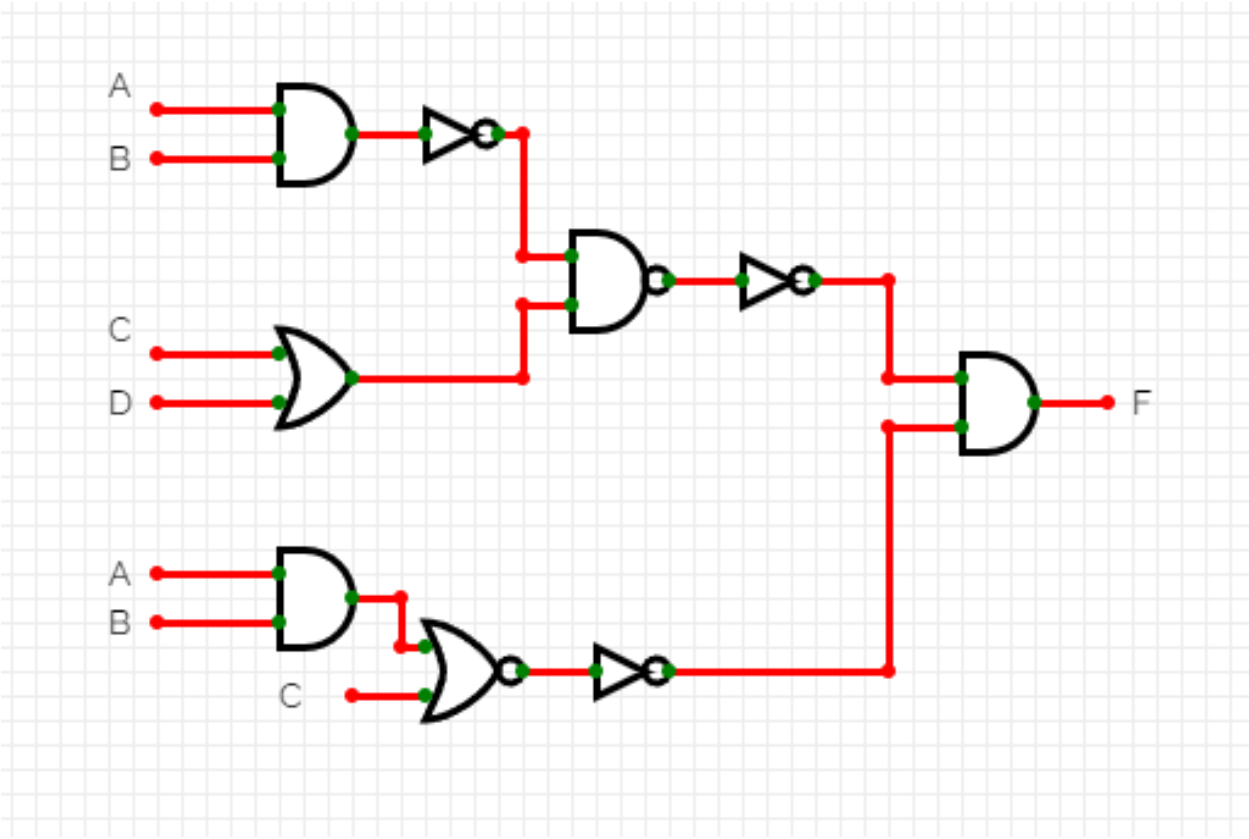
1. Design a combinational circuit diagram that takes in 3 inputs and produces 1 output. The output should be true whenever exactly 2 of the 3 inputs are true.

A. Define the 3 inputs and the 1 output for your circuit.
B. Create a truth table for the circuit
C. Draw the circuit design.

2. Provide the value of the logic function F. Provide an unsimplified version, then a simplified version using K-Maps or Boolean Algebra rules.



3. Derive the MPOS and MSOP equations for this k-map.

AB \ CD	00	01	11	10
00	1	0	1	1
01	1	0	1	1
11	1	1	0	0
10	1	1	1	1

4. Derive the equations for a 2x1 multiplexer. Then create a 4x1 multiplexer out of 2x1 multiplexers. Finally, create a 8x1 multiplexer with 4x1 and 2x1 multiplexers.

5a. Explain the behavior of an encoder. What are its inputs and outputs?
5b. Explain the behavior of a decoder. What are its inputs and outputs?

6a. What is an SR latch?
6b. What is a flip-flop?
6c. What is the purpose of the clock signal?
6d. What is the difference between an asynchronous and synchronous component?

7. Create a 3-bit counter that counts in the sequence
4 -> 7 -> 1 -> 2 -> C -> 4 -> 7 -> … using only D-FFs. There should be an asynchronous reset that resets the counter to 4. (Remember: The state of a counter can be separate from its output).
You must:

- Create an NSTT with the state bits and flip-flop inputs
- Derive the equation for the flip-flop inputs using k-maps
- Create a circuit diagram with flip-flops and any necessary logic gates