HW 3 CEC 470 Due: Tuesday Oct 11th at 11:59 pm

Total Points: / 40 Name: Jeremiah Webb ID: 2545328

1. **(4 pts (2 pts each))** Write arithmetic right shift and logical right shift representation for the following binary:
   a) 1000 1111 Arithemtic: 1100 0111 Logical: 0100 0111
   b) 0111 0000 Arithmetic: 0011 1000 Logical: 0011 1000
2. **(12 pts (6 pts each))** Use the Booth algorithm to multiply
   i. 23 (multiplicand) by -29 (multiplier),
   ii. -15 (multiplicand) by -19 (multiplier),

   where each number is represented using 6 bits. Show all the steps in a tabular form.

Binary for Multiplier (M) = -29 = 011101

Twos Complement of M= 100011

Binary for multiplicand (Q)= 23 = 010111

Twos Complement of Q= 10 1001

A	Q(23)	Q_{-1}	Operation
000000	100011	0	Initial Data
010111	100011	0	A = A - M
001011	110001	1	Shift Right
000101	111000	1	Shift Right
101110	111000	1	A = A + M
110111	011100	0	Shift Right
111011	101110	0	Shift Right
111101	110111	0	Shift Right

010100	110111	0	A = A - M
001010	011011	1	Shift Right

Answer = -667 = 1010011011

Binary for Multiplier (M) = -15 = 001111

Twos Complement of M= 11 0001

Binary for multiplicand (Q)= -19 = 010011

Twos Complement of Q= 101101

A	Q(-19)	Q_{-1}	Operation
000000	101101	0	Initial Data
001111	101101	0	A = A - M
000111	110110	1	Shift Right
111000	110110	1	A = A + M
111100	011011	0	Shift Right
001011	011011	0	A = A - M
000101	101101	1	Shift Right

000010	110110	1	Shift Right
110011	110110	1	A = A + M
111001	111011	0	Shift Right
001000	111011	0	A = A - M
000100	011101	1	Shift Right

Answer = 285 = 100011101

3. **[20 pts]** Implement the Booths multiplier using Logisim. Submit the screenshot and the .circ file. It should be able to multiply two 4-bits numbers (remember result could be 8-bits)