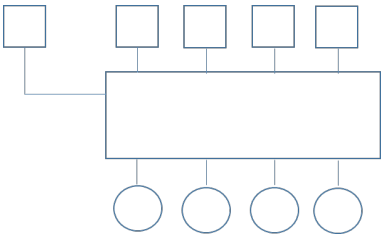
CS240 Spring 2021 Project Due: May 9, 2021 at Midnight

4 bit 2's Complement Multiplier

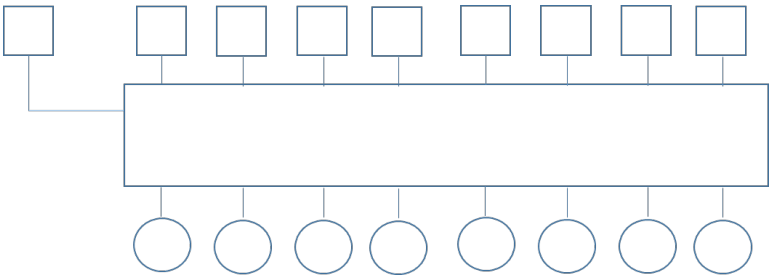
INPUT A: 4 bit 2's Complement number
INPUT B: 4 bit 2's Complement number
OUTPUT: the product of A x B represented as a 8 bit 2's Complement number

You are only allowed to use the basic gates: NOT, AND, OR, XOR. You may however, use these basic gates to build your own custom circuits (i.e. Adder). You are NOT ALLOWED to use Logisim's built in circuits. Each custom circuit is to be implemented as a sub-circuit as discussed in class.

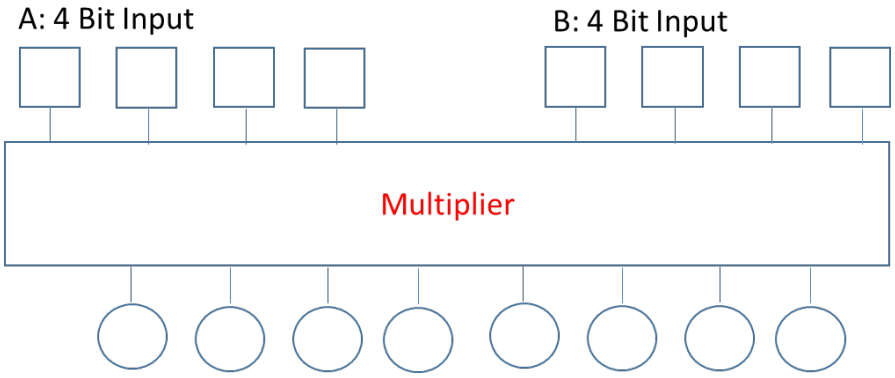
PART 1: Build a 4 bit controlled 2's Complement Inverter as a subcircuit named **4BitInverter**



PART 2: Build a 8 bit controlled 2's Complement Inverter as a subcircuit named **8BitInverter**



PART 3: Build a 4 Bit UNSIGNED Multiplier as a subcircuit named **UnsignedMultiplier**



PART 4: Using the 3 subcircuits you built in Parts 1-3, built a 4 bit 2's Complement multiplier that uses the inversion method discussed in class. Name this circuit: **SignedMultiplier**

HINTS: INVERSION METHOD:

1) If input A is negative, invert it. If input A is positive, leave it alone.
2) If input B is negative, invert it. If input B is positive, leave it alone.
3) Multiply A and B.
4) If both A and B originally had the same sign (both positive or both negative), do nothing.
5) If A and B originally had different signs (one was positive, the other negative), invert the product.

- All work is to be done individually.

- There should only be 1 file. Please zip the file and name it in the following convention: CS240_PROJECT_LASTNAME_FIRSTNAME.ZIP. As an example, John Smith would have a file named CS240_PROJECT_SMITH_JOHN. Failure to follow this simple instruction will result in a penalty of 5 points.

- Upload project submission to Blackboard.

- Once uploaded, please download and test your submission on another computer. If I cannot open your file, then I cannot grade it, resulting in a ZERO