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# M.Tech. Degree Examination, December 2011
Digital Circuits and Logic Design

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Explain the concept of threshold logic.   (06 Marks)
   b. Discuss the following :
      i)   Elementary properties ;   ii) Unite function.   (06 Marks)
   c. Show that a threshold logic realization of a full – adder requires only two threshold elements. (Note : both sum and carryout must be generated).   (08 Marks)

2 a. Explain the static hazard and hazard free-circuits, with example.   (08 Marks)
   b. What are critical and sub-critical errors? Determine the same for AND, OR, NAND, NOR and XOR gates.   (06 Marks)
   c. Explain the basic structure of a quadded network with the help of diagram.   (06 Marks)

3 a. Explain restoring-organs.   (04 Marks)
   b. Apply Boolean difference method to test wire 'h' in the circuit shown in Fig.Q.3(b).   (06 Marks)
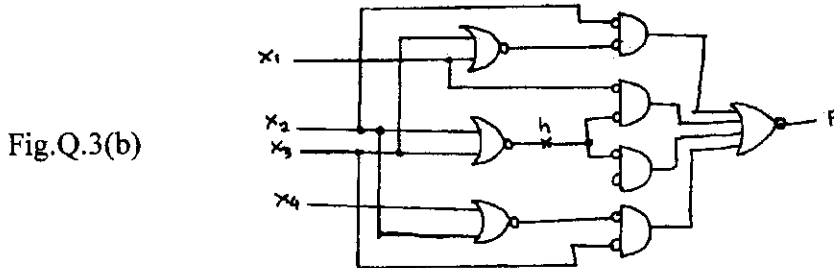
Fig.Q.3(b)

   c. For the circuit shown in Fig.Q.3(c), find all tests to detect the faults x_3, s-a-0 and s-a-1.   (10 Marks)

Fig.Q.3(c)
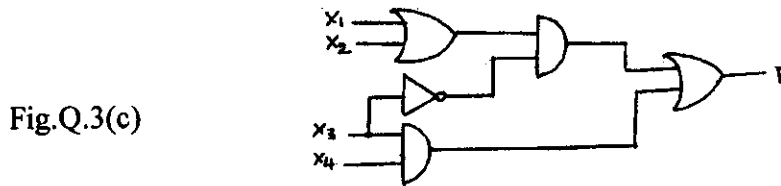
4 a. Write a note on fault-detection by path sensitizing.   (07 Marks)
   b. Explain the systematic generation of minimal fault-detection by generating b-tests. (07 Marks)
   c. List the capacities and limitations of finite state machines.   (06 Marks)

5 a. What are compatible states? For the tabular column Table Q.5(a) 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 Q.5(a)

b. What is merger graph? Draw the merger graph for the incompletely specified machine M shown in Table Q.5(b). **(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 Q.5(a)

6 a. Prove the following theorems :
   i) The equivalence partition is unique.
   ii) If two states S_i and S_j of machine 'M' are distinguishable, then they are distinguishable by a sequence of length n-1 or less, where n is the number of states in 'M'. **(08 Marks)**

   b. What is a tree? Explain the types of tree. **(06 Marks)**

   c. Draw the homing tree of m/c 'M' shown in table Q.6(c) and explain it. Write the response of m/c 'M' to the homing sequence 010. **(06 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 Q.6(c)

7 a. What is a diagnosable sequence m/c? Construct testing table and graph for m/c shown in Table Q.7(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 Q.7(a)

   b. Identify the m/c which is known to have two states and its response to the I/P response X is the o/p sequence Z, as shown below :

Time :	t_1-t_2	t_2-t_3	t_3-t_4	t_4-t_5	t_5-t_6	t_6-t_7	t_7-t_8
x :	1	1	1	0	1	0	1
z :	0	1	0	0	1	0	0

(10 Marks)

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

   b. Prove the theorem :
   If an n-state machine has a synchronizing, or sequences, then it has one such sequence whose length is at most $\dfrac{n(n+1)(n-1)}{6}$. **(10 Marks)**

   c. Write a short note on synchronizing experiments. **(05 Marks)**

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