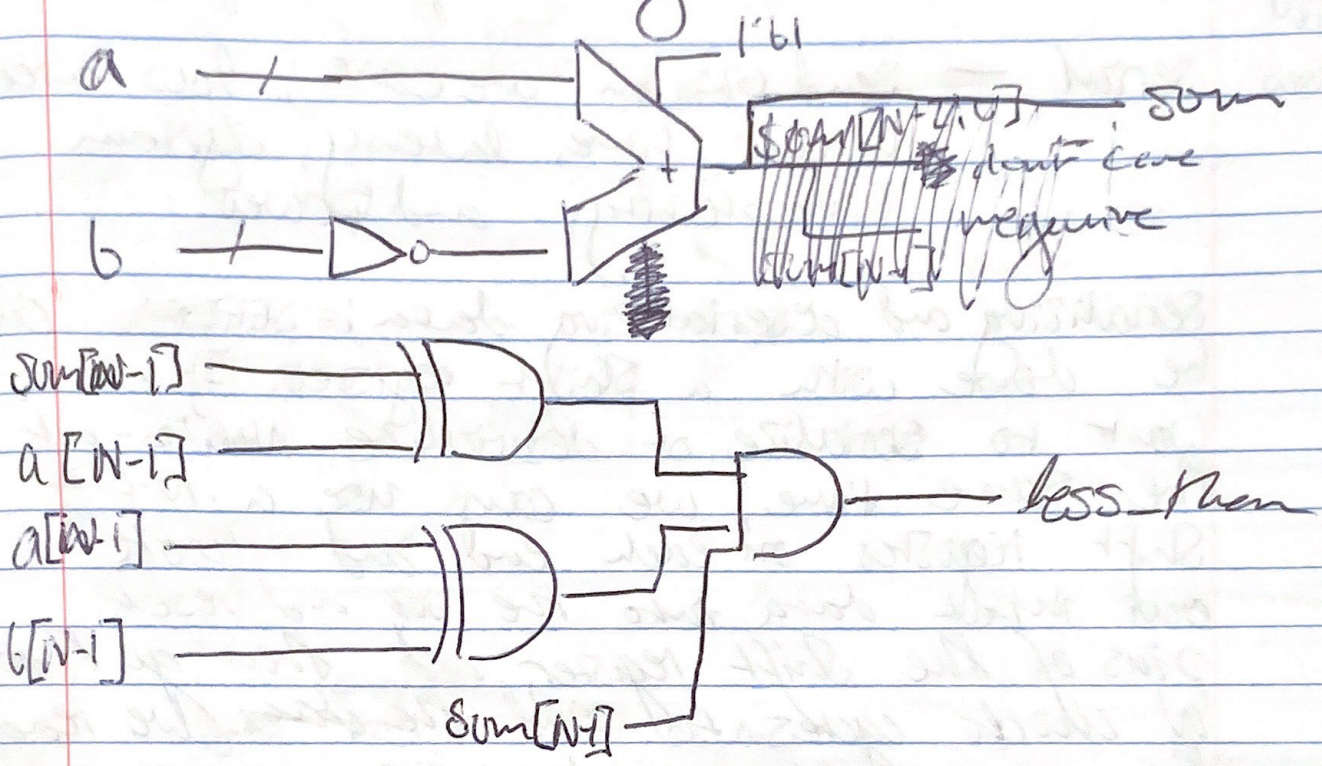
2. We will implement a+~b+1 using an adder, NOT, and putting 1'b1 into the adders carry.

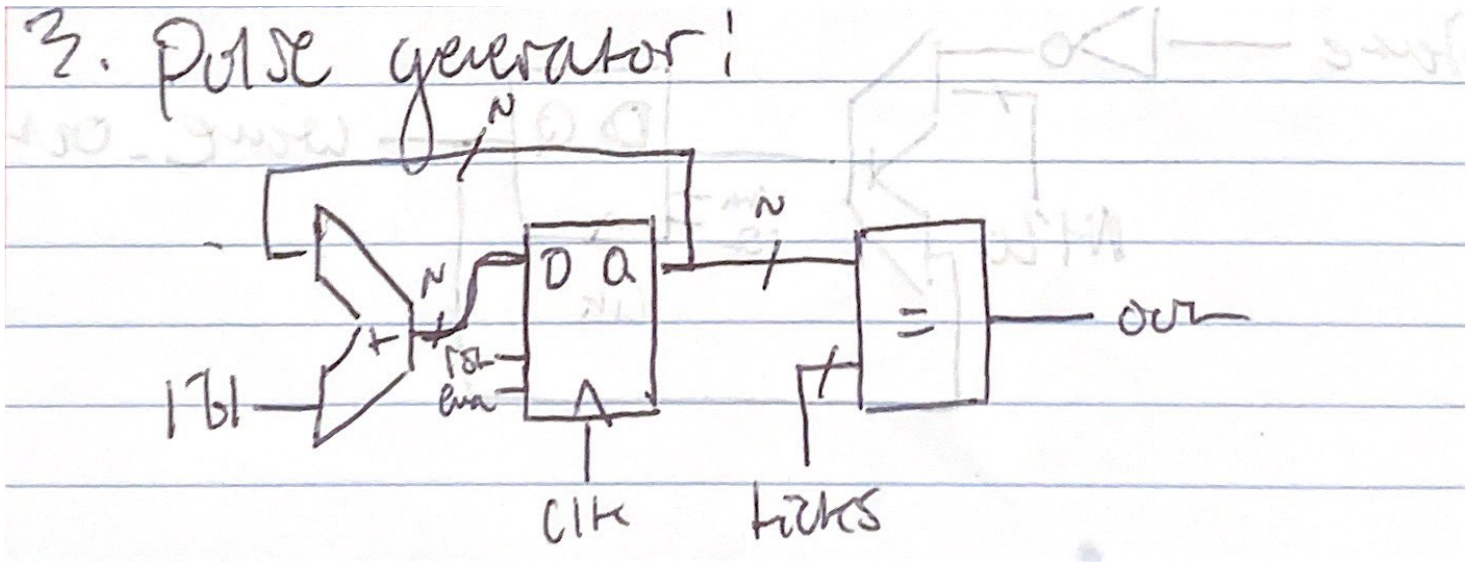


The second block checks if overflow is possible and if it may have happened.

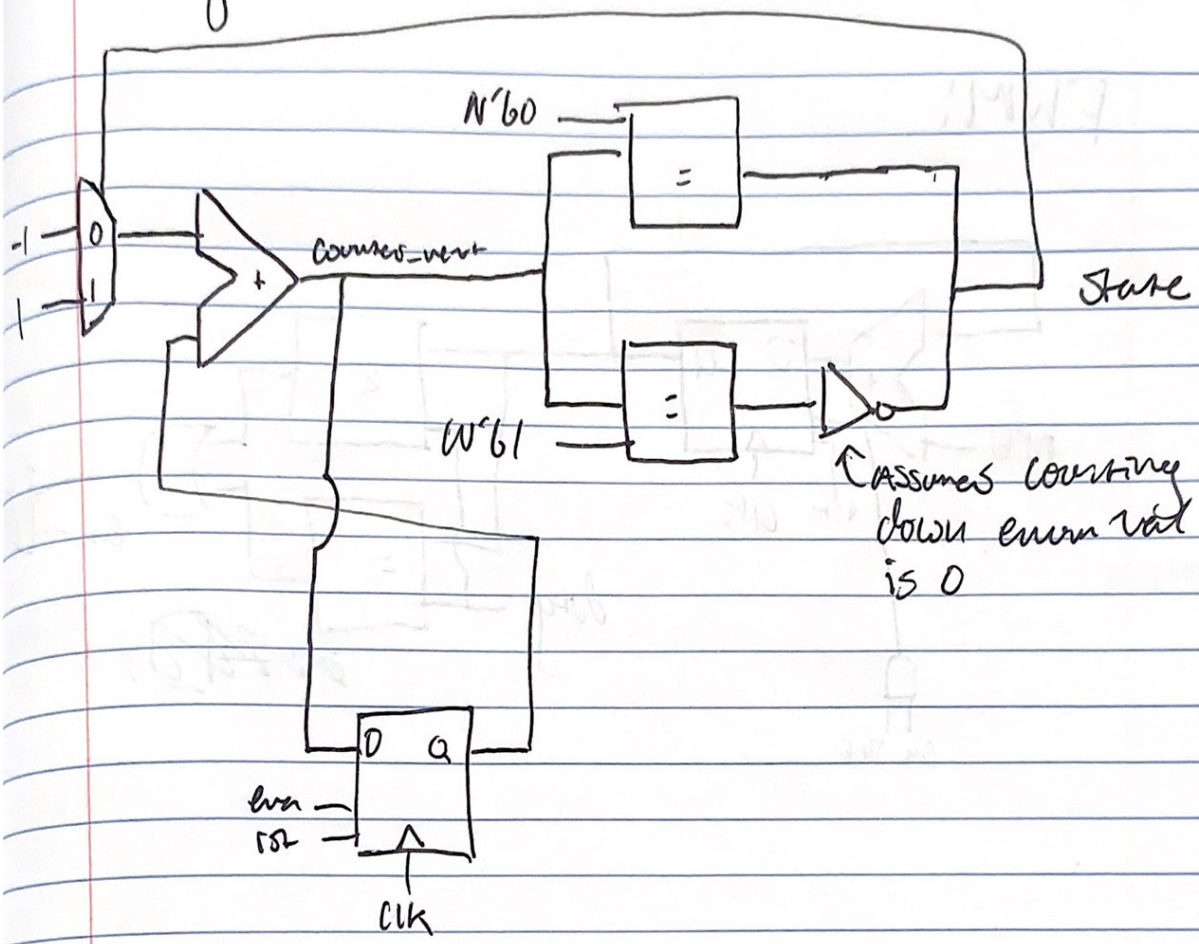
- If a and b have the same sign, $|a - b| \leq |\max(a, b)| <$ maximum signed int magnitude, so the difference cannot overflow. Thus, we need to know be the case where they can overflow! They have different signs.
- ~~If~~ Since we're subtracting from a and the difference should (be with no overflow) negative if a is negative since $-b$ must be negative too, or positive if a is positive since $-b$ must be positive. Thus if the signs differ between a and the difference, we have overflowed. This gives the XOR.

If we've overflowed the sign will flip, so the sum must be positive to indicate a negative actual sum. If we haven't overflowed the sum must be negative. This gives the last XOR.

3. Pulse generator:



Triangle wave:



PWM!