1.) For the following diagram, use the laws of Boolean Algebra to minimize this circuit. You do not have to name the laws used, but each step must be obvious to someone who knows the laws. Your solution should be in the form of a Boolean Equation.
2. Compute the minimal **Sum of Products** form for the following circuit.

\[ F = \]

\[ G = \]
3. A new technology has just been invented, in which AND and OR gates are more efficient than NAND and NOR gates. We thus have to go back and redesign our circuits. For the following circuit, convert it to use only AND, OR, and Inverter gates. *You should use as few gates as possible.*
4.) Draw the state diagram for the following circuit:

The “length” of a signal is the number of consecutive cycles it is at a specific value. So, the “length” of the true values in 00011110 is 4, and the “length” of the false values in 111101 is 1. A “surge” happens when there is a signal, either true or false, of length 1. Design a circuit with a single input, and an output SURGE, which is true as soon as a surge has been detected, and stays true forever after that. Note that the signal can start with a surge, such as “01”. However, “0011” has no surges in it.
5.) For the following state diagram, implement the circuit. You can use premade DFFs, and any basic gates. Your circuit should be as simple as possible.

The state encoding is the same as the state name.