CBCS SCHEME

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18ELD14

First Semester M.Tech. Degree Examination, Dec.2019/Jan.2020
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. Determine the function 'f' realized by the network shown in Fig. Q1 (a). Show the map. **(06 Marks)**

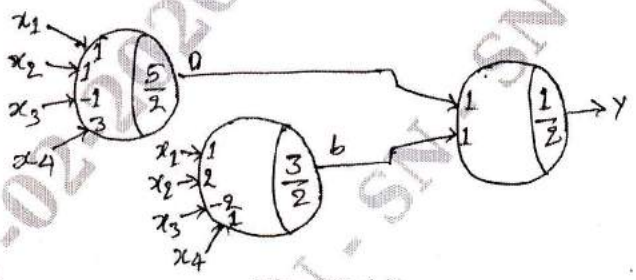

Fig. Q1 (a)

b. Find the minimal and maximum true vertices of $'f' = x_1\overline{x_2} + \overline{x_2}x_3 + x_1x_3$. **(04 Marks)**

c. Consider the switching function 'f'. $f(x_1,x_2,x_3,x_4) = \sum(3,5,7,10,12,14,15)$. Find a minimal threshold logic realization. **(10 Marks)**

OR

2 a. Explain the capabilities of Threshold logic. **(04 Marks)**

b. Determine which of the following functions are unate or not:

(i) $f_1(x_1,x_2,x_3,x_4) = \sum(1,2,3,8,9,10,11,12,14)$

(ii) $f_2(x_1,x_2,x_3,x_4) = \sum(0,8,9,10,11,12,13,14)$

(iii) $f_3(x_1,x_2,x_3,x_4) = \sum(2,3,6,10,11,12,14,15)$ **(06 Marks)**

c. Determine the following functions are threshold or not:

(i) $f_1(x_1,x_2,x_3) = \sum(0,2,4,5,6)$.

(ii) $f_2(x_1,x_2,x_3) = \sum(0,3,5,6)$

If the given functions are threshold then write down the threshold gate. **(10 Marks)**

Module-2

3 a. For the circuit of Fig. Q3 (a),

(i) Find all the tests to detect input A' s-a-0 by using the sensitized path approach. **(06 Marks)**

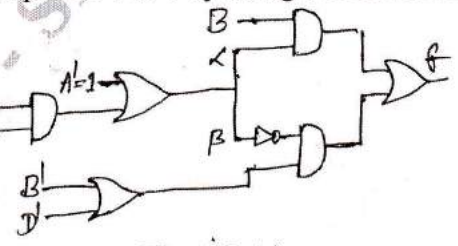

Fig. Q3 (a)

(ii) Show all the single faults that can be detected by the test (ABCD) =(1 1 1 1) **(04 Marks)**

b. For the circuit shown in Fig. Q3 (b), find all the tests to detect the faults x_3, s – a – 0 and x_3, s – a – 1.

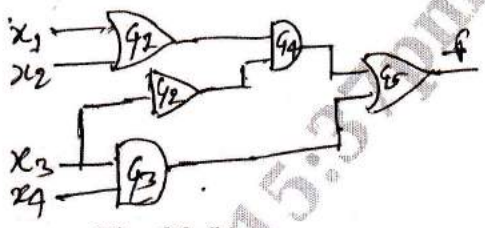

Fig. Q3 (b) **(10 Marks)**

OR

4 a. Use the map method to find a minimal set of tests for multiple faults for the 2-level AND-OR realization of the function,

$f(w,x,y,z) = w\bar{z} + x\bar{y} + \bar{w}x + w\bar{x}y$. **(10 Marks)**

b. Use the map method to find a minimal set of sets for multiple faults for the 2-level OR-AND realization of the function,

$f(w,x,y,z) = (w + \bar{x})(\bar{x} + \bar{z})(\bar{w} + y + \bar{z})$. **(10 Marks)**

Module-3

5 a. Explain the preset type of fault location experiment by considering the fault table as shown in Table Q5 (a). Write down corresponding (i) Reduced Table (ii) Fault dictionary. Also find out different sets of faults.

	f_1	f_2	f_3	f_4	f_5	f_6
T_1					1	1
T_2	1		1		1	
T_3				1	1	
T_4		1	1			
T_5	1					1
T_6	1		1			1

Table Q5 (a) **(10 Marks)**

b. Explain the adaptive four-level tree and adaptive three-level tree by considering T_2 & T_6 as initial test for the fault table shown in Table Q5 (b).

Tests	f_0	f_1	f_2	f_3	f_4	f_5	f_6	Output of fault free circuit
T_1						1	1	0
T_2		1		1		1		1
T_3					1	1		0
T_4			1	1				1
T_5		1					1	0
T_6		1		1			1	1

Table Q5 (b) **(10 Marks)**

OR

6 a. Draw the merger graph and its minimal form for the machine shown in Fig. Q6 (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 Q6 (a)

b. Find the tests to detect the faults at x_3, s – a – 0 and s – a – 1 for the circuit shown in Fig. Q6 (b).

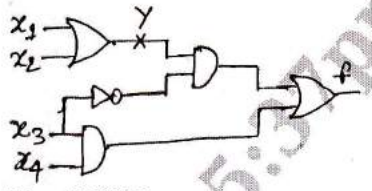

Fig. Q6 (b) **(10 Marks)**

Module-4

7 a. For the machine in Table Q7 (a), determine the π – Lattice and basic partitions. Also show the derivation of the basic partitions.

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

Table Q7 (a) **(10 Marks)**

b. For the machine given in Table Q7 (b). Find

(i) Closed partitions.

(ii) Give the functional relationship based on the $r_1 = \{\overline{A,B,C,D}; \overline{E,F,G,H}\}$, $r_2 = \lambda_0 = \{\overline{A,C,E,G}; \overline{B,D,F,H}\}$.

(iii) Write down the schematic diagram and π-Lattice for machine given in Table Q7 (b).

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

Table Q7 (b) **(10 Marks)**

OR

8 a. For the machine shown in Table Q8 (a), find (i) π-Lattice and schematic diagram, (ii) Non trivial closed partitions, (iii) Parallel decomposition. **(10 Marks)**

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

Table Q8 (a)

b. Explain the decomposition of the composite machine with the help of possible realizations. Also brief the π-lattice of the composite machine. **(10 Marks)**

Module-5

9 a. What is an experiment? Explain the types of experiments. **(05 Marks)**

b. Explain uncertainities by considering the machine shown in Table Q9 (b). **(05 Marks)**

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

Table Q9 (b)

c. Explain and write down the successor tree for the machine M_1 shown in Table Q9 (c).

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

Table Q9 (c) **(10 Marks)**

OR

10 a. Explain the Homing Experiment. Write down the Homing Tree for the machine M shown in Table Q10 (a). **(10 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 Q10 (a)

b. (i) What is the main feature of the second algorithm for the design of Fault Detection experiments?

(ii) Write down the general procedure of the second algorithm. **(10 Marks)**

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