Total Points: / 30   Name: Jeremiah Webb

1. **(1 pts)** What is the range of signed 10-bit integers?

   -512 to 511

2. **(4 pts)** Convert the following <u>**signed decimal numbers**</u> to their binary equivalents (use 9 bits):
   - i.   -64 = 111000000
   - ii. 100 = 001100100
   - iii. 145 = 010010001
   - v. 255 = 011111111

   Can we write the binary equivalent of ALL above four numbers using ONLY 8 bits? Yes or No. Give reasoning. **(1 pt)**

   We cannot just use 8 bit signed numbers, because the range of 8 signed bits are from -128 to 127, the range for 9 bits is -256 to 255

3. **(4 pts)** Represent the following decimal number in both **binary sign/magnitude and Two's complement** using 16 bits:
   - i. +512
   - Binary Sign = 0000001000000000
   - Two's Complement = 0000001000000000
   - ii. -29
   - Binary Sign = 1000000000011101
   - Two's Complement = 1111111111100011

4. **(2 pts)** Find the following differences using twos complement arithmetic:
   - i. 7-4
   - ii. 12-7

i.		ii.	
4 = 0100	7 = 0111	7 = 00111	12 = 01100
flip 1011	-4 = 1100	flip 11000	-7 = 11001
+ 1	+	+ 1	+
-----------	----------------	------------	-------------------
-4 = 1100	3 = 0011	-7 = 11001	5 = 00101

5. **(3 pts)** Covert the following binary (already in 2s complement) to decimal:

> i. 1 0 1 1 0 1 0 0
>
> ii. 0 1 1 1 1 1 1 1
>
> iii. 1 1 1 1 1 1 1 1

I. Negative leading 1

10110100 = -76

ii. Positive leading 0

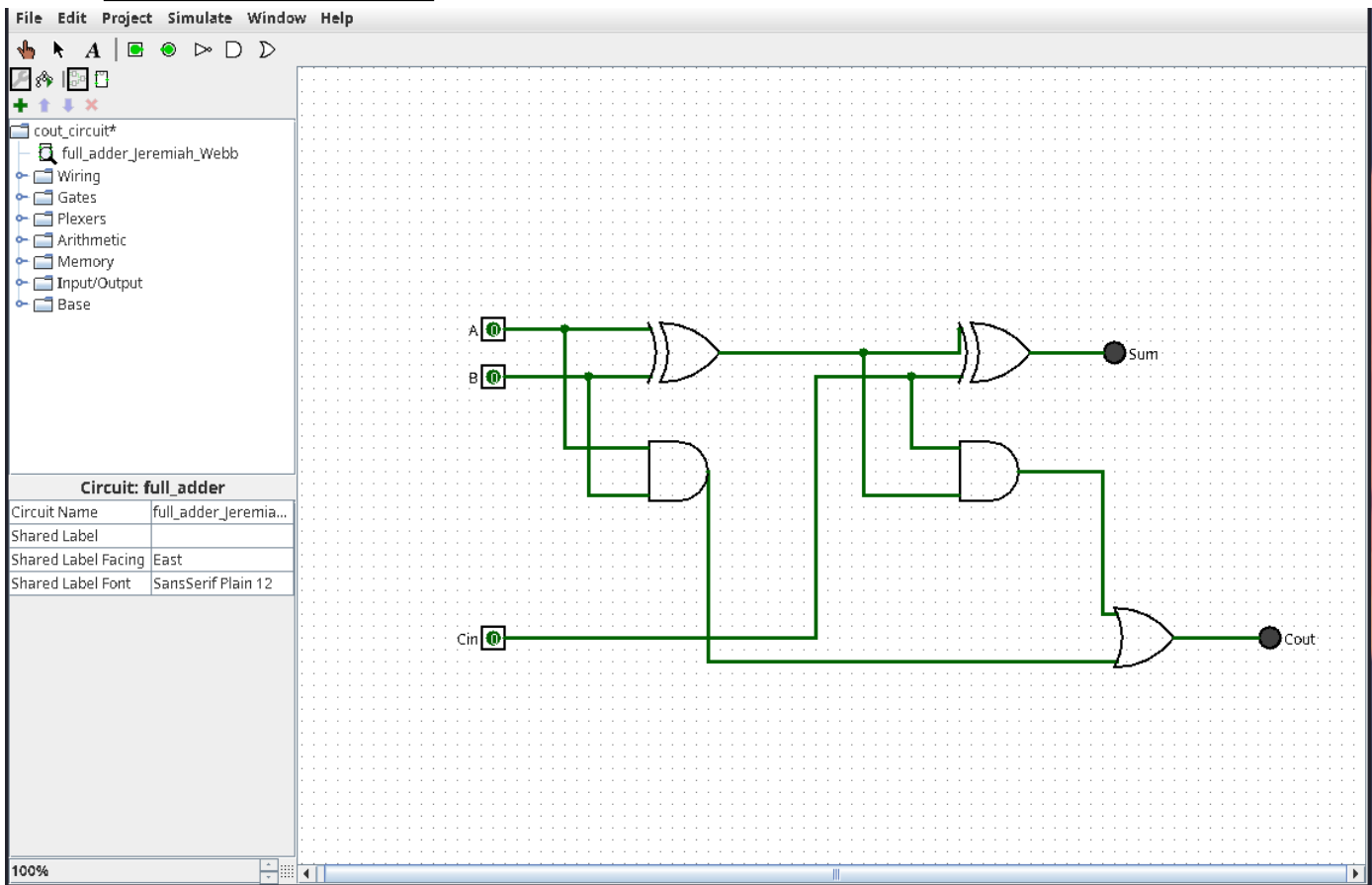01111111 = 127

iii. Negative leading 1

11111111 = -1

6. **(5 points)** Using Logisim implement a 1-bit full adder.
   - Name the circuit fulladder_yourfirstName_yourlastName.
   - Your fulladder should take 3 inputs (x,y,CarryIn) and yield two ouputs (sum, CarryOut).
   - Once built, be sure to test out your circuit for all possible input values to ensure that its implemented correctly!
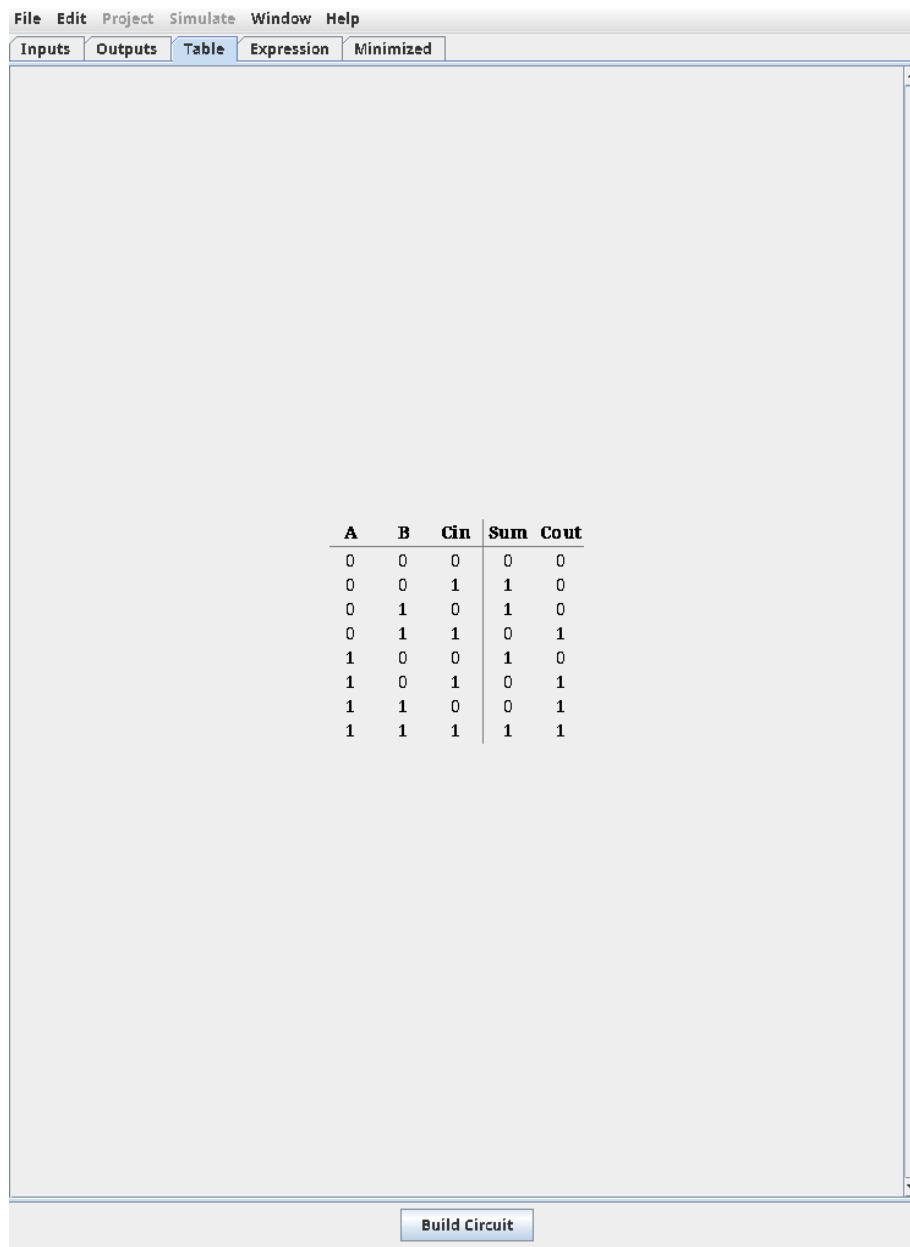
   Submit the following:
   1. .circ file
   2. Screenshot of the circuit

3. Screenshot of truth table

File Edit Project Simulate Window Help

| Inputs | Outputs | Table | Expression | Minimized |

| A	B	Cin	Sum	Cout
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

Build Circuit

7. **(10 points)** Implement a 6-bit ripple carry adder using the 1-bit full adder created in question 5.
    - Name your circuit rippleCarryAdder_yourfirstName_yourlastName.
    - Your rippleCarryAdder takes two 6-bit inputs X and Y and 1-bit input value CarryIn and produces a 6-bit Sum and a 1-bit CarryOut.
    - To build this circuit you should use 6 copies of 1-bit fulladder circuit designed in question 5.
    - Once built, be sure to test out your circuit for all possible input values to ensure that its implemented correctly!

<u>Submit the following:</u>
1. .circ file
2. Screenshot of the circuit showing addition of **101111 + 011100**
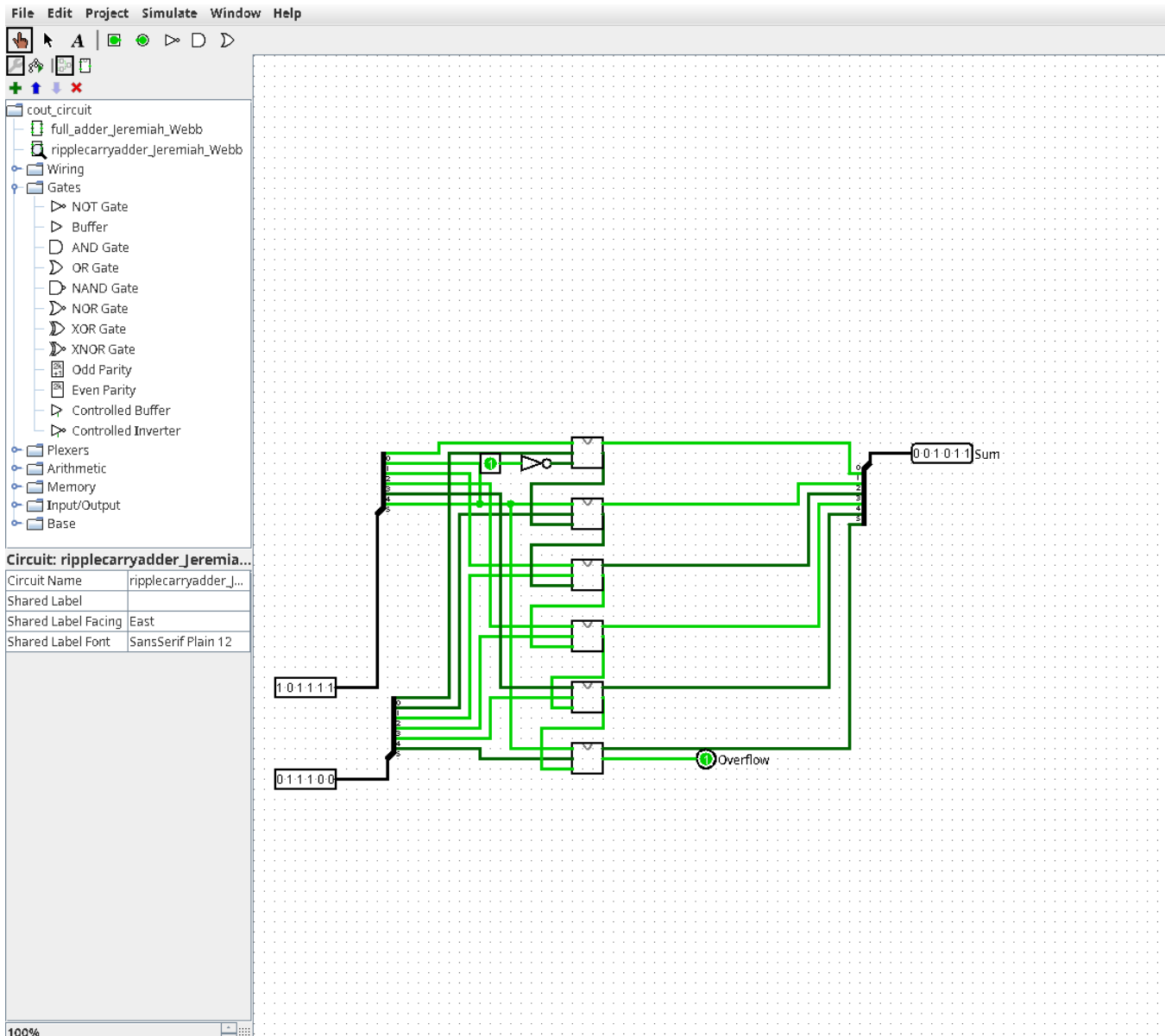
3. Screenshot of the circuit showing addition of **111111 + 000100**