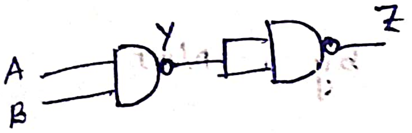
Assignment -1

1. Realize all basic gate (AND, OR, NOT) using Nand and NOR seaprately.

* Implementation of AND using NAND :-



Nand 1 o/p => $Y = \overline{AB}$

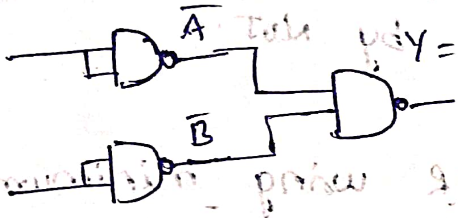
Nand 2 o/p => $Z = AB$.

1st Nand gate o/p is

$Y = \overline{AB}$

2nd Nand gate i/p is $Z = \overline{\overline{AB}} \Rightarrow \bar{A}\ \bar{B} \Rightarrow \overline{\overline{AB}} = AB$

* OR gate using NAND :-



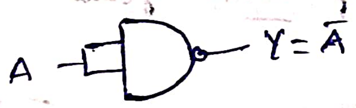
$Y = \overline{(\bar{A}\,\bar{B})} \Rightarrow \bar{\bar{A}} + \bar{\bar{B}} \Rightarrow A + B$

(By Demorgan's Law).

$\overline{A+B} \Rightarrow \bar{A}\,\bar{B}$

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

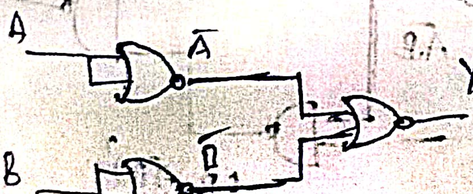
* NOT using NAND :-



$A = 0,\ Y = 1$

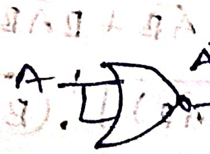
$A = 1,\ Y = 0$

* AND from NOR :-



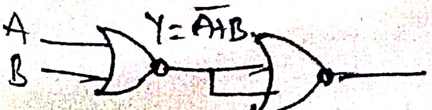
$Y = \overline{(\bar{A} + \bar{B})} \Rightarrow \bar{\bar{A}}\,\bar{\bar{B}} = AB = Y$

NOR from NOR



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

* OR from NOR :-



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

2. Realise all gates using Active Low input?

3. Which gate are called universal gate? Why?

A. NAND:

NOT gate :- A NAND gate with both input tied ~~together~~ acts as a NOT

AND :- A Nand followed by a NOT

OR :- using De-morgan's law

NOR gate :-

NOT :- Both the input are tied together.

AND :- using De-morgan's Law.

OR :- A NOR followed by NOT

4. Give implementation of XOR using minimum number of NAND gate and show the implementation of xnor gate using min no's of NOR gate.

=) XOR using Nand :-

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

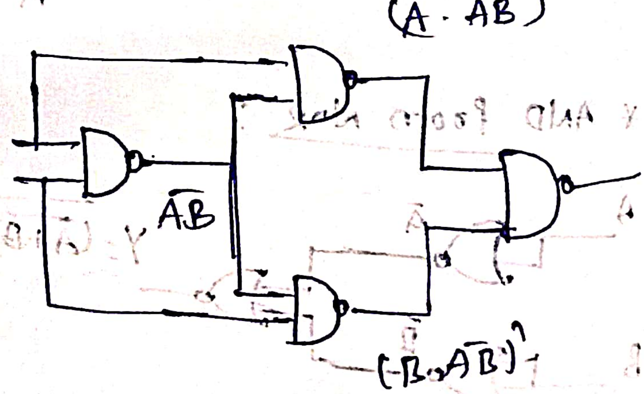
$(\overline{\overline{AB + \bar{A}\bar{B}}})$

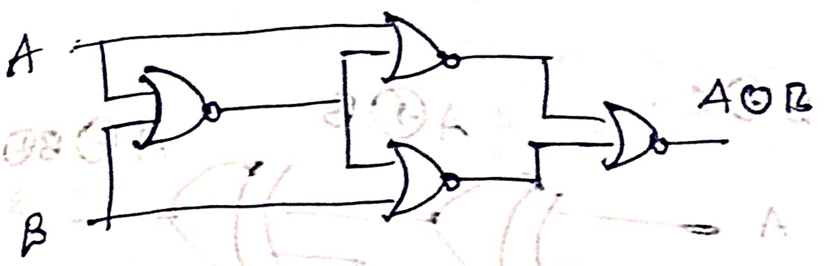
$(\overline{AB} \cdot \overline{\bar{A}\bar{B}})$

$(\overline{AB}) \cdot (A+B)$

$A \cdot \overline{AB} + B\overline{AB}$

$\overline{[\overline{(A \cdot \overline{AB})}]' \cdot \overline{(B \cdot \overline{AB})'}}'$





5. Simply $F = \Sigma(0,1,2,6,7,8,9,10,14,15)$ in SOP & simplify the Boolean exp $Y = \Sigma(0,2,3,5,7,10,11,15)$ in POS by using K-Map.

SOP form :- for eg : $A\bar{B} + \bar{A}BC$ — sum of pr

$2^n \rightarrow$ minterm

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

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

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

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

POS : $\Pi(0,2,3,5,7,10,11,15)$

AD \ EF	$\bar{E}\bar{F}$	$\bar{E}F$	EF	$E\bar{F}$
$\bar{C}\bar{D}$	0		0	0
$\bar{C}D$		0	0	
CD			0	
$C\bar{D}$			0	0

~~$\bar{D}E + EF + \bar{C}DF$~~

$(\bar{D}+E)(E+F)(\bar{C}+D+F)$

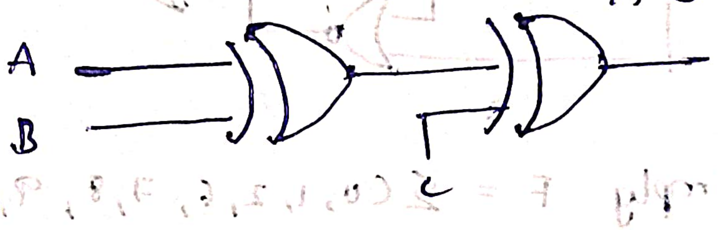
6. Realise the following using 2 input gat

~~Nand~~

a) $F(A,B,C) = A \oplus B \oplus C$.

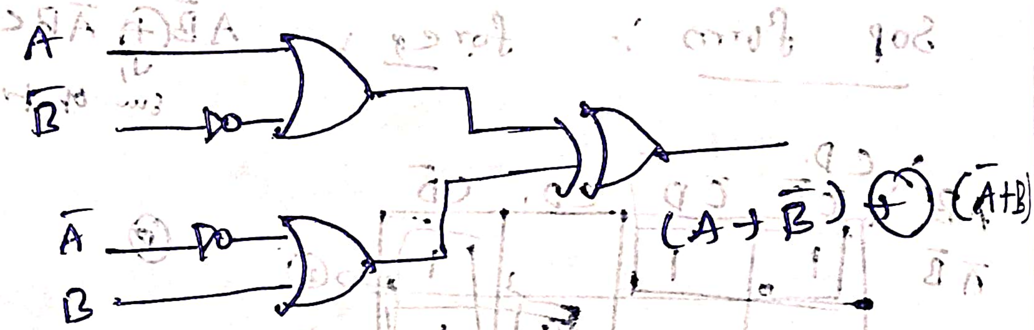
$A \oplus B$ $\quad$ $A \oplus B \oplus C$

$\cancel{A \oplus (B \oplus C)}$.



$\cancel{A \oplus (B\bar{C} + \bar{B}C)}$

~~8. Desi~~ b) $F(A,B) = (A+\bar{B}) \oplus (\bar{A}+B)$.

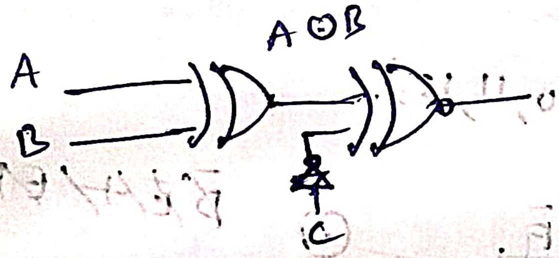


$(A+\bar{B}) \oplus (\bar{A}+B)$

~~c) F(A,B) = (A+B) ×~~

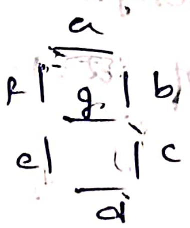
c) $F(A,B,C) = A \odot B \odot \bar{C}$

$A \odot B$



$A \odot B \odot \bar{C}$

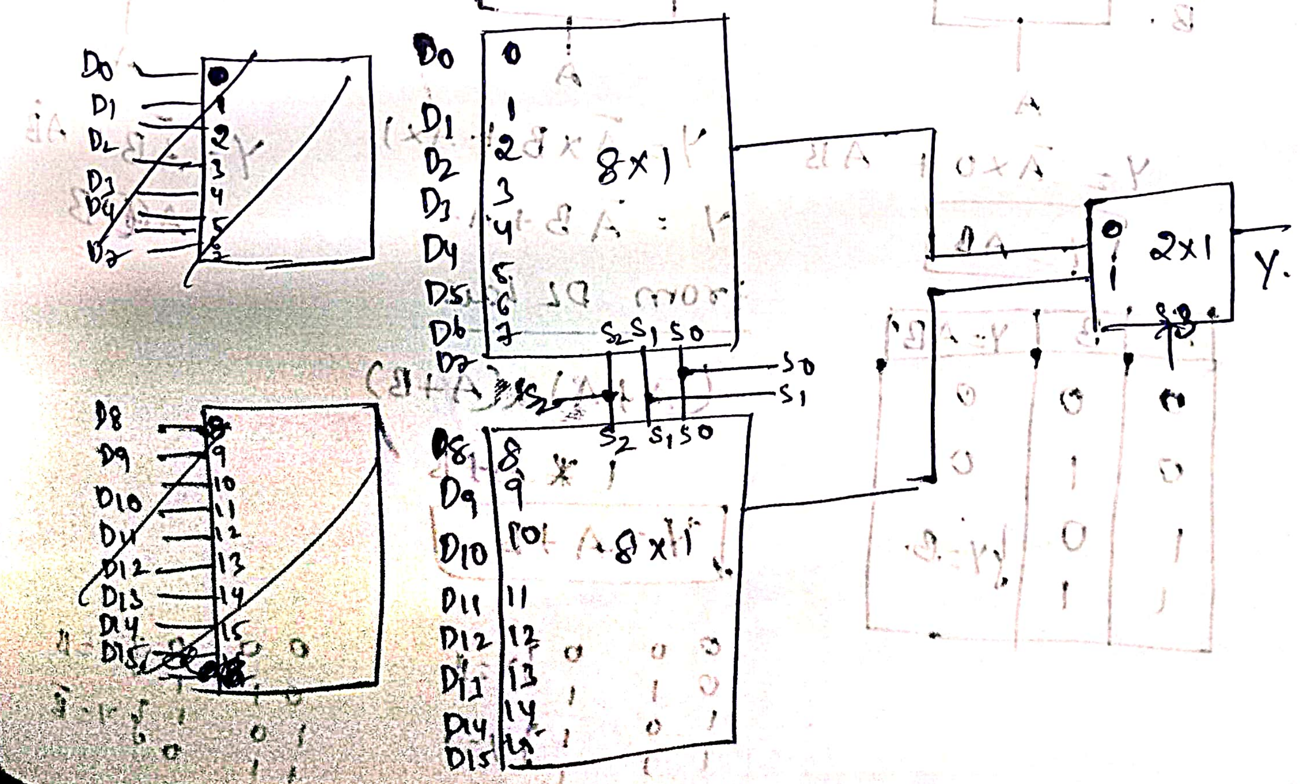
9. Design BCD to 7 segament Display ?



Input	a	b	c	d	e	f	g
0 0 0 0	1	1	1	1	1	1	0
0 0 0 1	0	1	1	0	0	0	0
0 0 1 0	1	1	0	1	1	0	1
0 0 1 1	1	1	1	1	0	0	1
0 1 0 0	0	1	1	0	0	1	1
0 1 0 1	1	0	1	1	0	1	1
0 1 1 0	1	0	1	1	1	1	1
0 1 1 1	1	1	1	0	0	0	0
1 0 0 0	1	1	1	1	1	1	1
1 0 0 1	1	1	1	0	0	1	1

Kmap are a, b, c, d, e, f, g

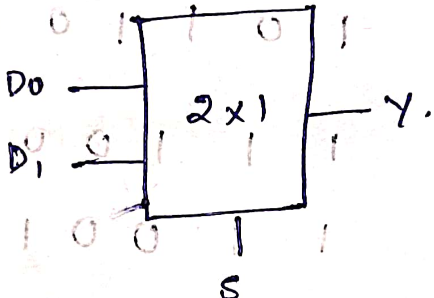
10. Construct 16:1 mux using 2×8:1 & 2:1 mux.



9. Design the following gates using min no of 2:1 mux. a) NOT B) AND c) OR D) XOR.

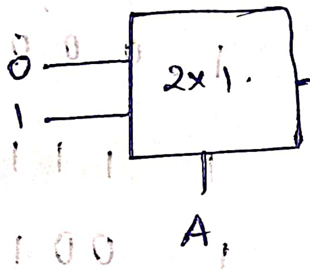
a) NOT :- A —▷o— $Y = \bar{A}$

Now MUX



if $s = 0$, $\bar{S} D_0 + S D_1$ $(S=1)$.

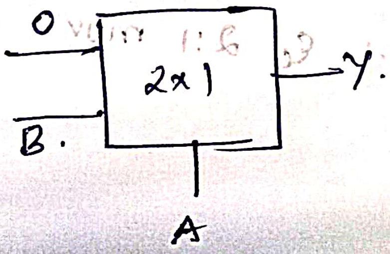
Now similarly



$\Rightarrow Y = \bar{A} \times 1 + A \times 0$

$\boxed{Y = \bar{A}}$

b) AND gate :-

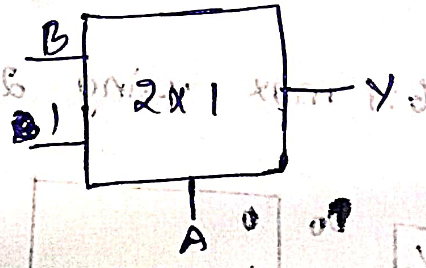


$Y = \bar{A} \times 0 + AB$

$\boxed{Y = AB}$

A	B	Y = AB'
0	0	0
0	1	0
1	0	}Y=B.
1	1	

c) OR gate :-



$Y = \bar{A} \times B + A \times 1$

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

from DL Law

$(\bar{A} + A) * (A + B)$

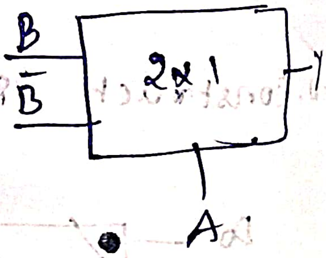
$1 * A + B$

$\boxed{Y = A + B}$

0 0 0 }Y=B

0 1 1

D) XOR gate



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

$A \oplus B$

0 0 0 }Y=B

0 1 1 }Y=$\bar{B}$