Homework 2: Universal Gates & Flip Flops

CS 200 • 10 Points Total
Due Wednesday, February 8, 2017

Assignment

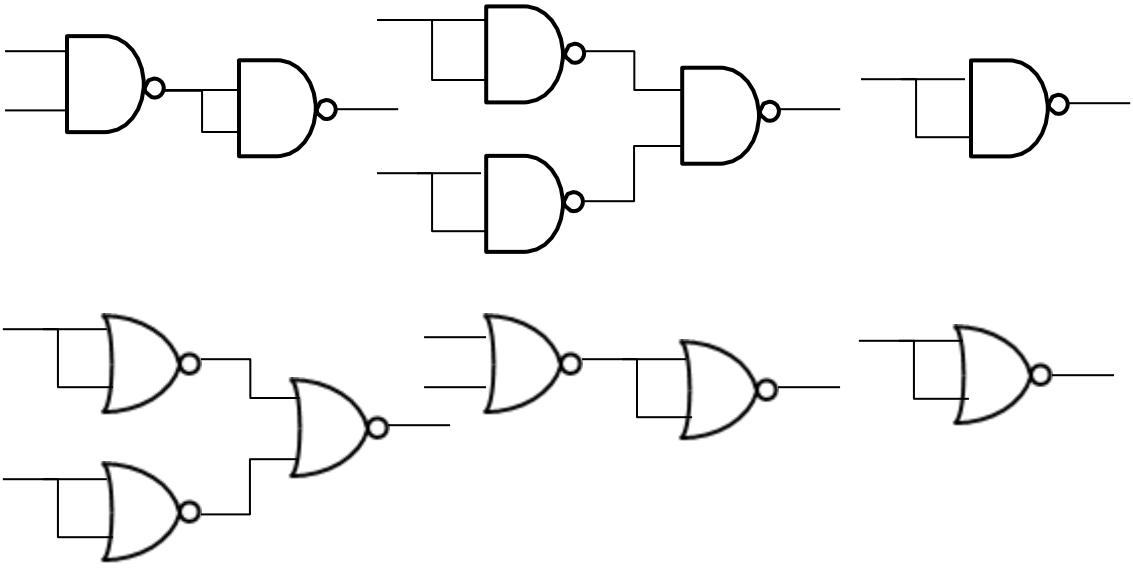
Answer each of the following questions based on Chapter 3 of the Null textbook.

1. Which gates are called "universal" gates? Why? (2 pts)

   NAND and NOR gates. Any circuit consisting of combinations of AND, OR, and/or NOT gates can be built with only NAND gate or only NOR gates.

2. Draw a NOT circuit using one of the universal gates from the previous question and then draw it again using the other universal gate. Repeat for the AND circuit, then the OR circuit. When done, you should have drawn six circuits. (3 pts)

AND OR NOT



3. What's the difference between combinational logic and sequential logic? (2 pts)

   Simply, when inputs are applied to a combinational logic circuit, the outputs are immediately available. A sequential circuit only presents the outputs when triggered and the outputs remain constant until the next trigger. In addition, sequential circuits depend on their prior state as an input in producing their new state; this is called ‘feedback’.

4. What ARE flip-flops? Don't give me the book definition. Tell me about what makes them different from all other sequential circuits. (2 pts)

   Flip-flops are sequential circuits that have two stable states. They usually only have one output (or one and its corresponding complement) and are also often edge-triggered, but it's the number of states that determines if a sequential circuit is a flip-flop or not. Also, it is incorrect to say that flip-flops are memory elements for sequential circuits. Not all sequential circuits contain flip-flops as a sub-element.

5. Make a table showing all the state transitions for a J-K flip-flop. (1 pt)

J	K	Present State Q(t)	Next State Q(t+1)
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

-OR-

J	K	Next State
0	0	No change
0	1	0 (reset)
1	0	1 (set)
1	1	Toggle