CS-230 - Homework Week 2 - Chapter 2

1. Explain the functioning of a flip-flop.
   a. When a flip-flop receives an input, the flip-flop will turn on the output. Then the next time the input is 1, the flip-flop turns off the output. The input has to be 0 in between state changes.
2. Is there any relationship between flip-flop and memory circuits?
   a. You can make memory circuits with flip-flops.
3. Consider a flip-flop with its initial state (output) as 0. The following input is given to it: 011101001.
   a. How many times does the flip-flop change its output (i.e., state)?
      i. It changes output 3 times.
   b. What is the final output of the flip-flop?
      i. The final output is 4
4. What is a binary counter?
   a. A binary counter is a circuit that increments with each input, this is calculated when the input goes from 0 to 1.
5. Consider a binary counter that is able to count up to 64 and with its initial state (output) being 0. The following input is given to it: 010101001. What is the final output of the counter?
   a. Decimal: 4
   b. Binary: 100
6. In terms of digital circuits, what is a clock?
   a. A clock is a circuit that produces alternating 0s and 1s at a regular pace measured in Hz.
7. What is a demultiplexer?
   a. A demultiplexer or demux is a circuit that takes an input and then selects a single output based on the input. To select an output, it will choose one path and turn the other paths off (This could also be reversed by choosing one path to have off and leaving all of the others on).
8. How can we reproduce a NOT gate with a NAND gate? Why would someone want to do so?
   a. One way we can reproduce a NOT gate with a NAND gate is by taking the NAND gate and setting one input to a constant 1. This will result in the output being the opposite of the variable input.