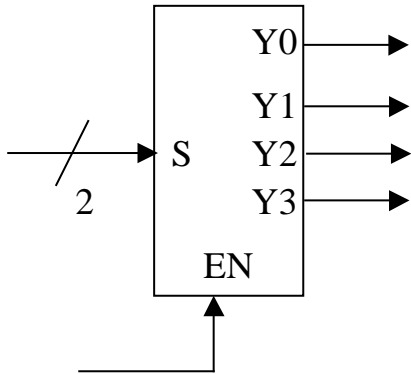


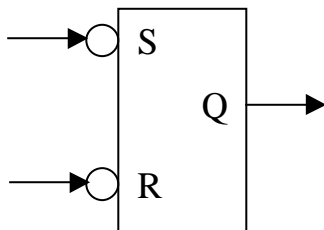
SSN: _____ (no names please)

Work all problems.

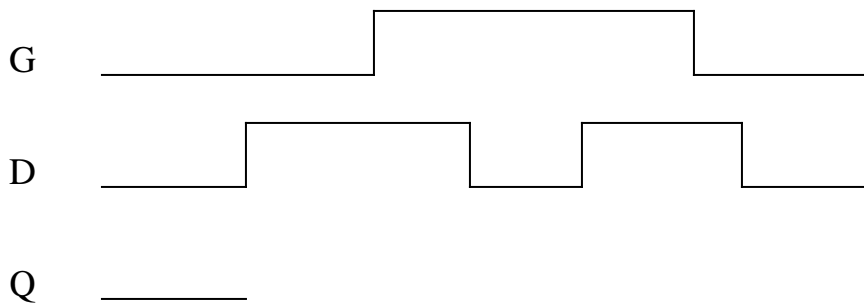
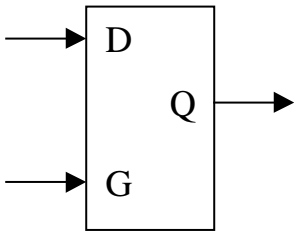
1. (5 pts) Identify the following device. What values do the inputs have to be for the outputs to have the following values $Y0=0$, $Y1=0$, $Y2=1$, $Y3=0$.



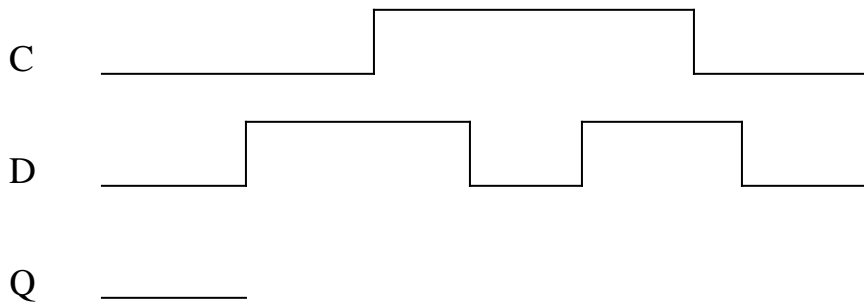
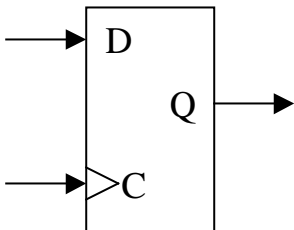
2. (8 pts) Assume that the initial state device shown below is a '0'. Draw a timing diagram that will cause the state of the device to be changed to '1'.



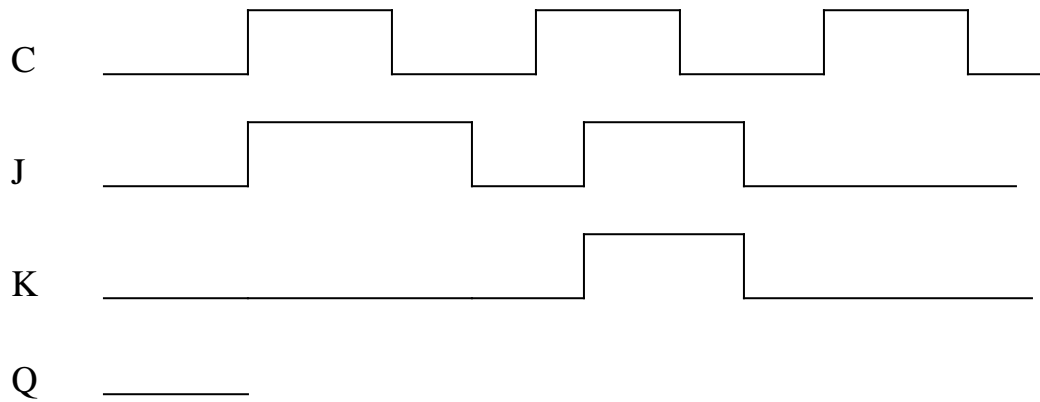
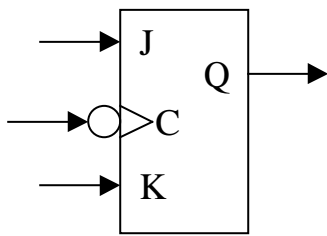
3. (8 pts) Complete the timing diagram below for the Q output of the device that is shown.



4. (8 pts) Complete the timing diagram below for the Q output of the device that is shown.



5. (8 pts) Complete the timing diagram below for the Q output of the device that is shown.



6. For a flip-flop of your choosing (D, J-K, T), draw a timing diagram and illustrate setup and hold time constraints.

7. (5 pts) What is the clock period of a 50 Mhz clock ($1 \text{ Mhz} = 10^6$)

8. (5 pts) What is the value of \$A3 shifted to the right by one position with the serial input bit = '1'?
9. (5 pts) How is an asynchronous input different from a synchronous input?
10. Draw the schematic for a 1-bit register. The inputs are CLK, D, LD. The output is Q. The LD input is high true.
11. Draw the diagram of a rising edge triggered D-FF using D Latches.

12. (10 pts) Draw a schematic for a 3-bit counter that has a parallel load. Use a three bit incrementer combinational logic block as one of your building blocks (the incrementer has a 3-bit input $A[2..0]$, a one bit input EN , a three bit output $Y[2..0]$. When $EN=1$, then $Y = A+1$; when $EN=0$, then $Y=A$). The inputs to the counter is CLK , $DIN[2..0]$, LD , EN . The output is $DOUT[2..0]$. The LD , EN inputs are high true. (You do not have to show the internals of the incrementer block).

13. (10 pts) Draw the schematic of a 4-1 mux using Tri-state buffers. You can use an decoder block in your design, and you do not have to show the internal details of the decoder.