Five Variable K Map

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Working With Maxterms

- At times, we may be required to work with maxterms.
  - The previous process actually worked with minterms. Remember that the numbers used for minterms are the opposites of the numbers used for maxterms:
    - $F(w, x, y, z) = \sum(0, 1, 2, 8, 9, 10, 11)$, uses minterms
    - $F(w, x, y, z) = \prod(3, 4, 5, 6, 7, 12, 13, 14, 15)$, uses maxterms
  - If you are given minterms, fill in 1's for the minterms and then fill the remaining cells with 0's
  - If you are given maxterms, fill in 0's for the maxterms and then fill the remaining cells with 1's
  - For SOP simplification, solve the map for the 1's
  - For POS simplification, solve the map for the 0's to get complemented function. Taking the complement of this complemented function we obtain function in POS form

Five-Variable Map

- A five-variable map holds thirty-two minterms for five variables.
  - We use two four variable map with one of the variables distinguishing between the two.
  - Each square in the first map is adjacent to the corresponding square in the second map (i.e. 4 and 20 are adjacent). It is just like placing one map on the top of the other.

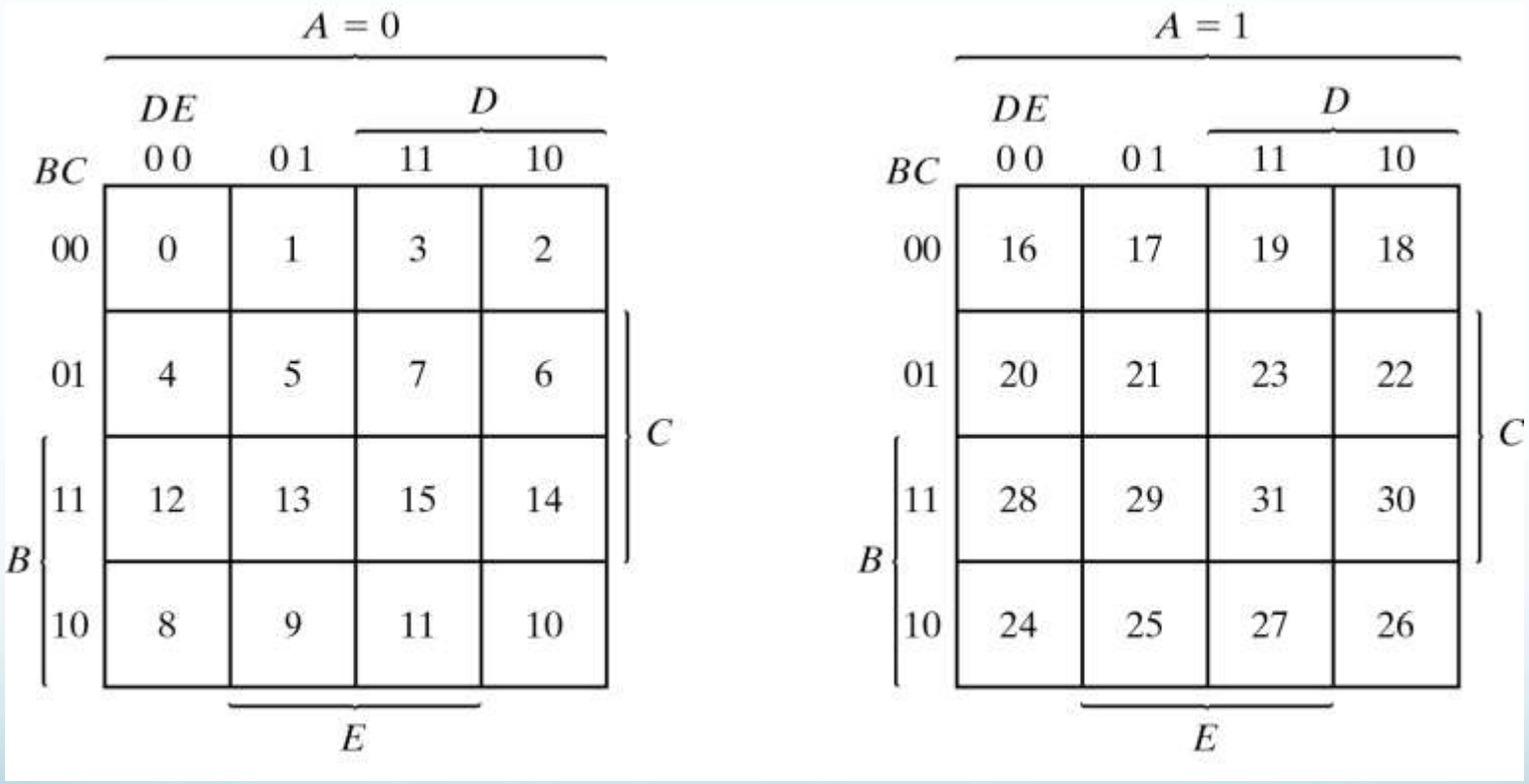
$v = 0$

wx \ yz	00	01	11	10
00	0	1	3	2
01	4	5	7	6
11	12	13	15	14
10	8	9	11	10

$v = 1$

wx \ yz	00	01	11	10
00	16	17	19	18
01	20	21	23	22
11	28	29	31	30
10	24	25	27	26

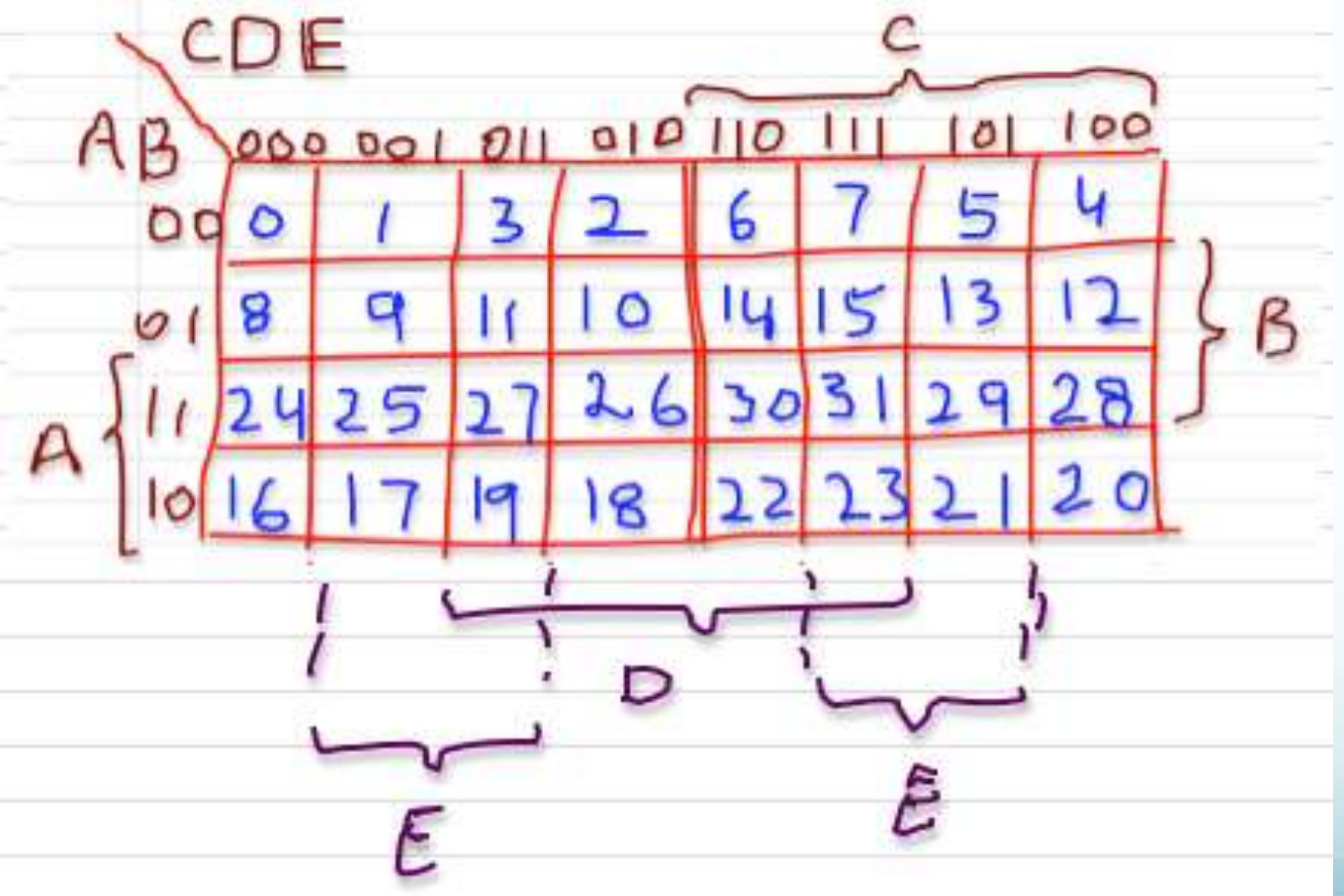
5-Variable Map Patterns



5-Variable Map Patterns

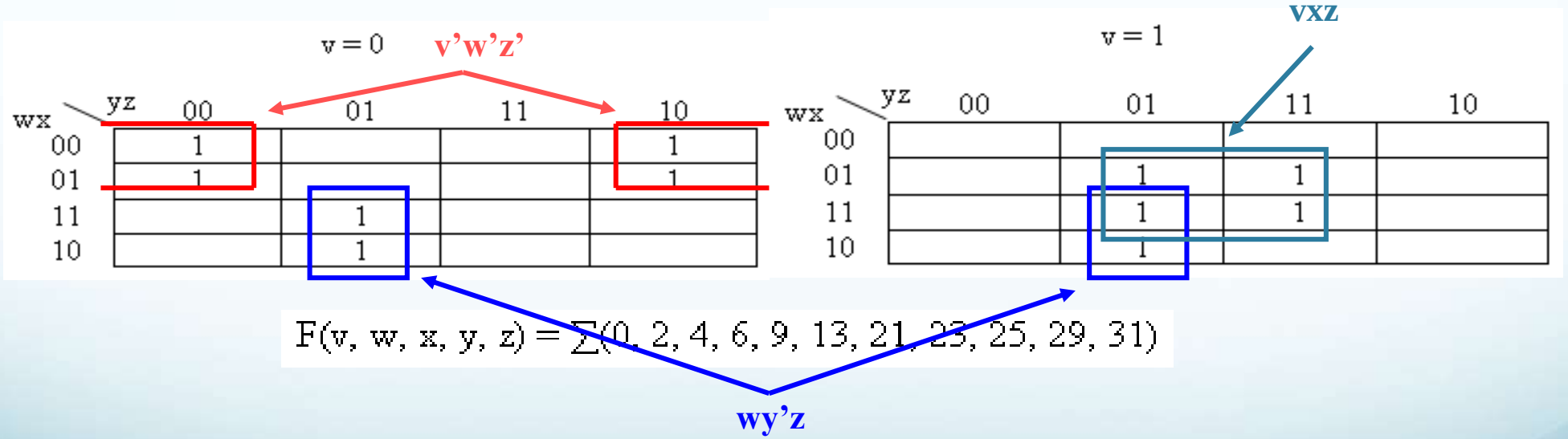
- The number of adjacent squares that may be combined always represent a number that is a power of 2 such as 1, 2, 4, 8, 16, and 32.
  - One square represents one minterm with five literals.
  - Two adjacent squares represents a term of four literals.
  - Four adjacent squares represents a term of three literals.
  - Eight adjacent squares represents a term of two literals.
  - Sixteen adjacent squares represents a term of one literal.
  - Thirty-two adjacent squares represents the entire map and produces a function that is always equal to 1.

Alternative Five Variable Map



Minimization Example (5-Variable Map)

- Example 3-7
- Simplify the Boolean function
  F(V,W,X,Y,Z) = Σ(0,2,4,6,9,13,21,23,25,29,31)

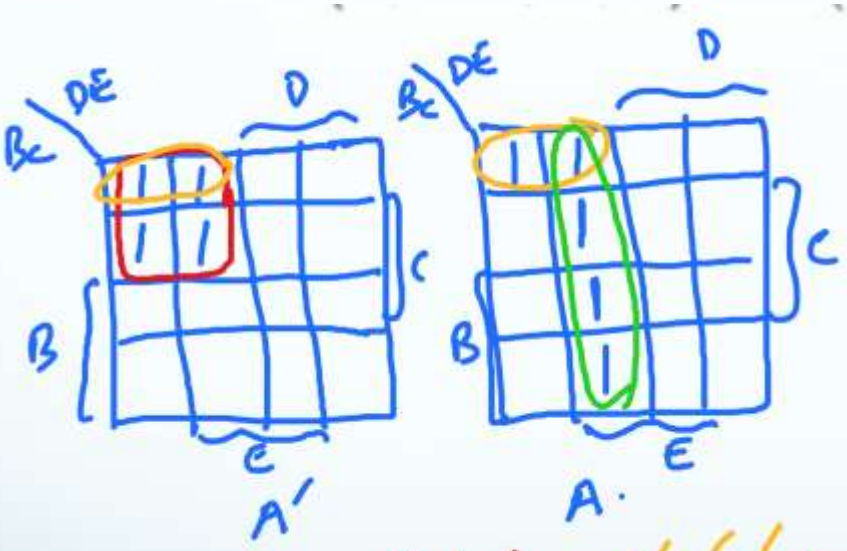


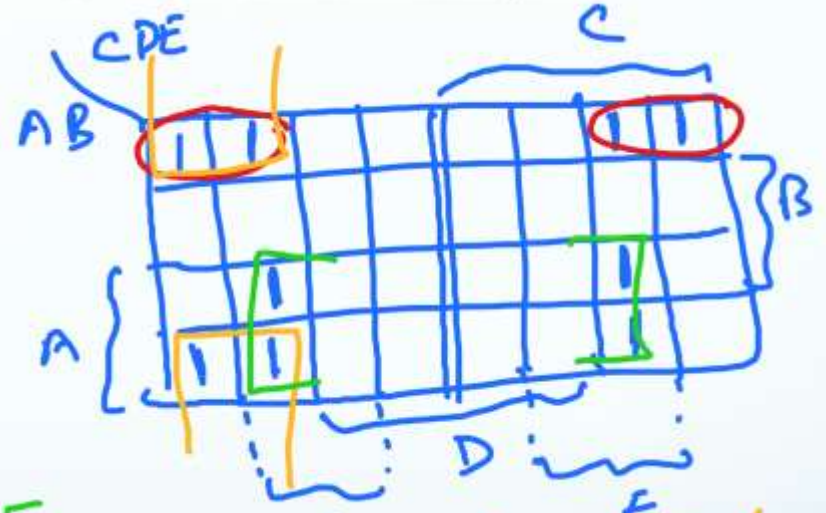
- **F = v'w'z' + wy'z + vxz**

Your Turn

- Simplify the following function in Sum of Products form

$$F(A, B, C, D, E) = \Sigma(0, 1, 4, 5, 16, 17, 21, 25, 29)$$





$F = A'B'D' + B'C'D' + AD'E$

Method 1 (Book)

$F = A'B'D' + B'C'D' + AB'E$

$F = A'B'D' + B'C'D' + AD'E$

Method 2 (Gray Code)

Overview of Karnaugh Map

- Karnaugh Map?
  - Made up of squares
  - Each square represent one minterm
  - The variables in squares change in gray code
  - Each variable covers an area in the squares
- Grouping of Squares Rules?
  - Every cell containing a 1 must be included at least once.
  - The largest possible “power of 2 rectangle” must be enclosed.
  - The 1’s must be enclosed in the smallest possible number of rectangles
- Mapping of Functions into the Karnaugh Map
  - Function expressed in sum of products or sum of minterms
  - Function expressed in product of sums or product of maxterms?
    - Convert it to sum of minterms or sum of products form

The End