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14ELD14

First Semester M.Tech. Degree Examination, Dec.2014/Jan.2015
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 network shown in Fig.Q.1(a). Show the map. (06 Marks)

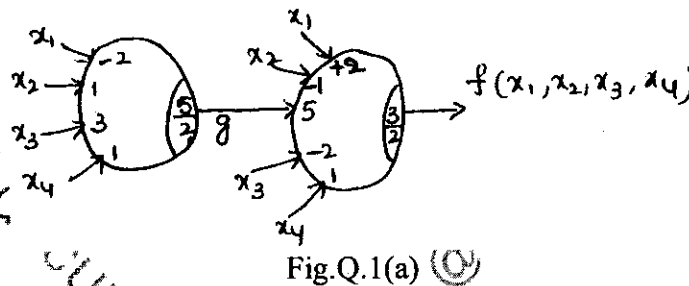


Fig.Q.1(a)

- b. Prove that every threshold function is Unate. (04 Marks)
 c. Given the switching function $f(x_1, x_2, x_3, x_4) = \Sigma(2, 3, 6, 7, 10, 12, 14, 15)$. Find a minimal threshold logic realization. (10 Marks)

- 2 a. In the network shown in Fig.Q.2(a) wires m, n, p and q may become either s – a – 0 or s – a – 1, while the remaining wires are considered “safe”.
 i) Construct a fault table.
 ii) Find a minimal cover of the table and use it to determine a minimal fault detection experiment. (12 Marks)

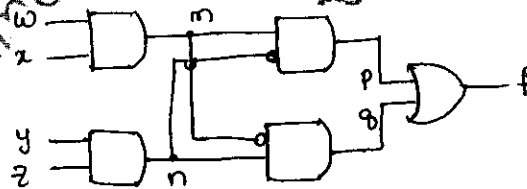


Fig.Q.2(a)

- b. Find a preset set of tests to locate all single faults and show the corresponding fault dictionary for the fault table shown below in Fig.Q.2(b) where Z is fault free O/P. (08 Marks)

Fault \ Tests	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	Z
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	1
T ₆	1		1			1	1

Fig.Q.2(b)

- 3 a. Use map method to find a minimal set of tests for multiple faults of the function.
 $f(w, x, y, z) = wz' + xy' + w'x + wx'y$. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. For the circuit shown in Fig.Q.3(b) find tests to detect the faults h s-a-o and k s-a-1 using Boolean difference method? (06 Marks)

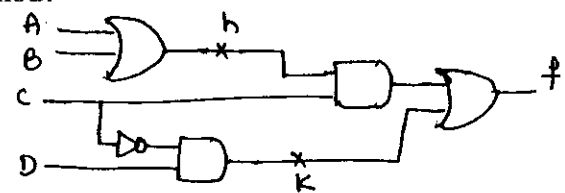


Fig.Q.3(b)

- c. Show the Quadded logic realization for the circuit shown in Fig.Q.3(c). (04 Marks)

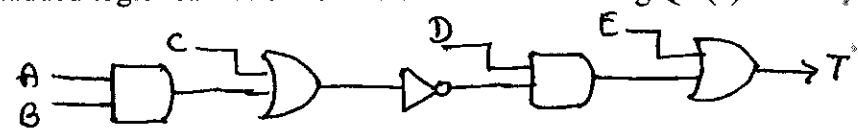


Fig.Q.3(c)

- 4 a. For the machine shown in Fig.Q4(a). Find the equivalence partition and a corresponding reduced machine in 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

Fig.Q.4(a)

PS	NS, Z			
	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

Fig.Q.4(b)

- b. Draw the merger graph and its minimal form for the machine in Fig.Q.4(b). (10 Marks)

- 5 a. For the machine given in Table 5(a), determine the π - lattice. (06 Marks)
 b. Define: i) Input-consistent ii) Output-consistent with respect to machines. (04 Marks)
 c. For the machine shown in Table 5(c), obtain a serial decomposition. (10 Marks)

Table 5(a)

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 5(c)

PS	NS		
	x=0	x=1	Z
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

$$\pi_0 = \pi(0)$$

$$\pi_a = \{A, B, G, H; \overline{C, D, E, F}\}$$

$$\pi_b = \{A, B; \overline{C, D}; \overline{E, F}; \overline{G, H}\}$$

$$\lambda_0 = \{A, C, E, G; \overline{B, D, F, H}\}. \quad (10 \text{ Marks})$$

6 The machine shown in table 6 has the following output consistent and input consistent partitions: $\lambda_o = \{\overline{A, E, F}; \overline{B, D}; \overline{C, G}\}$, $\lambda_i = \{\overline{A, E, F}; \overline{B, C, D, G}\}$.

- i) List all other closed partitions.
- ii) Use state splitting to decompose the machine into components which operate in parallel. (20 Marks)

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

Table 6

- 7 a. Explain the Homing experiments with examples. (10 Marks)
- b. Explain the adaptive distinguishing experiment by considering the machine shown in Table 7(b). (10 Marks)

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

Table 7(b)

- 8 a. Explain the general procedure for fault detection experiment for the machine that has a distinguishable sequence with repeated symbols. Apply the same to the machine in Table 8(a). (10 Marks)

PS	NS, ZZ ₁	
	x = 0	x = 1
A	B, 01	B, 00
B	A, 00	B, 00
C	D, 10	A, 01
D	D, 11	C, 01

Table 8(a)

- b. Design a diagnosable machine for the machine in Table 8(b), write testing table and testing graph for that machine. (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 8(b)
