The first 5 Questions are very short answer questions:

1. (2pts) What is the Hamming distance between these two bit patterns: 0011 and 1000?

2. (4pts) How far apart must valid code words be to allow Double Error Detection (DED)?
Single Error Correction (SEC)?
Triple Error Correction Quadruple Error Detection (TECQED)?

3. (4pts) What is the difference between the Mealy and Moore models of sequential design?

4. (4pts) What is the difference between a Flip-flop and a Latch?

5. (3pts) Write the equation for the carry into the 7th adder cell in an ALU using carry-lookahead, in terms of P's and G's.

6. (2pts) Write next to each of the following equations if they are SOP or POS.

$\bar{A}B\bar{C}+AB\bar{C}$

$(\bar{A}+B+\bar{C})(A+B+\bar{C})$

7. (3pts) Show how to make an OR, an AND, and a NOT gate using using only NOR gates.

8. (4 pts) Design a single-bit full adder using 2 4-input Muxes. (A 4-input Mux has 4 data inputs and 2 control lines).

9. (4 pts) Assume you have 8-bit data words, and your memory system supports Single Error Correction. For each of the following patterns recieved from memory identify and correct any errors that may have occurred during transmission or storage. Assume the same organization of carry and data bits as we used in class. The first one is done for you.

Given: **1 0 1 0 0 1 0 0 0 1 1 0** The Data Word is: **10101001**

Given: **0 0 1 1 1 0 1 0 0 1 1 0** The Data Word is:

10. (20pts) Given the following state transition table, draw the Karnaugh maps for Y1', Y2', and Y3', and Z in terms of X, Y1, Y2 and Y3, and then write minimum boolean equations for each.

Present State			Next State						Output (Z)	
			X=0			X=1			X=0	X=1
Y1	Y2	Y3	Y1'	Y2'	Y3'	Y1'	Y2'	Y3'		
0	0	0	0	1	1	0	1	0	0	1
0	0	1	1	0	1	1	1	1	0	0
0	1	0	0	1	0	0	1	0	0	1
0	1	1	1	0	0	1	1	0	0	0
1	0	0	0	0	1	0	0	0	1	1
1	1	0	0	0	1	0	0	0	1	1
1	1	1	1	0	1	1	1	0	0	0

11. (25pts) Given the following Karnaugh maps, implement the sequential machine using a Toggle FF for Y1, an RS FF for Y2, and a JK FF for Y3. You do not need to draw the gates, but you do need to write down the input equations for each of the inputs of each of the Flip Flops in the circuit.

Y1'

			X		
		1		**1**	
	1	**1**		**1**	*Y3*
Y2	**1**	**1**	**1**	**1**	
		1	**1**		
		Y1			

Y2'

			X		
	1	**1**			
		d	**1**		*Y3*
Y2		**1**	**1**		
	1			**1**	
		Y1			

Y3'

			X		
	1	**1**			
		1	**1**		*Y3*
Y2		**1**	**1**		
			1	**1**	
		Y1			

12. (25 pts) A vending machine takes dimes, quarters, and half-dollars. Pop is to be dispensed when a total of 50 cents has been deposited. Only one coin can be deposited at a time. No change is to be returned. Let X1=50 cents, X2=25 cents, and X3=10 cents. Z=1 indicates pop should be released, Z=0 signals No Pop. Draw the State Transistion Diagram (the circles and the arcs) for this finite state machine. Let S0=nothing deposited (the Start state). Once you have a state transition diagram, assign bit patterns to each state and write down the corresponding state transition table. Assume you are using a Mealy model. Also, label the trasitions on the diagram using the following format:

$$\frac{X1\ X2\ X3}{Z}$$

So, for example,

$$\frac{0\ 1\ 0}{0}$$

would be used to indicate that a quarter was deposited, and the output at that point should be a 0.