




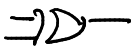



Lecture # 2

		i/p	o/p
#	Not 	A	A'
	AND 	A, B	A · B
	OR 	A, B	A + B
	NOR 		(A + B)'
	NAND 		(A · B)'
	XOR 		AB' + A'B
	XNOR 		AB + A'B'

Boolean arithmetic :-

$$\left. \begin{array}{l} 1 + 1 = 1 \\ 1 + X = 1 \\ 0 \cdot X = 0 \end{array} \right\} =$$

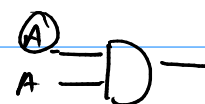
Cost \swarrow
 # Speed \leftarrow
 # Power \leftarrow
 # AREA \nwarrow

$$\begin{array}{c} 4 \\ \square \\ = \end{array} \quad \begin{array}{c} 3 \\ \square \\ 2^{30} \end{array}$$

IC

$$\underline{A} = A \cdot A = A$$

$\underline{AB + A \cdot A} =$
 $A(B + 1) =$
 $A \cdot 1 = A$



$AB + AB'$
 $A(B + B')$
 $A \cdot 1$
 $= A$

(A)		O/P
A	B	
0	0	0
1	1	1

$$= A + \textcircled{B} =$$

$\boxed{1}$

$$B = 0 -$$

$$\textcircled{B = 1} =$$

$$Y = \textcircled{AB' + B}$$

$$= \underline{\underline{A + B}}$$

$$\boxed{B = 0}$$

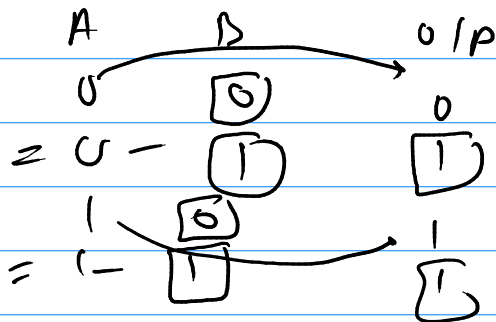
$$\boxed{Y = A}$$

$$\Rightarrow \textcircled{B = 0}$$

$$\boxed{Y = 1}$$

$$\Rightarrow \boxed{B = 1}$$

$$\boxed{A + B}$$



#

$$\boxed{(AB)' = \textcircled{A' + B'}}$$

$$(A + B)' = A'B'$$

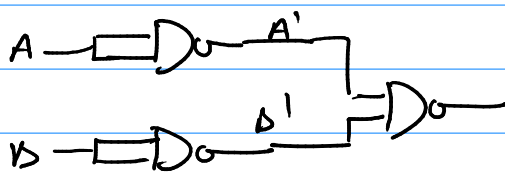
$$\Rightarrow$$

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

$$A = B \Rightarrow \text{NOT } A'$$

$\Rightarrow \textcircled{\text{NOT}}$

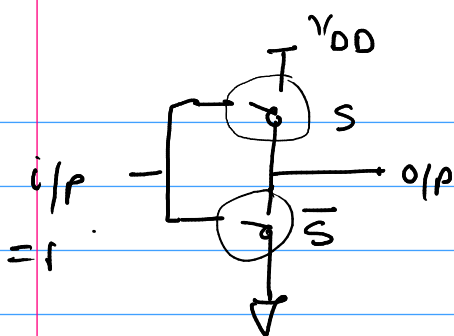
$$A \text{ --- } \text{AND} \text{ --- } B \Rightarrow \textcircled{\underline{\underline{AND}}}$$



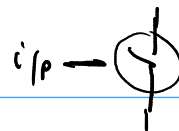
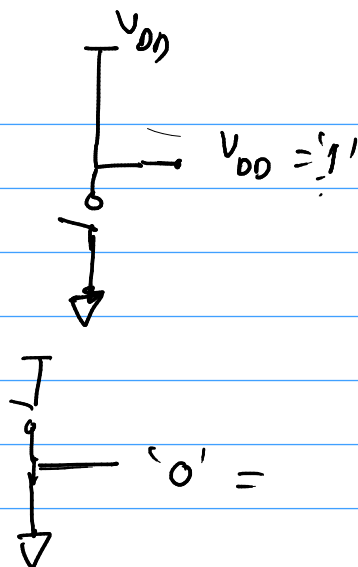
$$(A'B)' = (A')' + (B')' = \boxed{A + B}$$

$$\textcircled{\underline{\underline{OR}}}$$

$$= AB + BC' + D + EC$$



$i/p = 0$

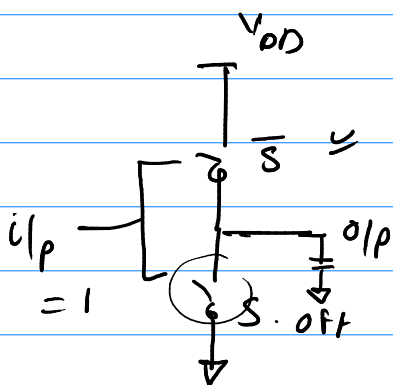


$i/p = 1$
= ON
= Closed

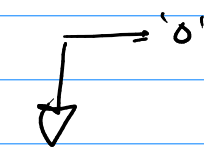
$i/p = 0$
⇒ open.

$V_{DD} \rightarrow '1'$

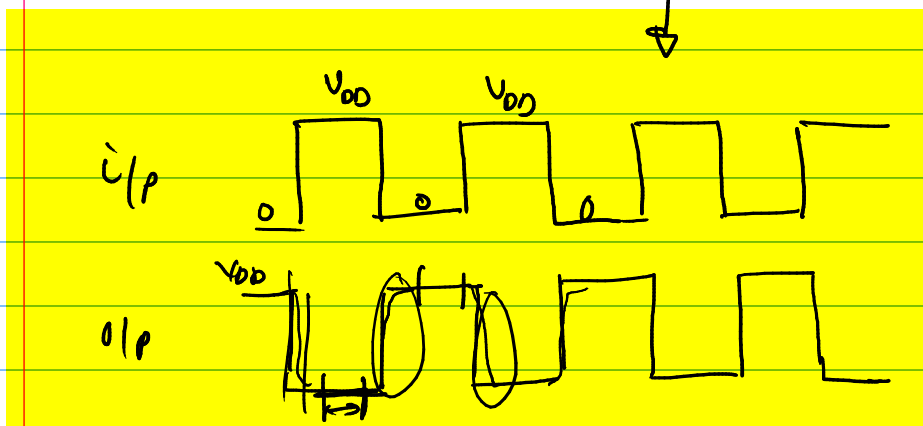
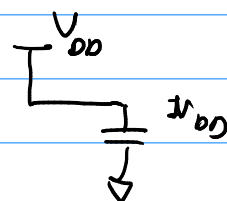
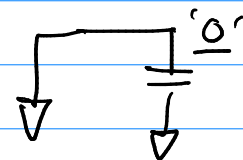
$0 \rightarrow \underline{'0'}$



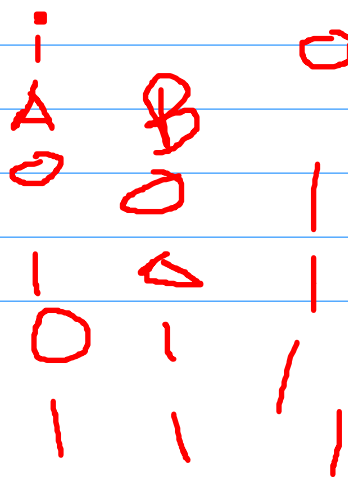
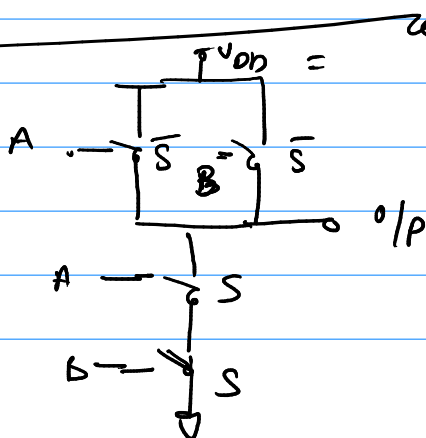
$i/p = 0$

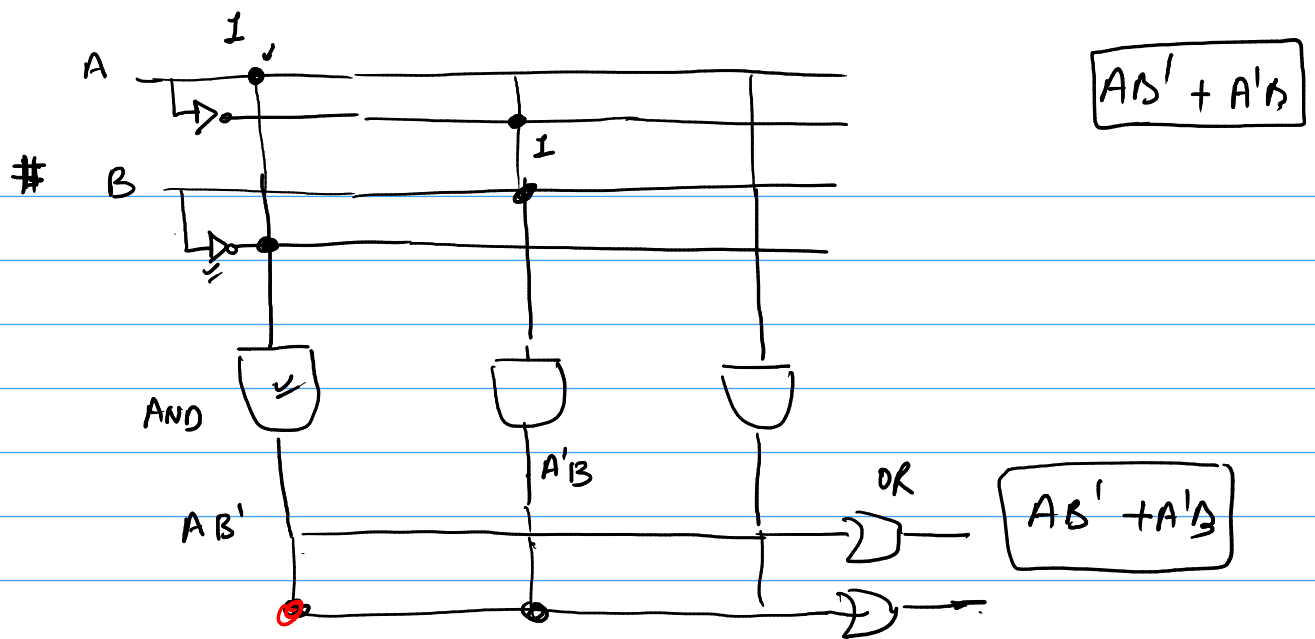


V_{DD}
 $V_{DD} = '1'$

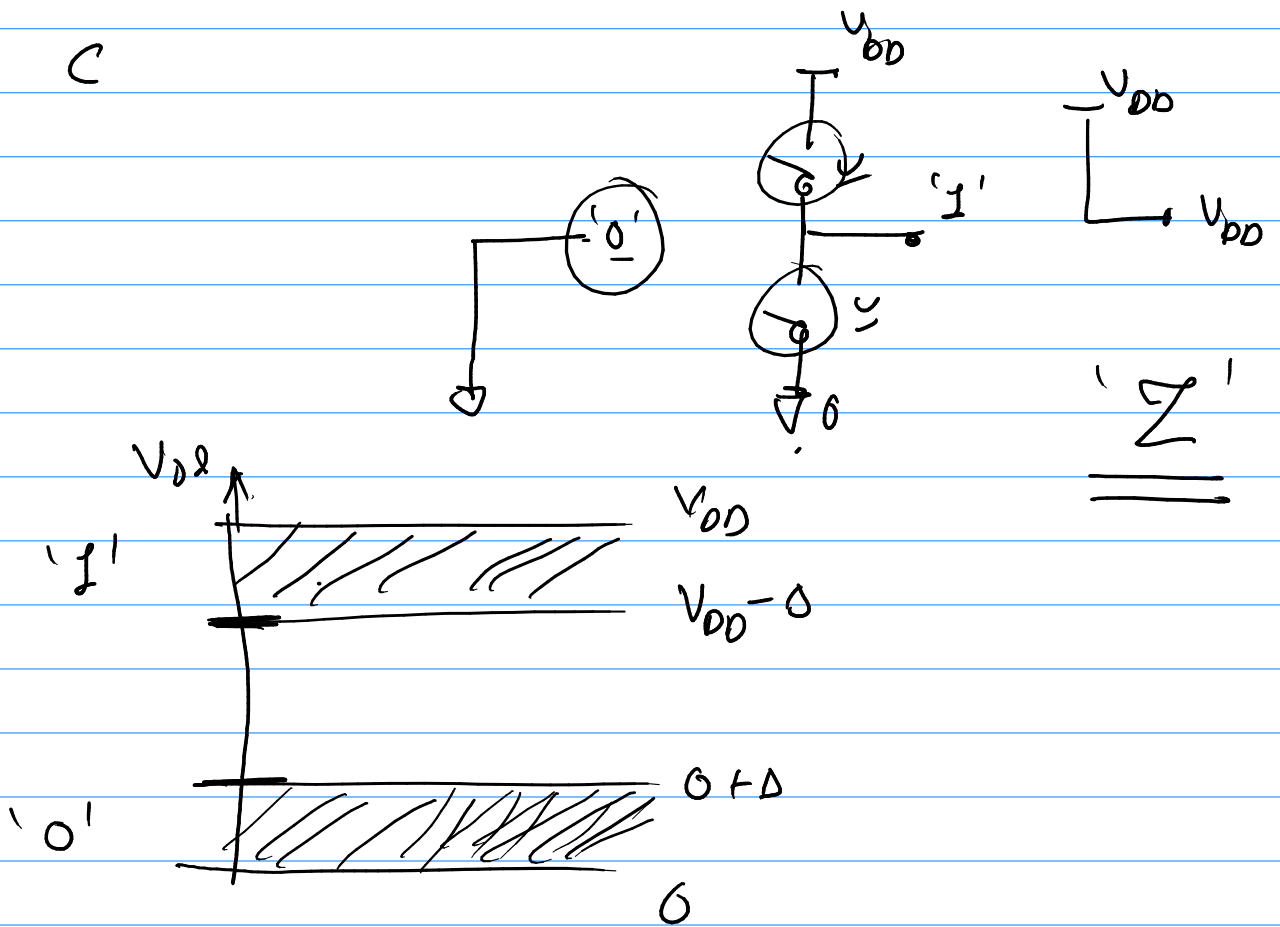


$$V \cdot I = 0$$

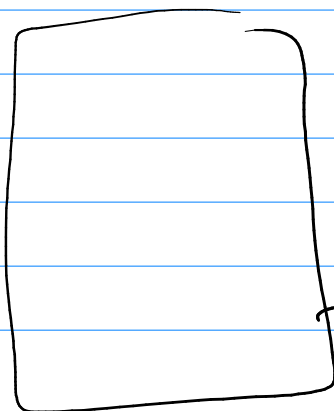




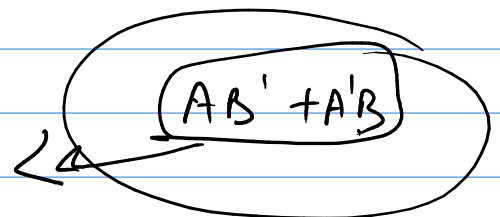
(1) C



HDL



1 1 0 1



VHDL

\Rightarrow

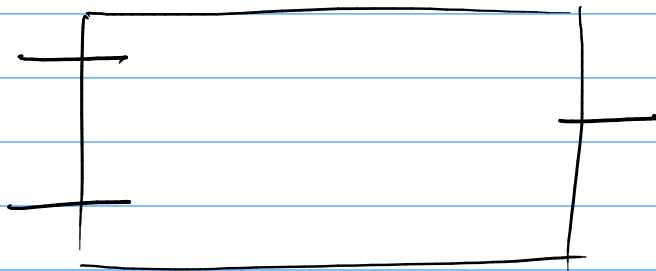
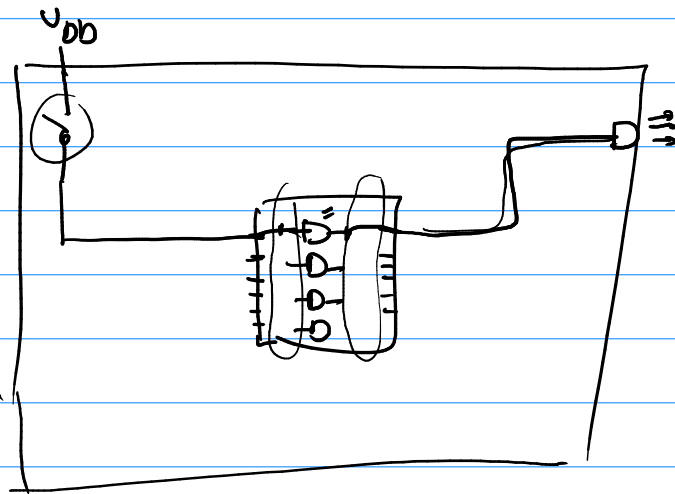
Verilog

\rightarrow

"Sameeto"

"Palnitay"

\rightarrow



10
x 99

$$Y = A B' + A'B$$

Module (input A, output Y,
input B,

\leftarrow

Black Box

$$Y = (A \text{ and } (\neg B)) \text{ or } (B \text{ and } (\neg A));$$

DATA
flow

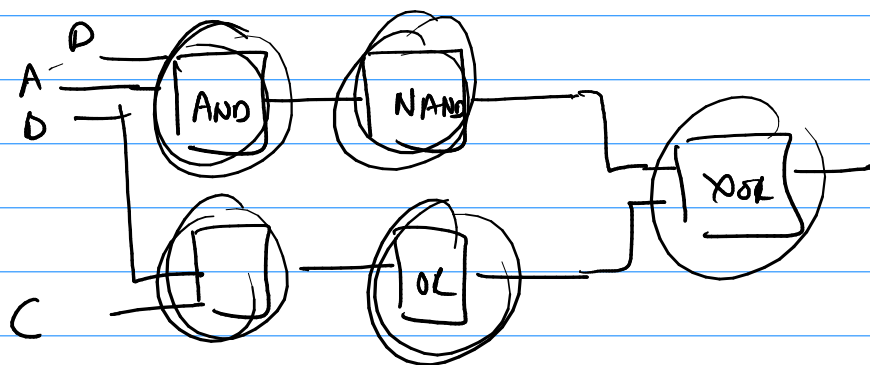
if (A=B)

Y = '0' ; =

Behavioural modeling

else

Y = '1' =



Structural.

#

12

GB

1100

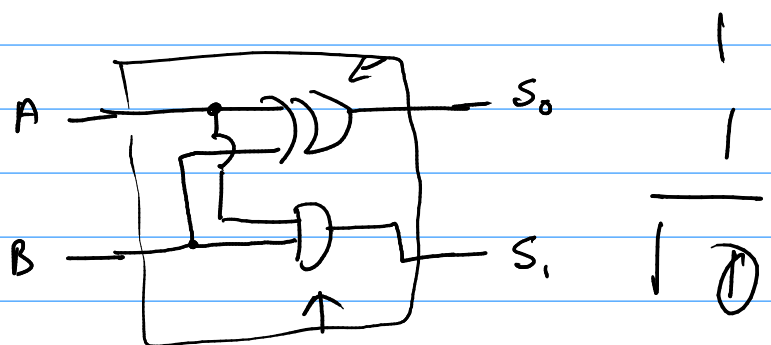
4 bit

1000

4 bit

10100

S ₁	S ₀	A	B
0	0	0	0
0	1	0	1
0	1	1	0
1	0	1	1



$$+11 \rightarrow$$

$$\downarrow$$

$$\boxed{01011}$$

$$\ominus 11 \rightarrow$$

0	1	2	3
000	001	010	011
+	+	+	+

$$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \begin{matrix} -1 \\ -2 \\ -3 \end{matrix} \begin{matrix} | \\ | \\ | \end{matrix} \begin{matrix} -1 \\ -2 \\ -3 \end{matrix}$$

$$\begin{array}{r} 1 \\ 001 \\ 110 \quad \underline{\text{1's}} \\ + 1 \quad \underline{\text{2's}} \\ \hline 111 \end{array}$$

$$\boxed{-1}$$

$$-1 \rightarrow$$

$$001$$

$$110$$

$$+ 1$$

$$\boxed{111} = \boxed{-1}$$

$$\begin{array}{r} 3 \\ -1 \\ \hline 2 \end{array}$$

-3	-2	-1	0	1	2	3
			000	001	010	011

$$001$$

$$011 + 1$$

$$101 + 1$$

$$111 + 1$$

$$\boxed{001} + 1$$

$$011$$

$$101$$

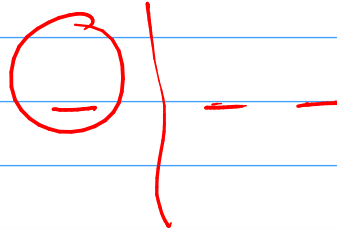
$$111$$

$$\begin{array}{r} 1 \\ 11 \\ + 1 \\ \hline 00 \end{array}$$

010

$$\begin{array}{r}
 + \quad \textcircled{3} = \textcircled{011} \\
 \quad \textcircled{-1} = \textcircled{110} \\
 \hline
 \quad \quad \textcircled{010} = \textcircled{2}
 \end{array}$$

$$\begin{array}{r}
 -1 \\
 001 \\
 \textcircled{110} \leftarrow \textcircled{-1} \\
 \hline
 111
 \end{array}$$



$$1 - 1 - 1 = 1$$

