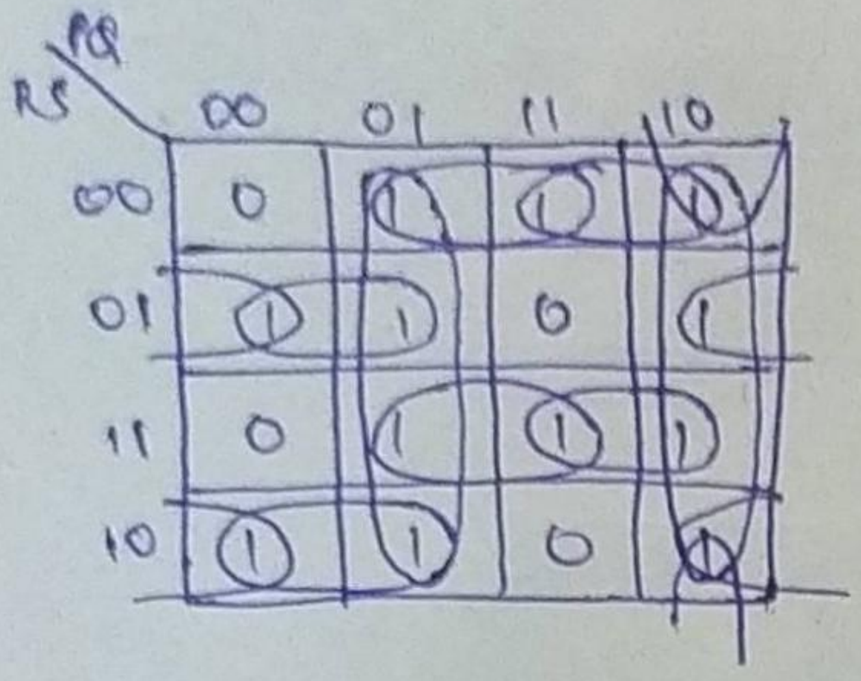
PROBLEM ON KMAP

Q. How many minimal expressions are represented by following KMAP



10 PI — 12 MT

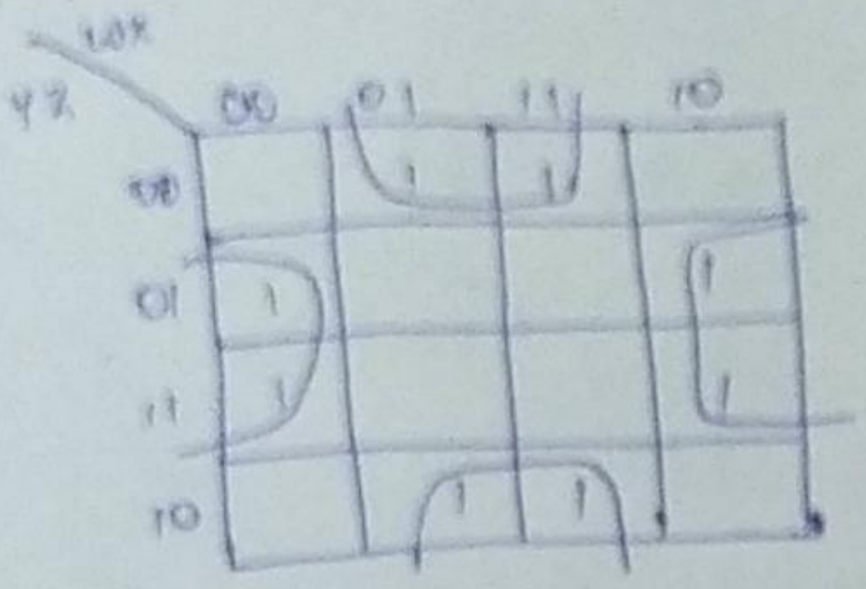
	1	2	4	5	6	7	8	9	10	11	12	15
$\bar{P}Q$			✓	✓	✓	✓						
$P\bar{Q}$							✓	✓	✓	✓		
$QR\bar{S}$			✓								✓	
$\times P\bar{R}\bar{S}$							✓				✓	
$\bar{P}\bar{R}S$	✓			✓								
$\times \bar{Q}\bar{R}S$	✓							✓				
QRS						✓						✓
$\times PRS$										✓		✓
$\bar{Q}R\bar{S}$		✓							✓			
$\times \bar{P}R\bar{S}$		✓		✓								

SOP = $\bar{P}Q + P\bar{Q} + QR\bar{S} + \bar{P}\bar{R}S + QRS + QR\bar{S}$

minimal expression = $2^4 = 16$.

FINDING THE FREE VARIABLES

Q. How many variables are free in the expression denoted by the following map?



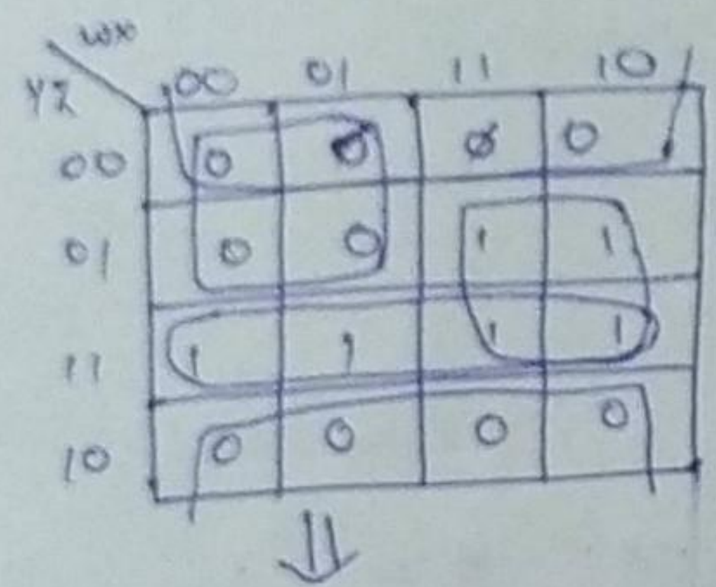
SOP = $X\bar{Z} + \bar{X}Z$

POS = $(X+Z)(\bar{X}+\bar{Z})$

free variable = 2 (W & Y)

RELATION B/W POS & SOP in case of don't cares

①



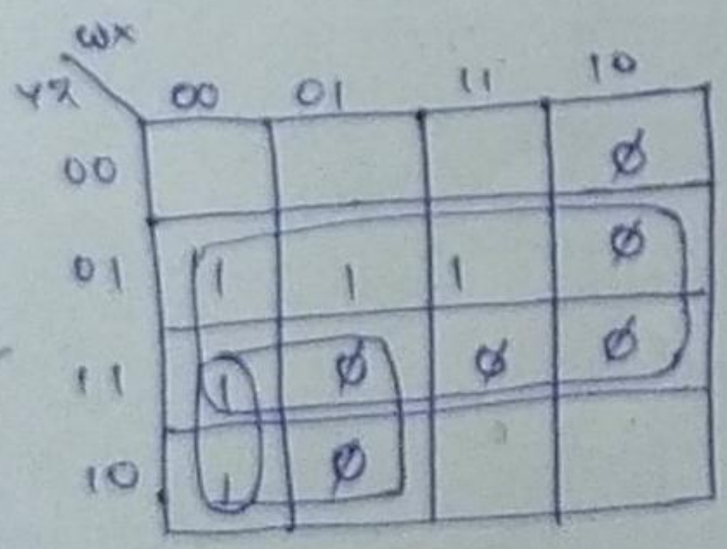
$\Rightarrow$ POS = $Z(W+Y)$

$= WZ + YZ$

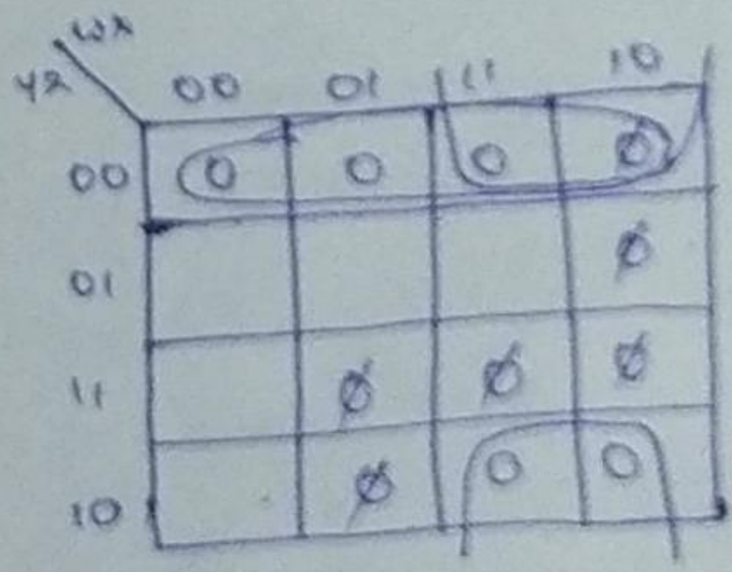
SOP = $(WZ + YZ)$

POS = SOP does not hold in both cases.

② $f(W, X, Y, Z) = \Sigma(1, 2, 3, 5, 13) + \Sigma_{\phi}(6, 7, 8, 9, 11, 15)$



SOP = $Z + \bar{W}Y$



POS = $(Y+Z)(\bar{W}+Z)$

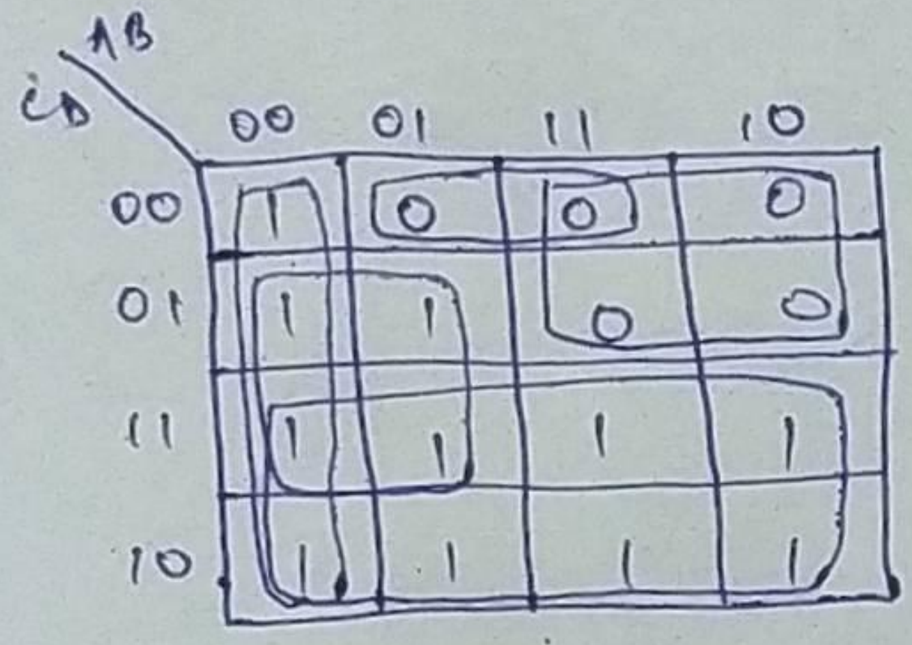
$= Z + \bar{W}Y$

SOP = POS

COMPARING # INDEPENDANT VARIABLES IN MINIMAL SOP & POS :-

1) Minimal expression represented by the map is free from

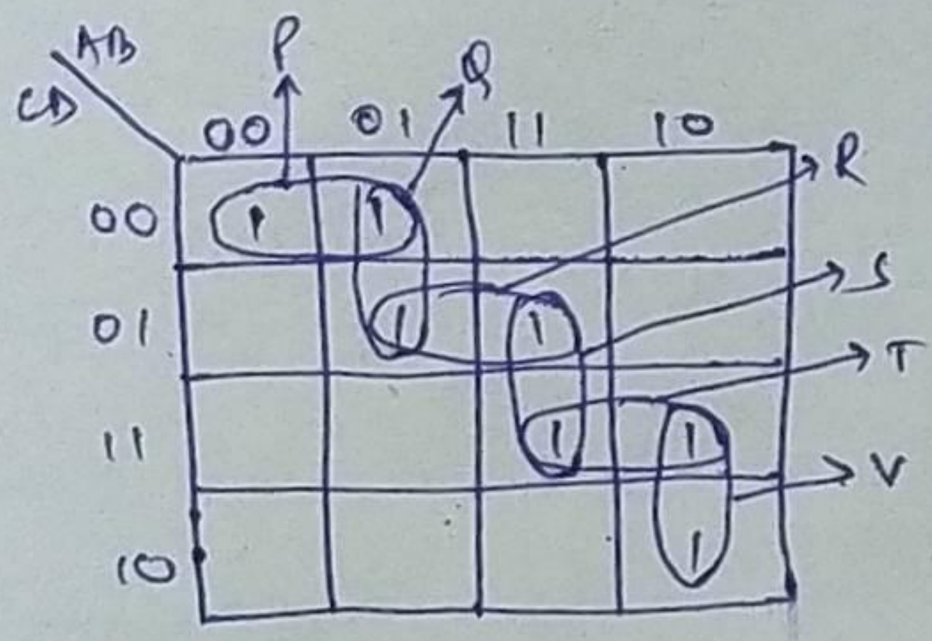
a) 1 b) 2 c) 3 d) dependant on all.



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

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

NO. OF IRREDUNDANT & MINIMAL EXPRESSION



PI → 6

EPI → 2

RPI → 4

Minimal SOP → $\bar{A}C\bar{D} + A\bar{B}C + B\bar{C}\bar{D} + ACD$

minimal exp → 3

	0	4	5	13	15	11	10
P	✓	✓					
Q		✓	✓				
R			✓	✓			
S				✓	✓		
T					✓	✓	
V						✓	✓

(8)	0	1	3	4	7	12	15	19	20	22	23	29	31
A = WXZ						X	X					X	X
B = XYZ					X		X				X		X
C = $\bar{W}$YZ			X		X			X			X		
D =										X	X		
E									X	X			
F				X					X				
G			X	X									
H		X			X								
I		X	X										

Minimal Exp = A + B C + E + H + G DFGI

	0	1	4	20	22
B					✓
E				✓	✓
F				✓	
G		✓			
H	✓		✓		
I	✓	✓			

EHI

~~DFGH~~

DFGA

~~DFHI~~

0 1 4 20 22

(I+H) (G+I) (F+H) (E+F) (D+E)

⇒ (I+GH)(F+H)(E+FD)

0 1 0 1 0 1

000 + 001 + 010 + 011 + 100 101 110 111

IFE + IFD + IHE + ~~IHFD~~ + ~~GHFE~~ + GHFD + GHE

= IFE + IFD + IHE + GHFD + GHE → No. of MIN = 4

3 3 3 4 3

FUNCTIONS "INVOLVING" FUNCTIONS

Q) Consider 3 variable function.

$$f_1(A,B,C) = \sum(0,7) + \sum_{\phi}(1,2,5)$$

$$f_2(A,B,C) = \sum(0,1,3) + \sum_{\phi}(4,7)$$

find $f_1 f_2$ & $f_1 + f_2$ when minimized.

→ $f_1 f_2 = \sum(0) + \sum_{\phi}(1,7)$

$1 \cdot 1 = 1$

$1 \cdot \phi = \phi$

ϕ

$f_1 + f_2 = \sum(0,1,3,7) + \sum_{\phi}(2,5,4)$

$1+0 = 1$

$0+1 = 1$

$1+1 = 1$

$0+\phi = \phi$

$1+\phi = 1$

Q) Consider a boolean operation '$' defined as

$A \$ B = \bar{A} + B$ then find $f_1 \$ f_2$

C \ AB	00	01	11	10
0	0	1	0	1
1	0	1	1	0

C \ AB	00	01	11	10
0	1	0	0	1
1	0	1	1	1

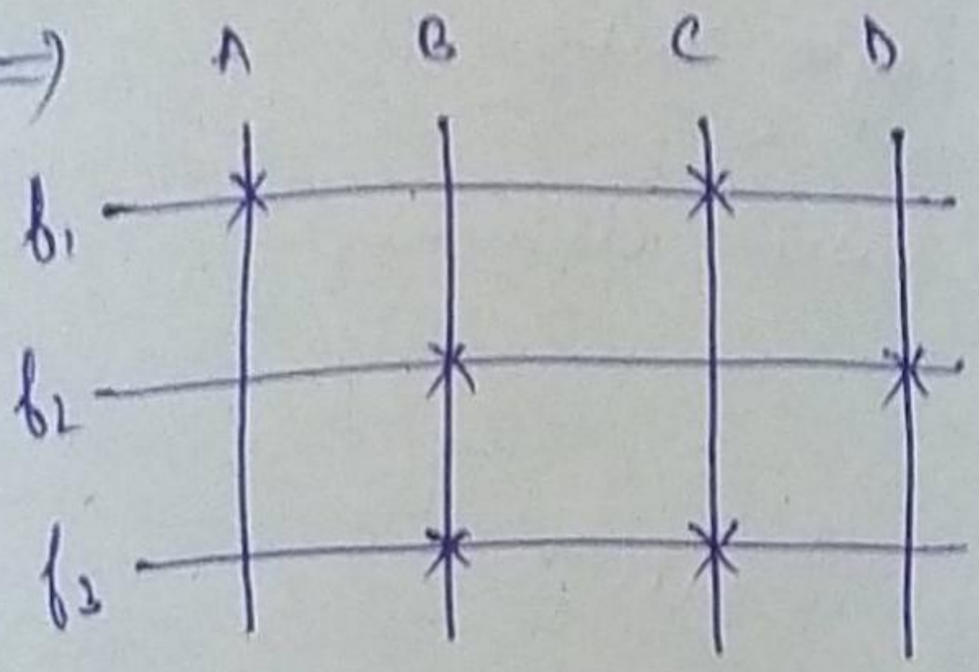
f_1

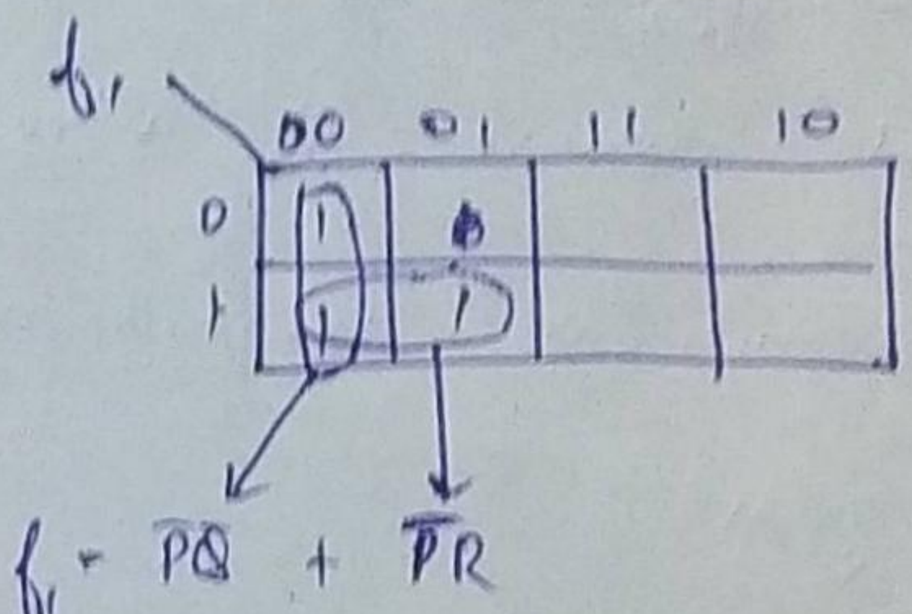
C \ AB	00	01	11	10
0	1		1	1
1	1	1	1	1

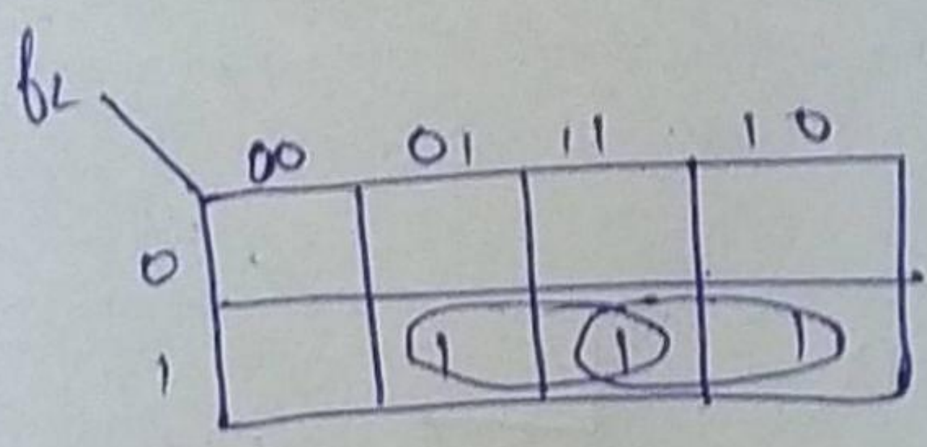
$= C + A + \bar{B}$

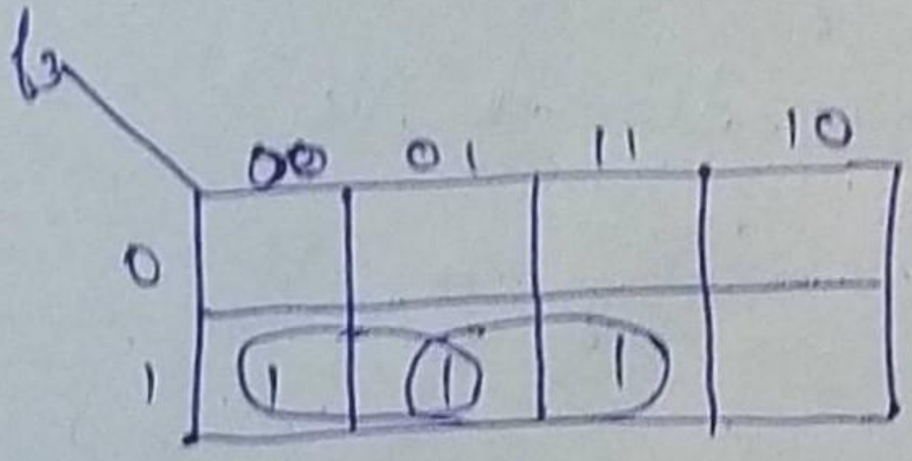
8) Consider three - three variable functions $f_1(P,Q,R) = \Sigma(0,1,3)$, $f_2(P,Q,R) = \Sigma(3,6,7)$, $f_3(P,Q,R) = \Sigma(1,3,7)$. These functions are sharing 4 prime & Implicants A, B, C, D (all of them are prime) as shown.

⇒



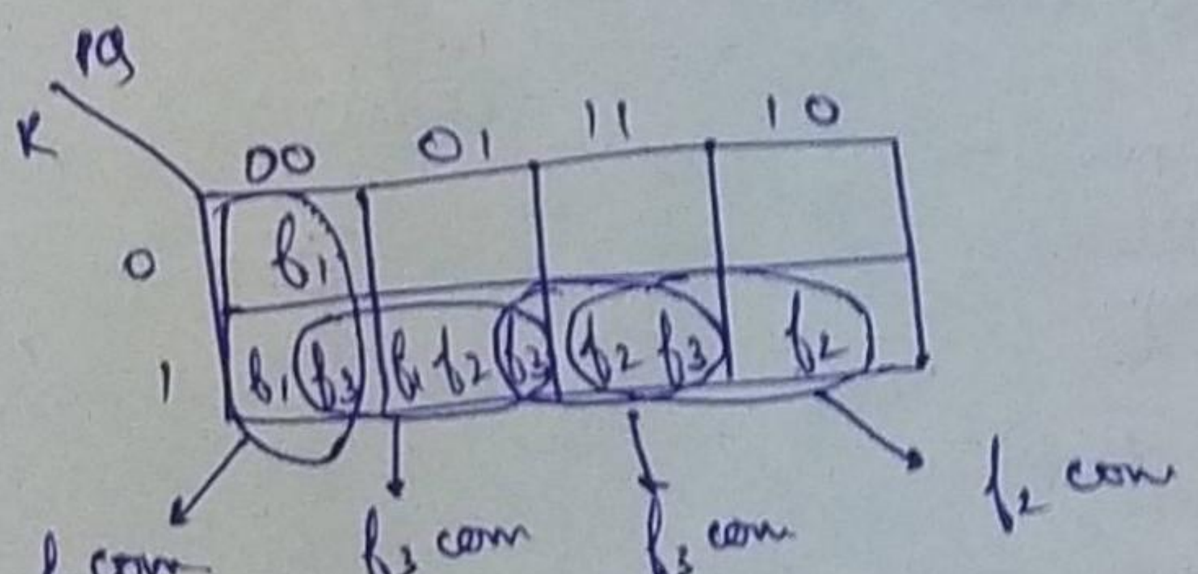






$A = \bar{P}\bar{Q}$, $B = QR$, $C = \bar{P}R$; $D = PR$

⇒



$f_1 - f_3 \rightarrow C = \bar{P}R$