EGC220
Class Notes
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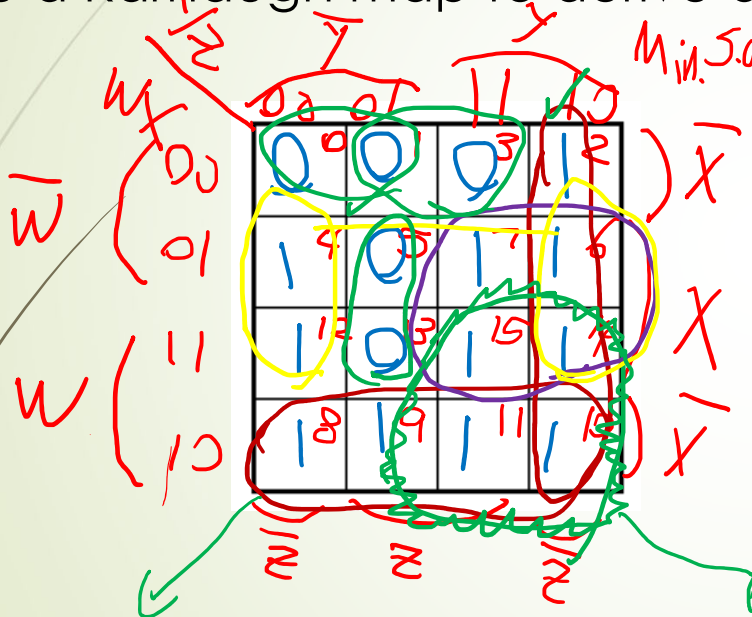
Test 1:

- Number systems
  - Convert any base to any base
  - Quick conversion between base 2, 4, 8, and 16
  - Add, subtract, multiply in any base
- Logic gate implementation of a Boolean function
- Boolean properties and laws
- Simplification of Boolean algebra using Boolean laws
- Representing Boolean functions in terms of
  - Sum of min-terms, product of max-terms, standard sum of products, standard product of sums, minimum sum of products, minimum product of sums
  - Representing Boolean functions using all NAND or NOR gates.
- Simplification using K-map (up to 5 variables)
  - SOP, POS, Standard SOP and POS, Min. SOP and POS
- Design of combinational circuits

1. Given $Y = f(w, x, y, z) = \Pi M(0, 1, 3, 5, 13)$,
   a. Write the complete truth table for $Y = f(w, x, y, z)$.
   b. Write $Y = f(w, x, y, z)$ in standard POS form and standard SOP form.
   c. Write $Y = f(w, x, y, z)$ in sum of min-terms and product of max terms.

$= \Sigma M(2, 4, 6, 7, 8, 9, 10, 11, 12, 14, 15)$

Use a Karnaugh map to derive a minimized POS and minimized SOP.



Min. S.O.P

$F = Y\bar{z} + W\bar{X} + XY + X\bar{z}$ ✓

$F = X\bar{Y}\bar{z} + \bar{W}\bar{X}\bar{Y} + \bar{W}\bar{X}z$

Min. P.O.S.

$F = (\bar{X} + Y + \bar{z})(w + X + Y)(w + X + \bar{z})$

essential

non-essential

1.Given $Y = f(w, x, y, z) = \Pi M(0, 1, 3, 5, 13)$,

1.Write the complete truth table for $Y = f(w, x, y, z)$.

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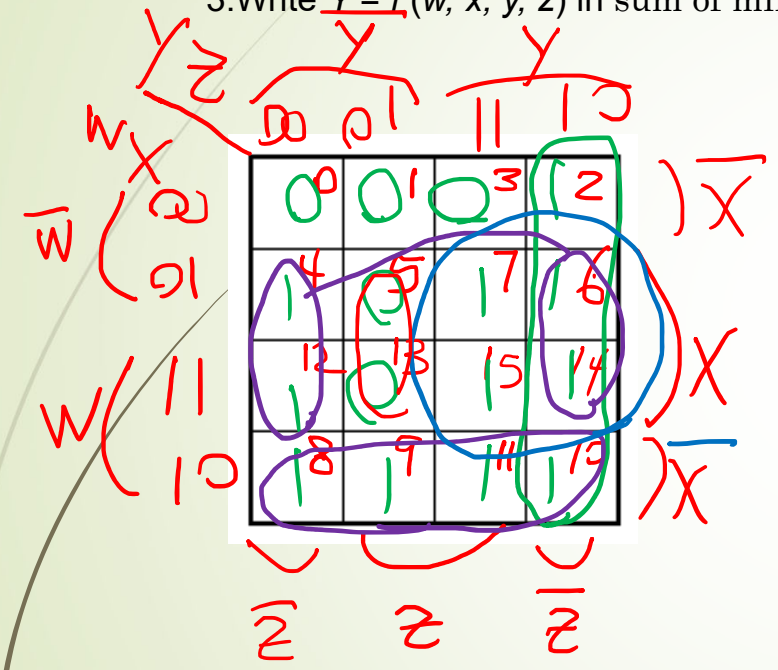
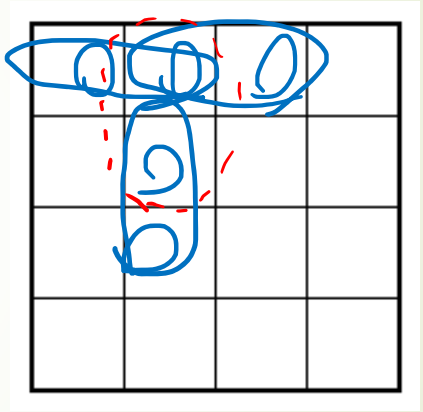




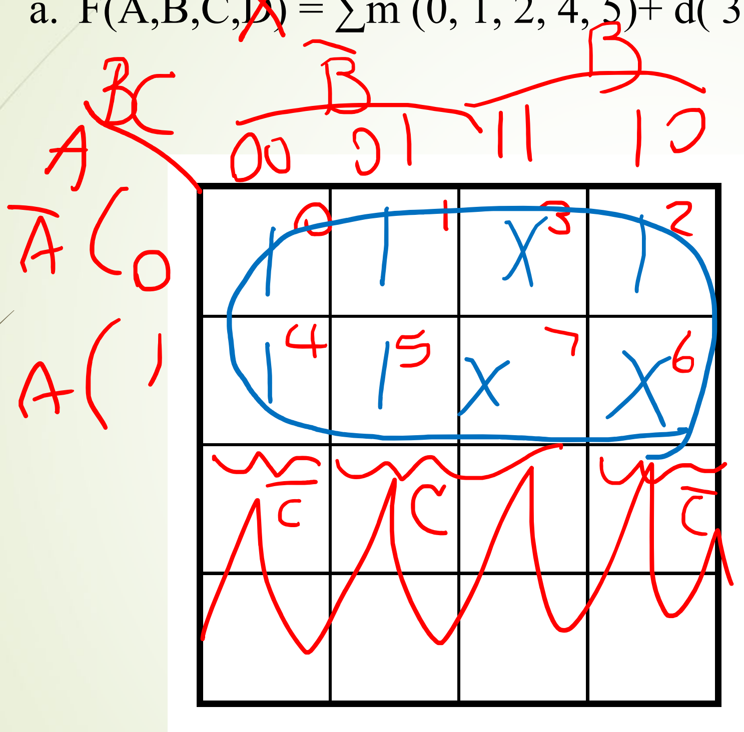
$$F = w\bar{x} + xy + x\bar{z} + y\bar{z}$$

$$\bar{F} = x\bar{y}z + \bar{w}\bar{x}\bar{y} + \bar{w}\bar{x}z$$

$$F = (\bar{x} + y + \bar{z})(w + \bar{x} + x)(w + x + \bar{z})$$

2. Simplify the following Boolean functions using four variables K-maps and express your answer in minimum sum of products and minimum product of sums.

a. F(A,B,C,~~D~~) = ∑m (0, 1, 2, 4, 5)+ d(3, 6, 7)



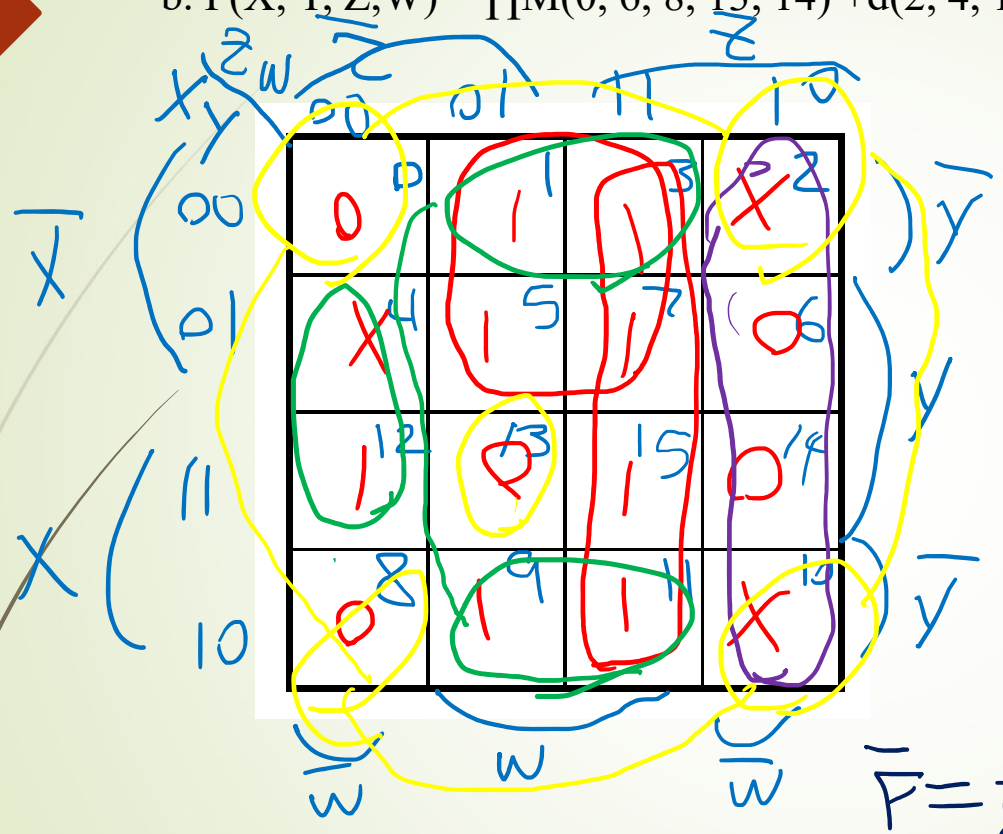
Min S.O.P

F = 1

Min P.O.S $\bar{F} = 0$

F = 1

b. $F(X, Y, Z, W) = \prod M(0, 6, 8, 13, 14) + d(2, 4, 10)$



Product of Max terms
*Sum of Min terms
$F = \Sigma M(1,3,5,7,9,11,12,15) + d(2,4,10)$

Min S.O.P
$F = \bar{Z}W + \bar{X}W + \bar{Y}W + Y\bar{Z}\bar{W}$

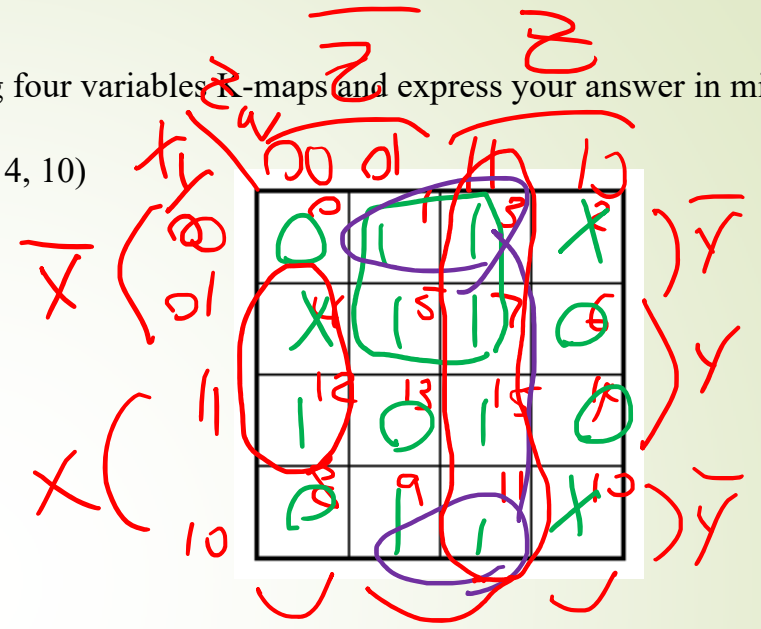
Min. P.O.S
$\bar{F} = \bar{Z}\bar{W} + \bar{Y}\bar{W} + XY\bar{Z}W$
$F = (\bar{Z}+W)(Y+W)(\bar{X}+\bar{Y}+Z+\bar{W})$

2. Simplify the following Boolean functions using four variables K-maps and express your answer in minimum sum of products and minimum product of sums.

b. F(X, Y, Z,W) = ∏M(0, 6, 8, 13, 14) +d(2, 4, 10)

$F = \bar{Y}W + \bar{Z}W + \bar{X}\bar{Y}W$

$Y\bar{Z}\bar{W}$ ✓

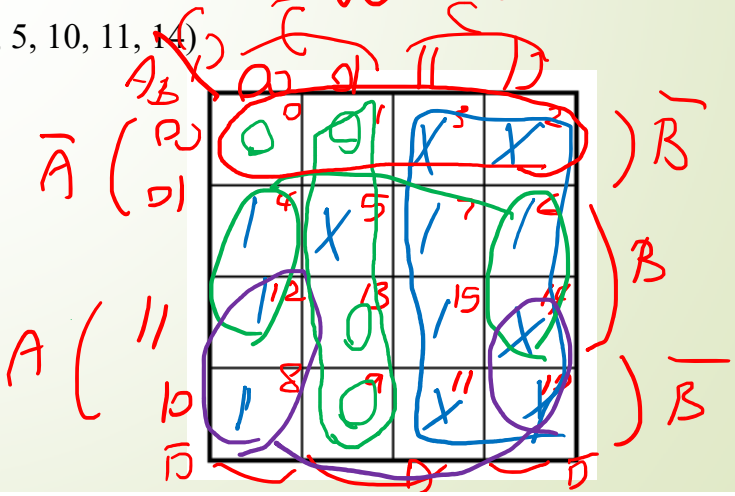


c. F(A, B, C, D) = ∑m(4, 6, 7, 8, 12, 15) +d(2, 3, 5, 10, 11, 14)

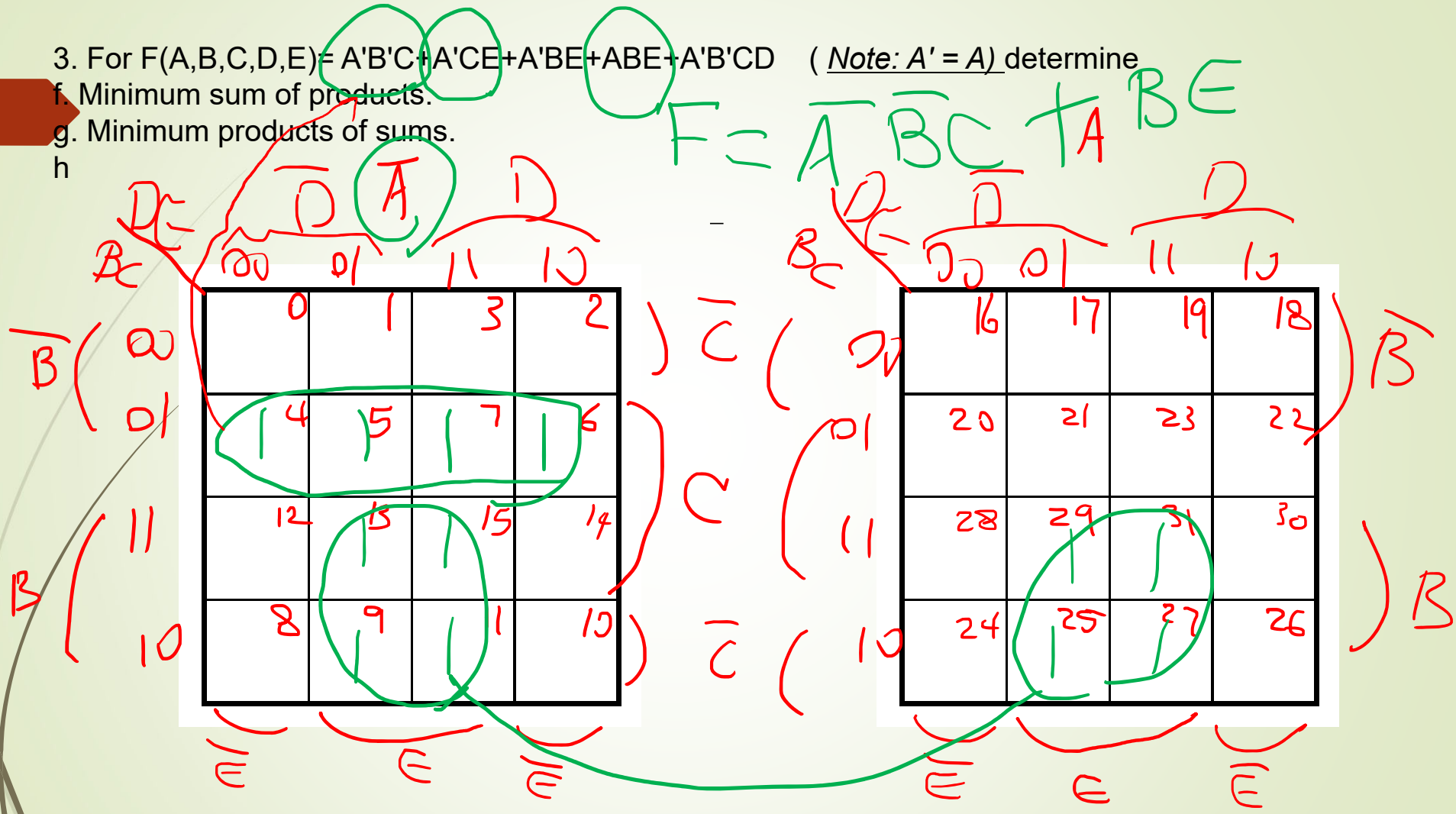
$F = C + B\bar{D} + A\bar{D}$

$\bar{F} = \bar{A}\bar{B} + \bar{C}\bar{D}$

$F = (A+B)(C+\bar{D})$



3. For F(A,B,C,D,E)= A'B'C+A'CE+A'BE+ABE+A'B'CD (*Note: A' = A)* determine
f. Minimum sum of products.
g. Minimum products of sums.
h



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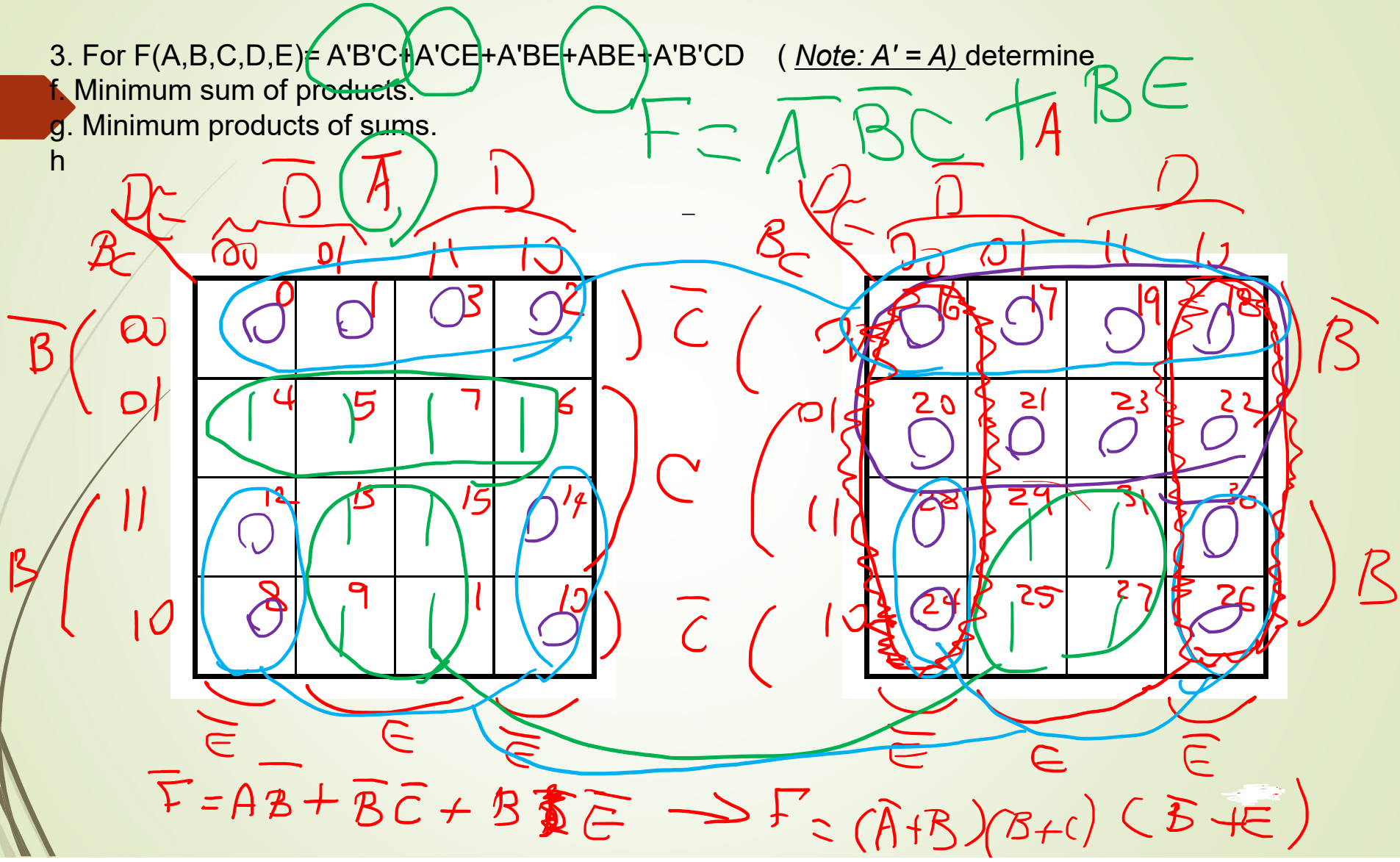

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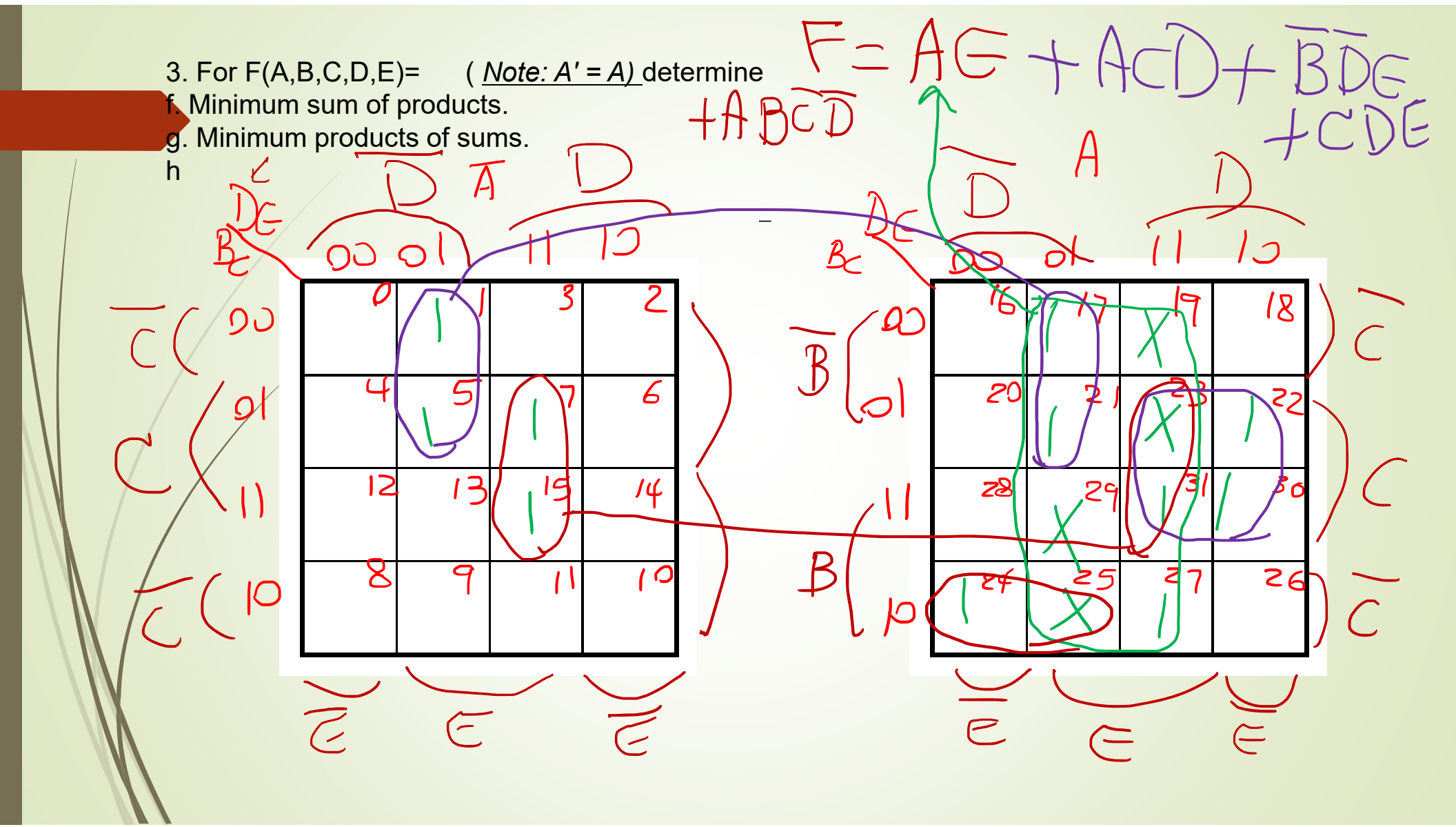
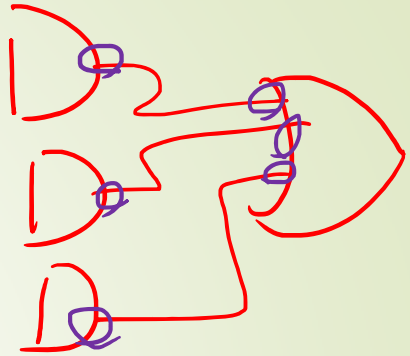


Min. S.O.P → NAND

$F = A\bar{B}C + ACD + BD$



Min. P.O.S → NOR

$F = (A + \bar{B} + C)(\bar{A} + D)(C + B)$