The Multiplexer

Many Inputs

Pick One!

"n to 1 switch"

Select

2 Inputs

\[ S = k \]

\[ A \]

\[ B \]

\[ Z \]

High Level

\[ 2 \]

\[ 3 \]

\[ 4 \]

4 Inputs

\[ s_0, s_1, a, b, c, d, p \]

\[ z \]

\[ A \]

\[ B \]

\[ S \]

\[ 2 \]

\[ 3 \]

\[ 4 \]

\[ S_S, S, S' \]
CALCULATOR

4 FUNCTIONS

1. BITWISE AND (A, B)
2. BITWISE OR (A, B)
3. BITWISE XOR (A, B)
4. BITWISE NOT (A)

WE ALREADY HAVE COMPONENTS!

A AND B A AND B A AND B A

WE NEED TO SELECT ONE BASED ON A NUMBER "OPCODE"

00 MEANS "AND"
01 MEANS "OR"
10 MEANS "XOR"
11 MEANS "NOT"

CALL IT S[1:0]
The Full Adder

How to add 2 binary #s?

Make a truth table!

Inputs: A B C_in
Outputs: S C_out

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C_in</th>
<th>S</th>
<th>C_out</th>
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\[ S = \overline{A}B\overline{C_{in}} + \overline{A}BC_{in} + A\overline{B}\overline{C_{in}} + ABC_{in} \]

\[ C_{out} = \overline{A}BC_{in} + \overline{A}BC_{in} + A\overline{B}C_{in} + ABC_{in} \]
1-bit ADDER
"FULL ADDER"

Diagram of a 1-bit adder circuit with inputs $A_1$, $B_1$, $A_0$, and $B_0$, and outputs $S_1$, $S_0$, $C_{out}$, and $C_{in}$.