Ripple-Carry Adder

By: Amber Ramsey, Cameron Cross, Cody Scholl, & Sam Wade

Why is the Ripple-Carry Adder Important?

- This component can take several inputs and use arithmetic to get a new output
- It is a part of the ALU (Arithmetic-Logic Unit)

Advantages

- It can perform addition process for n-bit sequences to get accurate results
- It’s design is not a complex process*

*If you have the Full Adder done

What Instructions does it support?

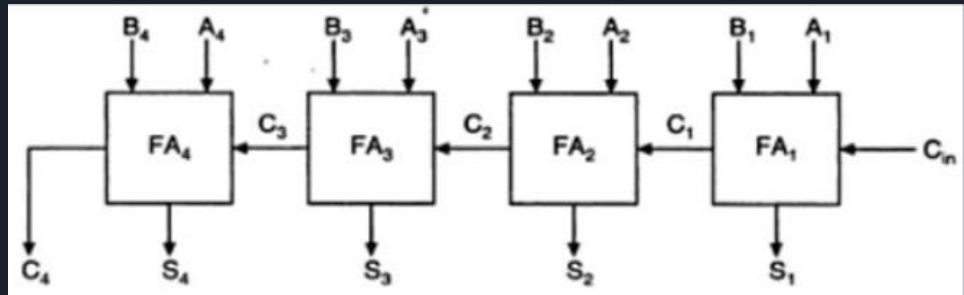
Addition

Subtraction
(Adding negative numbers)

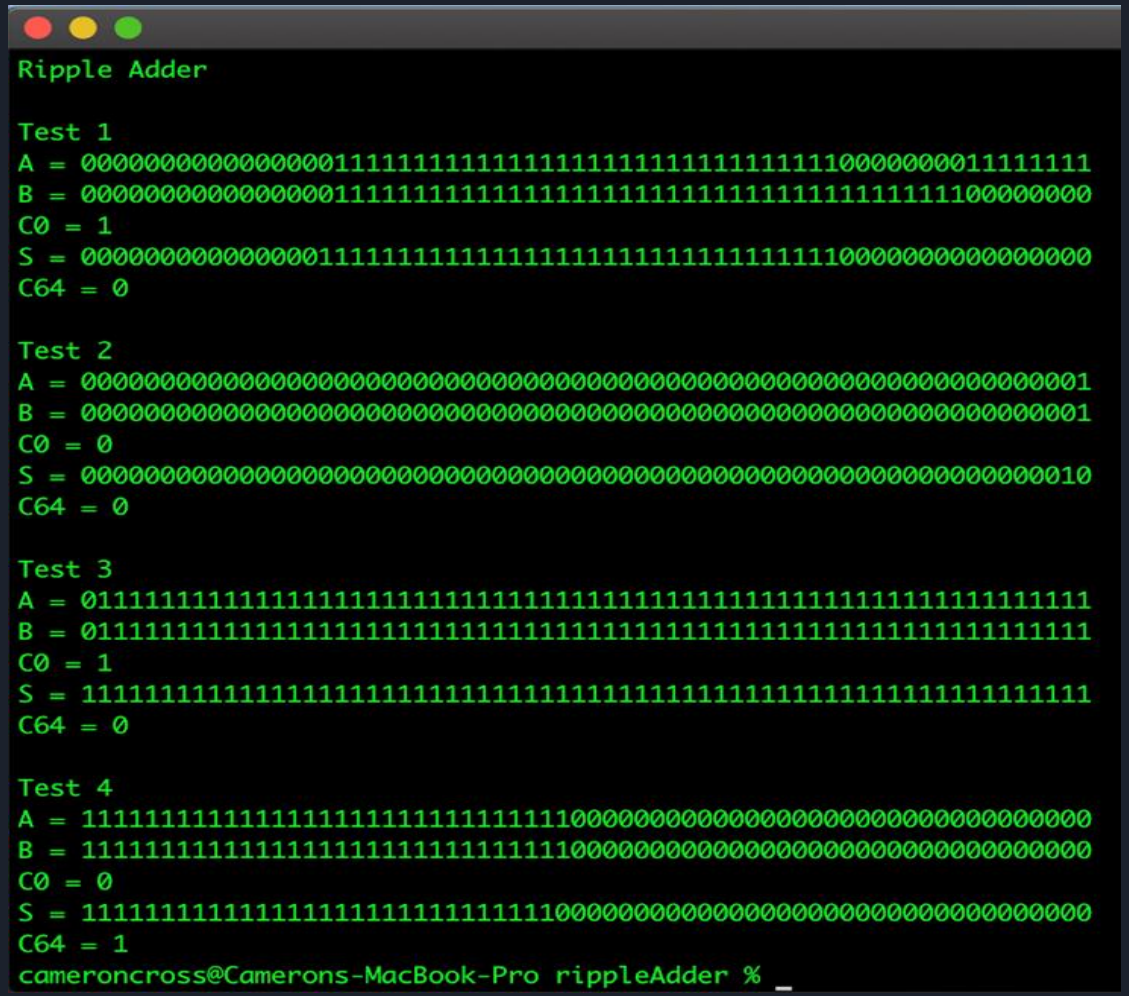
Overview Implementation

How to Implement:

- Need to have done the Full Adder done prior
- 129 inputs, with 65 outputs.
- For a 64 bit Ripple-Carry Adder, there would be 64 Full Adders being used where the carry input of each adder is the carry output of the previous Full Adder.
- Can be implemented using a Generate for loop, or by copy-pasting 64 Full Adder modules



Test Cases


Ripple Adder
Test 1
A = 00000000000000001111111111111111111111111111111100000000111111111
B = 00000000000000001111111111111111111111111111111111111111100000000
C0 = 1
S = 00000000000000001111111111111111111111111111111100000000000000000
C64 = 0
Test 2
A = 00000000000000000000000000000000000000000000000000000000000000001
B = 00000000000000000000000000000000000000000000000000000000000000001
C0 = 0
S = 00000000000000000000000000000000000000000000000000000000000000010
C64 = 0
Test 3
A = 01111111111111111111111111111111111111111111111111111111111111111
B = 01111111111111111111111111111111111111111111111111111111111111111
C0 = 1
S = 11111111111111111111111111111111111111111111111111111111111111111
C64 = 0
Test 4
A = 11111111111111111111111111111100000000000000000000000000000000000
B = 11111111111111111111111111111100000000000000000000000000000000000
C0 = 0
S = 11111111111111111111111111111100000000000000000000000000000000000
C64 = 1
cameroncross@Camerons-MacBook-Pro rippleAdder % _

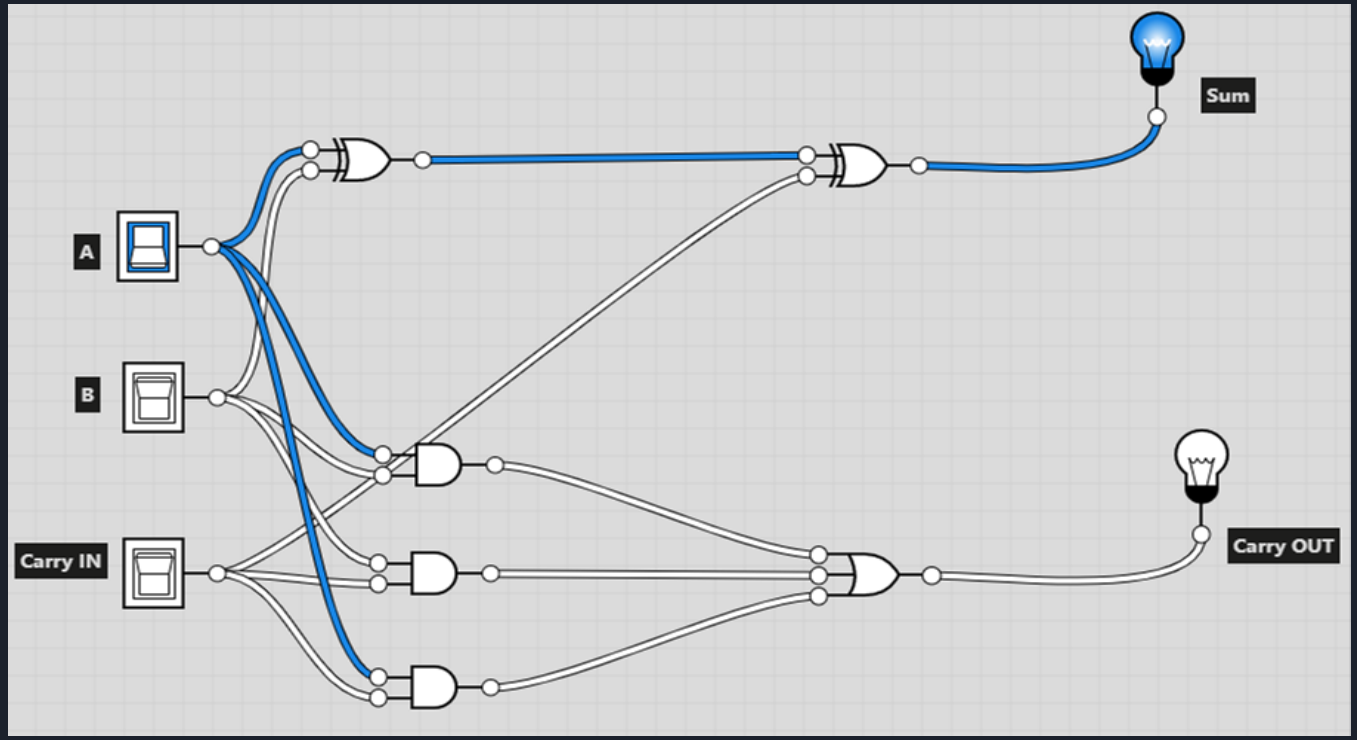
Issues During Implementation

- Trying to use a “for” loop was challenging
- Checking the 64 bit output

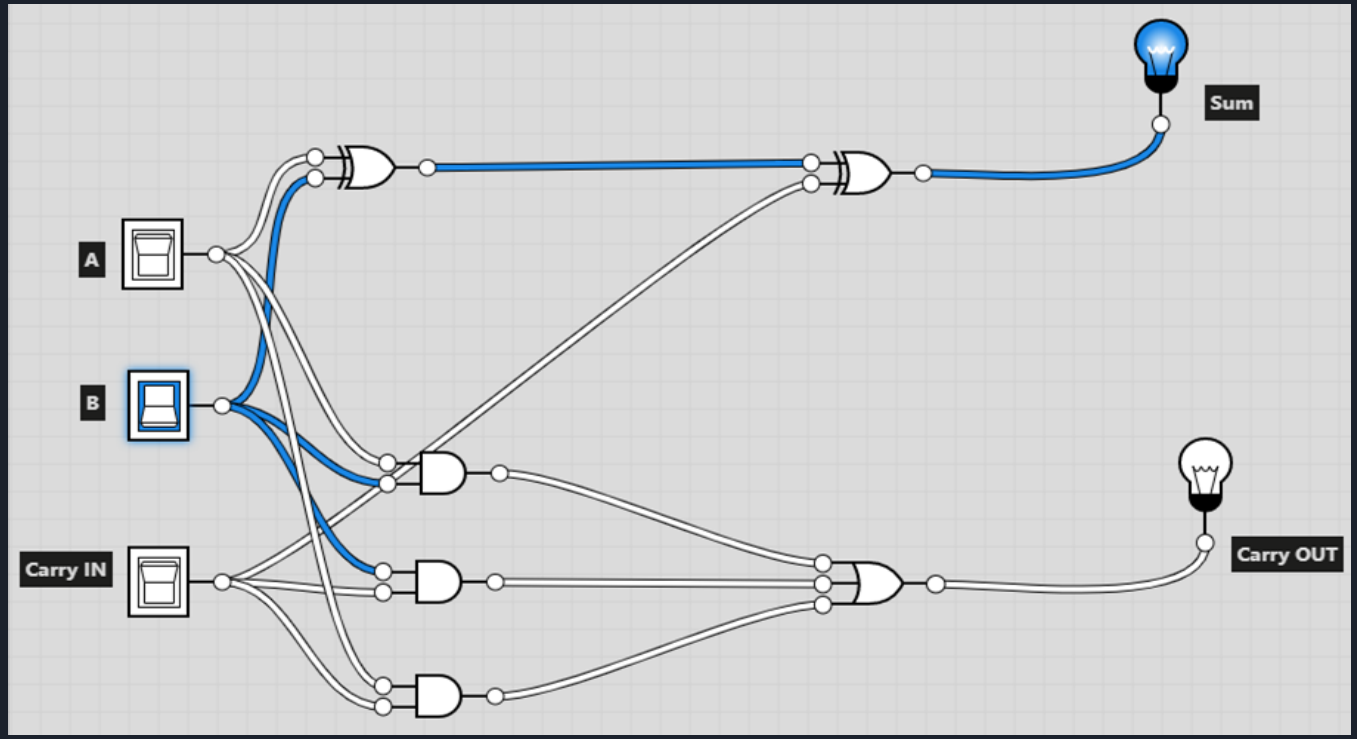
(Solved)

- We found out that the way we were doing the “for” loop was a only slightly wrong.
- We broke the input up into smaller sections by looking at the output for single full adders.

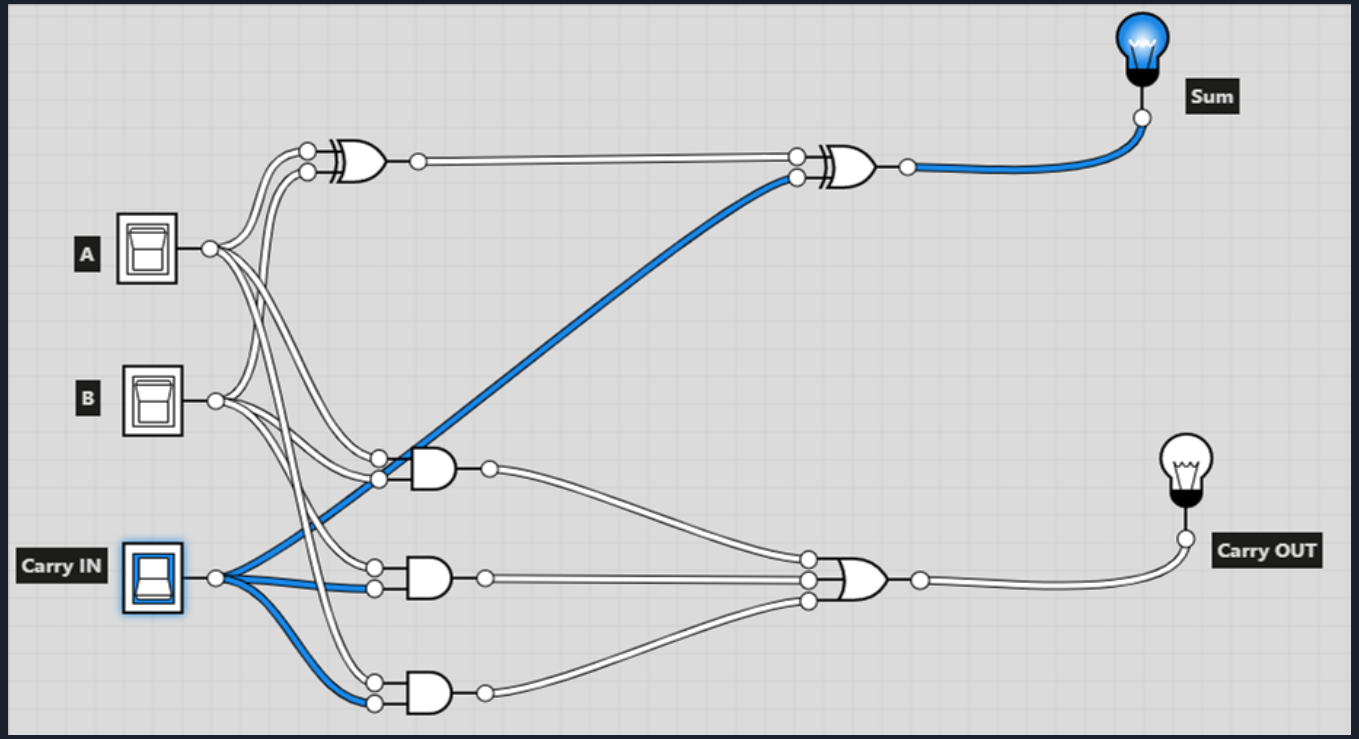
Input Pathing



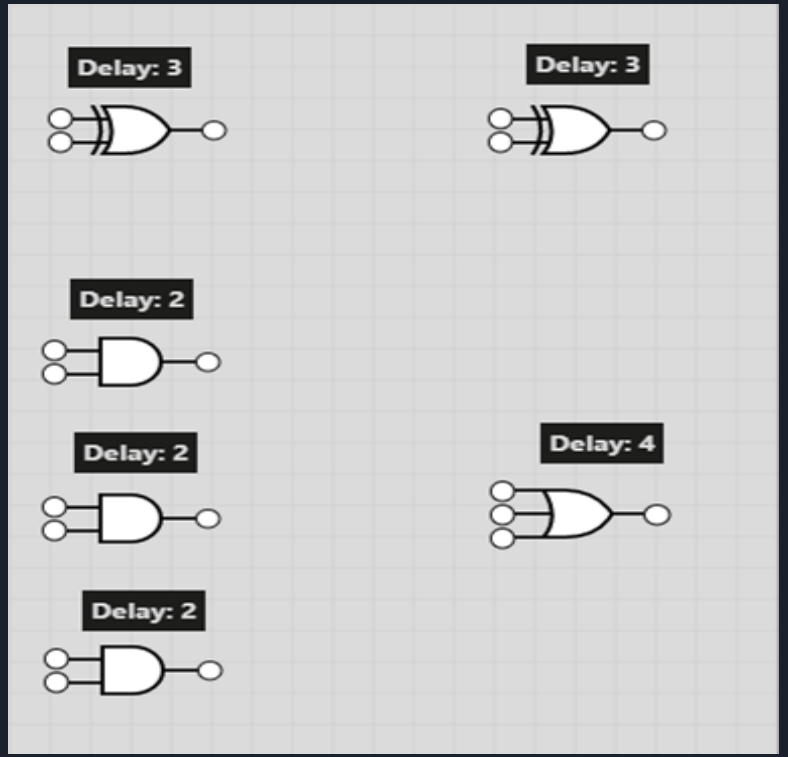
Input Pathing



Input Pathing



Gate Delay



Gate Delay For Full Adder: 6

Gate Delay for 64 bit Ripple Carry Adder: 6 x 64 = 384

Sources

- God
- https://www.elprocus.com/ripple-carry-adder-working-types-and-its-applications/
- Our amazing Computer Architecture professor!
- God

*God is so important, we listed Him multiple times

“Commit your work to the Lord, and your plans will be established” Prov. 16:3