CPE201 HW 9 (100 points)

Answer all questions completely. Put a box around the final solution. Put your name on it. Show your work.

By hand:

1. Assuming waveforms in Figure 1 go into an 8-bit bi-directional shift register. If the initial value in the register is the decimal number 108 (stored in binary), give the 8-bits of data in the shift register after each clock pulse.

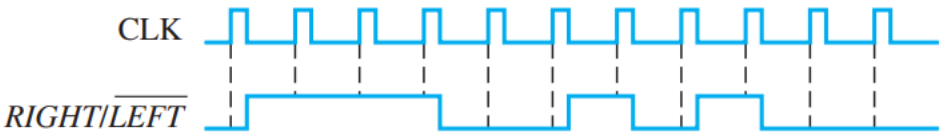

Figure 1

Start the counting of clock pulses at 1:

CLK	0	1	2	3	4	5	6	7	8	9	10	11
Dir	NA	L	R	R	R	L	L	R	L	R	L	L
Register Value	108	216	108	54	27	54	108	54	108	54	108	216
Binary	0110 1100	1101 1000	0110 1100	0011 0110	0001 1011	0011 0110	0110 1100	0011 0110	0110 1100	0110 1100	0110 1100	1101 1000

2. Using a 16-bit ring counter, give the initial pattern that will give the output sequence shown in Figure 2 at output Q_6.

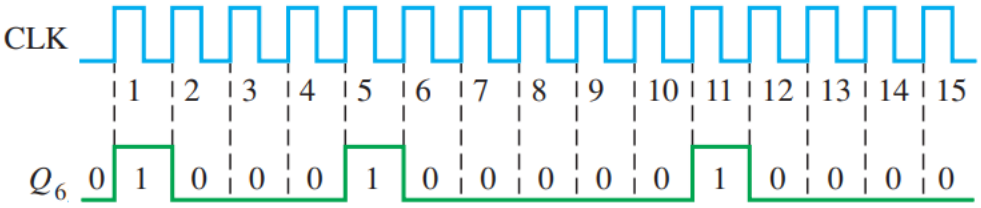

Figure 2

0000 0100 0001 0001
Q6 is highlighted

On the first shift, the contents of the register will shift to the right to contain, 0100 0100 0001 0000 and the first Q6 output is 0. One the second shift to the right, the register contains 0010 0010 0000 1000 and the second Q6 is 1. Continue the shifts to get the exact output pattern for Q6 shown in the figure.

3. Using an 8-bit right shift register that is preloaded with the binary value 10011110, give the value in the register after each clock pulse given the input in Figure 3.

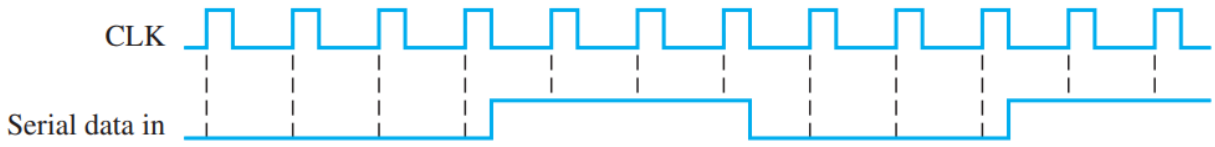

Figure 3

CLK	0	1	2	3	4	5	6	7	8	9	10	11	12
Register Value	158	79	39	19	9	132	194	225	112	56	28	142	199
Binary	1001 1110	0100 1111	0010 0111	0001 0011	0000 1001	1000 0100	1100 0010	1110 0001	0111 0000	0011 1000	0001 1100	1000 1110	1100 0111

4. Give the input and output signal waveforms for a 74HC194 to do the following actions sequentially:
    a. Clear the register
    b. Serially load in the value 0101 from the left
    c. Do nothing for 2 clock pulses
    d. Shift the value out to the right completely and replace it with 1010
    e. Do a parallel load of the value 0111

    Remember that there are 10 input lines and 4 output lines on this chip.

Clock	0	1	2	3	4	5	6	7	8	9	10	11
S0	X	0	0	0	0	0	0	1	1	1	1	1
S1	X	1	1	1	1	0	0	0	0	0	0	1
CLR’	0	1	1	1	1	1	1	1	1	1	1	1
SR SER	X	X	X	X	X	X	X	1	0	1	0	X
SL SER	X	1	0	1	0	X	X	X	X	X	X	X
D0	X	X	X	X	X	X	X	X	X	X	X	0
D1	X	X	X	X	X	X	X	X	X	X	X	1
D2	X	X	X	X	X	X	X	X	X	X	X	1
D3	X	X	X	X	X	X	X	X	X	X	X	1
Q0	0	1	0	1	0	0	0	1	0	1	1	0
Q1	0	0	1	0	1	1	1	0	1	1	0	1
Q2	0	0	0	1	0	0	0	1	1	0	1	1
Q3	0	0	0	0	1	1	1	1	0	1	0	1

X = Don’t Care

Having a zero or one for any don’t care is also correct. Here only the data inputs that are in use have a value.