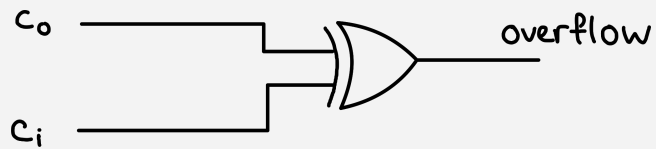


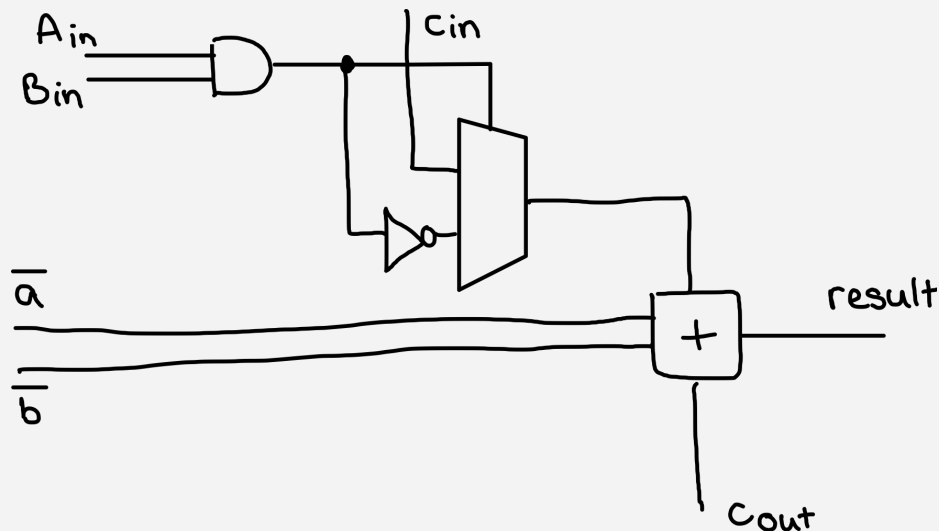
Homework 5

1. Overflow detector circuit using only the C_{in} and C_{out} :



Proof:

- When adding two numbers with the same sign, overflow occurs if the sum's sign bit changes. This condition aligns with the case when the Carry In (C_{in}) and Carry Out (C_{out}) bits differ in the most significant bit, so $C_{in} \text{ XOR } C_{out} = 1$ indicates overflow.
 - Adding numbers with opposite signs can't cause overflow, so the Carry In and Carry Out bits will match, making $C_{in} \text{ XOR } C_{out} = 0$, which correctly indicates no overflow.
2. We can set the C_{in} to 0, Operation to 2, Ainvert and Binvert to 0. Since there are XOR gates in the full adder, we just need to not add the C_{in} to get a XOR b.
 3. Using the suggested control signal 1110, meaning Ainvert = Binvert = 1 and Operation = 2 => we're using the full adder and a and b are inverted but this doesn't matter since we're figuring out if a and b are different



Using this circuit will ensure that C_{in} will be 0 when both Ainvert and Binvert are 1, using the XOR gate in the full adder just like in question 2