Name: _____

CIS 351 Practice Test 2

Updated February 15, 2022

1. Explain **specifically** what makes a carry-lookahead adder faster than a ripple-carry adder of the same size.

2. Draw a nine-bit carry-select adder with 3-adder blocks. How many adders and muxes are required to build your circuit? Give the propagation delay for all of the sum bits (not just the final ones).

3. Build a 4:1 mux using logic gates.

4. Show how to build an `AND` gate and an `OR` gate out of a mux.

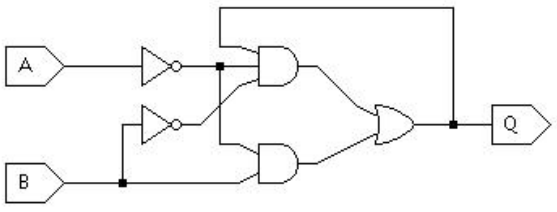
5. Use a Karnaugh map to simplify the following Boolean expression:

   ```
   A'B'C'D' + A'B'C'D + A'B'CD' + A'BC'D' + A'BC'D + AB'C'D' + AB'C'D + ABCD' + ABCD
   ```

   Remember: it should be easy to write out the truth table for an expression that is already in sum-of-products form.

6. Complete the characteristic table for the circuit shown below:

A_n	B_n	Q_n	Q_{n+1}
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	



What fundamental circuit has the same characteristic table?

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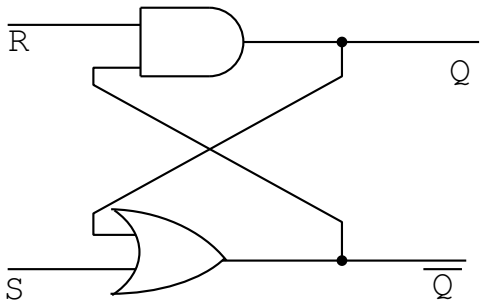
7. Complete the characteristic table for the circuit shown below: Note, there is no clock pulse here. Your answers should show the states Q and $\bar{Q}$ after they have reached a steady state given R, S, and current values of Q and $\bar{Q}$. If the given inputs will produce a non-deterministic output (i.e., the output depends on which gate changes first), write "random" in the row.

R	S	Q_{now}	$\bar{Q}_{now}$	Q_{next}	$\bar{Q}_{next}$
0	0	0	0		
0	0	0	1		
0	0	1	0		
0	0	1	1		
0	1	0	0		
0	1	0	1		
0	1	1	0		
0	1	1	1		
1	0	0	0		
1	0	0	1		
1	0	1	0		
1	0	1	1		
1	1	0	0		
1	1	0	1		
1	1	1	0		
1	1	1	1		



8. Choose a row labeled "random", and explain why the output is random.

9. Review the Sequential Circuits homework.

10. Review the "golfer" example from Week 5 activities – questions 20 - 22. (You should review the activities in general, but this one tests several skills you will need on the exam.)

11. Design a sequential circuit to run a countdown timer. This circuit should contain two registers: One for the minutes and one for the seconds. Decrement the seconds every time the clock ticks. Stop decrementing when the timer reaches 0. This circuit should have three outputs: `minutes`, `seconds`, and a one-bit `alarm` output that will be set to 1 when the timer reaches 0.

12. Review questions 1 - 3 from the Week 6 activities. You will not be asked about pipelined circuits on this exam (that will show up later), but you should understand circuit timing and be able to set the clock period for a non-pipelined sequential circuit.