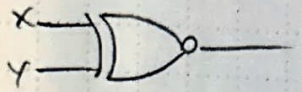
XOR Gate: Exclusive OR

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

XNOR Gate Exclusive NOR



X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	1

Logic Design with XOR and XNOR

$$F_1 = X\bar{Y}Z + \bar{X}YZ + \bar{X}\bar{Y}\bar{Z} + X\bar{Y}Z$$
$$= Z(X\bar{Y} + \bar{X}Y) + \bar{Y}(\bar{X}Z + XY)$$
$$= Z(X \oplus Y) + \bar{Y}(\overline{X \oplus Y})$$

Binary Addition

Single Bit Addition

$$\begin{array}{r} 0 \\ +\ 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 0 \\ +\ 1 \\ \hline 1 \end{array} \quad \begin{array}{r} 1 \\ +\ 0 \\ \hline 1 \end{array} \quad \begin{array}{r} 1 \\ +\ 1 \\ \hline 10 \end{array}$$

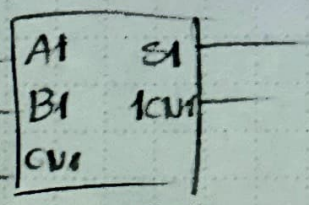
Multiple Bit Addition

$$\begin{array}{r} 6 \\ +\ 3 \\ \hline 9 \end{array} \quad \begin{array}{r} 0110 \\ +\ 0011 \\ \hline 1001 \end{array}$$

Two Types of Adders

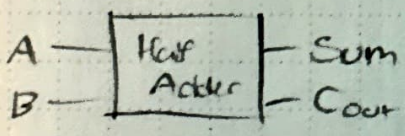
Half Adder
- 2 Inputs (A & B)
- 2 Outputs (Sum & C_{out})
- Used for LSB only

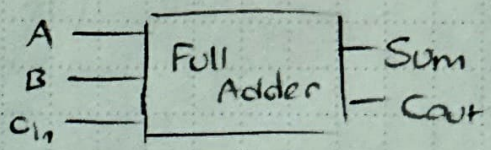
Full Adder
- 3 inputs (A, B, C_{in})
- 2 outputs (Sum and C_{out})
- Used for all other bits



74LS183D

MSI





Half Adder Design

A	B	Sum	C_{out}
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

$$Sum = \bar{A}B + A\bar{B} = A \oplus B$$
$$C_{out} = AB$$

Full Adder Design

A	B	C_{in}	Sum	C_{out}
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

$$Sum = \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + AB C_{in} + A\bar{B}\bar{C}_{in}$$
$$= A \oplus B \oplus C$$
$$C_{out} = AB + BC_{in} + AC_{in}$$

Signature:	Date: 2/10/25	Team Members:
Witness:	Date:	
Continued From Page #		Continued On Page #