DATE

Quine - McCluskey Minimization Method

THE CONCEPT OF ROW & COLUMN DOMINANCE

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Theorem

Let "a" and "b" be columns of the reduced prime Implicant table, If "b" dominates "a", Then "b" can be eliminated

"Dominating columns can be eliminated"

Theorem

Let "a" and "b" be ~~columns~~ rows of the reduced prime Implicant table, if "a" dominates "b", Then "b" can be eliminated.

"Dominated rows can be eliminated"

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(2)

Determine the minimal sum-of-products form for

$F(A,B,C,D,E) = \sum(1,2,3,5,9,10,11,18,19,20,21,23,25,26,27)$

Step 1: Using tabulation method, generating all the prime implicants and construct a prime implicant table, as shown in Table 1.

Name	Expression	1	2	3	5	9	10	11	18	19	20	21	23	25	26	27
P_1	C'D		X	X			X	X	X	X					X	X
P_2	BC'E					X		X						X		X
P_3	A'C'D	X		X		X		X								
P_4	A'B'D'E	X			X											
P_5	B'CD'E				X							X				
P_6	AB'CD'										X	X				
P_7	AB'DE									X			X			
P_8	AB'CE											X	X			

Table 1

Step 2: From the PI Table, we have to look into each column to find out if any column has only one minterm. If so, circle that minterm.

EPI EPI EPI

Name	Expression	1	2	3	5	9	10	11	18	19	20	21	23	25	26	27
P_1 *	C'D		X	X			X	X	X	X					X	X
P_2 *	BC'E					X		X						X		X
P_3	A'C'D	X		X		X		X								
P_4	A'B'D'E	X			X											
P_5	B'CD'E				X							X				
P_6 *	AB'CD'										X	X				
P_7	AB'DE									X			X			
P_8	AB'CE											X	X			
			✓				✓		✓		✓			✓	✓	

Name	Expression	1	2	3	5	9	10	11	18	19	20	21	23	25	26	27
*P_1	C'D		X	X			X	X	X	X					X	X
*P_2	BC'E					X		X						X		X
P_3	A'C'D	X		X		X		X								
P_4	A'B'D'E	X			X											
P_5	B'CD'E				X							X				
*P_6	AB'CD'										X	X				
P_7	AB'DE									X			X			
P_8	AB'CE											X	X			

Step 3 : Now find out the dominating rows –

Row Dominance.

2	3
X	X
	X

3 is dominating 2

Column 3 can be ticked (eliminated)

10	11
X	X
	X
	X

11 is dominating 10

Column 11 can be ticked (eliminated)

Theorem : Dominating Columns can be eliminated.

18	19
X	X
	X

19 is dominating 18

(19 can be ticked)

eliminated

20	21
	X
X	X
	X

21 is dominating 20

(21 can be ticked)

eliminated

25	26	27
	X	X
X		X

27 is dominating 25 and 26

(27 can be ticked)

eliminated

Total = 2, 10, 18, 20, 25, 26, 3, 11, 19, 28 and 21 Colums can be eliminated (ticked)

	Name	Expression	1	2	3	5	9	10	11	18	19	20	21	23	25	26	27
EPI ✓	*P_1	C'D		X	X			X	X	X	X					X	X
EPI ✓	*P_2	BC'E					X		X						X		X
	P_3	A'C'D	X		X		X		X								
	P_4	A'B'D'E	X			X											
	P_5	B'CD'E				X							X				
EPI ✓	*P_6	AB'CD'										X	X				
	P_7	AB'DE									X			X			
	P_8	AB'CE											X	X			

✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

Now we are left out with only column no 1, 5, 23.

Now we have to go with the Concept of

ROW DOMINANCE

→ P_3	A'C'D	X		X		X		X								
→ P_4	A'B'D'E	X			X											
→ P_5	B'CD'E				X							X				

} Hence eliminate P3 and P5

P4 is dominating row P3 and P5

(In the case of Row, we have to eliminate the dominated rows)

P_7	AB'DE									X			X			←
P_8	AB'CE											X	X			←

P7 and P8 are same so we can Consider either P7 or P8 in the final expression.

P3 and P5 are eliminated

Name	Expression	1	2	3	5	9	10	11	18	19	20	21	23	25	26	27
*P_1	C'D		X	X			X	X	X	X					X	X
*P_2	BC'E					X		X						X		X
→ P_3	A'C'D	X		X		X		X								
P_4	A'B'D'E	X			X											
→ P_5	B'CD'E				X							X				
*P_6	AB'CD'										X	X				
P_7	AB'DE									X			X			
P_8	AB'CE											X	X			

We are left out with P1, P2 and P6

Essential Prime Implicants.

P4 and (P7 or P8)

$F = P1 + P2 + P4 + P6 + P7$ Or

$F = P1 + P2 + P4 + P6 + P8$