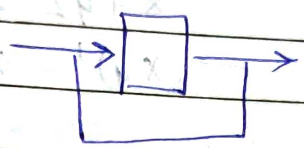
I. LOGIC GATES

→ Logic Blocks:

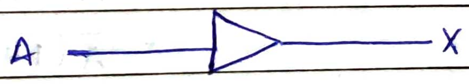
1. Combi~~a~~national logic block
   o/p depends only on i/p values. (All ALU functions)

2. Sequential logic block
   O/p depends on i/p and state (stored info)



→ Functions of gates can be described by:
- Truth table
- Boolean functions
- Karnaugh map.

★ NOTE: Buffer combinational gate:



A = X

A	X
0	0
1	1

II. BOOLEAN ALGEBRA

1. → I/p and o/p signals can be represented by Boolean variables
   → Function of digital logic circuits can be represented by logic ops ie., boolean functions.

TRUTH TABLE
- Table that describes the o/p values for all combinations of the input values called MINTERMS.
- n i/p variables → 2^n minterms

BASIC IDENTITIES OF BOOLEAN ALGEBRA

$x + 0 = x$	$x \cdot 0 = 0$
$x + 1 = 1$	$x \cdot 1 = x$
$x + x = x$	$x \cdot x = x$
$x + x' = 1$	$x \cdot x' = 0$
$x + y = y + x$	$xy = yx$
$x + (y+z) = (x+y)+z$	$x(yz) = (xy)z$
$x(y+z) = xy + xz$	$x + yz = (x+y)(x+z)$
$(x+y)' = x'y'$	$(xy)' = x' + y'$
$x'' = x$	

De Morgan's Law

1) $A \cdot \bar{A}C$

$= 0 \cdot C$

$= 0$

2) $ABCD + ABD$

$= ABDC + ABD$

$= ABD(C+1)$

$= ABD$

3) $AB + ABC + ABCD + C$

$= AB(1+C) + C(ABD+1)$

$= AB + C$

4) $xy + xyz + xy\bar{z} + \bar{x}yz$

$= xy(1+z) + y(x\bar{z} + \bar{x}z)$

$= xy + xy\bar{z} + \bar{x}yz$

$= xy(1+\bar{z}) + \bar{x}yz$

$= xy + \bar{x}yz$

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

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

$= y(x+z)$

5) $\overline{ABC} + \bar{A}B\bar{C} + \bar{A}BC$

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

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

$= \bar{A}(1+B) + \bar{B} + \bar{C}$

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

$= \overline{ABC}$

6) $AB + \overline{AC} + A\bar{B}C(AB+C)$

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

$= \bar{A} + B + \bar{C} + 0 + A\bar{B}C$

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

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

$= 1$

7) $\overline{\bar{A}B + \bar{A} + AB}$

$= \overline{\bar{A}(B+1) + AB}$

$= \overline{\bar{A} + AB}$

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

$= A\bar{B}$

8) $\bar{A}BC\bar{D} + BC\bar{D} + B\overline{CD} + B\bar{C}D$

$= BC\bar{D}(\bar{A}+1) + B\overline{CD} + B\bar{C}D$

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

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

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

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

$= \cancel{BCD}\ B(\bar{C} + \bar{D} + \bar{C}D)$

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

$= B\overline{CD}$

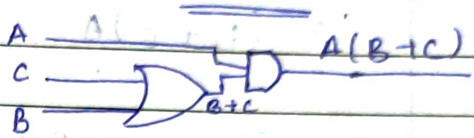
9) $ABC + A\bar{B}C + AB\bar{C}$

$= AC(B+\bar{B}) + AB\bar{C}$

$= AC + AB\bar{C}$

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

$= A(C+B)$



A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

10) $\overline{ABC} + \bar{A}B\bar{C} + ABC$

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

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

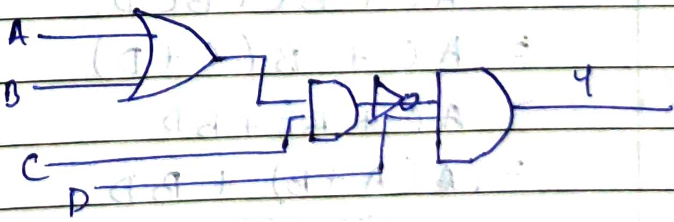
$= \bar{A} + BC + \bar{B} + \bar{C}$

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

$= 1$ //

NOTE: The logic functions should be simplified to minimum no. of gates as it is more favourable in terms of speed and design but is more expensive.

11) $\overline{(A+B)\,C}\;D$



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

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

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

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

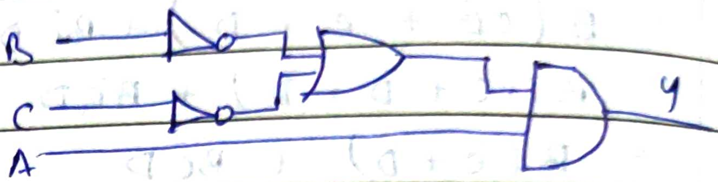
Review questions

1) Why NAND & NOR Gates are called Universal Gates?

2) (a) $AB\bar{C} + A\bar{B}$

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

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



(b) $\overline{AB}CD + BD + A\bar{C}D$

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

$= \bar{A}CD + \bar{B}CD + BD + A\bar{C}D$

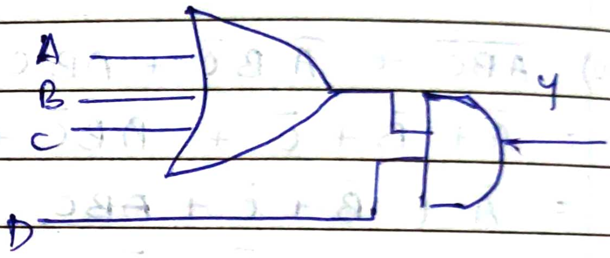
$= \bar{A}CD + D(B+C) + A\bar{C}D$

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

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

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

$= D(C + A + B)$



3) Execute using NAND / NOR Gate

$y = \bar{A}BC + AC + B\bar{C}D$

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

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

$= AC + BC + B\bar{C}D$

$= AC + B(C + D)$

$= AC + BC + BD$

$= C\cancel{A}(A+B) + BD$

4) Ex NOR Gate using NOR.

$F = AB + A'B'$

NOR: $\overline{A+B}$

VARIABLES

A	B	C	Min terms m_n	Max terms M_n
0	0	0	$\bar{A}\bar{B}\bar{C} = m_0$	$A + B + C = M_0$
0	0	1	$\bar{A}\bar{B}C = m_1$	$A + B + \bar{C} = M_1$
0	1	0	$\bar{A}B\bar{C} = m_2$	$A + \bar{B} + C = M_2$
0	1	1	$\bar{A}BC = m_3$	$A + \bar{B} + \bar{C} = M_3$
1	0	0	$A\bar{B}\bar{C} = m_4$	$\bar{A} + B + C = M_4$
1	0	1	$A\bar{B}C = m_5$	$\bar{A} + B + \bar{C} = M_5$
1	1	0	$AB\bar{C} = m_6$	$\bar{A} + \bar{B} + C = M_6$
1	1	1	$ABC = m_7$	$\bar{A} + \bar{B} + \bar{C} = M_7$

1) $Y = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}BC + AB\bar{C}$

$= m_0 + m_1 + m_3 + m_6$

$= \Sigma m(0,1,3,6) = \Pi M(2,4,5,7)$

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

$= (M_1)(M_3)(M_6)$

$= \Pi M(1,3,6) = \Sigma m(0,2,4,5,7)$

1) $AB + ABC + AB(D+E)$

$= AB(1+C) + AB(D+E)$

$= AB(1+C+D+E)$

$= \underline{AB}$

2) $\overline{ABC} + \bar{A}B\bar{C} + \bar{A}BC$

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

$= \bar{A}(1+B) + \bar{B} + \bar{C}$

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

$= \overline{ABC}$

3) $(A+B)(A+C)$

$= A + BA + AC + BC$

$= A + BC$

4) $ABC + A\bar{B}C + AB\bar{C}$

$= AC(B+\bar{B}) + AB\bar{C}$

$= AC + AB\bar{C}$

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

$= A(B+C)$

(Q) Convert the given expression in the standard S.O.P & POS.

(a) $Y = AC + BC + BA$

~~$= AC + BC$~~

~~$= (A+B)C$~~

$=$ ~~AB~~ ~~$AC + BC$~~

$Y = AC(B+\bar{B}) + BC(A+\bar{A}) + AB(C+\bar{C})$

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

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

SOP $= \Sigma m(7, 3, 5, 6)$

000
001
010
011
100
101
110
111

(b) $Y = (A+B)(B+C)(A+C)$

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

// $x+yz = (x+y)(x+z)$

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

$= \Pi M(0, 1, 4, 2)$

Convert minterms

$= \Sigma m(3, 5, 6, 7)$

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

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

$= BA + BC + A\bar{B}C \quad = AB + BC$

KARNAUGH MAP

→ Uses S.O.P

→ Max 5 variables allowed

2 bit (variables)

	0	1
0		
1		

3 variables:

LSB ↑ BC

	00	01	11	10
$\bar{A}$ 0	0 000	1 001	3 011	2 010
A 1	4 100	5 101	7 110	6 110

↑ MSB

4 variables

AB \ CD	00	01	11	10
00	0	1	3	2
01	4	5	7	6
11	12	13	15	14
10	8	9	11	10

Q) Plot the boolean expression on Kmap

(a) $y = AB\bar{C} + ABC + \bar{A}\bar{B}C$

(b) $y = \bar{A}B\bar{C}\bar{D} + A\bar{B}C\bar{D} + \bar{A}BC\bar{D} + A\bar{B}CD + AB\bar{C}D$

(a)

A \ BC	00	01	11	10
$\bar{A}$ 0	0	1 1	3	2
A 1	4	5	7 1	6 1

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

Pair take common variable.

(b)

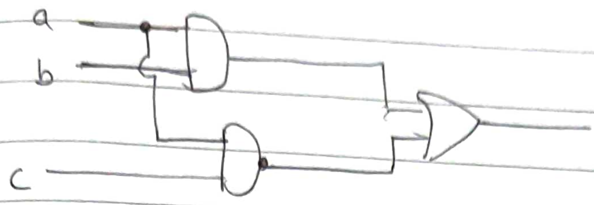
AB \ CD	00	01	11	10
00	0	1	3	2
01	4 1	5	7	6 1
11	12	13 1	15	14
10	8	9	11 1	10 1

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

$+ A\bar{B}C$

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

Logic Circuits



$Y = ab + \overline{ac}$

	I/p			O/p		
	a	b	c	ab	$\overline{ac}$	$ab + \overline{ac}$
m_0	0	0	0	0	1	1
m_1	0	0	1	0	1	1
m_2	0	1	0	0	1	1
m_3	0	1	1	0	1	1
m_4	1	0	0	0	1	1
m_5	1	0	1	0	0	0
m_6	1	1	0	1	1	1
m_7	1	1	1	1	0	1

$Y = \Sigma m(0,1,2,4,5,6,7)$ or $\Pi M(5)$

min terms are nothing but product terms where input variable appear in true form / false form and for all min

max terms are sum terms

$m_0 \rightarrow \bar{a}\bar{b}\bar{c}$	$M_0 \rightarrow a + b + c$
$m_1 \rightarrow \bar{a}\bar{b}c$	$M_1 \rightarrow a + b + \bar{c}$
$m_2 \rightarrow \bar{a}b\bar{c}$	$M_2 \rightarrow a + \bar{b} + c$
$m_3 \rightarrow \bar{a}bc$	$M_3 \rightarrow a + \bar{b} + \bar{c}$
$m_4 \rightarrow a\bar{b}\bar{c}$	$M_4 \rightarrow \bar{a} + b + c$
$m_5 \rightarrow a\bar{b}c$	$M_5 \rightarrow \bar{a} + b + \bar{c}$
$m_6 \rightarrow ab\bar{c}$	$M_6 \rightarrow \bar{a} + \bar{b} + c$
$m_7 \rightarrow abc$	$M_7 \rightarrow \bar{a} + \bar{b} + \bar{c}$

SOP

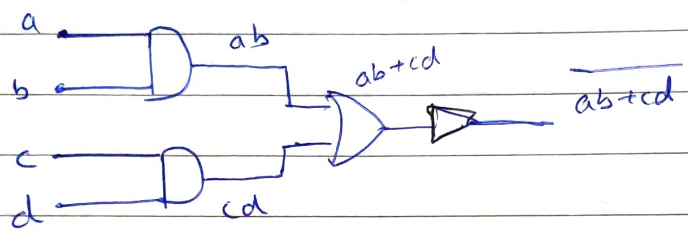
$\bar{a}b\bar{c}$

$Y = \bar{a}\bar{b}\bar{c} + \bar{a}\bar{b}c + \cancel{\bar{a}bc} + \bar{a}bc + a\bar{b}\bar{c} + ab\bar{c}$
$+ abc$

POS :-

$Y = (\bar{a} + b + \bar{c})$

Q A ckt has 4 input variable. Draw ckt with 4 gates, write exp for Y, input of Y, write all min terms, maxterms



max term	minterm	a	b	c	d	ab	cd	ab+cd	$\overline{ab+cd}$
$\bar{a}+\bar{b}+\bar{c}+d$	$abc\bar{d}$	0	0	0	1	0	0	0	1
$\bar{a}+\bar{b}+c+\bar{d}$	$ab\bar{c}d$	0	0	1	0	0	0	0	1
$\bar{a}+\bar{b}+c+d$	$ab\bar{c}\bar{d}$	0	0	1	1	0	1	1	0
$\bar{a}+b+\bar{c}+\bar{d}$	$a\bar{b}cd$	0	1	0	0	0	0	0	1
$\bar{a}+b+\bar{c}+d$	$a\bar{b}c\bar{d}$	0	1	0	1	0	0	0	1
$\bar{a}+b+c+\bar{d}$	$a\bar{b}\bar{c}d$	0	1	1	0	0	0	0	1
$\bar{a}+b+c+d$	$a\bar{b}\bar{c}\bar{d}$	0	1	1	1	0	1	1	0
$a+\bar{b}+\bar{c}+d$	$\bar{a}bcd$	1	0	0	0	0	0	0	1
$\bar{a}+b+\bar{c}+d$	$\bar{a}bc\bar{d}$	1	0	0	1	0	0	0	1
$a+\bar{b}+c+\bar{d}$	$\bar{a}b\bar{c}d$	1	0	1	0	0	0	0	1
$a+\bar{b}+\bar{c}+d$	$\bar{a}b\bar{c}\bar{d}$	1	0	1	1	0	1	1	0
$a+b+\bar{c}+\bar{d}$	$\bar{a}\bar{b}cd$	1	1	0	0	1	0	1	0
$a+b+\bar{c}+d$	$\bar{a}\bar{b}c\bar{d}$	1	1	0	1	1	0	1	0
$a+b+c+\bar{d}$	$\bar{a}\bar{b}\bar{c}d$	1	1	1	0	1	0	1	0
$\bar{a}+\bar{b}+\bar{c}+\bar{d}$	abcd $\cancel{\bar{a}\bar{b}\bar{c}\bar{d}}$	1	1	1	1	1	1	1	0
$a+b+c+d$	$\bar{a}\bar{b}\bar{c}\bar{d}$	0	0	0	0	0	0	0	1

K Map :

It is a tabular representation of the function. any boolean function will have 1's or multiple output. For some of i/p combination the o/p is 1 and for others o/p is 0.
These 1 and 0 are mapped to Kmap. using fixed method the number of 1's & 0's are grouped to get a minimal cost expression for the function.

$Y = ab + a\bar{c}$ $\qquad$ $Y = \Sigma m(0,1,2,3,4,6,7)$

$Y' = \pi M(5) = \bar{a} + b + \bar{c}$

a \ bc	00	01	11	10
0	1 ₀	1 ₁	1 ₃	1 ₂
1	1 ₄	0 ₅	1 ₇	1 ₆

ab \ c	0	1
00	0	1
01	2	3
11	6	7
10	4	5

ab \ cd	00	01	11	10
00	0	1	3	2
01	4	5	7	6
11	12	13	15	14
10	8	9	11	10

The K Map technique is suitable if number of variable is 3, 4, 5. if more than 5, different technique are used to get optimum solution.

$Y = \Sigma m(0,1,2,3,4,6,7)$

$a \backslash bc$	$\bar{b}\bar{c}$ 00	$\bar{b}c$ 01	bc 11	$b\bar{c}$ 10
$\bar{a}$ 0	1 (0)	1 (1)	1 (3)	1 (2)
a 1	1 (4)	0 (5)	1 (7)	1 (6)

$b + \bar{a} +$

$Y = \bar{a} + b + \bar{c}$

2) $Y = \Sigma m(0,2,3,5,6)$

	$\bar{b}\bar{c}$	$\bar{b}c$	bc	$b\bar{c}$
$\bar{a}$	1 (0)	0 (1)	1 (3)	1 (2)
a	0 (4)	1 (5)	0 (7)	1 (6)

SOP → $Y = b\bar{c} + \bar{a}(b) + \bar{a}\bar{c} + a\bar{b}c$

POS → $Y = a\bar{b}\bar{c} + \bar{a}\bar{b}c + abc$

$= (\bar{a}+b+c)(a+b+\bar{c})(\bar{a}+\bar{b}+\bar{c})$

(3) $F(w,x,y,z) = \Sigma m(0,2,4,6,7,8,9,11,15)$

$ab \backslash$	$\bar{c}\bar{d}$	$\bar{c}d$	cd	$c\bar{d}$
$\bar{a}\bar{b}$	1 (0)	0 (1)	0 (3)	1 (2)
$\bar{a}b$	1 (4)	0 (5)	1 (7)	1 (6)
ab	0 (12)	0 (13)	1 (15)	0 (14)
$a\bar{b}$	1 (8)	1 (9)	1 (11)	0 (10)

~~$Y =$~~ $\bar{a}\bar{c} + a\bar{b} + bc + abc$

$Y = \bar{a}\bar{d} + bcd + acd + a\bar{b}\bar{c}$

$Y = (\bar{a}+\bar{b}+c)(a+c+\bar{d})(a+b+\bar{d})(\bar{a}+\bar{c}+d)$

3)

$\Sigma m() \rightarrow$ mark 1s

$\Pi m() \rightarrow$ mark 0s

)

$Y = \Pi m(2,4,6)$

	$b+c$	$b+\bar{c}$	$\bar{b}+\bar{c}$	$\bar{b}+c$
a	1	1	1	0
$\bar{a}$	0		1	0

$Y = a(\bar{b}+c)(\bar{a}+c)$

)

$= \cancel{\Sigma M}($

$(w(x,y,z) = \Sigma m(6,7,8,9) + D(12,13,14,15)$

$wx \backslash yz$	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{w}\bar{x}$	0	0	0	0
$\bar{w}x$	0	0	1	1
wx	X	X	X	X
$w\bar{x}$	1	1	0	0

$\rightarrow$ SOP

$Y = (w\bar{y}) + (xy)$

POS $Y = (\bar{w}\bar{y}$

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

) $f(w,x,y,z) = \Pi m(6,7,8,9) + D(12,13,14,15)$

	$y+z$	$y+\bar{z}$	$\bar{y}+\bar{z}$	$\bar{y}+z$
$w+x$	1	1	1	1
$w+\bar{x}$	1	1	0	0
$\bar{w}+\bar{x}$	X	X	X	X
$\bar{w}+x$	0	0	1	1

$Y = (\bar{w}+y)(\bar{x}+\bar{y})$

HW

1) $f(a,b,c,d) = \Sigma m(1,2,6,7,8,13,14,15) + D(3,5,12)$

2) $f(w,x,y,z) = \Sigma m(2,3,8,10,11,12,14,15) + D(0,5,9)$

3) $f(a,b,c,d) = \Sigma\ \bar{b}\bar{c}\bar{d} + a\bar{b}\bar{d} + ab\bar{d} + abd$

1)

$\Sigma m(1,2,6,7,8,13,14,15) + D(3,5,12)$

	$\bar{c}\bar{d}$	$\bar{c}d$	cd	$c\bar{d}$
$\bar{a}\bar{b}$	0_{0}	1_{1}	1_{3}	X_{2}
$\bar{a}b$	0_{4}	X_{5}	1_{7}	1_{6}
ab	X_{12}	1_{13}	1_{15}	1_{14}
$a\bar{b}$	0_{8}	0_{9}	0_{11}	0_{10}

$Y = bc + \bar{a}d + bd$

$Y = (\bar{a}+b)(\bar{c}+d)$

(2)

	$\bar{c}\bar{d}$	$\bar{c}d$	cd	$c\bar{d}$
$\bar{a}\bar{b}$	X_{0}	0_{1}	1_{3}	1_{2}
$\bar{a}b$	0_{4}	X_{5}	0_{7}	0_{6}
ab	1_{12}	0_{13}	1_{15}	1_{14}
$a\bar{b}$	1_{8}	X_{9}	1_{11}	1_{10}

$Y = ac + \bar{b}c + a\bar{c}\bar{d}$

$Y = (a+c)(a+\bar{b})(c+\bar{d})$

(3)

	$\bar{c}\bar{d}$	$\bar{c}d$	cd	$c\bar{d}$
$\bar{a}\bar{b}$	1_{0}	0_{1}	0_{3}	0_{2}
$\bar{a}b$	0_{4}	0_{5}	0_{7}	0_{6}
ab	1_{12}	1_{13}	1_{15}	1_{14}
$a\bar{b}$	1_{8}	0_{9}	0_{11}	1_{10}

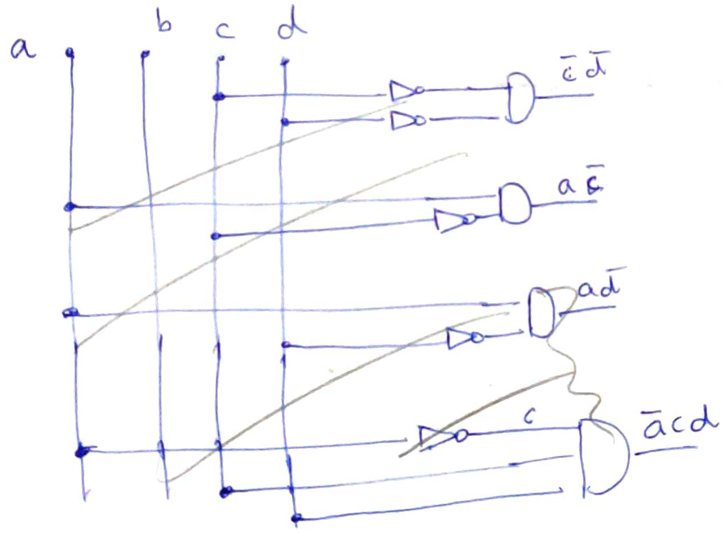
$Y = ab + \bar{b}\bar{c}\bar{d} + ac\bar{d}$

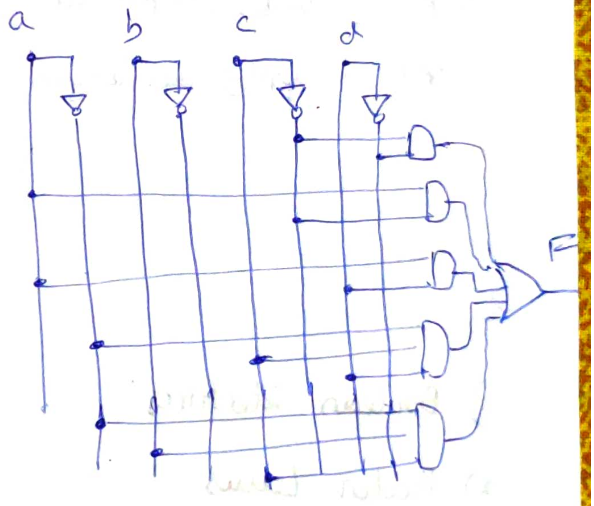
Q) simply minterms using Kmap and draw o/p using simple logic gates.

1) $F = \Sigma m(0,3,6,7,9,10,12,14) + D(4,8,13)$

	$\bar{c}\bar{d}$	$\bar{c}d$	cd	$c\bar{d}$
$\bar{a}\bar{b}$	1 (0)	0 (1)	1 (3)	0 (2)
$\bar{a}b$	X (4)	0 (5)	1 (7)	1 (6)
ab	1 (12)	X (13)	0 (15)	1 (14)
$a\bar{b}$	X (8)	1 (9)	0 (11)	1 (10)

$$Y = \bar{c}\bar{d} + a\bar{c} + a\bar{d} + \bar{a}cd + \bar{a}bc$$





An SOP expression is implemented using 2 level ckt in level 1 is AND array, each AND gate is for 1 term & level 2 OR gates are used to sum the product terms.

In order to implement POS expression, the 2 level circuit will have 1st OR array,

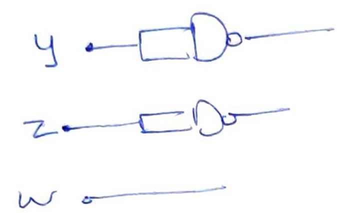
~~Fz~~ NAND gate

1) double compliment, → demorgan

$$Y = \bar{y}\bar{z} + w\bar{y}$$

$$= \overline{\overline{\bar{y}\bar{z} + w\bar{y}}} = \overline{\overline{\bar{y}\bar{z}} \cdot \overline{w\bar{y}}}$$

~~An~~



Any SOP can be converted using NAND gate

Step 1 : double compliment

Step 2 : apply demorgan to inside bar

Q

1) Boolean identitiy
2) Boolen Laws
3) solving exp using identities & laws
4) solving exp using demorgan thm
5) given complex exp solve using Kmap
6) K map, dont care terms,
7) convert SOP to POS & POS to SOP & canocial forms

Half adder

It is a combination circuit which adds only 2 bits, and produces ~~called~~ sum and carry.

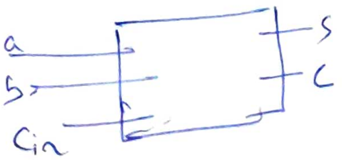
I/P		O/P	
a	b	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

Draw ~~stair~~ using Basic gate & NAND gate also

Full adder

It is a combinational ckt which adds 3 bits ~~giving~~ x, y, and Cin from another circuit.

Full adder produces 2 outputs sum & carry

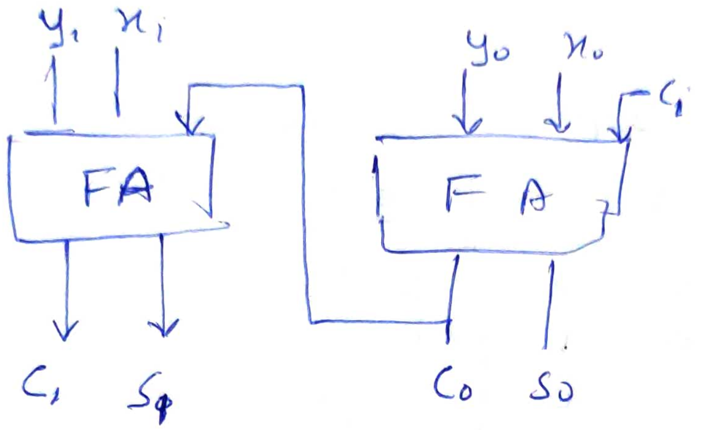


I/P			O/P	
a	b	C	S	Co
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Add 2 numbers of 2 digit (Parallel adder)

Num1 = ~~$x_0 y$~~ x_1 x_0

Num 2 = y_1 y_0



Parallel adder adds any 2 number, binary digit

if there are 2 number with 4 digits each. It requires 4 full adder connected in cascade. Such adder circuits are called as parallel adder (or Ripple carry adder).

Q) difference b/w ~~Sequencial~~ Sequencial & combination logic gates.

Q) Advantages & disadvantages of sequencial & combination gates