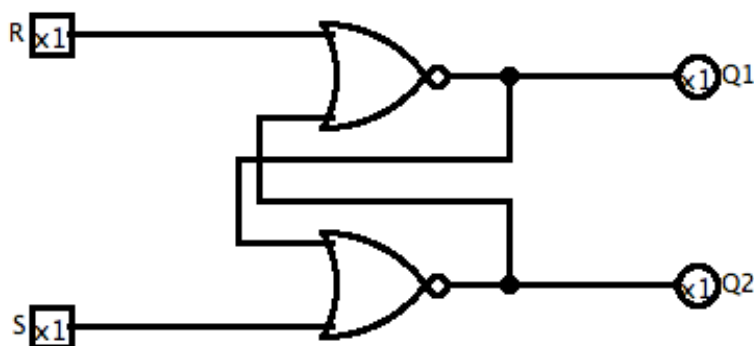


cs281: Computer Organization:
Digital Circuit Design
Lab 6

1 Mystery1

Implement the following circuit from Figure 1, wiring the R input to switch S_7 , the S input to switch S_8 , the $Q1$ output to LED display digit 1, and the $Q2$ output to LED display digit 2.

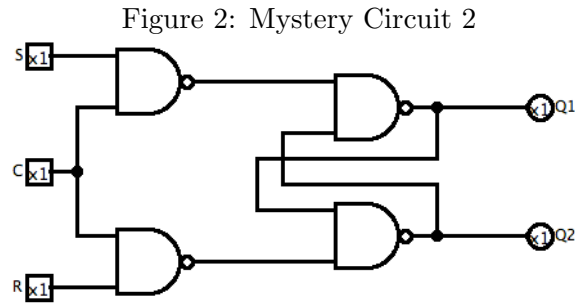
Figure 1: Mystery Circuit 1



1. Before you begin testing against the various input combination, note what is different about this circuit from those you have designed in the past.
2. Start with $S = 1$ and $R = 0$. What are the outputs $Q1$ and $Q2$?
3. Next set $S = 0$ and $R = 0$. What are the outputs $Q1$ and $Q2$?
4. Next set $S = 0$ and $R = 1$. What are the outputs $Q1$ and $Q2$?
5. Next set $S = 0$ and $R = 0$. What are the outputs $Q1$ and $Q2$? Is this consistent with your earlier experiment?
6. Experiment further with the input values of S and R . What can you say about the outputs $Q1$ and $Q2$ based on the inputs and the *history* of their values?
7. Is this a combinational circuit? Justify your answer. (Hint: Think about the definition of what it means to be combinational.)
8. Assume that we begin with a current value of 1 for $Q1$, and $S = R = 0$. Using the circuit picture start by labeling the 0/1 values on each line segment. Next, follow the sequence of events that occur when R transitions from 0 to 1. Working from left to right and top to bottom, label each line segment with the values on each of the wires, crossing out values that must change.
9. From this new picture, repeat for S also transitioning to 1.

2 Mystery2

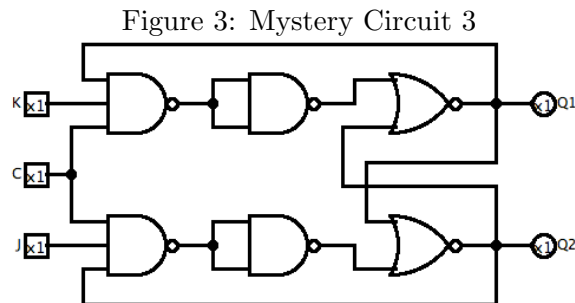
Implement the following circuit from Figure 2, wiring the R input to switch S_5 , the S input to switch S_6 , the C input to switch S_1 , the $Q1$ output to LED display digit 1, and the $Q2$ output to LED display digit 2.



1. Using a similar strategy to that employed in the last problem, map out a truth table for outputs $Q1$ and $Q2$ based on the inputs R , S , and C . Note that some of the entries in the table may have to take into account prior history. Do your best to characterize the behavior of these outputs.

3 Mystery3

Implement the following circuit from Figure 3, wiring the K input to switch S_5 , the J input to switch S_6 , the C input to switch S_1 , the $Q1$ output to LED display digit 1, and the $Q2$ output to LED display digit 2.



1. Using a similar strategy to that employed in the last problem, map out a truth table for outputs $Q1$ and $Q2$ based on the inputs J , K , and C . Note that some of the entries in the table may have to take into account prior history. Do your best to characterize the behavior of these outputs.