CBCS SCHEME

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20ELD14

First Semester M.Tech. Degree Examination, July/August 2022
Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define threshold element, threshold function, positive and negative unate functions. **(10 Marks)**

b. Identify minimal true and maximal false vertices for the function :
$f(x_1, x_2, x_3, x_4) = \Sigma m(2, 3, 6, 7, 15)$
Find the weight threshold vector for the same. **(10 Marks)**

OR

2 a. Implement the following Boolean function using single threshold element.
$f(x_1, x_2, x_3) = \Sigma m(0, 2, 4, 6, 7)$. **(10 Marks)**

b. Implement full adder using two threshold elements. **(10 Marks)**

Module-2

3 a. Using path sensitization method, generate complete test set to detect line 2 s–a–0 fault considering two single paths and one double path for the circuit shown in Fig.Q3(a).

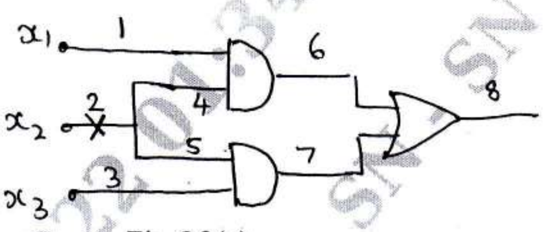

Fig.Q3(a) **(10 Marks)**

b. Using K-map method, find minimal set of test for multiple faults for two level AND-OR realization of the function $f(a, b, c, d) = ad' + bc' + a'b + ab'c$. **(10 Marks)**

OR

4 a. What do you mean by critical and subcritical errors? Summarize three errors for AND, OR, NAND, NOR, majority and modulo 2 gates. **(10 Marks)**

b. For the circuit shown in Fig.Q4(b) show that faults e s–a–0 and h s – a – 1 are undetectable. Generate complete test sets for faults e s–a–1 and h s–a–0.

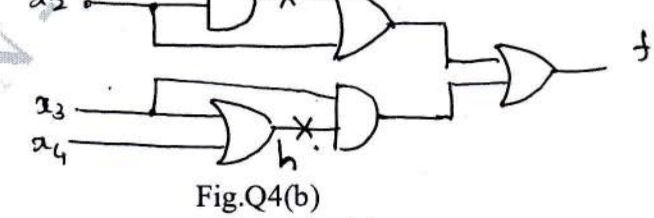

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. For the machine shown in Table Q5(a), find equivalence partition and show a standard form of corresponding reduced machine. Find minimum length sequence that distinguishes state S0 from S4.

PS	NS, Z	
	x = 0	x = 1
S_0	S_4, 0	S_3, 1
S_1	S_5, 0	S_3, 0
S_2	S_4, 0	S_1, 1
S_3	S_5, 0	S_1, 0
S_4	S_2, 0	S_5, 1
S_5	S_1, 0	S_2, 0

Table Q5(a)

(10 Marks)

b. For the Machine shown in Table Q5(b), draw merger table and reduce the machine.

PS	NS, Z			
	0 0	0 1	1 1	1 0
A	B,0	C,0	B,1	A,0
B	E,0	C,0	B,1	D,1
C	A,0	B,0	C,1	D,1
D	C,0	D,0	A,1	B,0
E	C,0	C,0	C,1	E,0

Table Q5(b)

(10 Marks)

OR

6 a. For the incompletely specified machine shown in Table Q6(a), find minimum state reduced machine containing original one.

PS	NS, Z			
	0 0	0 1	1 0	1 1
A	0,0	–,–	A,0	–,–
B	–,–	E,0	B,0	D,1
C	D,0	B,1	–,–	–,–
D	C,0	A,1	E,0	–,–
E	B,0	–,–	A,0	E,1

Table Q6(a)

(10 Marks)

b. By taking direct sum of M_1 and M_2 show that state A of M_1 is equivalent to state H of M_2. Prove that machine M_1 is contained in machine M_2.

M_1

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

M_2

PS	NS, Z	
	x = 0	x = 1
E	H, 1	E, 0
F	F, 1	E, 0
G	E, 0	G, 1
H	F, 0	E, 1

(10 Marks)

Module-4

7 a. Define : closed partition, input consistent partition, output consistent partition. **(10 Marks)**

b. Explain serial decomposition and parallel decomposition of finite state machines. **(10 Marks)**

OR

8 a. Find the input consistent and output consistent partitions for the machine shown in Table Q8(a). Decompose the machine into three series components such that output logic is minimized.

Given :

$\pi_1 = \{\overline{ABEF}, \overline{CDGH}\}$.

PS	NS		Z	
	x=0	x=1	x=0	x=1
A	D	C	0	0
B	C	D	0	1
C	E	F	0	0
D	F	F	0	1
E	G	H	0	0
F	H	G	0	1
G	B	A	0	0
H	A	B	0	1

Table Q8(a)

(10 Marks)

b. Closed partitions for a FSM are shown below, construct π - lattice for the same.

$\pi(I) = \{\overline{A, B, C, D, E, F, G}\}$

$\pi_1 = \{\overline{ACDE}, \overline{BFG}\}$

$\pi_2 = \{\overline{AG}, \overline{BE}, \overline{CDF}\}$

$\pi_3 = \{\overline{ABEG}, \overline{CDF}\}$

$\pi_4 = \{\overline{AEF}, \overline{BCDG}\}$

$\pi_5 = \{\overline{AE}, \overline{BG}, \overline{CD}, \overline{F}\}$

$\pi_6 = \{\overline{A}, \overline{B}, \overline{CD}, \overline{E}, \overline{F}, \overline{G}\}$

$\pi(0) = \{\overline{A}, \overline{B}, \overline{C}, \overline{D}, \overline{E}, \overline{F}, \overline{G}\}$

(10 Marks)

Module-5

9 a. Find the shortest preset distinguishing sequence for the FSM shown in Table Q9(a).

PS	NS, Z	
	x = 0	x = 1
A	C, 1	D
B	A, 1	C
C	D, 2	B
D	C, 2	A

Table Q9(a) **(10 Marks)**

b. Show the testing table and testing graph for machine shown in TableQ9(b). Add to the machine one output terminal so that the sequence 11 will be a distinguishing sequence.

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

Table Q9(b) **(10 Marks)**

OR

10 a. Describe Homing experiments and distinguishing experiments. **(10 Marks)**

b. The following experiment has been proposed as a fault detection experiment for machine shown in Table Q10(b). When started in state A and under the assumption that number of states will not increase as a result of malfunction. Prove that it is a proper fault detection experiment.

Input	0	0	1	0	0	1	0	1	0	1	1	0	0	0	1	0	0
Output	2	2	2	0	1	0	2	2	0	0	2	1	2	1	1	2	2

PS	NS, Z	
	x = 0	x = 1
A	A, 2	B, 2
B	C, 0	A, 1
C	D, 1	E, 0
D	E, 2	A, 0
E	B, 1	C, 2

Table Q10(b) **(10 Marks)**

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