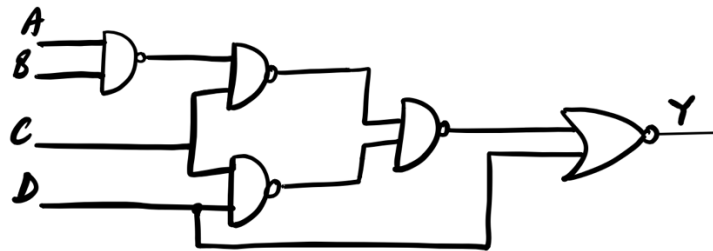Final Exam Dec 17, 2020
Deadline Dec 18, 2020 by 6 pm Pacific Time

Problem 1 (5 + 10 points)

a: find the simplified Boolean equation for the logic circuit shown, indicating the output at each stage.

b: Design an automobile alarm circuit to detect certain undesirable conditions. Three switches are used to indicate the states of the door by the driver's seat, the ignition and the head lights respectively. Design the logic circuit with these three switches as inputs so that the alarm will be activated whenever either of the following conditions exist:

   i)   The headlights are ON (logic 1) while the ignition is OFF (logic 0)
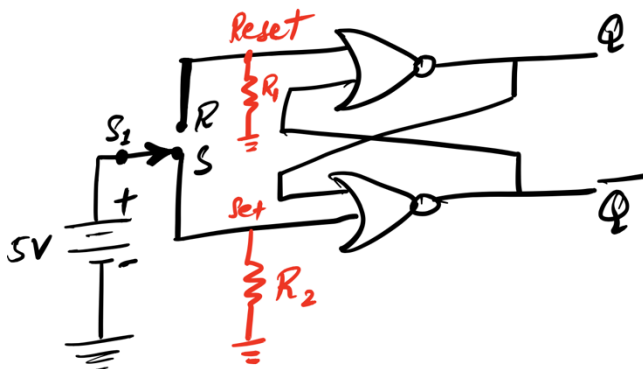   ii)   The door is open (logic 0) while the ignition is ON

Problem 2 (15 + 5 points)

a: Draw a Binary Weighted Digital to Analogue Converter (DAC) diagram and explain how it operates.
b: What is the advantage of D/A converter with R-2R resisters.

Problem 3 (5 + 10 points)

a: What does the following diagram do and explain the use of pull down resistors (R1 and R2).

b: Draw logic diagram of a M/S J-K flip-flop and explain its working with truth table.
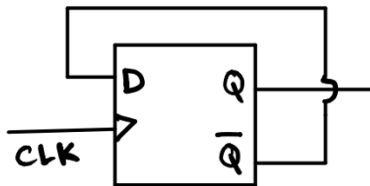
Problem 4: (20 points)

Explain 4-bit synchronous up counter with logic diagram, truth table and timing diagram.

Problem 5: (5+5 points)

a: What voltage levels should be used to measure the rise time and fall time for a signal going from 0.2 V to 3.9 V? Draw the schematic diagram.

b: Sketch the Q output of the D-flip-flop shown below in relation to clock. Assume that initially Q=0. What is the Q output frequency if the clock frequency is 10 KHz?

Problem 6: (20 points)

Draw a parallel-in-serial-out shift register using D-flip-flop and explain its operation when Shift/Load' has different values.