2 conditions for orthogonal

> Neutural
> Mutal exclusive terms

$$* \ \underline{K-MAP} \ (Konaurgh \ MaP) \qquad \underline{L-20}$$

○ Boolean variable → symbol which can take
   value   0 or 1

   $$Ex \qquad n \begin{cases} 0 \\ 1 \end{cases}$$

○ Literal → use of variable or its complement
   in   an   expression

   $$f(x,y) = \bar{x}y + x\bar{y}$$

   $\downarrow$ $\downarrow$

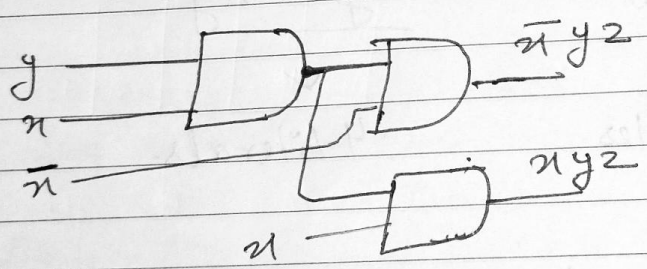   2 variables   4 Literals

* Implement the following function

   $$f(x,y,z) = \bar{x}yz + xyz$$

x y z $f($
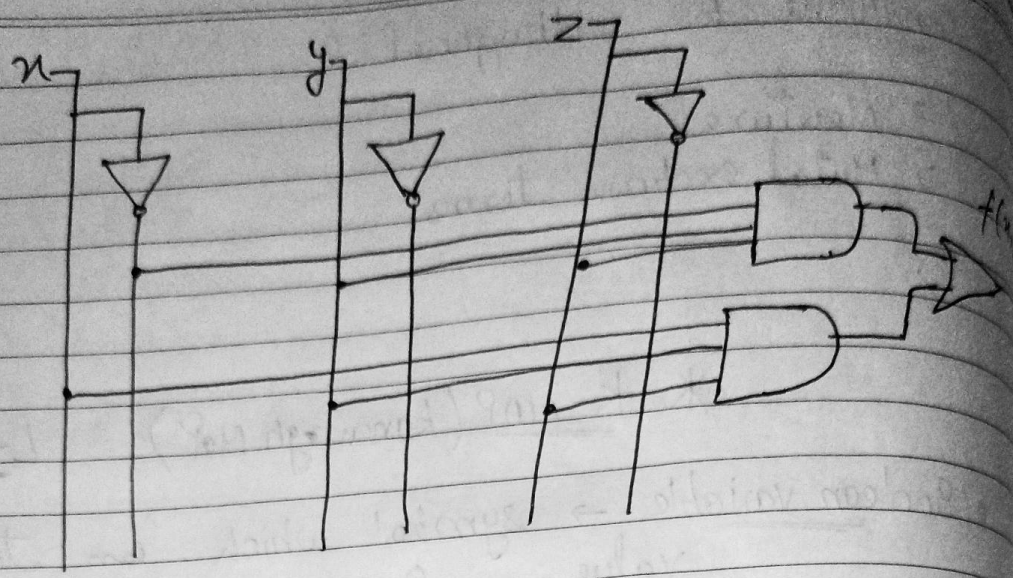
2 AND gate (3 I/P)
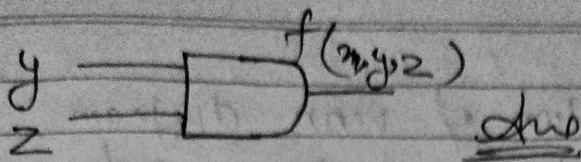1 OR gate
1 Not gate

∮ Another way to implement:-

$\bar{x}yz$

xyz

y
n
$\bar{n}$
n

○ <u>Minimization</u>

$f(x, y, z) = \bar{x}yz + xyz$

$yz(x + \bar{x})$

↓ complement law

$yz(1)$

$\underline{yz}$

$$y \quad \rightarrow \boxed{} \quad f(x,y,z)$$
$$z \quad \rightarrow \qquad \underline{Ans}$$

There are two way to minimize an expression

1) Boolean laws   2) ~~kara~~ Karnaugh Map

Summary :-

→ before implementing the function by logic getes we must first minimize it

→ for minimization we can apply boolean laws on identities. But some time its difficult to minimize expression by laws like :

$$f(A, B, c) = AB + \bar{A}C + BC$$

$$\downarrow 1 \cdot BC \text{ (crucial step)}$$
$$\underline{identity\ law}$$

$$AB + \bar{A}C + (A + \bar{A}) \cdot BC$$
$$\underline{AB} + \bar{A}C + \underline{ABC} + \bar{A}BC$$

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

Hence better option is Karnaugh Map.

K-Map

→ Application of venn diagram
→ based on goay code
→ Minimum possible k map is for
  1 var & max for n variable
→ for "n" var boolean f^n we've to
  to make 2^n minterms & for
  each minterm we have cell in k-Map
Hence total no. of cells $= 2^n$ (for n variable)

Q 4 var k map has no. of cells $\Rightarrow 2^4 = 16$

Q $f(A,B,C,D) = \Sigma m(0, 1, 13, 15)$

AB CD	00	01	11	10
00	m0	m4	m12	m8
01	m1	m5	m13	m9
11	m3	m7	m15	m11
10	m2	m6	m14	m10

AB CD	00	01	11	10
00	m0	m1	m3	m2
01	m4	m5	m7	m6
11	m12	m13	m15	m14
10	m8	m9	m11	m13

2 way to make a K-Map

Size of rectangle
1
2
4
8
16
32
)
.

CD	0	4	12	8
	1	5	13	9
	3	7	15	11
	2	6	14	10

AB CD	00	01	11	10
00				
01	(1)		(1)	
11			(1)	
10				

$\overline{A}\overline{B}\overline{C} + ABD$

$\begin{cases} 2^n \times 2^m = 1 \times 2 \\ n = 0, \ m = 1 \end{cases}$

8 $f(A,B,C,D) = \Sigma m(0,7,8,15)$

CD \ AB	00	01	11	10
00	1₀	4	•₁₂	1₈
01	1	5	1₃	9
11	2	1₇	1₁₅	11
10	3	6	14	10

$B\,C\,D_1 + \bar{B}\,C\,\bar{D}$

9 $f(A,B,C,D) = \Sigma m(0,2,12,14)$

CD \ AB	00	01	11	10
00	1₀	4	1₁₂	8
01	1	5	13	9
11	3	7	15	11
10	1₂	6	1₁₄	10

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

9 $f(A,B,C,D) = \Sigma m(3,5,6,15)$

CD \ AB	00	01	11	10
00				
01		1		
11	1		1	
10		1		

$\bar{A}BCD + ABCD + \bar{A}BC\bar{D} + \bar{A}\bar{B}CD$

9 $f(A,B,C,D) = \Sigma m(0,1,2,3)$

CD \ AB	00	01	11	10
00	1			
01	1			
11	1			
10	1			

$\bar{A}\bar{B}$

Size of rectang → literal
$1 \rightarrow 4$
$2 \rightarrow 3$
$4 \rightarrow 2$

Q $f(A,B,C,D) = \Sigma m(5,7,13,15)$

CD \ AB	00	01	11	10
00				
01		1	1	
11		1	1	
10				

BD

AD

Q $f(A,B,C,D) = \Sigma m(0,1,2,3,4,5)$

CD \ AB	00	01	11	10
00	1	1		
01	1	1		
11	1			
10	1			