USN

10EC029

M.Tech. Degree Examination, January 2011

Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks:100

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

1 a. Consider the type of threshold function for which all the weights are equal, that is $w_1 = w_2 = \ldots = w_n$. In particular, those $f(x_1, x_2, \ldots, x_n)$ for which,

$$f(x_1, x_2, \ldots x_n) = 1 \quad \text{if and only if} \quad \sum_{i=1}^{n} x_i \geq T/w$$

$$f(x_1, x_2, \ldots x_n) = 0 \quad \text{if and only if} \quad \sum_{i=1}^{n} x_i < T/w.$$

Determine the value of f when : i) $T/w = 0$ ii) $T/w > n$ iii) $0 < T/w < n$ **(04 Marks)**

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

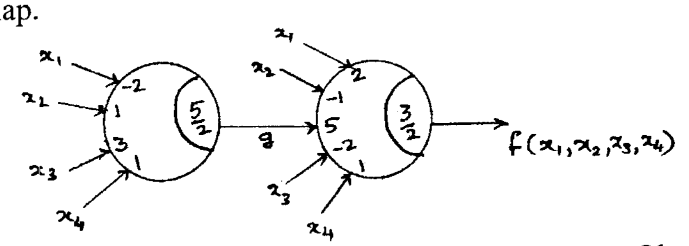

Fig.Q1(b)

c. Determine whether the following function is unite or not. Obtain a single / two-element realization.

$$f(x_1, x_2, x_3, x_4) = \Sigma(0, 3, 4, 5, 6, 7, 8, 11, 12, 15)$$ **(10 Marks)**

2 a. Given the fault table shown Table.Q2(a) where f denotes the fault-free output.

i) Find the minimal set of tests to detect all single faults.

ii) Find preset set of tests to locate all single faults and show the corresponding fault dictionary. **(10 Marks)**

Faults / Test	f	f_1	f_2	f_3	f_4	f_5	f_6
T_1	1	1		1			1
T_2	0	1					1
T_3	1		1	1			
T_4	0				1	1	
T_5	1	1		1		1	
T_6	0					1	1

Table.Q2(a)

b. Define Boolean differences. Derive the different properties of Boolean differences. **(08 Marks)**

c. Show that the combinational circuit $Y = A\bar{B} + BD$ having hazards. **(02 Marks)**

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

i) Find all the tests to detect input A′ s – a – O by using the sensitized path approach.

ii) Show all the single faults that can be detected by the test (A B C E) = (1 1 1 1).

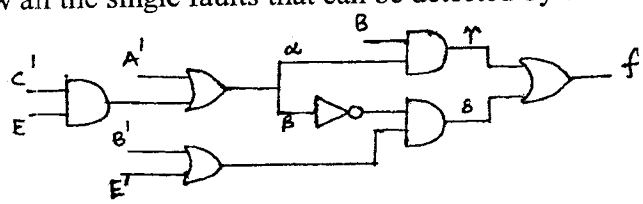

Fig.Q3(a)

(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.

3 b. Find the minimal set of test for multiple faults for the two level OR – AND network shown in Fig.Q3(b). **(06 Marks)**

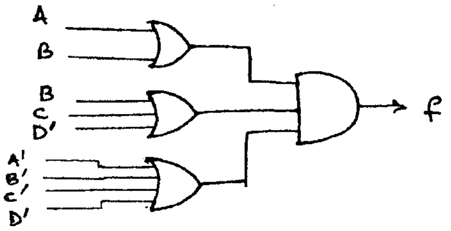

Fig.Q3(b)

c. Prove that every two level OR – AND network N_1 has an equivalent AND – OR network N_2 such that the inputs of N_2 are complements of the inputs N_1. **(04 Marks)**

4 a. For the machine M1 in Table.Q4(a), find the equivalence partition and a corresponding reduced machine in the standard form. Find a minimum length sequence that distinguishes state A from 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.Q4(a)

PS	NS, Z		
	I_1	I_2	I_3
A	C, 0	E, 1	–
B	C, 0	E, 1	–
C	B, –	C, 0	A, –
D	B, 0	C, –	E, –
E	–	E, 0	A, –

Table.Q4(b)

b. For the incompletely specified machine shown in Table.Q4(b), find a minimum-state reduced machine containing the original one. **(10 Marks)**

5 a. Obtain the merger table for the machine shown in Table.Q5(a). Give the computability graph and a minimal machine which covers the machine M3. **(10 Marks)**

PS	NS, Z	
	I_1	I_2
A	E, 0	B, 0
B	F, 0	A, 0
C	E, –	C, 0
D	F, 1	D, 0
E	C, 1	C, 0
F	D, –	B, 0

Table.Q5(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.Q5(b)

b. For the machine M4 given in Table.Q5(b), determine the π - lattice. **(06 Marks)**

c. Define : i) input-consistent ii) Output-consistent with respect to machines, and explain. **(04 Marks)**

6 a. In the following set of partitions, π_1 and π_2 designate the closed partitions, while λ_0 and λ_I designate the output-consistent and input consistent partitions.

i) Construct the π - lattice by obtaining all the necessary sum of products.

ii) Show the schematic diagrams showing the possible decomposition that yield minimal inter dependencies of the state variables as well as the outputs.

$\pi_1 = \{\overline{A,B,E,F};\overline{C,D,G,H}\}$ $\lambda_0 = \{\overline{A,B,G,H};\overline{C,D,E,F}\}$

$\pi_2 = \{\overline{A,F,C,H};\overline{B,D,E,G}\}$ $\lambda_i = \{\overline{A,C};\overline{B,D};\overline{E,G};\overline{F,H}\}$ **(10 Marks)**

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

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

Table.Q6(b)

$\pi_0 = \pi(0)$

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

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

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

7 a. Explain the Homing experiments, with examples. **(10 Marks)**

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

8 a. Design a fault detection experiment for the machine shown in Table.Q8(a), by conducting adaptive and preset experiments. **(10 Marks)**

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

Table.Q8(a)

b. Explain the general procedure for the fault detection experiment for the machine that has a distinguishable sequence with repeated symbols. Apply the same to the machine shown in Table.Q8(b). **(10 Marks)**

PS	NS, ZZ_1	
	x = 0	x = 1
A	B, 01	D, 00
B	A, 00	B, 00
C	D, 10	A, 01
D	D, 11	C, 01

Table.Q8(b)

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