Almost ready to move into chapter 5 and start building a processor
Review: The Multiplexor

- Selects one of the inputs to be the output, based on a control input

\[
\begin{array}{c}
\text{S} \\
\downarrow \\
\text{A} \\
\rightarrow 0 \\
\text{B} \\
\rightarrow 1 \\
\rightarrow \text{C}
\end{array}
\]

\textit{note: we call this a 2-input mux even though it has 3 inputs!}

- Lets build our ALU using a MUX:
Building a 32 bit ALU

![Diagram of a 32-bit ALU]

- **Operation**
- **CarryIn**
- **Result**
- **CarryOut**

- **a**
- **b**

- **a0**
- **b0**
- **CarryIn**
- **ALU0**
- **Result0**

- **a1**
- **b1**
- **CarryIn**
- **ALU1**
- **Result1**

- **a2**
- **b2**
- **CarryIn**
- **ALU2**
- **Result2**

- **a31**
- **b31**
- **CarryIn**
- **ALU31**
- **Result31**
What about subtraction \((a - b)\) ?

- Two's complement approach: just negate \(b\) and add.
- How do we negate?

- A very clever solution:
Adding a NOR function

- Can also choose to invert a. How do we get “a NOR b”?
Handling slt
Special Case for Bit 31
Complete ALU

- **Notice control lines:**
  
  0000 = and
  0001 = or
  0010 = add
  0110 = subtract
  0111 = slt
  1100 = NOR

- **Output “Zero” is used for checking equality**