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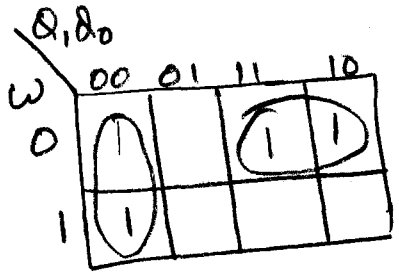
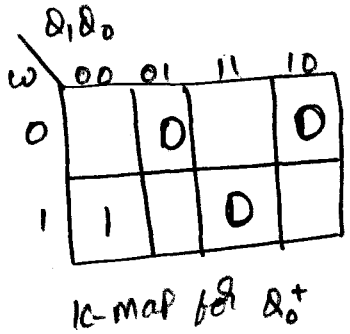
4. (10 points)
An FSM is defined by the following state transition table.

Present State $Q_1 Q_0$	Next state W=0 $Q_1^+ Q_0^+$	Next state W=1 $Q_1^+ Q_0^+$	Output Z
00	10	11	0
01	00	00	0
10	10	00	0
11	10	00	1

(a) Derive the next state and output equations.



K-map for Q_1^+



K-map for Q_0^+

$Q_1^+ = \overline{Q_1}Q_0 + Q_1\overline{w}$

$Q_0^+ = \overline{Q_1}\overline{Q_0}w$

→ Since this is a Moore machine, output depends only on current state

$Z = Q_1 Q_0$

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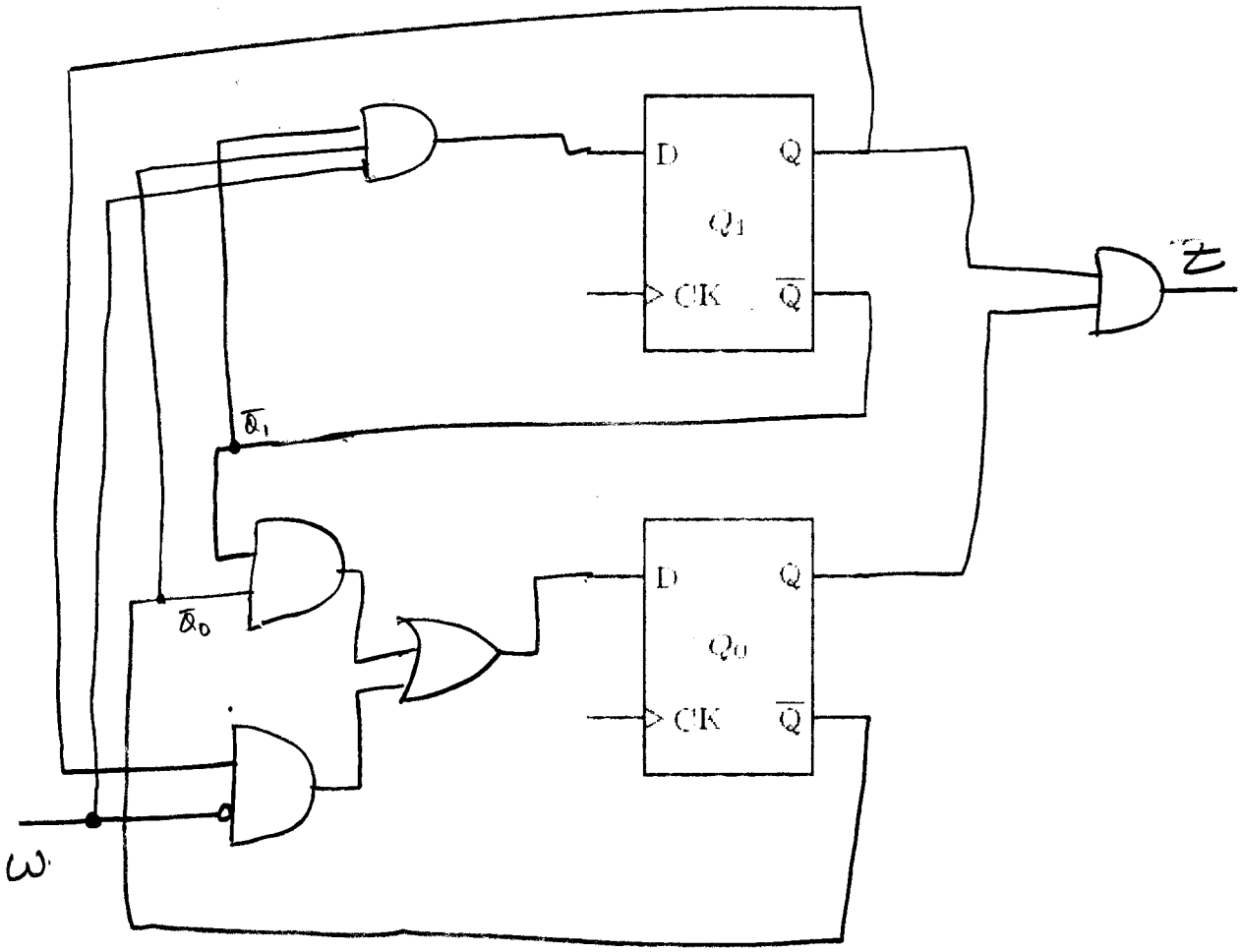
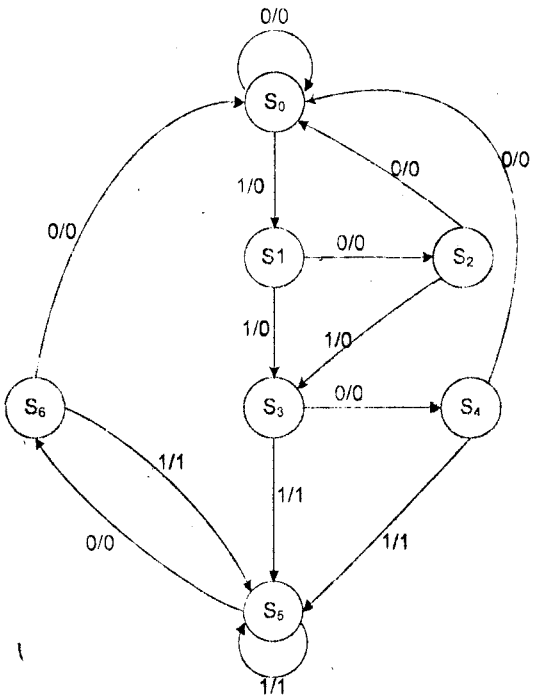
(b) Provide the logic schematic of this machine using only D flip-flops, AND gates, OR gates, and NOT gates.



First Name: Last Name: PID:

5. Consider the following state diagram:



(a) Fill out the blanks in the state table

Present State	Next State		Output Y	
	A = 0	A = 1	A = 0	A = 1
S_0	S_0	S_1	0	0
S_1	S_2	S_3	0	0
S_2	S_0	S_3	0	0
S_3	S_4	S_5	0	1
S_4	S_0	S_5	0	1
S_5	S_6	S_5	0	1
S_6	S_0	S_5	0	1

First Name: Last Name: PID:

(b) Label the rows and columns with states, and then fill the implication table.

	S_0	S_1	S_2	S_3	S_4	S_5
S_1	S_0-S_2 ~~S_1-S_3~~					
S_2	S_0-S_0 ~~S_1-S_3~~	S_2-S_0 ~~S_3-S_3~~				
S_3	X	X	X			
S_4	X	X	X	S_4-S_0 ~~S_5-S_5~~		
S_5	X	X	X	S_4-S_6 S_5-S_5	~~S_0-S_6 S_5-S_5~~	
S_6	X	X	X	S_4-S_0 ~~S_5-S_5~~	S_0-S_0 S_5-S_5	~~S_0-S_6 S_5-S_5~~

(c) List all the original states, grouped into maximal classes of compatibility. Use only as many groups as necessary

g_0 = S_0 ✓

g_1 = S_1 ✓

g_2 = S_2 ✓

g_3 = $\{S_3, S_5\}$ ✓

g_4 = $\{S_4, S_6\}$

g_5 = _____

g_6 = _____

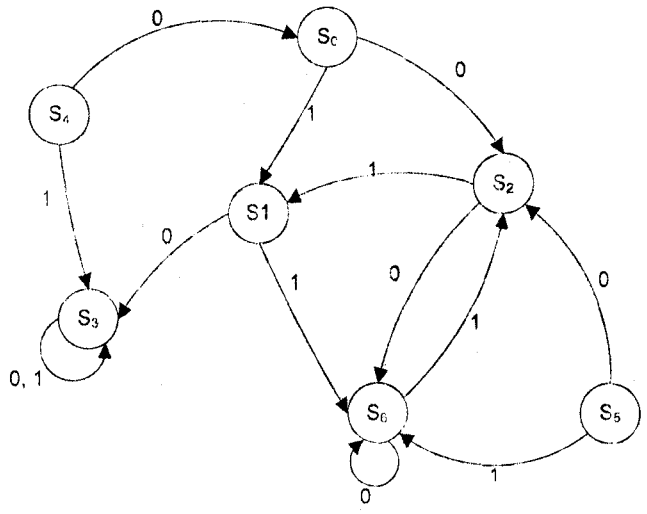
First Name: Last Name: PID:

(d) Show the minimized state transition and output table. Fill in only as many rows of the table as necessary.

Present State	Next State		Output Y	
	A = 0	A = 1	A = 0	A = 1
g_0	g_0	g_1	0	0
g_1	g_2	g_3	0	0
g_2	g_0	g_3	0	0
g_3	g_4	g_3	0	1
g_4	g_0	g_3	0	1
g_5				
g_6				

First Name: Last Name: PID:

6. Consider the finite state machine shown below.



Implement a state assignment using the minimum bit-change heuristic. Show your result in both K-map and the table.

	00	01	11	10
0	S_0	S_2		S_4
1	S_1	S_6	S_5	S_3

State Name	Assignment		
	Q_2	Q_1	Q_0
S_0	0	0	0
S_1	0	0	1
S_2	0	1	0
S_3	1	0	1
S_4	1	0	0
S_5	1	1	0
S_6	0	1	1