EGC220
Class Notes
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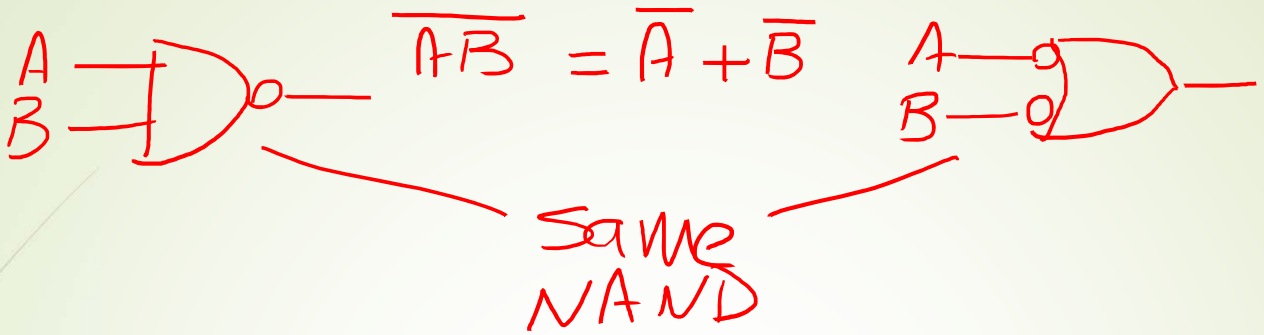
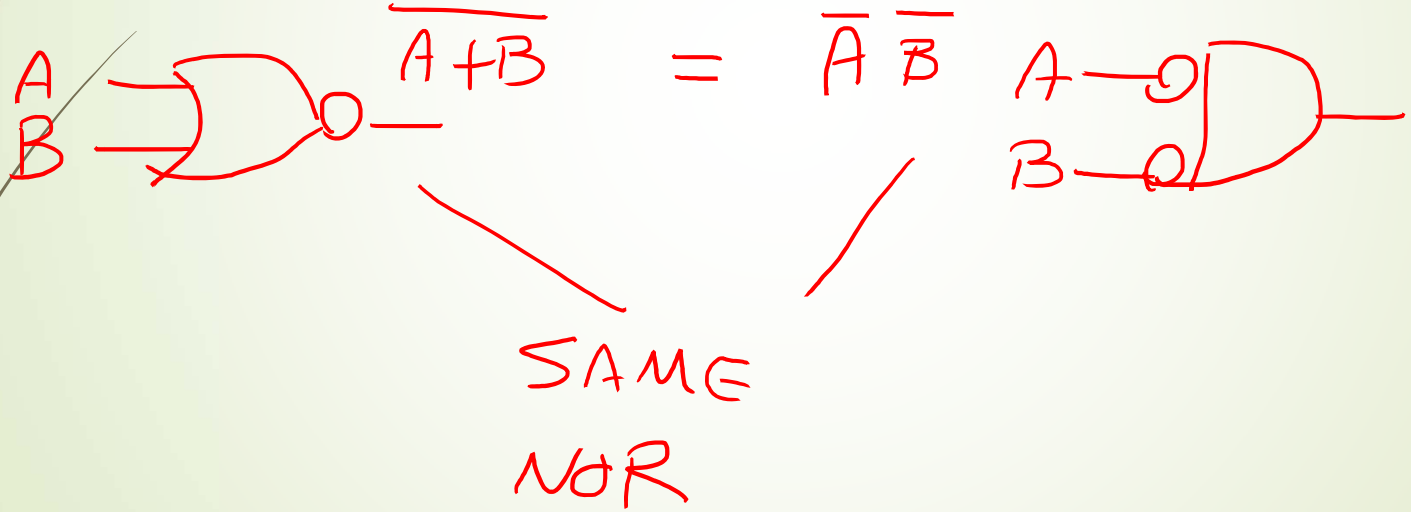
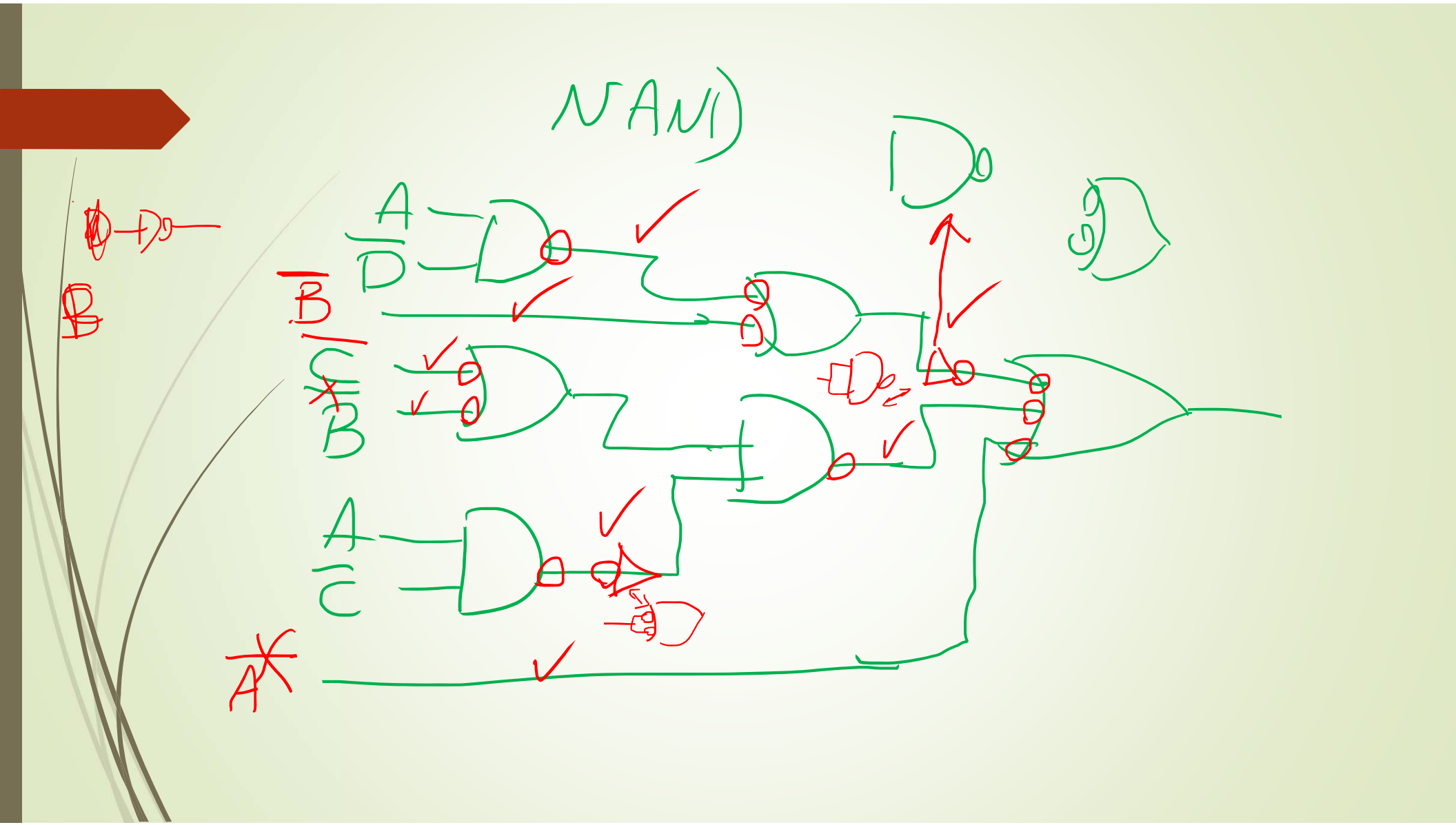
Test 1:

- 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

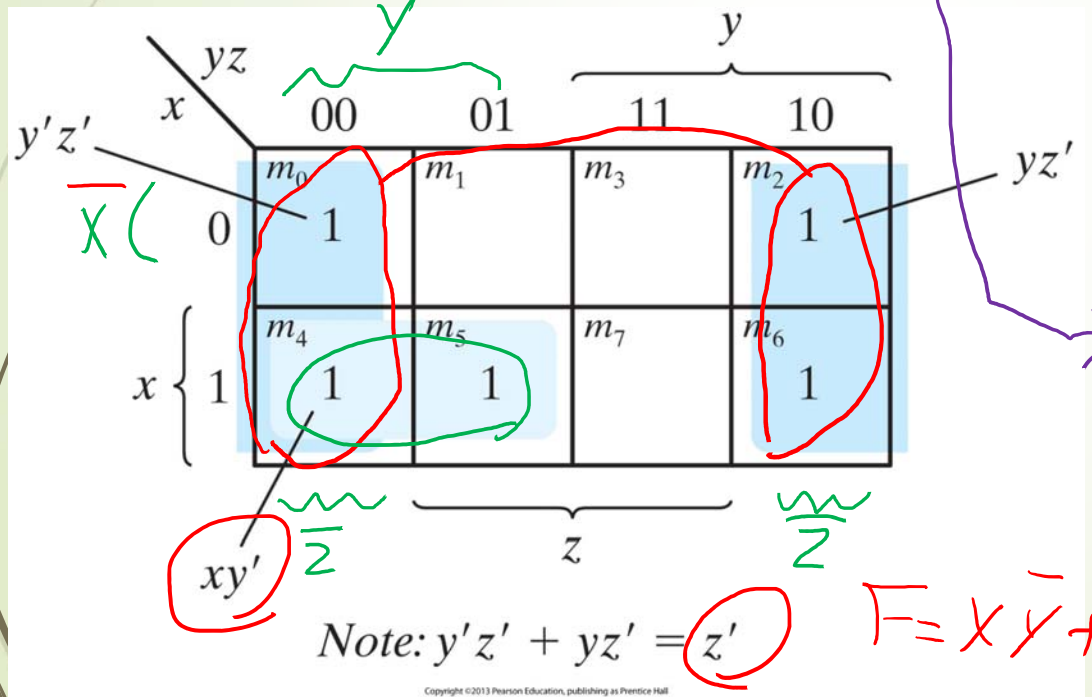

A
B
$\overline{AB} = \overline{A} + \overline{B}$
A
B
same
NAND


A
B
$\overline{A+B} = \overline{A}\,\overline{B}$
A
B
SAME
NOR


NAND
A
D
B
B
A
C
A

Simplification criteria in K-map

1. Least number of groups.
2. Make each group as large as possible.
3. Make sure each group is essential



$\bar{x}\bar{y}\bar{z} + x\bar{y}\bar{z} + \bar{x}y\bar{z} + xy\bar{z}$

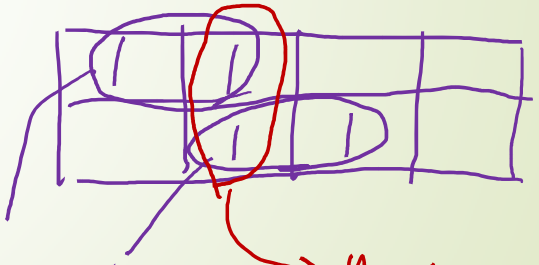
$m_0 \quad m_4 \quad m_2 \quad m_6$

$\bar{y}\bar{z}(\bar{x}+x) + y\bar{z}(\bar{x}+x)$

$\bar{y}\bar{z} + y\bar{z} = \bar{z}(\bar{y}+y) = \bar{z}$

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

$m_4 \quad m_5$



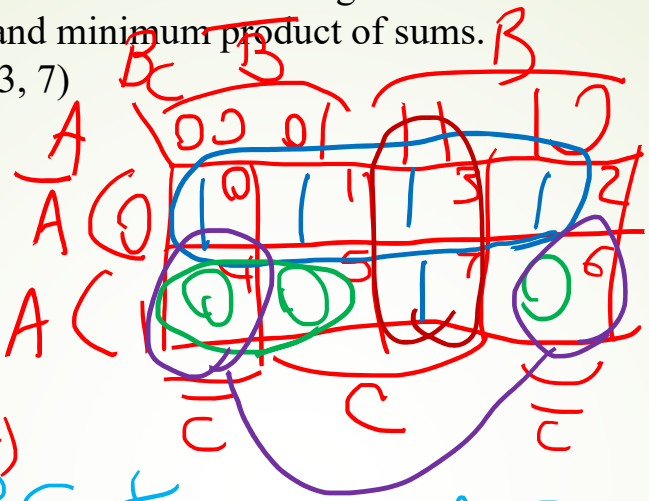
essential

non-essential ∴ shouldn't be included

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

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

a. $F(A,B,C) = \Sigma m(0, 1, 2, 3, 7)$



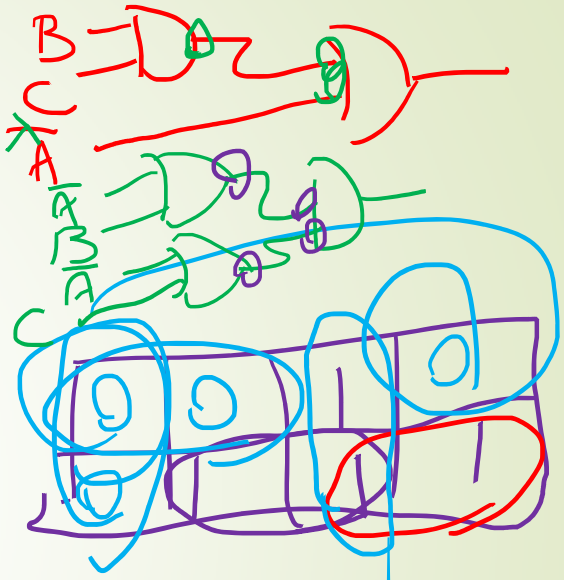
Min SOP $F = \bar{A} + BC$

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

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

b. $F(A,B,C) = \Sigma m(3,5,6,7)$

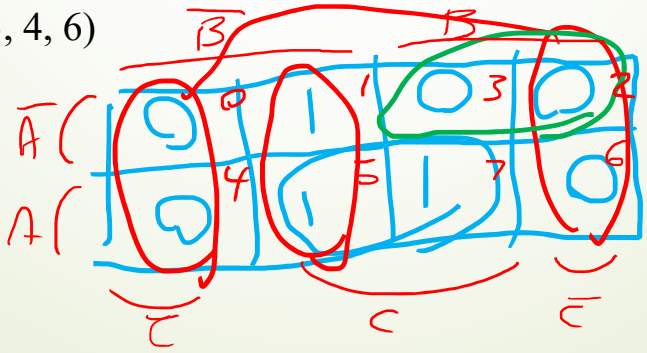
$\pi M(0,1,2,4)$



Min SOP $F = BC + AC + AB$

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

c. $F(A,B,C) = \Pi M(0, 2, 3, 4, 6)$



$F = \bar{B}C + AC$

min SOP

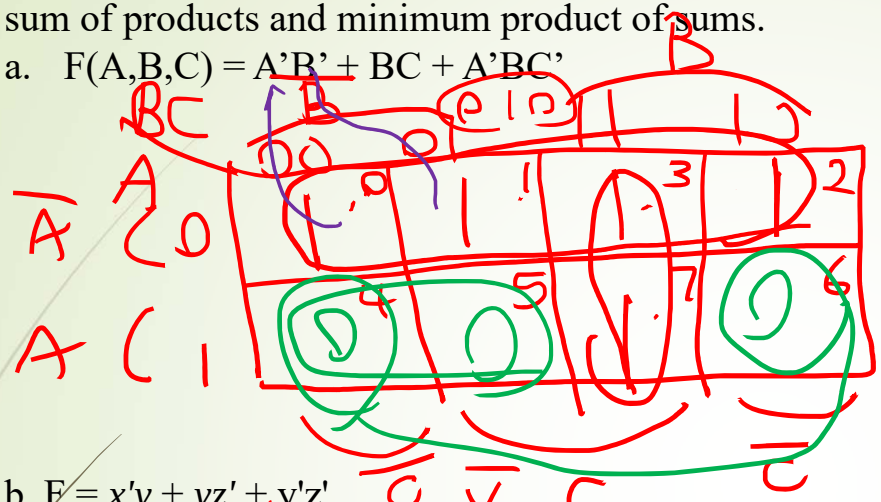
$\bar{F} = \bar{C} + A\bar{B}$

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

min POS

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

a. F(A,B,C) = A'B' + BC + A'BC'

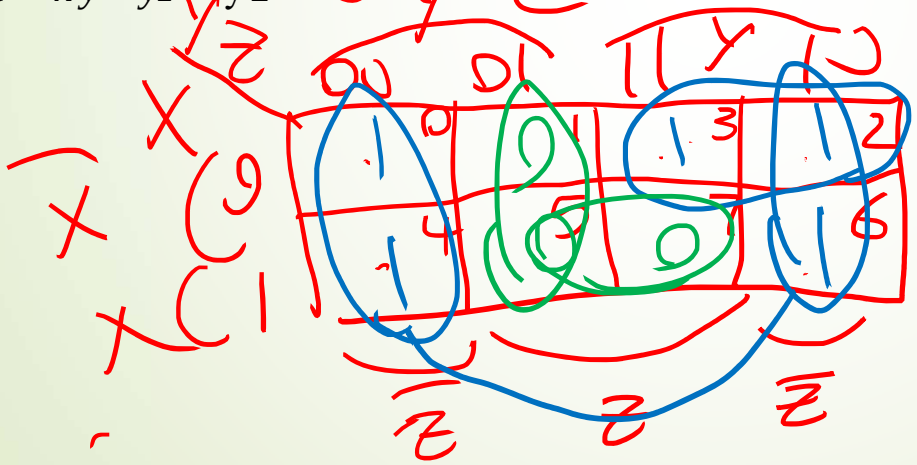


$F = \bar{A} + BC$ Min. S.o.P

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

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

b. F = x'y + yz' + y'z'



$F = \bar{z} + \bar{x}y$ Min.S.o.P

$F = \bar{y}z + xz$

$F = (y + \bar{z})(\bar{x} + \bar{z})$ Min.P.O.S

3. For the following Boolean expression F =AC′ + A′B′C + ABC′ + AB′C, determine

a. Truth table
b. Sum of min terms
c. Product of max terms
d. Standard sum of products
e. Standard product of sums
f. Minimum sum of products
g. Minimum products of sums
h. Gate implementation using all NAND gates
i. Gate implementation using all NOR gates.