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12EC029

M.Tech. Degree Examination, Dec.2013/Jan.2014

Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks:100

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

1 a. Explain the weighted sum concept of threshold gate with an example. **(05 Marks)**

b. Prove that every threshold function is Unate. **(05 Marks)**

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 function and if it is find a weight threshold vector. **(10 Marks)**

2 a. What is a fault table? Explain how this helps in fault detection with an example. **(04 Marks)**

b. Given the fault table shown in the table Q2(b), where z denotes the fault free output for the corresponding test, find the minimal set of tests to detect all single faults. Find a preset set of tests to locate all single faults and show the corresponding fault dictionary. Find the minimal adaptive fault-location experiment. **(12 Marks)**

Test \ Faults	f_1	f_2	f_3	f_4	f_5	z
T_1			1	1	1	0
T_2	1	1				1
T_3				1	1	1
T_4		1				0
T_5					1	1

Table.Q2(b)

c. What are the classes of faults? Define each. **(04 Marks)**

3 a. Using path sensitization method, determine the test vectors for the s-a-1 faults at g and h in the circuit shown in Fig.Q3(a) below: **(08 Marks)**

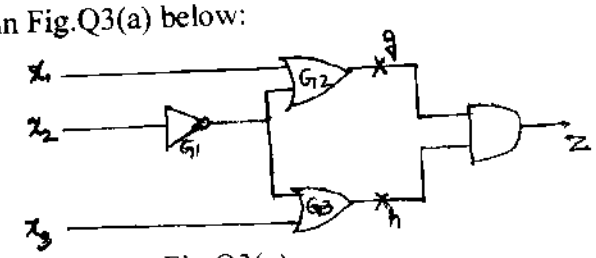

Fig.Q3(a)

b. Use the map method to find a minimal set of tests for multiple faults for the two level AND-OR realization of the function: $f(w, x, y, z) = wz' + xy' + w'x + wx'y$. **(08 Marks)**

c. Differentiate between critical and sub-critical errors. **(04 Marks)**

4 a. Define: i) Restoring organs, ii) Boolean differences. **(04 Marks)**

b. Explain the basic structure of a Quadded network with the help of diagrams. **(06 Marks)**

c. What are compatible states? For the tabular column Table.Q4(c) shown machine M. Find the augmented machine and corresponding minimal machines. **(10 Marks)**

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

Table.Q4(c)

5 a. i) Find the equivalence partition for the machine shown in Table.Q5(a).
ii) Show a standard form of the corresponding reduced machine.
iii) Find a minimum length sequence that distinguishes state B. **(10 Marks)**

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

Table.Q5(a)

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(b)

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

6 a. Determine the set of all mm pairs for the machine shown in Table.Q6(a). **(10 Marks)**

PS	x_1x_2		NS	Z
	00	01	10	
A	C	B	D	0
B	A	E	C	0
C	E	B	D	0
D	C	C	E	0
E	E	D	B	1

Table.Q6(a)

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

$\pi_0 = \pi(0)$

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

$\pi_b = \{\overline{A,B}; \overline{C,D}; \overline{EF}; \overline{GH}\}$

$\lambda_0 = \{\overline{A,C,E,G}; \overline{B,D,F,H}\}$

Table.Q6(b)

b. For the machine shown in Table.Q6(b), obtain a serial decomposition. **(10 Marks)**

7 a. For the machine shown in Table.Q7(a), find the shortest homing sequence. Determine whether or not synchronizing sequence exists and if it does exist, find the shortest one. **(10 Marks)**

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

Table.Q7(a)

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.Q7(b)

b. Explain the adaptive distinguishing experiment by considering the machine shown in Table.Q7(b).