Name: ____________________________________

Read each question carefully before answering. Answer all parts. Show all work, calculations, and/or reasoning, otherwise no points will be awarded. Properly labeled loops must be shown on K-maps. Point values are as indicated.

---

1. (25 points) Design a Mealy Machine that generates an even parity bit (Z) for the 3 preceding bits of input (X). An example sequence of inputs and outputs are given below. Define all of the states and derive a reduced state table. (There are exactly enough rows on the state table template that is given below.)

$X =$	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1
$Z =$	0	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	1	0	1	1

Current State	Next State		Output	
	$X = 0$	$X = 1$	$X = 0$	$X = 1$

2. Your buddy (who may or may not be any good at digital systems) gives you the following state table...

Current State	Next State		Output	
	$X = 0$	$X = 1$	$X = 0$	$X = 1$
A	F	B	0	0
B	E	A	0	1
C	H	G	0	1
D	H	D	1	0
E	B	F	1	1
F	G	B	0	0
G	A	C	0	0
H	C	A	1	1

(a) (5 points) Is this a Mealy machine or a Moore machine? Explain how you know.

(b) (10 points) Use an implication table to reduce the number of states. Indicate which (if any) states are equivalent.

3. (20 points) Determine if the two sequential circuits (given below as state tables) are equivalent. Justify your answer.

C.S.	N.S.		YZ
	$X=0$	$X=1$	
A	B	D	00
B	D	B	01
C	C	B	11
D	A	C	10

C.S.	N.S.		YZ
	$X=0$	$X=1$	
S_0	S_2	S_4	00
S_1	S_1	S_2	11
S_2	S_4	S_5	01
S_3	S_5	S_4	00
S_4	S_3	S_1	10
S_5	S_4	S_2	01

4. (25 points) You wish to design a Moore machine non-overlapping sliding window detector that has an output $Z = 1$ when the input sequence contains **10101**. Clearly define all states that are required to implement this circuit, then draw the state diagram for this circuit.

5. The following is a fully reduced state table.

Current State	Next State		Output
	$X = 0$	$X = 1$	
A	A	B	0
B	C	B	0
C	D	E	0
D	A	B	1
E	F	B	0
F	D	E	1

(a) (5 points) How many flip-flops will you need to implement this circuit?

(b) (5 points) Implement the guidelines for state assignment.

Guideline 1: **Guideline 2:** **Guideline 3:**

(c) (5 points) Use a K-map to determine state assignments for each state. Indicate the binary values for each state.

	AB			
C	00	01	11	10
0				
1				

(d) (10 points) Fill out the corresponding transition table.

Current State	Next State		Output (Z)
	$X = 0$	$X = 1$	
000			
001			
011			
010			
100			
101			
111			
110			