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# Switching Circuit & Logic Design

Lecture 15 : Quinn-McCluskey Method

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# What we learned ?

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Fundamental :  $PA + PA' = P(A+A') = P$

$$\begin{aligned}\Sigma_m(0,1,4,5) &= A'B'C' + A'B'C + AB'C' + AB'C \\ &= A'B' (C' + C) + AB' (C' + C) = (A'+A)B' = B'\end{aligned}$$

Step 1 : Combined two pairs of adjacent terms

Step 2 : Two terms combined again

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# Which terms can be paired ?

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If the terms differ in one position

$$AB'C + ABC = A(B' + B)C = AC$$

$$AB'CD' + AB'CD = AB'C(D' + D) = AB'C$$

Etc.

# Quine-McCluskey

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List all minterms

Arrange all minterms in groups of same numbers of 1's

Compare each term of the lower index group with every term in the succeeding group.

Combined terms : Original fixed representation with the differing one replaced by a dash (-).

Combine the terms generated in Step 3 in the same fashion.

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# Example

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$$F = \Sigma_m (0, 1, 6, 7, 8, 9, 13, 14, 15)$$

Index	MinTerm	Binary
Index 0	0	0000
Index 1	1	0001
	8	1000
Index 2	6	0110
	9	1001
Index 3	7	0111
	13	1101
	14	1110
Index 4	15	1111

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# Example

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Column 1		
Index	MinTerm	Binary
Index 0	0	0000
Index 1	1 8	0001 1000
Index 2	6 9	0110 1001
Index 3	7 13 14	0111 1101 1110
Index 4	15	1111

Column 2				
Pairs	A	B	C	D
0,1	0	0	0	-
0,8	-	0	0	0
1,9	-	0	0	1
8,9	1	0	0	-
6,7	0	1	1	-
6,14	-	1	1	0
9,13	1	-	0	1
7,15	-	1	1	1
14,15	1	1	1	-

Column 2				
Pairs	A	B	C	D
0,1	0	0	0	-
0,8	-	0	0	0
1,9	-	0	0	1
8,9	1	0	0	-
6,7	0	1	1	-
6,14	-	1	1	0
9,13	1	-	0	1
7,15	-	1	1	1
14,15	1	1	1	-

Column 3				
Quads	A	B	C	D
0,8,1,9	-	0	0	-
6,14,7,15	-	1	1	-

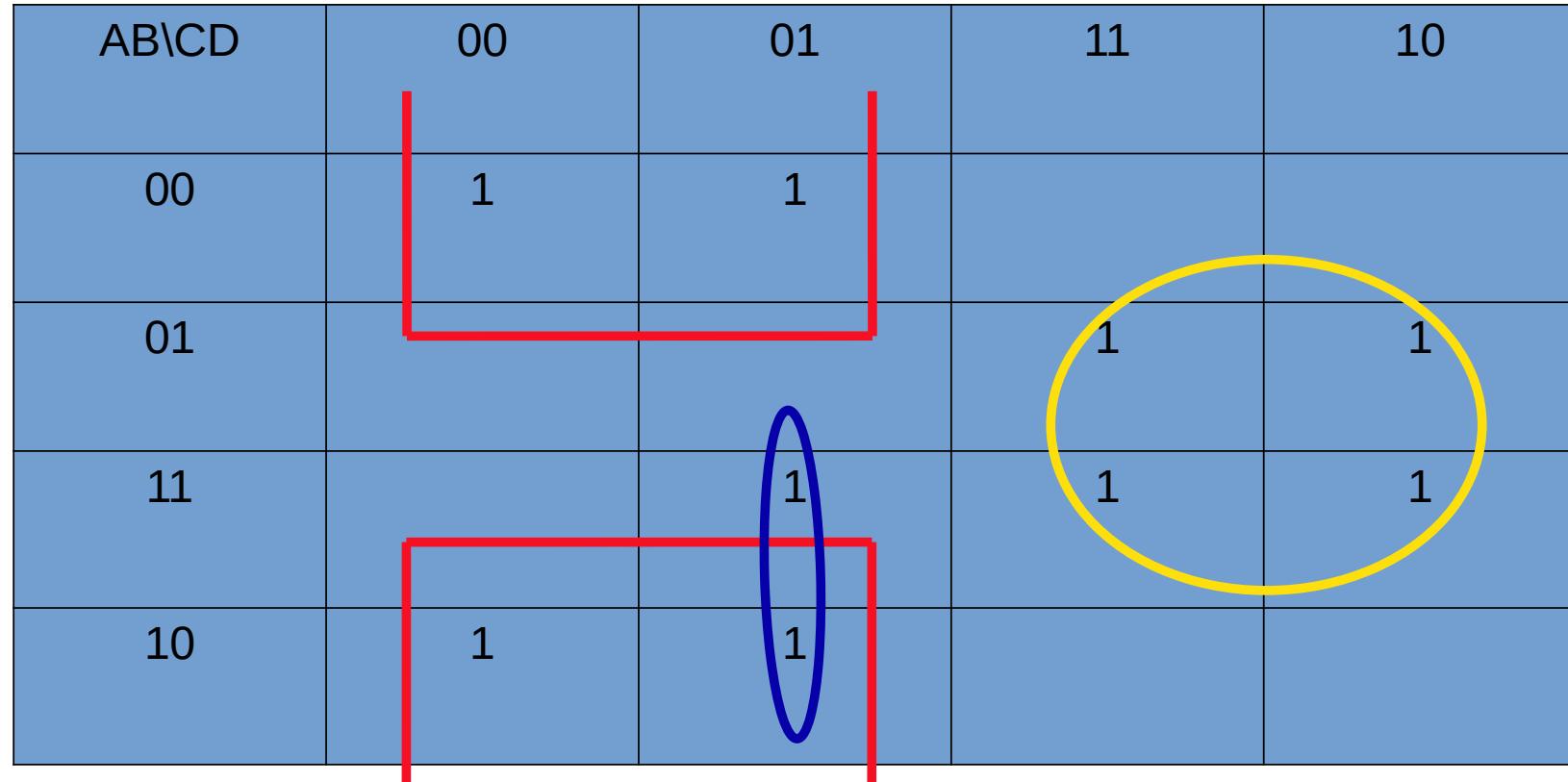
Column 2				
Pairs	A	B	C	D
0,1	0	0	0	-
0,8	-	0	0	0
1,9	-	0	0	1
8,9	1	0	0	-
6,7	0	1	1	-
6,14	1	1	1	0
9,13	1	-	0	1
7,15	-	1	1	1
14,15	1	1	1	-

Column 3				
Quads	A	B	C	D
0,8,1,9	-	0	0	-
6,14,7,15	-	1	1	-

# With K-Map

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$$F = \Sigma_m (0, 1, 6, 7, 8, 9, 13, 14, 15)$$



# Minimise with QM

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$\Sigma_m(6,7,8,9)$   
+ d(10,11,12,13,14,15)

Index 1	8	1	0	0	0
Index 2	6	0	1	1	0
	9	1	0	0	1
	10	1	0	1	0
	12	1	1	0	0
Index 3	7	0	1	1	1
	11	1	0	1	1
	13	1	1	0	1
	14	1	1	1	0
Index 4	15	1	1	1	1

# Minimise with QM

Index 1	8	1	0	0	0
Index 2	6	0	1	1	0
	9	1	0	0	1
	10	1	0	1	0
	12	1	1	0	0
Index 3	7	0	1	1	1
	11	1	0	1	1
	13	1	1	0	1
	14	1	1	1	0
Index 4	15	1	1	1	1

