CS & IT ENGINEERING

Me

DIGITAL Logic

MINIMIZATION

Lecture No. 07

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01 Prime Implicants

02 Essential Prime Implicants

03 Question Practice

03 Discussion

IMPLICANTS AND PRIME IMPLICANTS

i) Implicants: The total number of min-terms in the Boolean expression are called Implicants. Or in K-map the total number of 1 is called Implicants.

2> Prime Implicants :- Total number of possibilities of formation of group are called PI.

IMPLICANTS AND PRIME IMPLICANTS

iii) Essential PI/Selective PI:

iv) Reduced PI: The total number of min-terms in the Boolean expression are called Implicants. Or in K-map the total number of 1 is called Implicants.

Note: For an n-variables Boolean function, the maximum, number of prime implicants is 2(n –1). A group of square or rectangle made up of bunch of adjacent min-terms which is allowed by definition of K-Map are called prime implicants(PI) i.e. all possible groups formed in K-Map.

PRIME IMPLICANTS AND ESSNTIAL PRIME IMPLICANTS

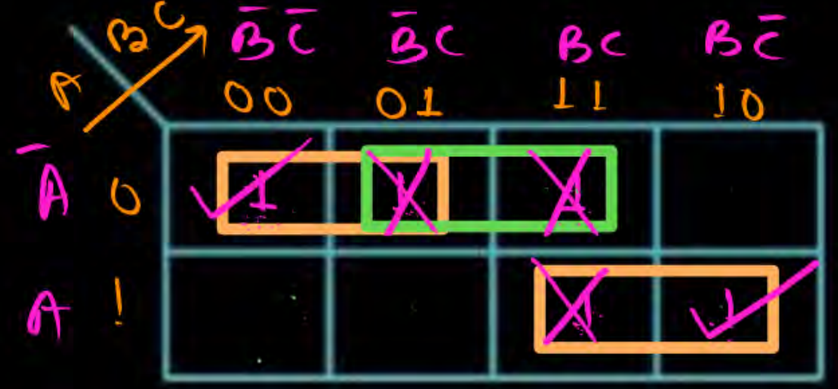
Selective Prime Implicant (SPI)

Reduced Prime Implicant (RPI)

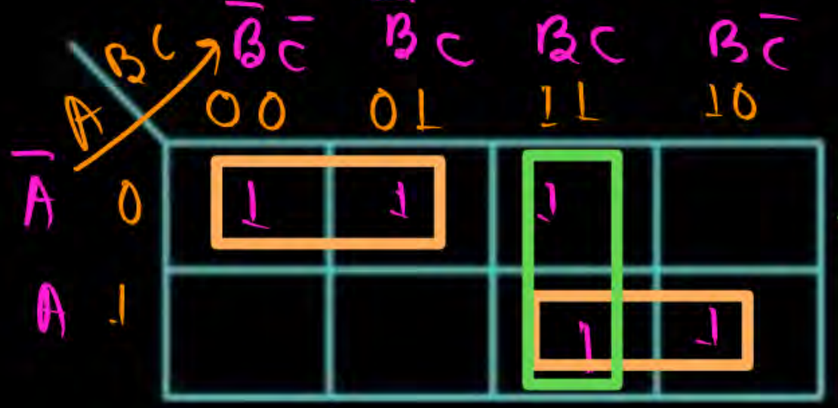
PI = {$\bar{A}\bar{B}$, AB, $\bar{A}$C, BC}

Q.1

$$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}BC + AB\bar{C} + ABC = \Sigma m(0, 1, 3, 6, 7)$$



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



$= \bar{A}\bar{B} + AB + BC$

Implicants = 5

Prime Implicants = 4

Essential prime Implicants = 2

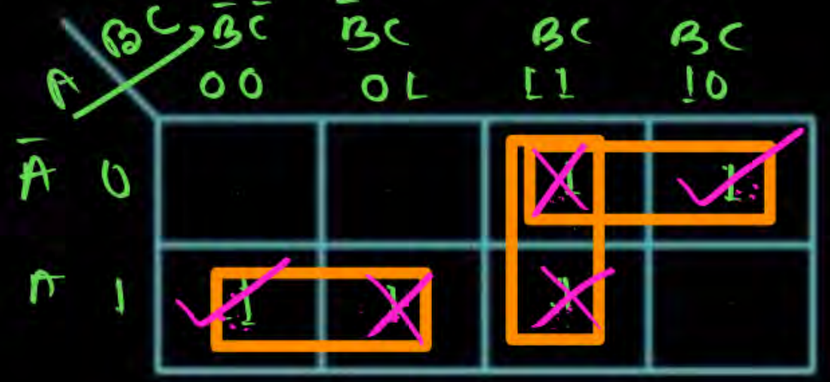
SPI = 1

RPI = 1

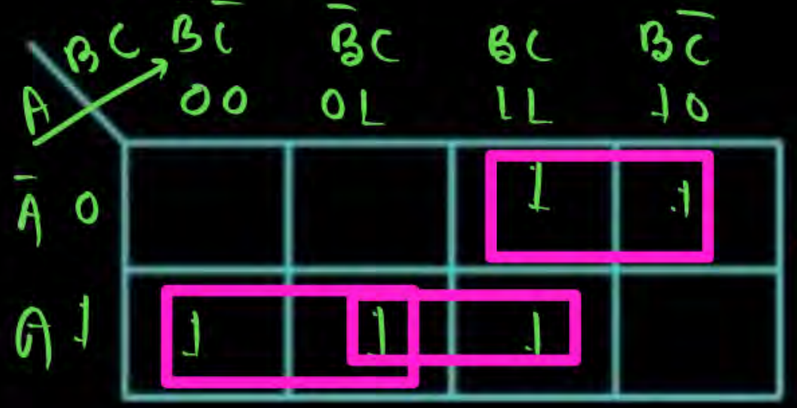
Q.2

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

$f(A, B, C) = \sum m\,(2, 3, 4, 5, 7)$



$= A\bar{B} + \bar{A}B + BC$



$= A\bar{B} + \bar{A}B + AC$

Implicant = 5

PI = 4

EPI = 2

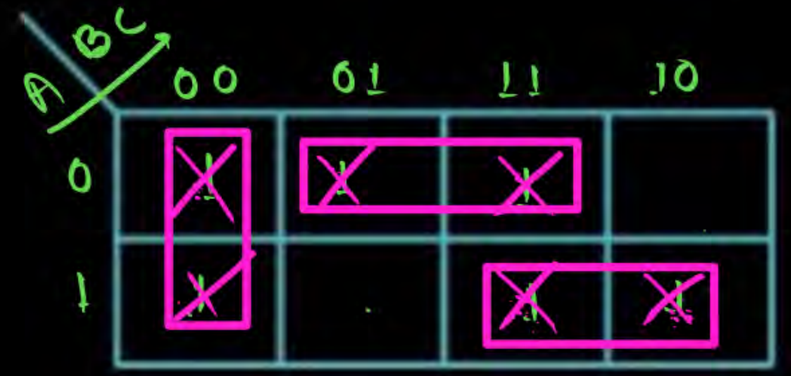
SPI = 1

RPI = 1

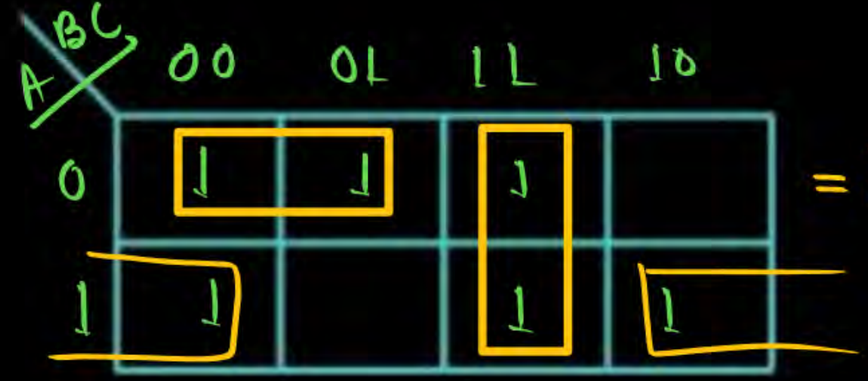
Q.3

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

$f(A, B, C) = \sum m\,(0, 1, 3, 4, 6, 7)$



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



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

Implicants = 6

PI = 6

EPI = 0

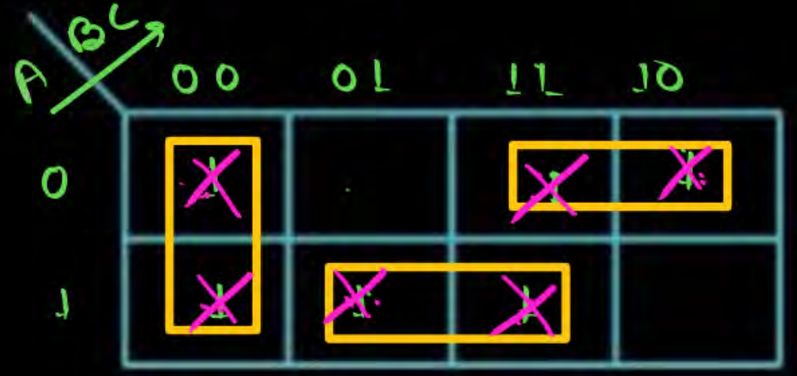
SPI = 3

RPI = 3

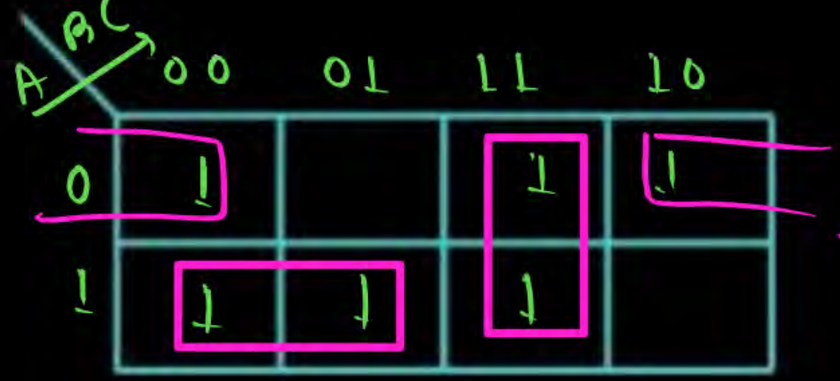
Q.4

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

$f(A, B, C) = \sum m\,(0, 2, 3, 4, 5, 7)$



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



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

Implicants = 6

PI = 6

EPI =

SPI = 3

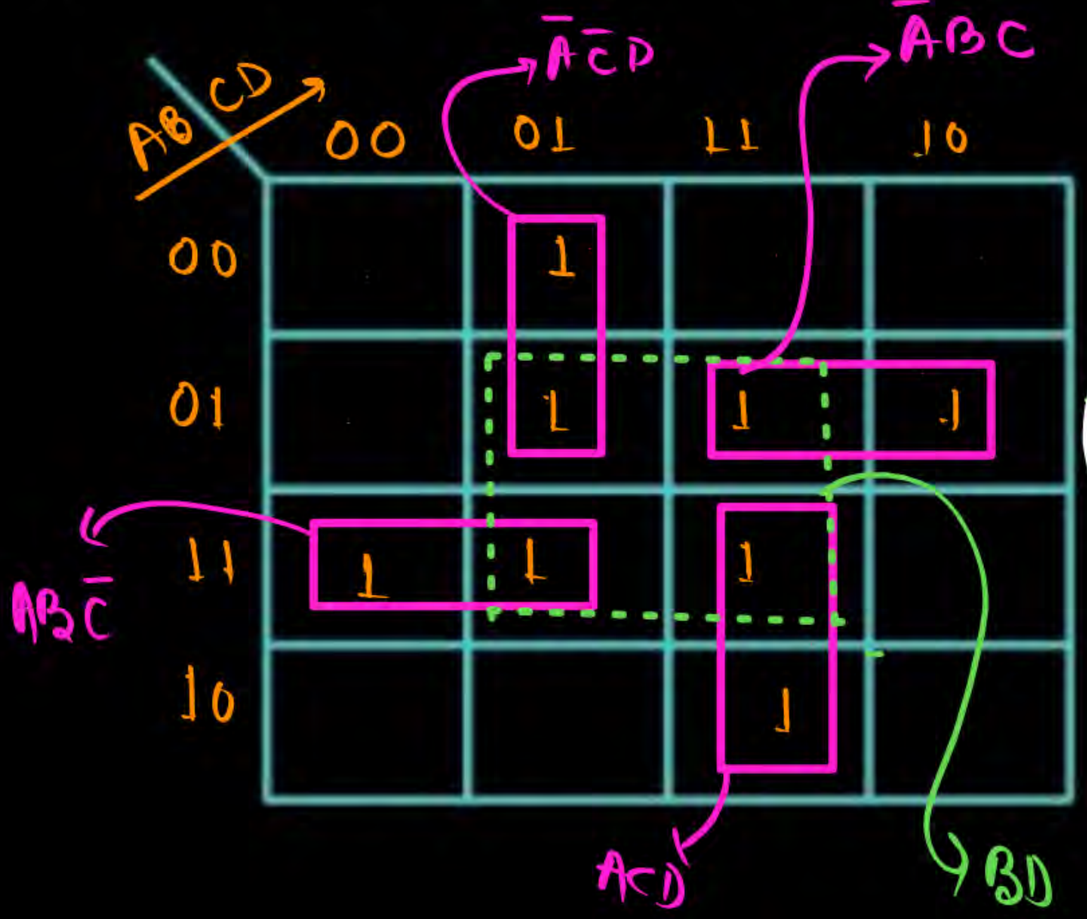
RPI = 3

Q.5

$PI = \{\bar{A}\bar{C}D, AB\bar{C}, ACD, \bar{A}BC, BD\}$

$EPI = \{\bar{A}\bar{C}D, AB\bar{C}, AD, \bar{A}BC\}$

$f(A, B, C, D) = \sum m\,(1, 5, 6, 7, 11, 12, 13, 15)$



$= \bar{A}\bar{C}D + \bar{A}BC + ACD + AB\bar{C}$

Implicants = 8

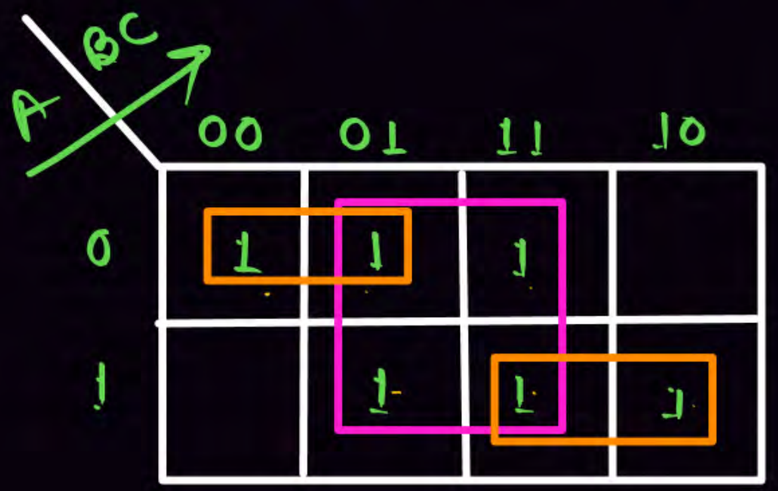
PI = 5

EPI = 4

SPI = 0

RPI = 1

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



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

I = 6

PI = 3

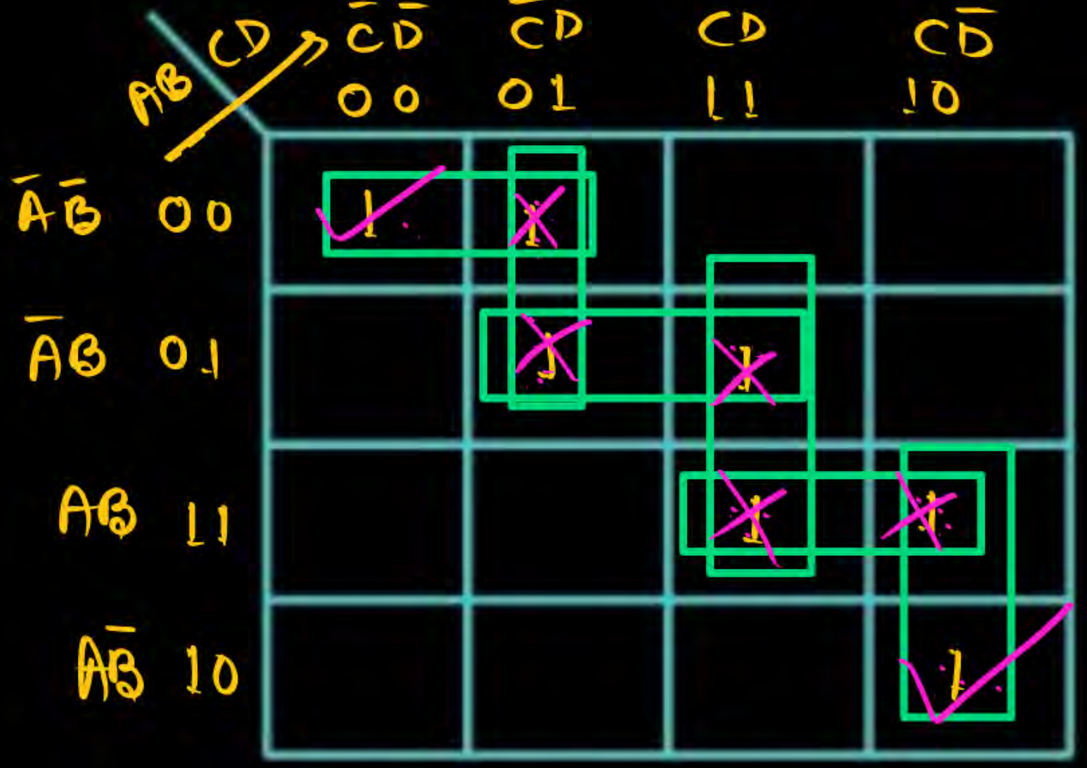
EPI = 3

SPI = 0

RPI = 0

Q.6

HW



I = 7

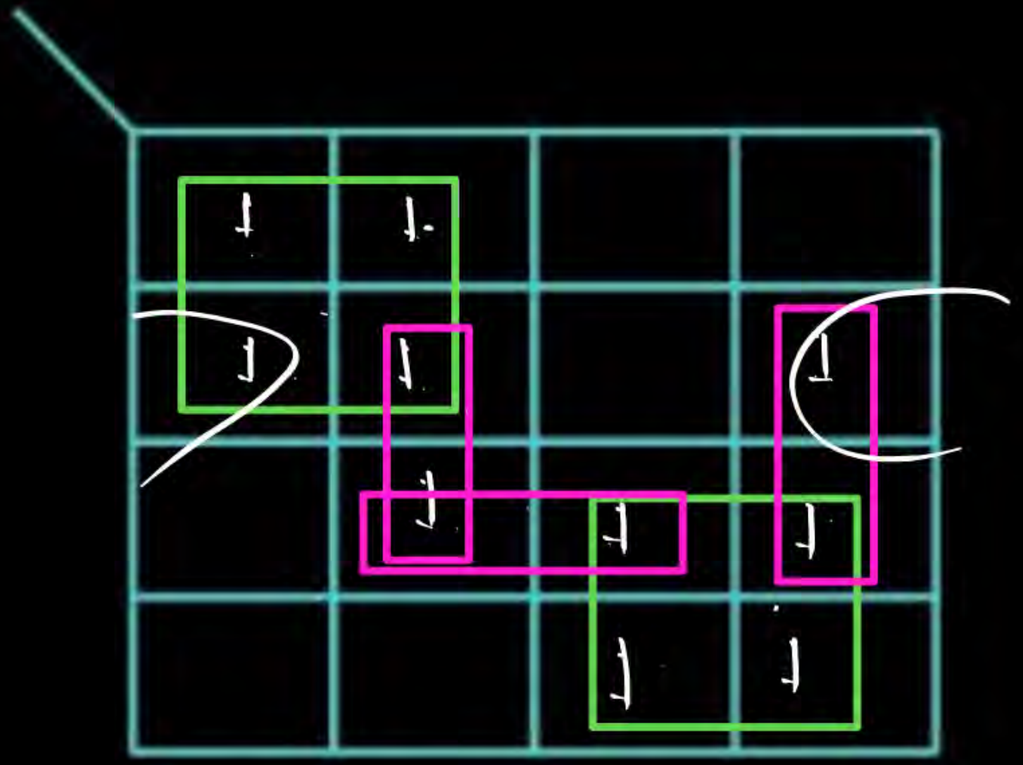
PI = 6

EPI = 2

SPI = 1

RPI = ?

Q.7



I = 10

PI = 6

EPI = 2

SPI = 2

RPI = 2

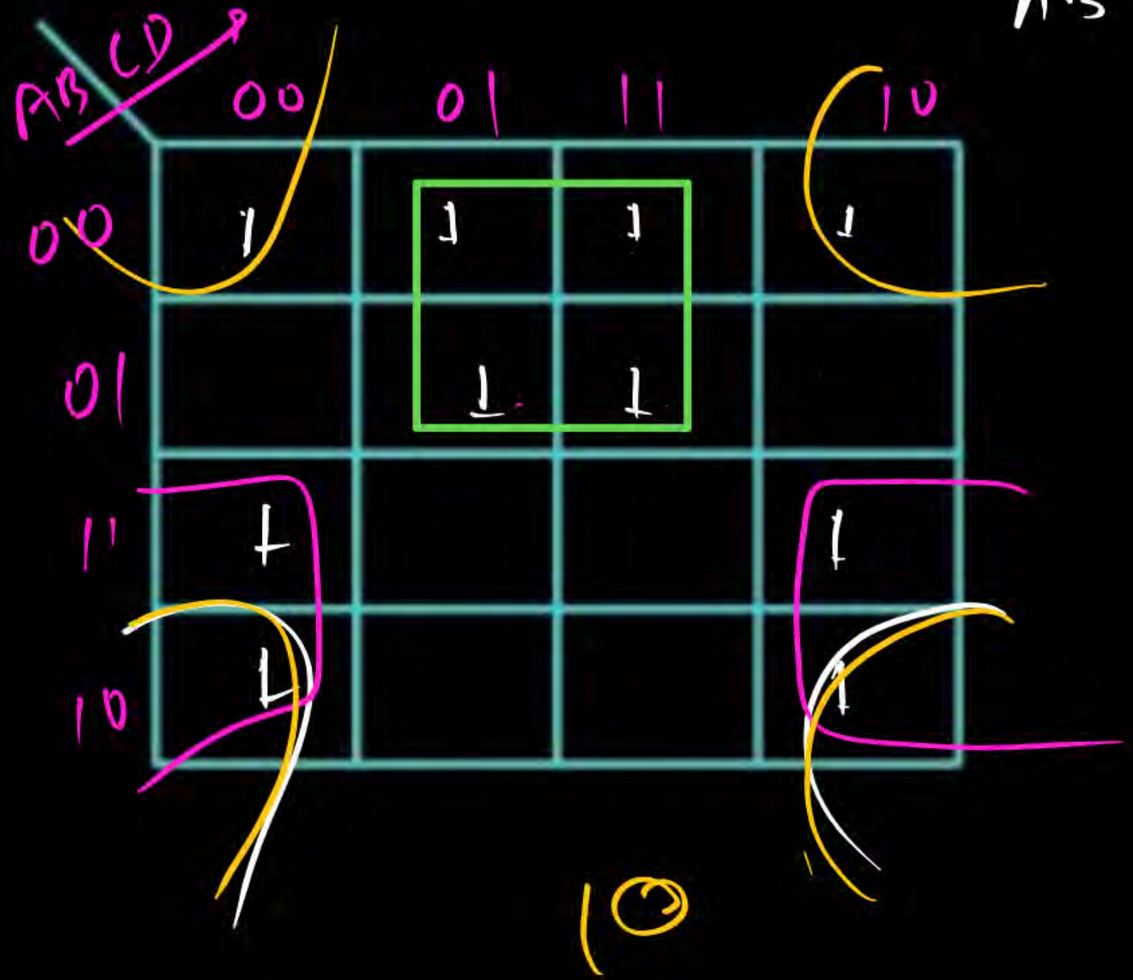
Q.8

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

$EPI = \{ \bar{A}D, A\bar{D} \}$

$\bar{B}\bar{D} + \bar{A}D + A\bar{D}$ → Ans-1

$\bar{A}\bar{B} + \bar{A}D + A\bar{D}$



I = 10

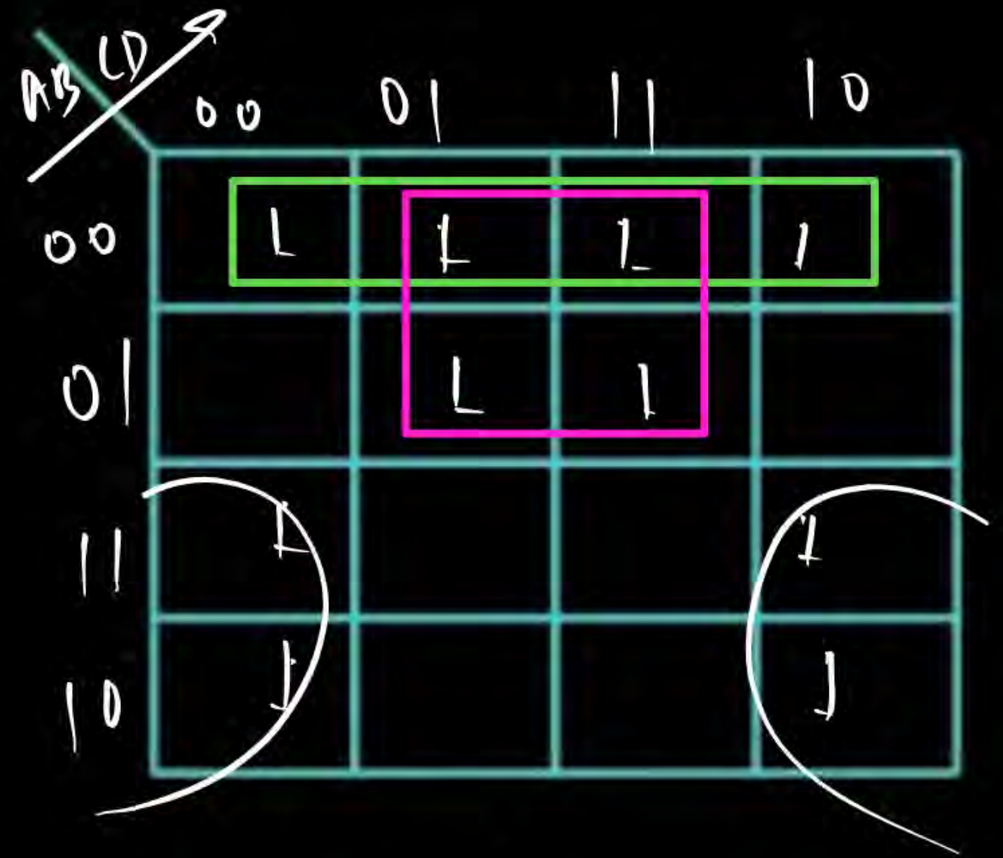
PI = 4

EPI = 2

SPI = 1

RPI = 1

Q.9



$\bar{A}\bar{B} + \bar{A}D + A\bar{D}$

Q.10

HW

Let a function F which has 3 input variables (x, y, z). The function F will be high only when at least two of the input variables are set to high. Draw the K-Map for the given function. Let the number of PI in K-Map = 'a' and the number of EPI in K-Map = 'b'. Find the quadratic mean of 'a' and 'b' _____

A 3

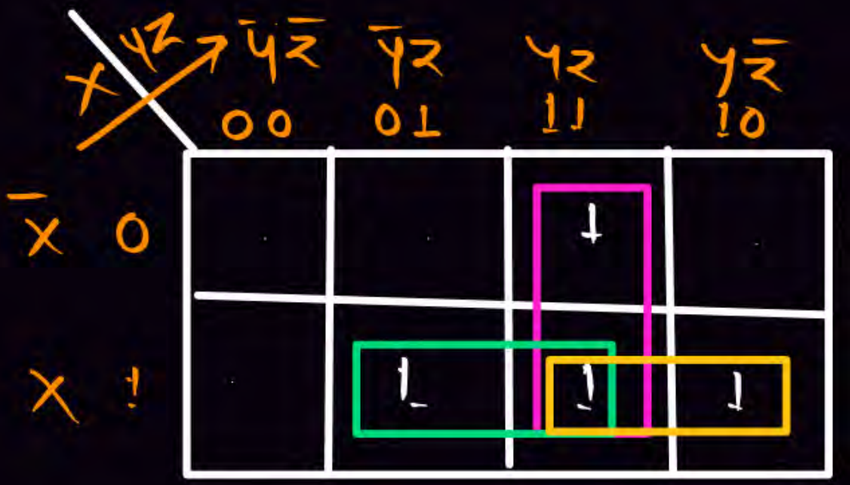
B 4

C 5

D 6

	X	Y	Z	f
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

$f(x,y,z) = \sum m(3,5,6,7)$



a = PI = 3

b = EPI = 2

$f = xy + yz + xz$

Quadratic mean

$= \sqrt{\frac{a^2+b^2}{2}}$

$= \sqrt{\frac{3^2+3^2}{2}} = 3$

Q.11

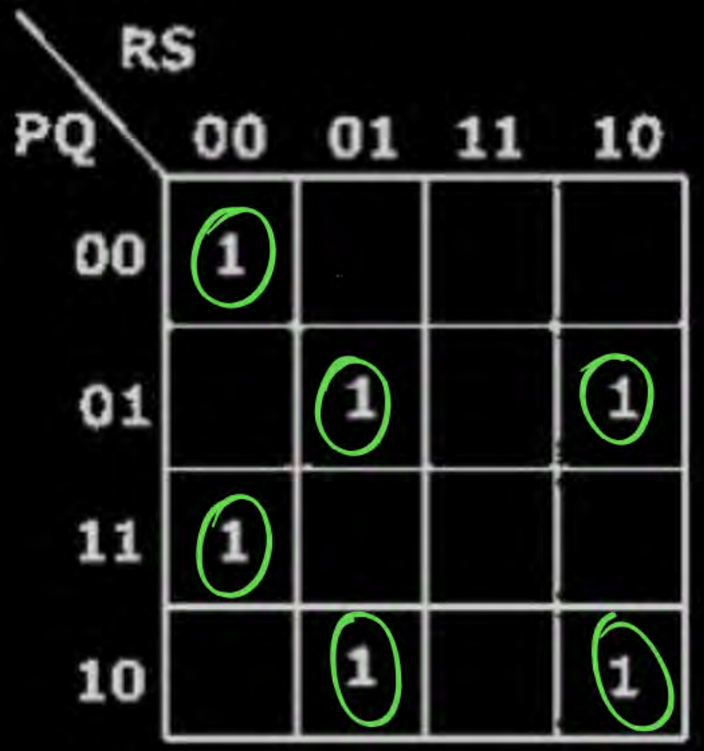
Find the number of Prime implicants & Essential prime implicants in the given K

A 3, 3

B 4, 6

C 5, 6

D 6, 6



PI = 6

EPI = 6

Thank you

GW

Soldiers !