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Q.1)  $F(A, B, C) = \sum (0, 2, 6, 7, 8, 10, 12, 13, 15)$

Using Quine-mcCluskey method -

1st step

2 0010 ✓ (2,1) 0-10

8 1000 ✓ (2,10) 0-10 ✓

6 0110 ✓ (8,10) 10-0 ✓

10 1010 ✓ (8,12) 1-00

12 1100 ✓ (6,7) 011-

7 0111 ✓ (13,15) 110-

13 1101 ✓ (7,15) -111

15 1111 ✓ (13,15) 11-1

0 0000 ✓ (0,8) 00-0 ✓

10 1010 ✓ (0,8) -600 ✓

12 1100 ✓ (0,8) 1-600 ✓

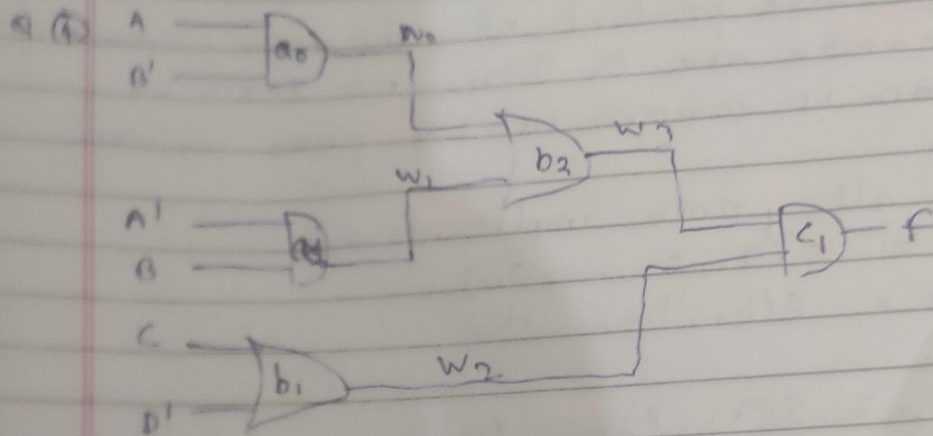
14 1110 ✓ (0,8) 1-600 ✓

15 1111 ✓ (0,8) 1-600 ✓

	0	2	6	7	8	10	12	13	15
(0,2,8,10)	(X)	X	X		X	(X)			
(2,6)		X	X						
(8,12)			X	X	X				
(6,7)				X					
(12,13)				X					
(7,15)									
(12,15)									

Hence, only essential prime implicant is  $\overline{C}A_1B_1\overline{C}$  which is  $\overline{C}A_1B_1\overline{C}$ .

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We need gate level code :-

```

=> module ckt (A, B, C, D, F) ;
    input A, B, C, D ;
    output F ;
    wire not_A, not_B, not_D ;
    wire w0, w1, w2, w3 ;

    not n0 (not_A, A) ;
    not n1 (not_B, B) ;
    not n2 (not_D, D) ;
    and a0 (w0, A, not_B) ;
    and a1 (w1, not_A, B) ;
    or b1 (w2, C, not_D) ;
    or b2 (w3, w0, w1) ;
    or c1 (F, w3, w2) ;
endmodule
  
```

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Q.3 As, pairwise product of all ~~term~~ prime implicants are 0. Then, no term is common in any prime implicant like a

let all prime implicants are :-

$$P_1 = \sum(a_1, a_2, \dots, a_n)$$

$$P_2 = \sum(b_1, b_2, \dots, b_n)$$

:

$$P_n = \sum(x_1, x_2, \dots, x_n)$$

No term is common otherwise, multiplication  $\neq 0$

As, no term is common and for minimal expression we need all terms in ~~the~~ minimal expressions

We need to take all of them

Hence, minimal expression

$$f = P_1 + P_2 + \dots + P_n$$

which is unique. (H.P.)



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Q(2) By tabulation method

$$f(W, X, Y, Z) = \sum(0, 1, 4, 5, 6, 7, 9, 11, 15) + \phi(10, 14)$$

YZ \ WX	00	01	10	11
00	1	1	0	0
01	1	1	0	1
11	0	1	X	X
10	0	1	0	0

Hence,

Groups

(0, 1, 4, 5)	<del><math>\bar{W}\bar{Y}</math></del>	$\bar{W} \cdot \bar{Y}$
(4, 5, 6, 7)	<del><math>\bar{W}Y</math></del>	$\bar{W} \cdot Y$
(1, 9)	<del><math>\bar{X}\bar{Y}Z</math></del>	$\bar{X} \cdot \bar{Y} \cdot Z$

① 
$$F = \bar{W} \cdot \bar{Y} + \bar{W} \cdot Y + \bar{X} \cdot \bar{Y} \cdot Z$$
  
(minimal expression)

② Prime implicants

(0, 1, 4, 5)	$\Rightarrow$	$\bar{W} \cdot \bar{Y}$
(4, 5, 6, 7)	$\Rightarrow$	$\bar{W} \cdot Y$
(1, 9)	$\Rightarrow$	$\bar{X} \cdot \bar{Y} \cdot Z$
(9, 11)	$\Rightarrow$	$W \cdot \bar{X} \cdot Z$
(7, 15)	$\Rightarrow$	$X \cdot Y \cdot Z$