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Department of Electrical Engineering



Digital Design

First Semester 2020-21

Tutorial : 04

QM Method

Digital Design Tutorial : 04

1. Obtain the Boolean Expression using k-map and verify with QM method

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

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1. Obtain the Boolean Expression using k-map and verify with QM method
 $F(a,b,c,d) = \sum m(0,1,2,5,6,7,8,9,10,14)$

Determination of Prime Implicants

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

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

(1, 5)
(5, 7)
(6, 7)
(0, 1, 8, 9)
(0, 2, 8, 10)
(2, 6, 10, 14)

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












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2. Obtain the Boolean Expression using k-map and verify with QM method

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

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

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	
G4	13	1	1	0	1	
	15	1	1	1	1	

Groups	Minterm ID	W	X	Y	Z
G0'	0, 2	0	0	d	0
G1'	2, 3	0	0	1	d
	2, 6	0	d	1	0
	2, 10	d	0	1	0
G2'	3, 7	0	d	1	1
	5, 7	0	1	d	1
	6, 7	0	1	1	d
	5, 13	d	1	0	1
	9, 13	1	d	0	1
	12, 13	1	1	0	d
G3'	7, 15	d	1	1	1
	13, 15	1	1	d	1

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

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

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

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	

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

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

E.M.T E.P.I

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