USN | | | | | | | | | | 08EC029

M.Tech. Degree Examination, May/June 2010
Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Find the function $f(x_1, x_2, x_3, x_4)$ realized by the threshold element shown in Fig.Q1(a). Show the map of the function. **(06 Marks)**

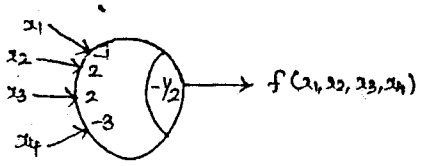

Fig.Q1(a)

b. Discuss the following : **(06 Marks)**
i) Elementary properties ii) Unate function

c. Determine whether the function $f(x_1, x_2, x_3, x_4) = \Sigma (0, 1, 3, 4, 5, 6, 7, 12, 13)$ is a threshold element, and if it is find the weight threshold vector. **(08 Marks)**

2 a. Explain the static hazard and hazard tree circuits, with example. **(08 Marks)**

b. Explain the quadded logic, with an example. **(06 Marks)**

c. Apply Boolean difference method to test wire 'h' in the circuit shown in the Fig.Q2(c). **(06 Marks)**

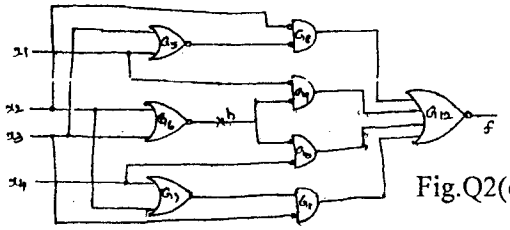

Fig.Q2(c)

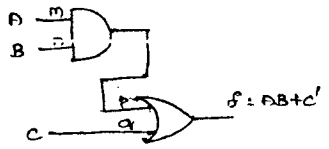

Fig.Q3(a)

3 a. Explain and construct the fault table for the circuit shown in Fig.Q3(a). **(06 Marks)**

b. Write a note on fault detection by path sensitizing. **(06 Marks)**

c. Briefly discuss the following : **(08 Marks)**
i) Possible strategies in failure tolerant design ii) Restoring organs.

4 a. List the capacities and limitations of finite state machines. **(06 Marks)**

b. Discuss the property of Mealy m/c and Moore m/c. **(04 Marks)**

c. Find the minimal form of machine M shown in Table.Q4(c) below. Also find its isomorphic machine and deduce its standard form. **(10 Marks)**

PS	NS, z	
	x = 0	x = 1
A	E, 0	C, 0
B	C, 0	A, 0
C	B, 0	G, 0
D	G, 0	A, 0
E	F, 1	B, 0
F	E, 0	D, 0
G	D, 0	G, 0

Table.Q4(c)

5 a. What is merger graph? Draw the merger graph for the incompletely specified machine M1 shown in Table.Q5(a). **(10 Marks)**

PS	NS, z			
	I_1	I_2	I_3	I_4
A	-	C, 1	E, 1	B, 1
B	E, 0	-	-	-
C	F, 0	F, 1	-	-
D	-	-	B, 1	-
E	-	F, 0	A, 0	D, 1
F	C, 0	-	B, 0	C, 1

Table.Q5(a)

PS	NS, z	
	x = 0	x = 1
A	A, 0	C, 0
B	B, 0	B, -
C	B, 0	A, 1

Table.Q5(b)

5 b. What are compatible states? For the tabular column Table.Q5(b) shown machine 'M', find the augmented machine and corresponding minimal machines. (10 Marks)

6 a. Given the machine M shown in Table.Q6(a) and the two assignments α and β, derive in each case the logical equations for the state variables and the output function and compare the results. Draw the circuit and block diagram corresponding to both the assignments.

PS	NS,		z	
	x = 0	x = 1	x = 0	x = 1
A	A	D	0	1
B	A	C	0	0
C	C	B	0	0
D	C	A	0	1

Table.Q6(a)

$$\alpha = \begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix} \qquad \beta = \begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{bmatrix}$$

(10 Marks)

b. Explain input independence and autonomous clock. For the machine 'M' shown in Table.Q6(b), find input consistent partition. If the assignments are as follows, find the logical equation for machine.

PS	NS,		z	
	x = 0	x = 1	x = 0	x = 1
A	D	C	0	1
B	C	D	0	0
C	E	F	0	1
D	F	F	0	0
E	B	A	0	1
F	A	B	0	0

Table.Q6(b)

Assignments
A → 000
B → 001
C → 010
D → 011
E → 100
F → 101

Draw the realization of machine 'M' using autonomous clock and draw the autonomous clock of machine M. (10 Marks)

7 a. What are covers and implication graph? For the machine 'M' shown in Table.Q7(a), the closed partition by state splitting. Write the corresponding logical equations and also the implication graph.

PS	NS		Z	
	x = 0	x = 1	x = 0	x = 1
A	A	B	0	1
B	C	B	0	0
C	A	C	0	0

Table.Q7(a)

(10 Marks)

b. What is a tree? Explain the types of tree. (05 Marks)

c. Draw the homing tree of the machine 'M' shown in the Table.Q7(c) and explain it. Write the response of machine 'M' to the homing sequence 010. (05 Marks)

PS	NS, z	
	x = 0	x = 1
A	B, 0	D, 0
B	A, 0	B, 0
C	D, 1	A, 0
D	D, 1	C, 0

Table.Q7(c)

8 a. What is an experiment? Explain the types of experiment. (05 Marks)

b. Prove the theorem:
If an n-state machine has a synchronizing sequence, or sequences, then it has one such sequence whose length is at most $\frac{n(n+1)(n-1)}{6}$. (10 Marks)

c. Write a short note on machine identification. (05 Marks)

* * * * *