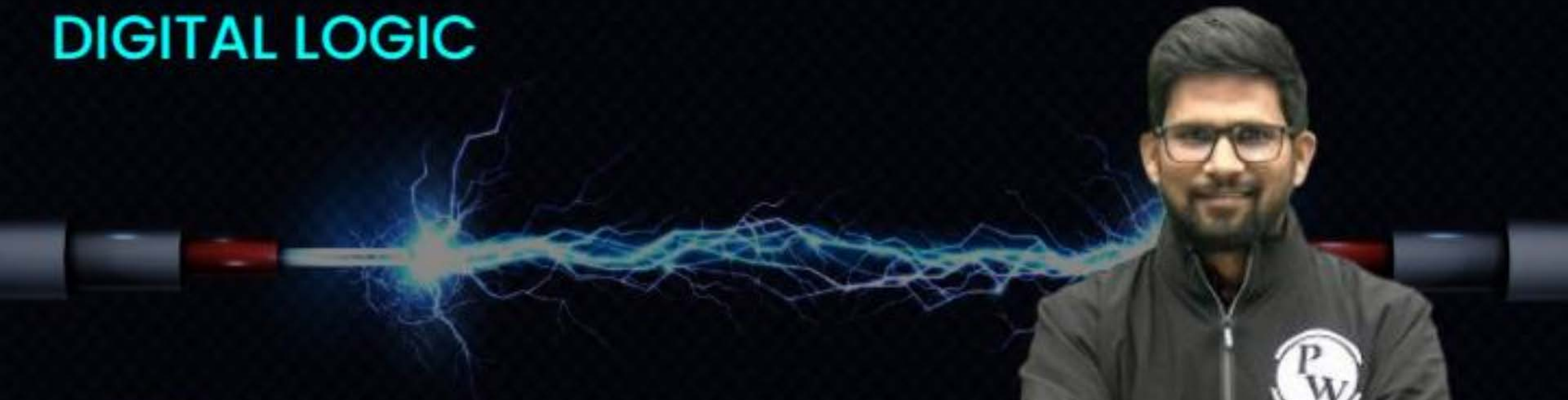
COMPUTER SCIENCE & IT

DIGITAL LOGIC



Lecture No: 04

Miscellaneous Topics

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Recap of Previous Lecture

- 2's compliment representation of signed no.
-
-

Number System Cont.

- $A = (11001)_2 = (-7)_{10}$

  $B = (01001)_2 = (+9)_{10}$

  $C = (11110)_2 = (-2)_{10}$

- $A - B + C$ $\quad (\quad)_{10}$

$= -7 - 9 - 2$ $\quad (01110)_2$

$= (-18)_{10}$ $\quad (+14)_{10}$

$-(2^4)$ to $+[2^4 - 1]$

-16 to 15

$A - B =$ $11001 = A$

$+ \ 10111 = -B$

$\overline{\textcircled{1}\,10000} = (-16)_{10}$

discard

$A - B + C =$ $10000 = (A - B)$

$+ \ 11110 = C$

$\overline{\textcircled{1}\,01110}$

discard

BCD Codes → weighted code

- Binary Coded decimal (8421-Code)

$(235)_{10} = (11101011)_2$

$= (0010\ 0011\ 0101)_{BCD}$

$(987)_{10} = (1001\ 1000\ 0111)_{BCD}$

	8421
0 →	0000
1 →	0001
2 →	0010
3 →	0011
4 →	0100
5 →	0101
6 →	0110
7 →	0111
8 →	1000
9 →	1001

1010
1011
1100 → invalid BCD Codes
1101
1110
1111

Excess - 3 Codes

→ Unweighted code

→ non-self complimentary

8421 → BCD Code

	BCD Code	Excess-3 Code
0	0000	0011
1	0001	0100
2	0010	0101
3	0011	0110
4	0100	0111
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

→ self complimentry in nature

- 2421 code
- 3321 code
- 4221 code

↓ summation of weights is 9

↓ self complimentry in nature

in unweighted Code system Excess-3 is the only code which is self complementry in nature.

$$(7359)_{10} = (0111\ 0011\ 0101\ 1001)_{BCD} = (1010\ 0110\ 1000\ 1100)_{Excess\text{-}3}$$

Gray Code / Number System

→ Unweighted no. system

→ Unit distance code [UDC]

$2^4\ 2^3\ 2^2\ 2^1\ 2^0$

$(16)_{10} = (10000)_2 = (11000)_{gray} = (10000)_2$

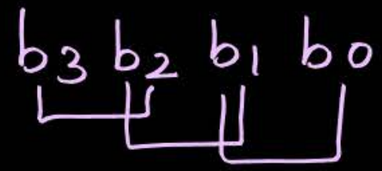
$(17)_{10} = (10001)_2 = (11001)_{gray} = (10001)_2$

$(18)_{10} = (10010)_2 = (11011)_{gray} = (10010)_2$

$(19)_{10} = (10011)_2 = (11010)_{gray} = (10011)_2$

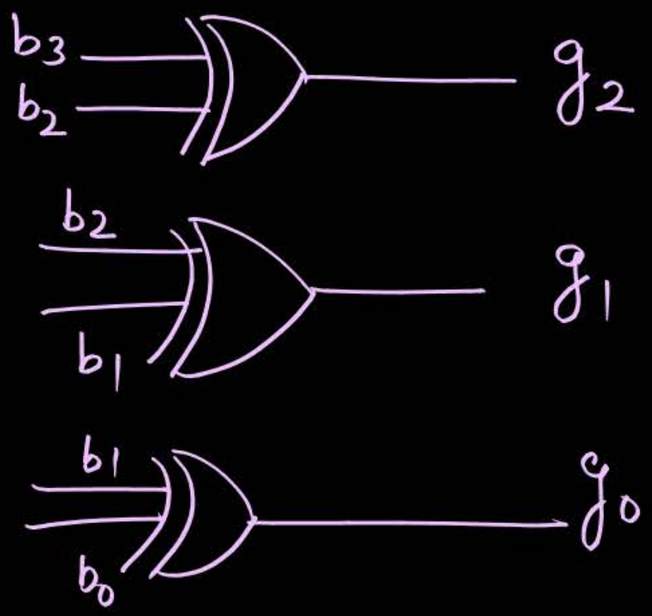
$(20)_{10} = (10100)_2 = (11110)_{gray} = (10100)_2$

Binary to Gray Code Conversion :



$g_3\ g_2\ g_1\ g_0$

$g_3 = b_3$



$(1100\,10)_2 = (101011)_{gray}$

$0 = (00)_2 = (00)_{gray}$

$1 = (01)_2 = (01)_{gray}$

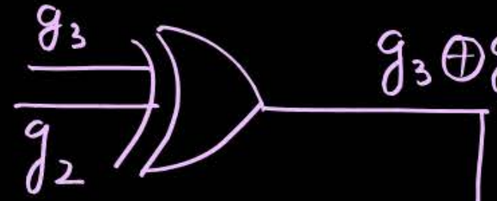
$2 = (10)_2 = (11)_{gray}$

$3 = (11)_2 = (10)_{gray}$

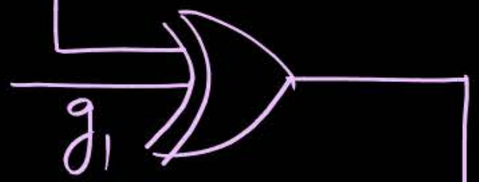
Gray to Binary Conversion :

$g_3 g_2 g_1 g_0$ $\qquad$ $b_3 b_2 b_1 b_0$

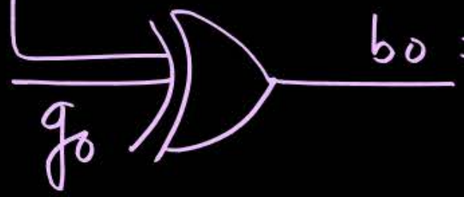
$b_3 = g_3$



$g_3 \oplus g_2 = b_2$



$b_1 = g_3 \oplus g_2 \oplus g_1$

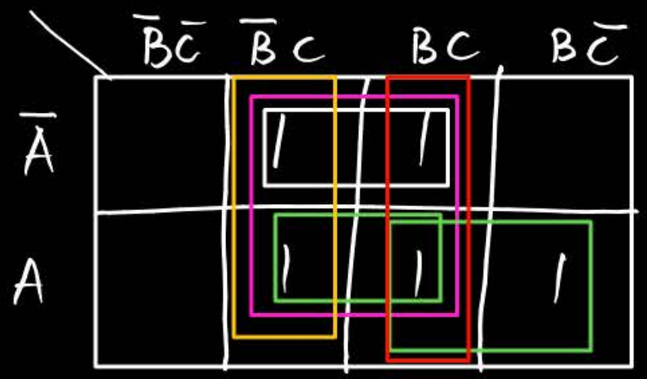


$b_0 = g_3 \oplus g_2 \oplus g_1 \oplus g_0$

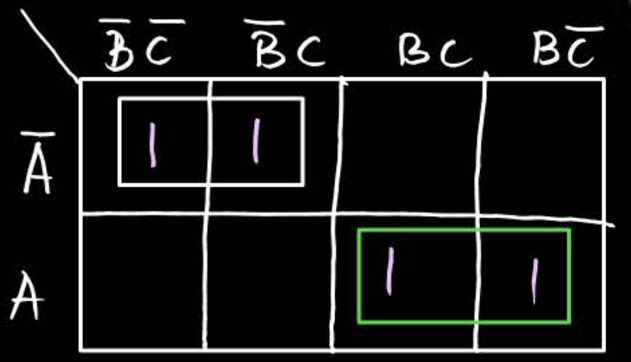
$(1\,1\,0\,1\,1\,0\,1\,1\,0)_{gray} = (1\,0\,0\,1\,0\,0\,1\,0\,0)_2$

Implicants

All single 1's,
all possible groups
(all possible pairs,
all possible quads,
all possible octates etc.)
are called as implicants.



$PI = C, AB$



$NRPI = \bar{A}\bar{B}, AB$

$PI = \bar{A}\bar{B}, AB$

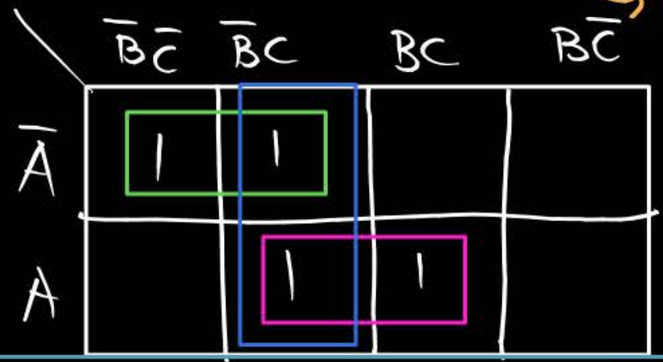
$\therefore PI = \bar{A}\bar{B}, AB$

$\bar{A}\bar{B}\bar{C}$, $\bar{A}\bar{B}C$, ABC, $AB\bar{C}$

$\bar{A}\bar{B}$, AB

implicants

$PI = \bar{A}\bar{B}, \bar{A}\bar{B}$



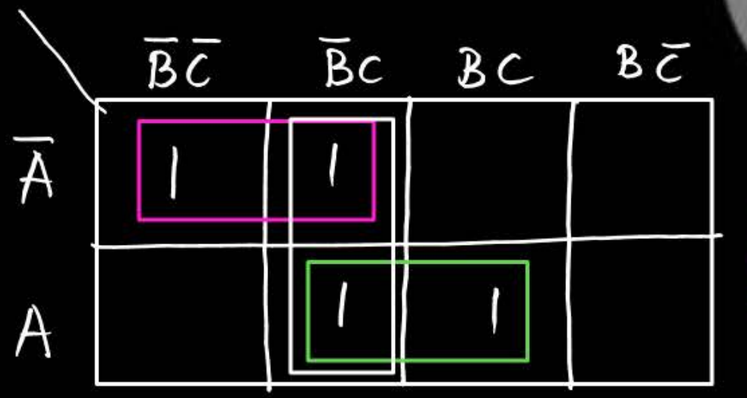
$\bar{A}\bar{B}\bar{C}$, $\bar{A}\bar{B}C$, $A\bar{B}C$, ABC, $\bar{A}\bar{B}$, AC, $\bar{B}C$

implicants

$PI = \bar{A}\bar{B}, AC, \bar{B}C$

Prime implicant :

- The implicant which can't be combined further to form a bigger group is called as prime implicant.



PI $= \bar{A}\bar{B}, AC, \bar{B}C$

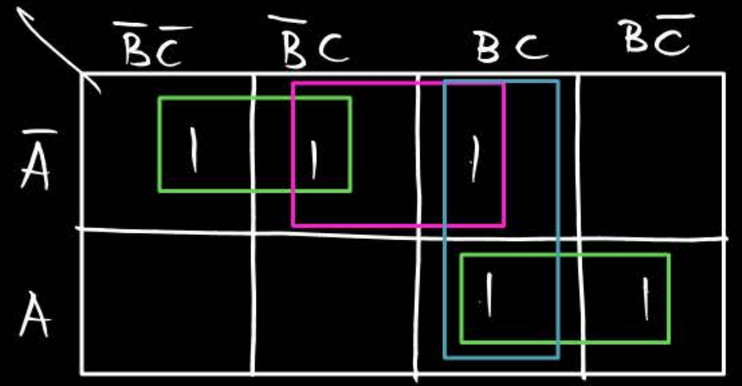
EPI $= \bar{A}\bar{B}, AC$

Essential PI :

→ A PI is said to EPI if atleast single '1' should be there which is covered only by that PI.

NRPI $= \bar{A}\bar{B}, AB, BC$ ✓✓

RPI $= \bar{A}C$



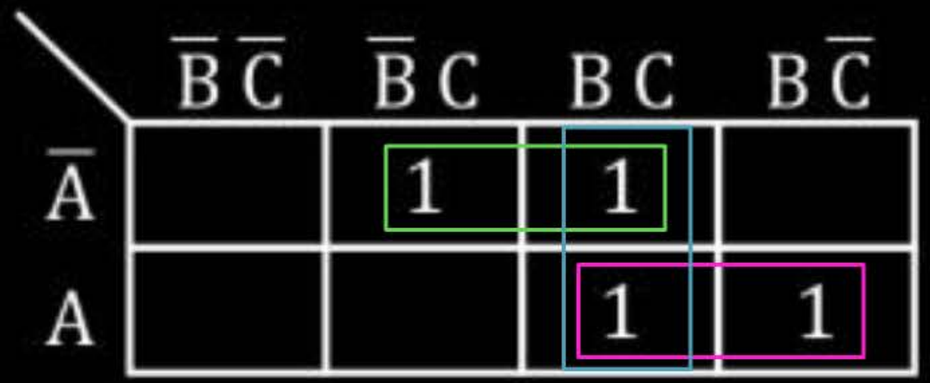
NRPI $\rightarrow \bar{A}\bar{B}, AB, \bar{A}C$

RPI $\rightarrow BC$

PI $= \bar{A}\bar{B}, \bar{A}C, BC, AB$

EPI $= \bar{A}\bar{B}, AB$

Examples :



Prime Implicants → $\bar{A}C, AB, BC$,

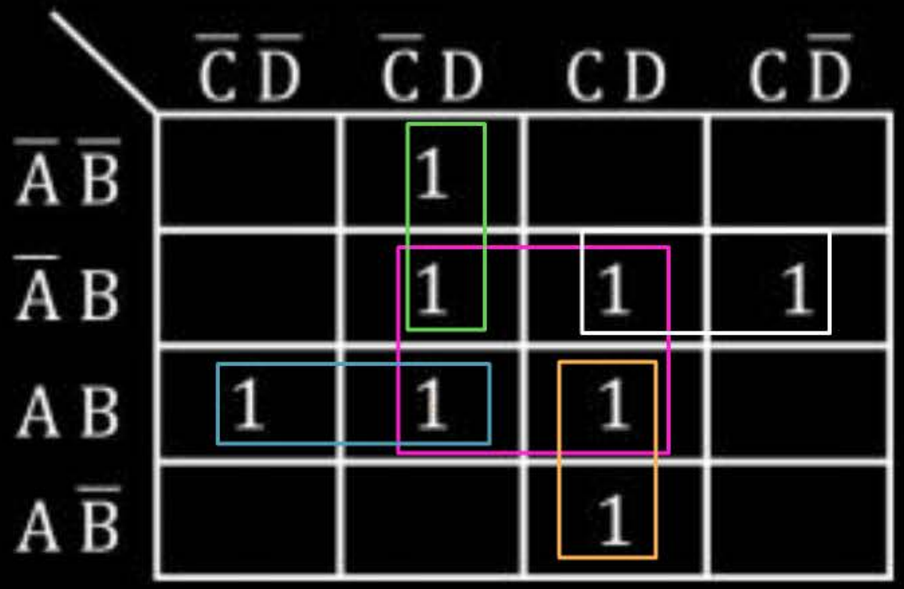
RPI = BC

NRPI = $\bar{A}C, AB$

Essential Prime Implicants → $\bar{A}C, AB,$

Non-Essential Prime Implicants → BC

Examples :

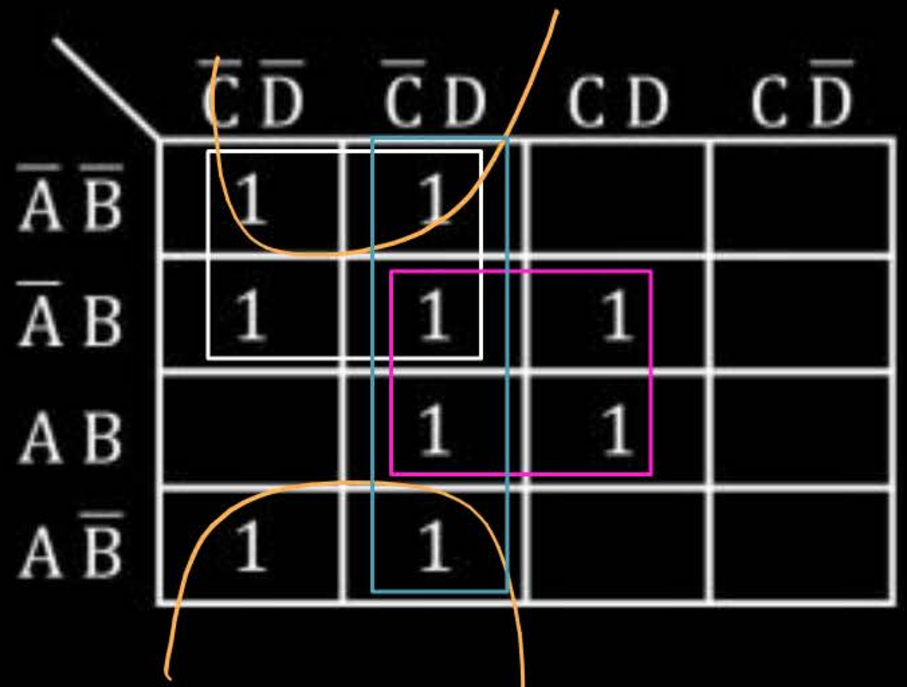


Prime Implicants → $\bar{A}CD, \bar{A}BC, AB\bar{C}, ACD, BD$

Essential Prime Implicants → $\bar{A}CD, \bar{A}BC, AB\bar{C}, ACD$

Non-Essential Prime Implicants → BD

Examples :

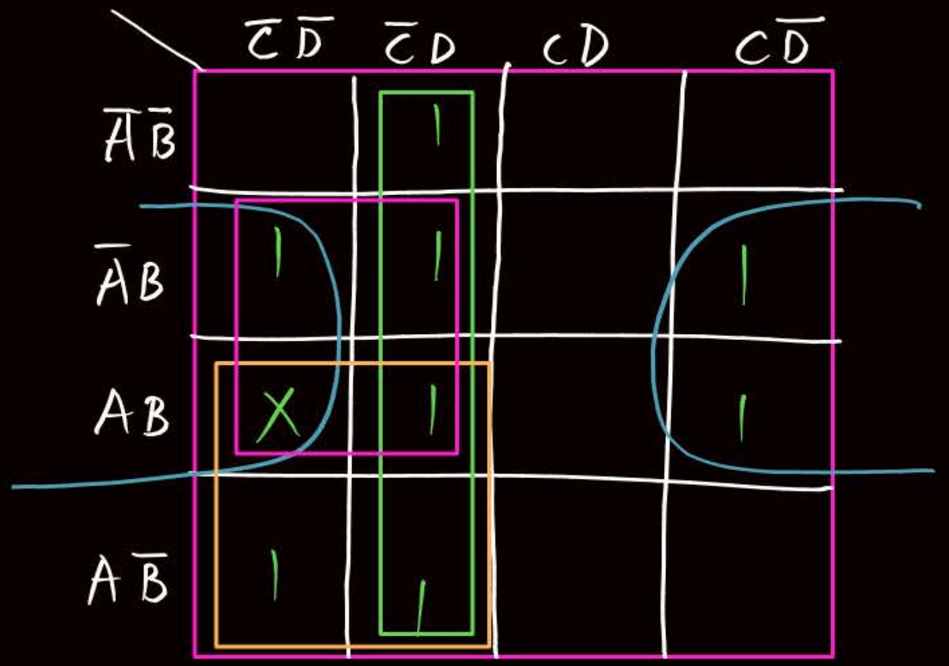


Prime Implicants → $\bar{A}\bar{C}$, $\bar{B}\bar{C}$, BD, CD

Essential Prime Implicants → $\bar{A}\bar{C}$, $\bar{B}\bar{C}$, BD

Non-Essential Prime Implicants → $\bar{C}D$

#Q.

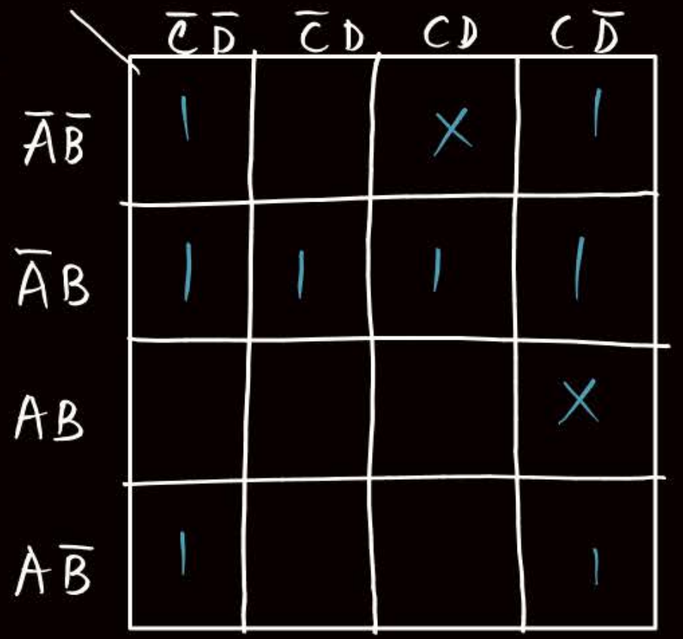


PI: $\bar{C}D$, $B\bar{C}$, $A\bar{C}$, $B\bar{D}$

EPI: $\bar{C}D$, $A\bar{C}$, $B\bar{D}$

NEPI: $B\bar{C}$,

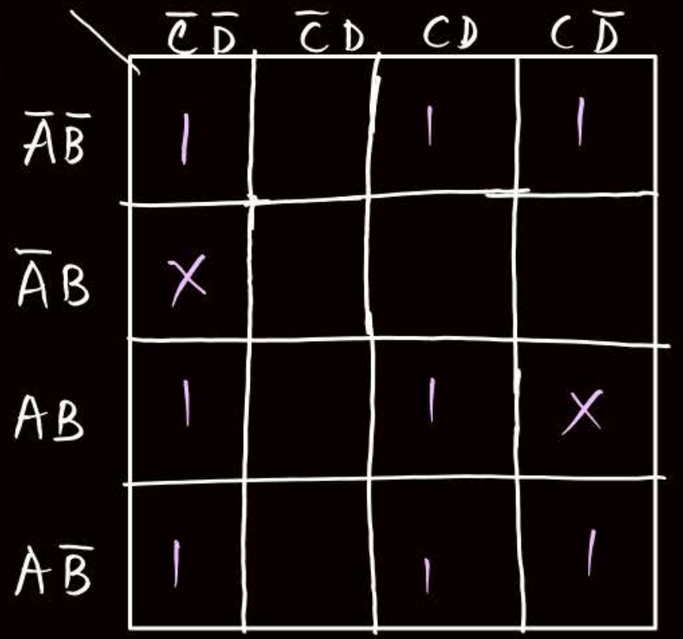
Q.



PI →

EPI →

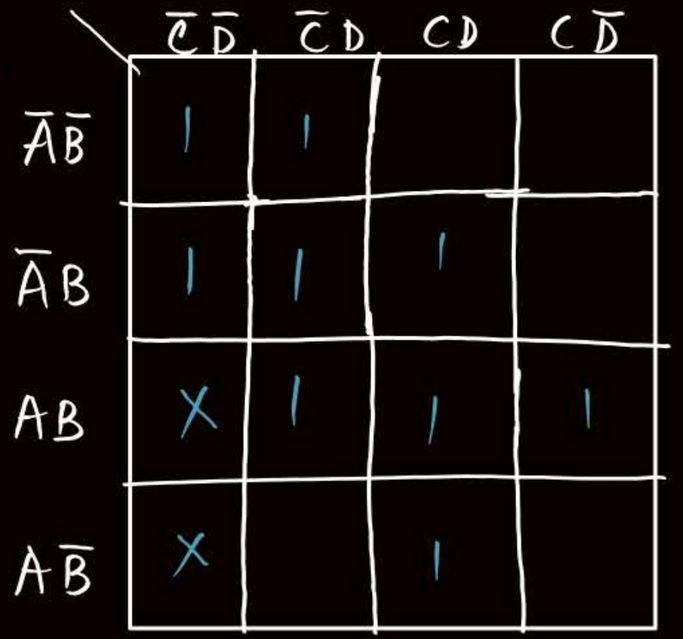
Q.


$\bar{C}\bar{D}$
$\bar{C}D$
CD
$C\bar{D}$
$\bar{A}\bar{B}$
$\bar{A}B$
AB
$A\bar{B}$
1
1
1
X
1
1
X
1
1
1

PI →

EPI →

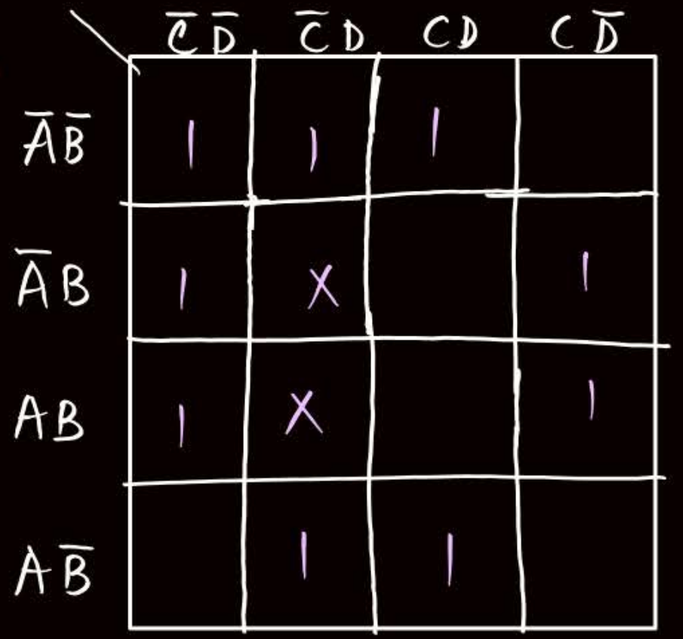
Q.


$\bar{C}\bar{D}$
$\bar{C}D$
CD
$C\bar{D}$
$\bar{A}\bar{B}$
$\bar{A}B$
AB
$A\bar{B}$
1
1
1
1
1
1
X
1
1
X
1

PI →

EPI →

Q.


$\bar{C}\bar{D}$
$\bar{C}D$
CD
$C\bar{D}$
$\bar{A}\bar{B}$
$\bar{A}B$
AB
$A\bar{B}$
1
1
1
1
X
1
1
X
1
1
1

PI →

EPI →

Topic : 2 Min Summary

- Number system
- PI, EPIs

Thank you

GW

Soldiers !