

III B.Tech I Semester Regular Examinations, November 2006
DIGITAL SYSTEMS DESIGN
(Electronics & Computer Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. Find the CAMP – II Printout for the function.

$$f = \sum (0, 1, 3, 5, 7 - 10, 13 - 15, 17, 21, 25, 29) \quad [16]$$

2. (a) What are the basic building blocks of an ASM chart? Explain about them?
 (b) Show the eight exit paths in an ASM block emanating from the decision boxes that check the eight possible binary values of three control variables x, y and z. [8+8]

3. (a) List the PLA programming table for the combinational circuit defined by the functions.

$$F_1(abc) = \sum (3, 5, 6, 7)$$

$$F_2(abc) = \sum (0, 2, 4, 7)$$

- (b) What is meant by PLA? Draw a block diagram and explain its working. [8+8]

4. (a) Describe the Boolean difference method in a combinational circuit. shown in figure1

- (b) Find the test set to detect A^1 - SA0 and A^1 - SA1 faults using path sensitization method. [8+8]

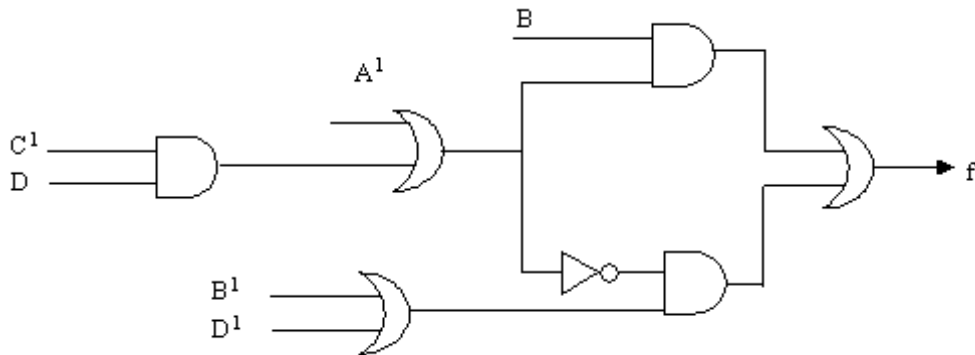


Figure 1:

5. In a multiprocessor array of 4×4 certain processor 12, 23, 33, 42 and 44 are faulty. Show by the diagram how these faulty processors can be taken out of the array that will still function correctly. Also explain the principle of reconfiguration process adopted.

[16]

6. (a) Describe the procedure for the design of fault detection experiments.
 (b) Construct a fault detection experiment for the machine shown below. [8+8]

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

7. Use COMPACT algorithm to find column folded PLA for the given PLA whose set of subsuming rows are given below. [8+8]

Column	SSRs
A	4,5,10
B	1,2,3,6,11,12
C	2,9
D	4,7,8,9,10
E	3,5,6,10,11
F	1,5,7,8,12
G	1,2,3,7,9,12
H	3,9

8. (a) State and prove EPC test criteria.
 (b) With the help of a map, determine the minimal test set for the following PLAs. Also list undetectable faults, if any. [8+8]

x_1	x_2	x_3	x_4	z_1	z_2	z_3
1	1	0	2	0	1	0
2	1	0	2	1	0	1
1	0	2	2	0	1	1
0	0	2	1	1	1	0

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1. With the help of a Map, find the CAMP Printout of the following cyclic function. After branching, how many times, and at which Minterms, will the program fail to get a VSPC and therefore skip the Minterm? The function will be input in the same order as given in the function.

$$f(abcd) = \sum (0, 1, 3, 5 - 8, 10 - 14) \quad [16]$$

2. (a) What are the basic building blocks of an ASM chart? Explain about them?
(b) Show the eight exit paths in an ASM block emanating from the decision boxes that check the eight possible binary values of three control variables x, y and z. [8+8]
3. (a) Write short notes on ROM.
(b) Tabulate the PAL programming table that implements the following Boolean functions.

$$W(ABCD) = \sum (2, 12, 13)$$

$$X(ABCD) = \sum (7 - 15)$$

$$Y(ABCD) = \sum (0, 2 - 8, 10, 11, 15)$$

$$Z(ABCD) = \sum (1, 2, 8, 12, 13) \quad [8+8]$$

4. (a) A two level AND - OR network realizes the function
 $f = x_1x_3^1x_4 + x_2x_4 + x_1^1 + x_3^1 + x_4^1 + x_1x_2x_3$
 Derive the a - and b - tests for detecting multiple stuck at faults.
 (b) The figure ??fig4M071) shown below is a 3 - bit parity checker circuit. Using path sensitization method, find the test vectors for SA0 and SA1 faults on each line of the circuit.

[8+8]

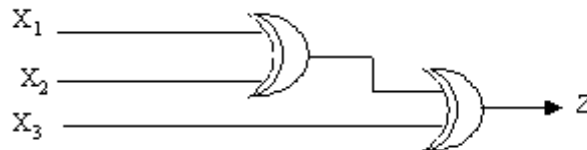


Figure 1:

5. Write a note on fault tolerant VLSI processor arrays. Explain with the help of a VLSI processor array structure. [16]

6. (a) What is a diagnisable sequential machine? Discuss the design of definitely diagnisable machine.
- (b) For the machine shown below determine whether or not preset distinguishing sequences exist, and if any do exist, find the shortest ones. [8+8]

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

7. Use COMPACT algorithm to find column folded PLA for the given PLA whose set of subsuming rows are given below. [8+8]

Column	SSRs
A	4,5,10
B	1,2,3,6,11,12
C	2,9
D	4,7,8,9,10
E	3,5,6,10,11
F	1,5,7,8,12
G	1,2,3,7,9,12
H	3,9

8. (a) State and prove EPC test criteria.
- (b) With the help of a map, determine the minimal test set for the following PLAs. Also list undetectable faults, if any. [8+8]

x_1	x_2	x_3	x_4	z_1	z_2	z_3
1	1	0	2	0	1	0
2	1	0	2	1	0	1
1	0	2	2	0	1	1
0	0	2	1	1	1	0

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1. Find the CAMP – II Printout for the function.

$$f = \sum (0, 1, 3, 5, 7 - 10, 13 - 15, 17, 21, 25, 29) \quad [16]$$

2. (a) Explain how the ASM chart differs from a conventional flowchart?
- (b) Construct an ASM chart for a digital system that counts the number of people in a room. People enter the room from one door with a photocell that changes a signal x from 1 to 0 when the light is interrupted. They leave the room from a second door with a similar photocell with a signal y. Both x and y are synchronized with the clock, but they may stay ON or OFF for more than one clock pulse period. The data processor subsystem consists of an up - down counter with a display of its contents. [8+8]
3. (a) Contrast the structures of FPGA's and CPLD's.
- (b) Tabulate the truth table for an 8 X 4 ROM that implements the following four Boolean functions.

$$\begin{aligned} A(xyz) &= \sum (1, 2, 4, 6) \\ B(xyz) &= \sum (0, 1, 6, 7) \\ C(xyz) &= \sum (2, 6) \\ D(xyz) &= \sum (1, 2, 3, 5, 7) \end{aligned} \quad [8+8]$$

4. (a) A two level AND - OR network realizes the function

$$f = 0200 + 1002 + 2121$$

Find the minimum test set to detect all the faults using Kohavi algorithm.

- (b) For the circuit shown in figure??, find a minimum test set for all stuck at faults by the fault table method. Assume that faults can occur only on lines a, b, c, d and e.

[8+8]

5. (a) Define the term fault tolerance of a system?
- (b) How many difference approaches are there to have fault tolerance of a digital system? Explain about one such approach. [4+12]
6. (a) What is a diagnosable sequential machine? Discuss the design of definitely diagnosable machine.

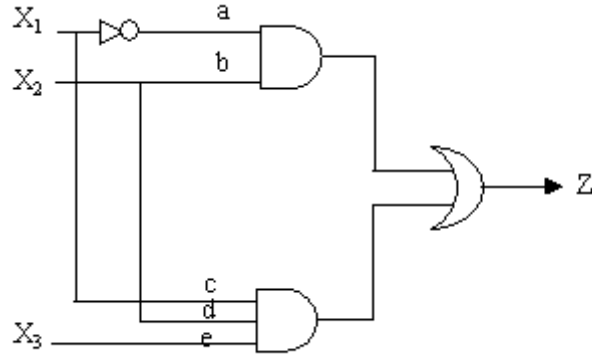


Figure 1:

- (b) For the machine shown below determine whether or not preset distinguishing sequences exist, and if any do exist, find the shortest ones. [8+8]

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

7. (a) Discuss the types of faults in PLAs.
 (b) Minimize the following function implemented on PLA using IISC algorithm.
 $f = 2120 + 0102 + 1121 + 0002$ [8+8]
8. (a) Describe the Fujiwara's DFT scheme.
 (b) With the help of a map, determine the minimal test set for the following PLAs.
 Also list undetectable faults, if any. [8+8]

x_1	x_2	x_3	x_4	z_1	z_2
1	2	0	1	1	0
2	0	1	1	1	0
1	1	0	2	1	1
0	1	1	0	0	1

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1. (a) Explain the cubical operations Sharp, disjoint Sharp, Disjunction, Adjacency.
(b) Find the CAMP-II printout for the function

$$f(abcd) = \sum (2 - 8, 10 - 13, 15)$$
[8+8]
2. (a) Draw an ASM chart for a circuit with two 8-bit registers RA and RB that receive two unsigned binary numbers and perform subtraction operation $RA \leftarrow RA - RB$ and set a borrow flip flop to 1 if the answer is negative.
(b) Write short notes on hardware description languages. [8+8]
3. List the PLA programming table for the BCD to Excess-3 code converter. [16]
4. (a) Describe the Boolean difference method in a combinational circuit. shown in figure1
(b) Find the test set to detect A^1 - SA0 and A^1 - SA1 faults using path sensitization method. [8+8]

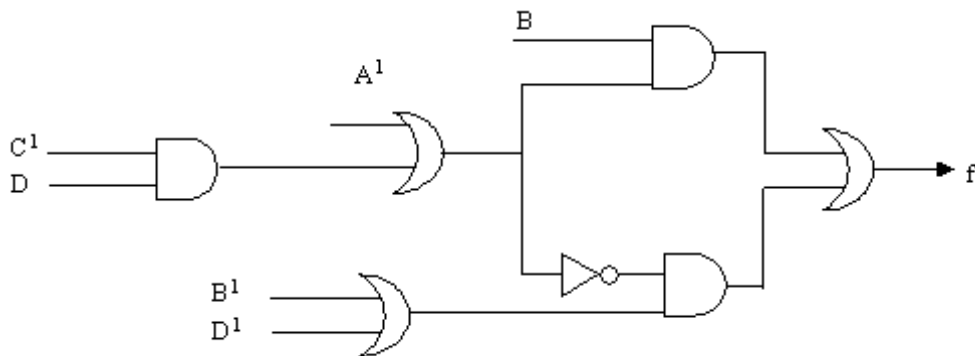


Figure 1:

5. (a) Define the term fault tolerance of a system?
(b) How many difference approaches are there to have fault tolerance of a digital system? Explain about one such approach. [4+12]
6. An unknown three state machine with two input symbols 0 and 1 is provided with the input sequence X, and it responds by producing the output sequence Z, as shown below:

X	1	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	1	1	0	0	1	0	1
Z	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	0	0

Show that this experiment is sufficient to identify the machine uniquely. [16]

7. (a) Discuss the types of faults in PLAs.
- (b) Minimize the following function implemented on PLA using IISC algorithm.

$$f = 2120 + 0102 + 1121 + 0002$$
 [8+8]
8. (a) Explain folding theorem. What are the necessary and required conditions to fold a PLA along the column to have maximum folding?
- (b) Write short notes on the test generation for the faults in PLA. [8+8]
