1- (10,14)(11,15) 1-1-
9	1001 ✓			
10	1010 ✓			
11	1011 ✓	1111 - 15		
14	1100 ✓		(7,15) -111 (11,15) 1-11 (14,15) 111-	
15	1111 ✓			

(1,9)(3,11)	$B'D$
(2,10)(3,11)	$B'C$
(8,9)(10,11)	AB'
(3,7)(11,15)	CD
(10,11)(14,15)	AC

	1	2	3	7	8	9	10	11	14	15
(1,9,3,11) $B'D$	(X)		X			X		X		
(2,10,3,11) $B'C$		(X)	X				X	X		
(8,9,10,11) AB'					(X)	X	X	X		
(3,7,11,15) CD			X	(X)				X		X
(10,11,14,15) AC							X	X	(X)	X

$B'D + B'C + AB' + AC + (CD)$

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$f = \Sigma(3,4,6,11,15,19,20,22,27,30,31) + \Sigma_d(5,7,14,12,29)$

3	00011 ✓	00100	(4,5) 0010 -	(4,5,6,7) 001 --
4	00100 ✓	00011	(4,6) 001 - 0	(4,6,20,22) -01 - 0
5	00101 ✓	00101	(4,20) - 0100	
6	00110 ✓	00110		(3,7,11,15) 0 - - 11
7	00111 ✓	10010	(3,7) 00 - 11	
11	01011 ✓	10100	(3,11) 0 - 011	(3,11,19,27) - - 011
14	01110 ✓	00111	(3,19) - 0011	(6,7,14,15) 0 - 11 -
15	01111 ✓	01011	(5,7) 001 - 1	(6,14,22,30) - - 110
18	10010 ✓	01110		
19	10011 ✓	10011	(6,7) 0011 -	(11,15,27,31) - 1 - 11
20	10100 ✓	10110	(6,14) 0 - 110	(14,15,30,31) - 111 -
22	10110 ✓	01111	(6,22) - 0110	
27	11011 ✓	11011	(18,19) 1001 -	
30	11110 ✓	11110	(18,22) 10 - 10	
31	11111 ✓	11111	(20,22) 101 - 0	
			(7,15) 0 - 111	
			(11,15) 01 - 11	
			(11,27) - 1011	
			(14,15) 0111 -	
			(14,30) - 1110	
			(19,27) 1 - 011	
			(22,30) 1 - 110	
			(15,31) - 1111	
			(27,31) 11 - 11	
			(30,31) 1111 -	

This has not be combined with any of the other pairs so it should be included in prime implicants.

Ans: $B'CE' + AB'C'D$

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Prime implicants

(18,19)	1001-	$AB'C'D$
(18,22)	10-10	$AB'DE'$
(4,5,6,7)	001--	$A'B'C$
(4,6,20,22)	-01-0	$B'CE'$
(3,7,11,15)	0--11	$A'DE$
(3,11,19,27)	--011	$C'DE$
(6,7,14,15)	0-11-	$A'CD$
(6,14,22,30)	--110	CDE'
(11,15,27,31)	-1-11	BDE
(14,15,30,31)	-111-	BCD

→ because it contains the remaining

	3	4	6	11	15	19	20	22	30	31
$AB'C'D$ (18,19)						X				
$AB'DE'$ (18,22)								X		
$A'B'C$ (4,5,6,7)		X	X							
$B'CE'$ (4,6,20,22)		X	X				X	X		
$A'DE$ (3,7,11,15)	X				X	X				
$C'DE$ (3,11,19,27)	X				X		X			
$A'CD$ (6,7,14,15)				X		X				
CDE' (6,14,22,30)				X				X	X	
BDE (11,15,27,31)					X	X				X
BCD (14,15,30,31)						X			X	X

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