Paper 7, TDC Part-3
Chapter– 4, Combinational Logic Design
Lecture - 8

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Combinational Logic Design

Grouping Eight Adjacent Ones :

Eight cells from a group of 8 adjacent ones or zeros if three of the literals, associated with the minterms/maxterms are not same and the other literals are same.

for a 2-Variable K-map we have maximum of 4 cells so ~~we~~ there is no possibility of grouping of 8 cells.

In case of 3-variable K-map, there is only one possibility of eight ones or zeros

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appearing in the K-map and thus corresp-onds to output equal to 1, irrespective of the values of the input variables. Figure below ~~given all~~ shows the grouping of eight adjacent ones in a 4-variable K-map.

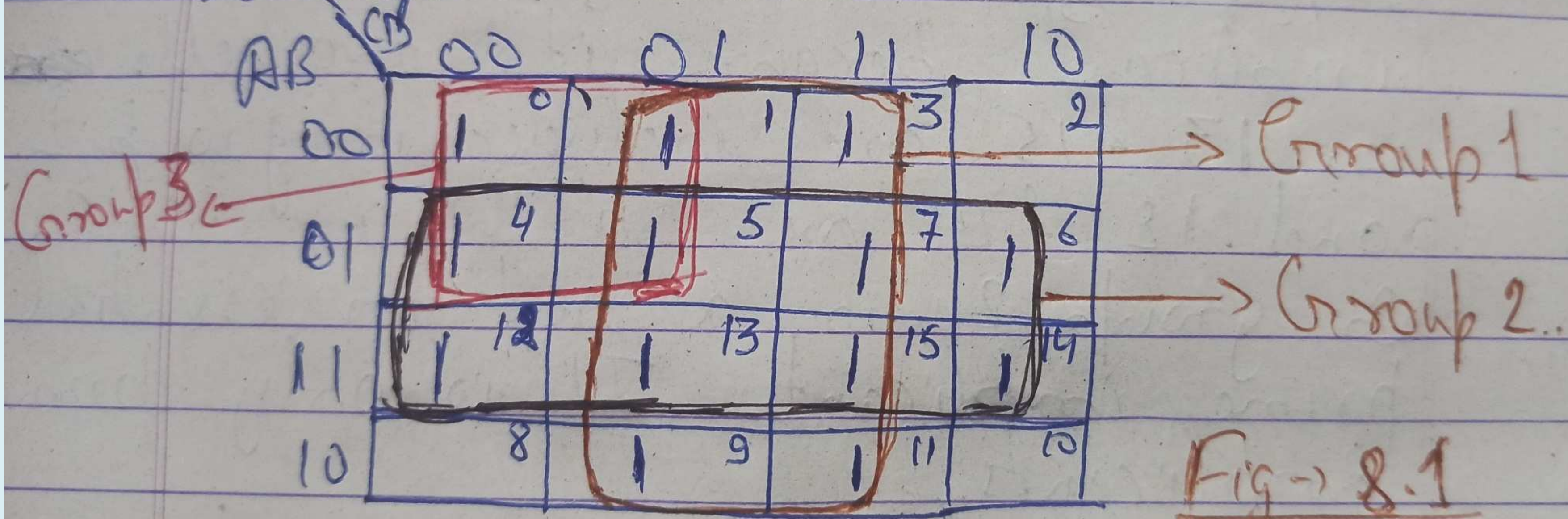

Fig -> 8.1

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The above K-map have 2 groups of eight adjacent One's.
Group 1 involves cells with decimal value $\Rightarrow$ 1, 3, 5, 7, 9, 11, 13 & 15 while Group 2 involves cells with decimal value $\Rightarrow$ 4, 5, 6, 7, 12, 13, 14 & 15. Table below gives all possible groups of Eight adjacent ones in a 4-variable K-map.

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Table 5.7 ***Groups of Eight Adjacent Ones in 4-variable K-map***

Decimal numbers of cells forming groups of adjacent eights in a 4-variable K-map
0, 4, 12, 8, 1, 5, 13, 9,
0, 4, 12, 8, 2, 6, 14, 10
0, 1, 3, 2, 4, 5, 7, 6
0, 1, 3, 2, 8, 9, 11, 10
1, 5, 13, 9, 3, 7, 15, 11
4, 5, 7, 6, 12, 13, 15, 14
12, 13, 15, 14, 8, 9, 11, 10
3, 7, 15, 11, 2, 6, 14, 10

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Grouping 8 adjacent cells reduce (eliminate) 3 literals than the number of literals in the original minterms.

As in the K-map of fig 8.1, we have 2 groups.

Group 1 have cells with decimal value 1 → $\bar{A}\bar{B}\bar{C}D$
Ilarly for 3 → $\bar{A}\bar{B}CD$, 5 → $\bar{A}B\bar{C}D$, 7 → $\bar{A}BCD$
9 → $A\bar{B}\bar{C}D$, 11 → $A\bar{B}CD$, 13 → $AB\bar{C}D$
& 15 → $ABCD$.

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So in all these minterms we find that literal 'D' is present (same) in all terms while the other literals are not common in all terms. So the resulting value of group 1 is 'D'

Ilarly for group 2 we find out that literal 'B' is present (same) in all terms while other literals are not common in all terms so for group 2 resulting value is group 2 is 'B'.

If we solve for the function Y of the K-map of fig 8.1, we have ~~three~~ groups. 2-groups of adjacents 8 cells & 1-group '3' of adjacent 4-cells as shown in fig 8.1.

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As, $Y = \Sigma m(0, 1, 3, 4, 5, 7, 6, 9, 11, 12, 13, 14, 15)$

or in simplified form,

$Y = D + B + \bar{A}\bar{C}$ → As per grouping of m_0, m_1, m_4 & m_5

D → As per grouping of $m_1, m_3, m_5, m_7, m_{13}, m_{15}, m_9$ & m_{11}

B → As per grouping of $m_4, m_5, m_6, m_7, m_{12}, m_{13}, m_{14}$ & m_{15}

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Grouping of 2, 4 and 8 Adjacent Zeros

When we want to write the logic function in terms of Maxterms we need to group adjacent zero's in the K-map. The procedure of grouping ~~one is~~ 0's is similar to the grouping of 1's in the K-map. But grouping of 0's help in the writing of logic function in POS form.

Grouping of 0's result as below,

1.) Group of 2 adjacent zeros result in a term with one literal less than the number of variables. The literal which is not same in the 2 maxterms gets eliminated.

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2.) Group of 4 adjacent zeros result in a term with 2 literals less than the number of variables. The two literals which are not same in all the 4 maxterms get eliminated.

3.) Group of eight adjacent zeros result in a term with 3 literals less than the number of variables. The 3 literals which are not same in all the 8 maxterms get eliminated.

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As of now we have seen groups of 2, 4 and 8 adjacent ones and zeros. The same logic can be extended to 16, 32 and 64 adjacent ones and zeros which occur in K-maps with more than 4, 5. variables.

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Refer book- Modern Digital Electronics by RP Jain.

Thank You