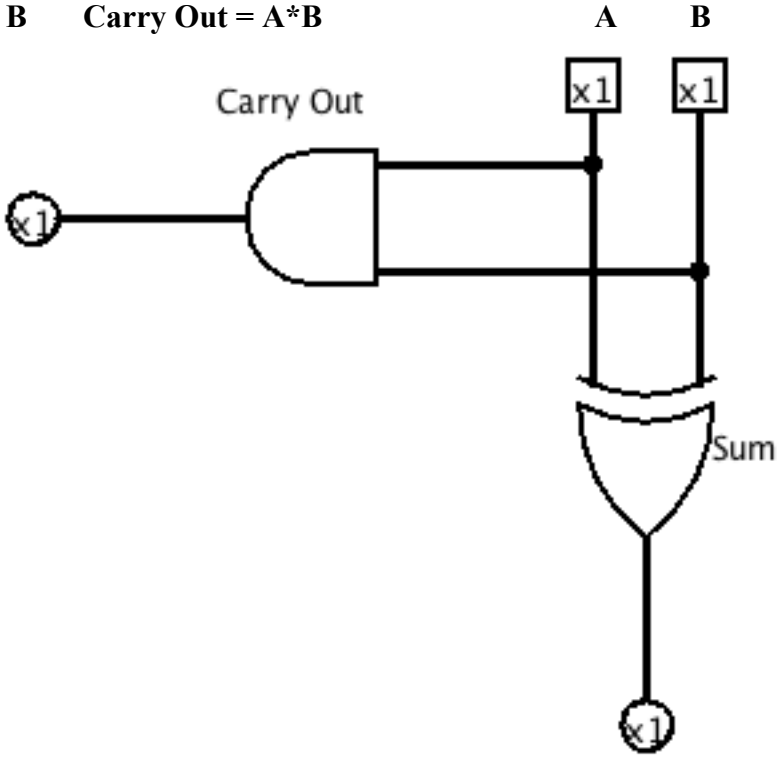
Half Adder

A	B	Sum	Carry Out
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

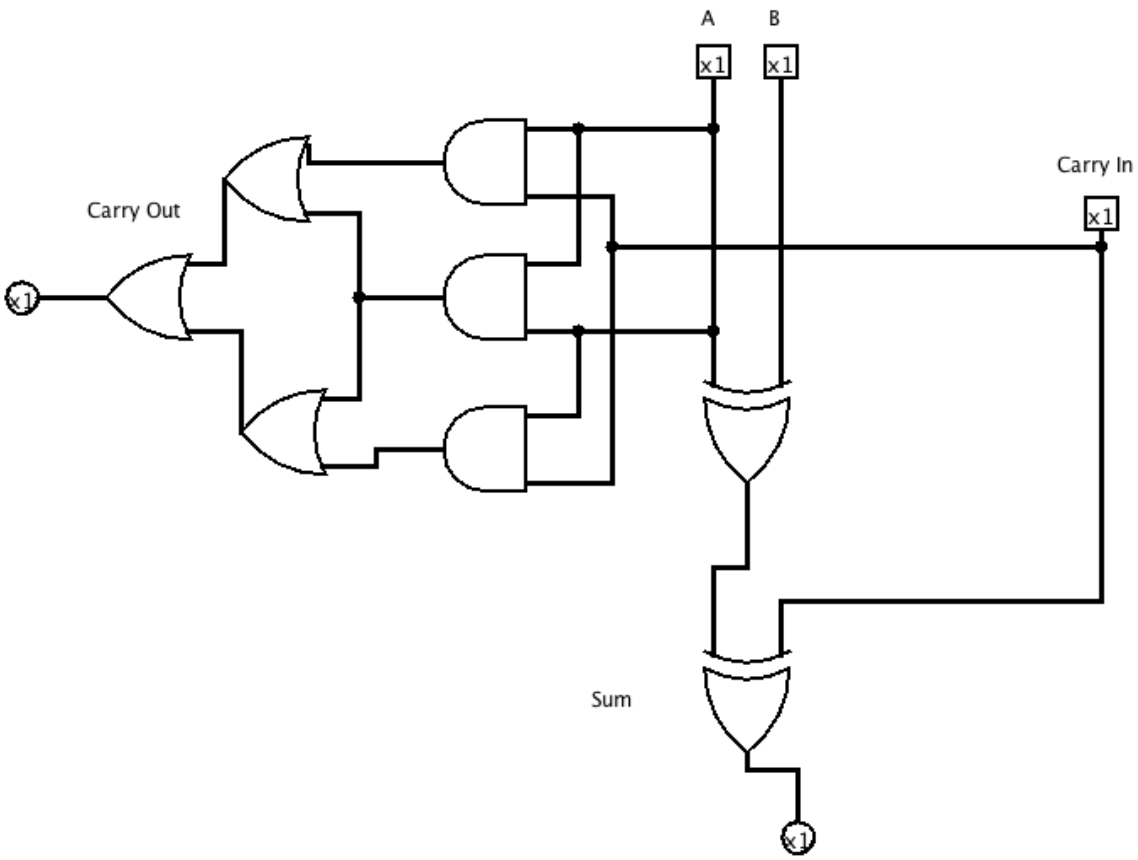
Sum = A xor B **Carry Out = A*B**



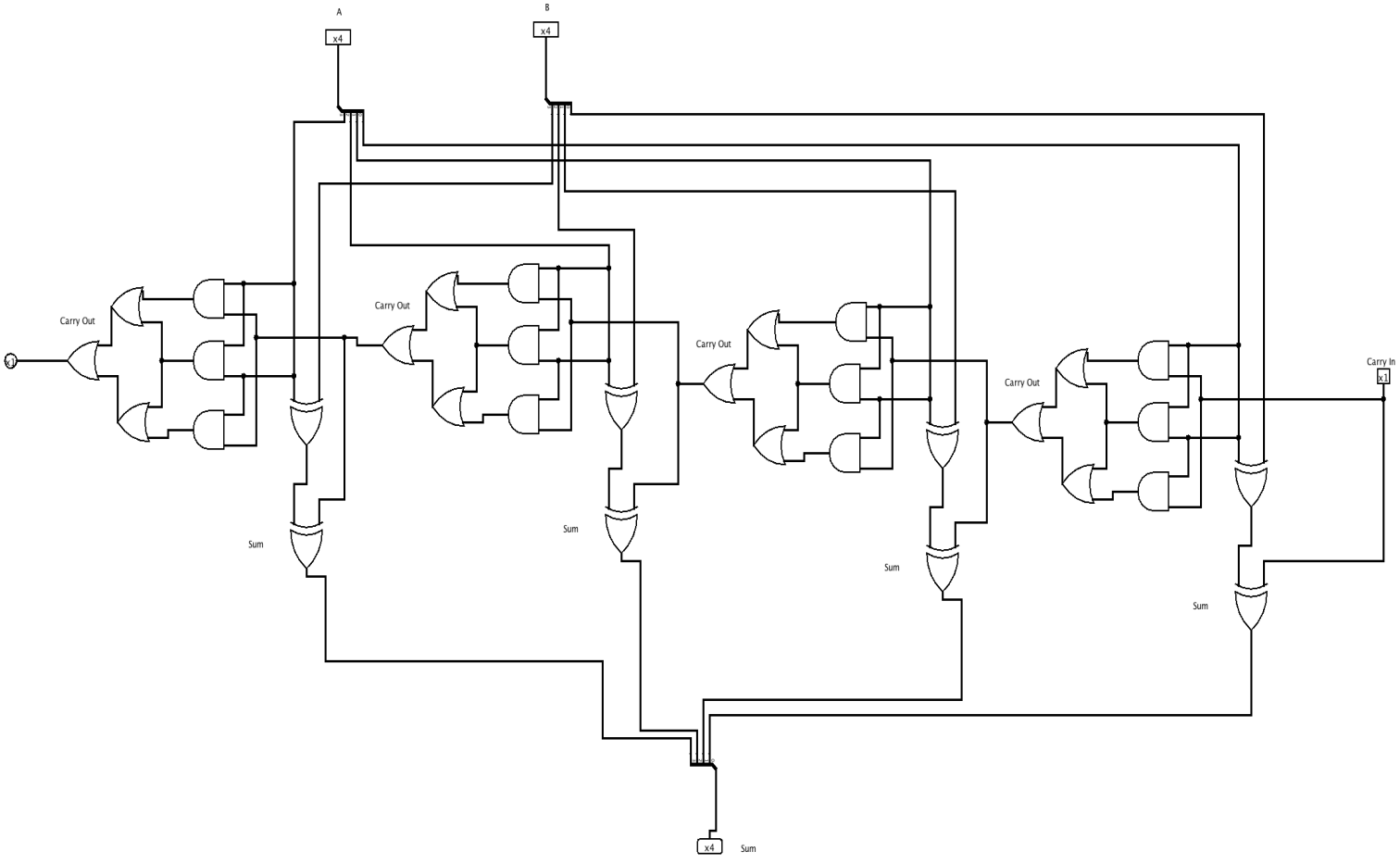
Full Adder

A	B	Carry In	Sum	Carry Out
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

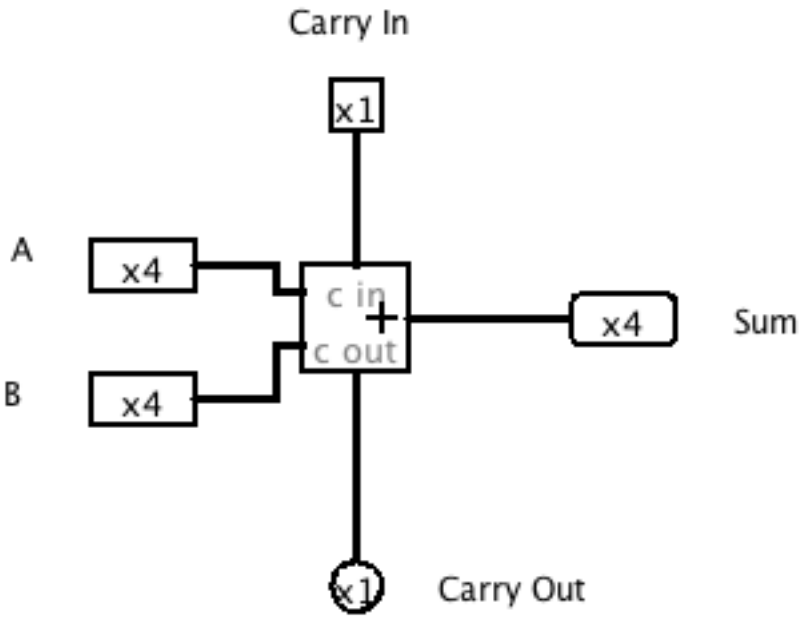
Sum = A xor B xor Cin **Carry Out= BCin + ACin + AB**


A
B
x1
x1
Carry In
x1
Carry Out
x1
Sum
x1

4-bit Adder


A
x4
B
x4
Carry Out
Carry Out
Carry Out
Carry Out
Carry In
x1
Sum
Sum
Sum
Sum
x4
Sum

Logisim 4-bit Adder



Questions:

1. **0-15**

2.

Binary A input	Binary B input	Binary sum	Decimal A input	Decimal B input	Decimal Sum	Carry (0 or 1)
0000	0111	0111	0	7	7	0
1100	0101	0001	12	5	17	1
0101	0101	1010	5	5	10	0
1111	1111	1110	15	15	30	1
0010	0110	1000	2	6	8	0

3. **When the sum goes over 15 in decimal.**

4. **The carry out pin signifies that the sum has gone over 15, or in a more general sense the carry out pin signifies that the sum has gone out of its memory range. So, the carry out pin could signify an error code.**

5. **Sum = (X+Y) mod 16**

Controlled Bitwise Not- 8 bit