

Paper 7, TDC Part-3
Chapter– 4, Combinational Logic Design
Lecture - 23

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Combinational Logic Design

In this lecture we will discuss the K-Map techniques for 5 variables logical function.

Five and Six Variable K-Maps: →

A five variable logic function (equation) need K-map of 5 variable ~~for the~~ to find the optimum solution of the logic function. In a 5 variable K-map we have to consider 2 four variable

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K-maps superimposed on one another
~~not~~ i.e. we draw the K-Map as shown
below for 5 variable function.

A=0					A=1				
BC \ DE	00	01	11	10	BC \ DE	00	01	11	10
00	0	1	3	2	00	16	17	19	18
01	4	5	7	6	01	20	21	23	22
11	12	13	15	14	11	28	29	31	30
10	8	9	11	10	10	24	25	27	26

For 5-variable function we have 32
entries in the truth table i.e. 32
combination of binary digits are possible.

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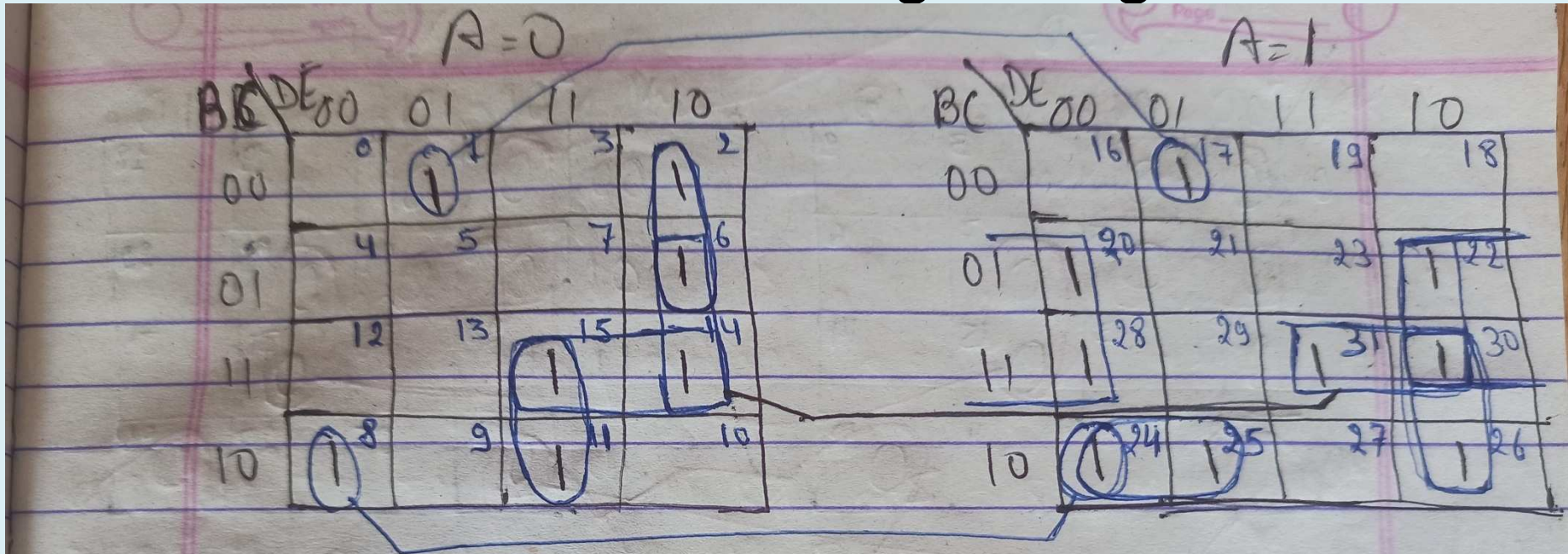
combination of binary digits are possible.
So a 5 variable K-map will have
2 four variable K-Map ~~is~~ ~~16~~ ~~boxes~~
imposed on ~~one~~ ~~one~~ another so that
it will result in 32 boxes with decimal
number 0-31 corresponding to each box
as shown above.

Example 1) $F(A, B, C, D, E) = \sum m(1, 2, 6, 8, 11, 14, 15, 17, 20,$
 $22, 24, 25, 26, 28, 30, 31)$

Simplify the above given logic expression and
~~draw~~ ~~the~~ ~~circuit~~ ~~using~~ ~~basic~~ ~~gates~~.

Soln: To simplify the logic expression of 5 variables
we draw 2 four-variable K-map ~~as~~ ~~disc~~

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$\bar{B}\bar{C}\bar{D}\bar{E} = 1$ & 17 will overlap so form group of 2 ones,

$\bar{B}\bar{C}\bar{D}E = 8$ & 24 " " " " " & " ,

$BCD = 15, 14, 31$ & 30 " " " " " & " ,

Other ones that form groups are

$\bar{A}\bar{B}DE = 2$ & 6 will form group of 2 ones

$\bar{A}BDE = 15$ & 11 " " " " & " ,

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$\bar{A}BDE = 15$ & 11 " " " " 2 ones
 $A\bar{B}\bar{C}D = 24$ & 25 " " " " 2 "
 $ABD\bar{E} = 26$ & 30 " " " " 2 ones
 $ACE = 20, 22, 28$ & 30 " " " " 4 ones

So,

$$F(A, B, C, D, E) = \bar{B}\bar{C}DE + \bar{A}\bar{B}D\bar{E} + B\bar{C}D\bar{E} + A\bar{B}DE \\ + A\bar{B}\bar{C}\bar{D} + ABDE + BCD + ACE$$

Example 6) $F(A, B, C, D, E) = \Pi M(0, 1, 4, 5, 7, 8, 10, 12, 15, 16, \\ 17, 20, 21, 23, 24, 26, 28, 31)$

Simplify the above given logic expression to obtain simplified POS expression.

Ans =

let's draw 5-variable K-MAP, as drawn in next slide.

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$V=0$					$V=1$				
$W \backslash YZ$	00	01	11	10	$W \backslash YZ$	00	01	11	10
00	0	0	3	2	00	0	0	19	18
01	0	0	7	6	01	0	0	23	22
11	0	13	15	14	11	0	29	31	30
10	0	9	11	10	10	0	25	27	26

$(W+Y) = 0, 1, 4, 5, 16, 17, 20 \text{ \& } 21$ will form group of 8 ones
 $(Y+Z) = 0, 4, 8, 12, 16, 20, 24 \text{ \& } 28$ " " " " 8
 $(X+\bar{Y}+\bar{Z}) = 7, 15, 23 \text{ \& } 31$ will form group of 4 ones
 ~~$(\bar{W}+\bar{X}+\bar{Z}) = 8, 10, 24 \text{ \& } 26$~~ " " " " 4 ones
 $(\bar{W}+X+Z)$

The req expression in POS form is

$$F(V, X, Y, Z) = (W+Y)(Y+Z)(X+\bar{Y}+\bar{Z})(\bar{W}+X+Z)$$

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Refer book- Modern Digital Electronics by RP Jain.

Thank You