

Full Adder

Last updated 10/31/24

Full Adder

- Binary Addition

$$\begin{array}{r} \text{Carry} \\ 1 \\ + 0 \\ \hline \text{Sum} \end{array}$$

$$\begin{array}{r} 0 \\ 0 \\ + 0 \\ \hline 0 \end{array}$$

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

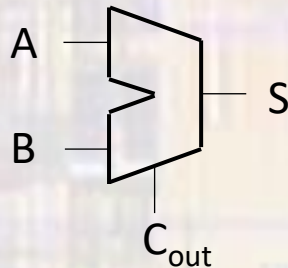
$$\begin{array}{r} 0 \\ 1 \\ + 0 \\ \hline 1 \end{array}$$

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

Full Adder

- A **Half** Adder is used to add two binary bits
 - 2 inputs
 - A, B
 - 2 outputs
 - Sum, Carryout (C_{out})

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



$$\begin{array}{l} S = A \oplus B \\ C_{out} = AB \end{array}$$

Full Adder

- Binary Addition
 - Looking at the 2's column

$$\begin{array}{r} \text{Carry-out} \\ 011 \\ + 011 \\ \hline \text{sum } 0 \end{array}$$

Carry-in from 1's column

$$\begin{array}{r} 01 \\ 001 \\ + 001 \\ \hline 10 \end{array}$$

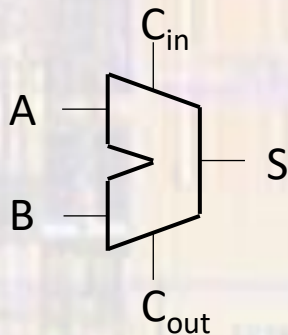
$$\begin{array}{r} 11 \\ 001 \\ + 011 \\ \hline 00 \end{array}$$

$$\begin{array}{r} 11 \\ 011 \\ + 001 \\ \hline 00 \end{array}$$

$$\begin{array}{r} 11 \\ 011 \\ + 011 \\ \hline 10 \end{array}$$

Full Adder

- A **Full Adder** is used to add two binary bits
 - 3 inputs
 - A, B, C_{in}
 - 2 outputs
 - Sum, Carryout (C_{out})



C_{in}	A	B	C_{out}	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$$\begin{aligned} S &= A \oplus B \oplus C_{in} \\ C_{out} &= AB + AC_{in} + BC_{in} \end{aligned}$$