Faculty of Engineering & Technology

Fifth Semester B.E. (Electronics Engg.) (C.B.S.) Examination

SWITCHING THEORY AND AUTOMATA

Time : Three Hours] [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

1\. (a) Simplify the function using Kmap :

$$f(v, w, x, y, z) = \Sigma m(1, 2, 6, 7, 9, 13, 14, 15, 17, 22, 23, 25, 29, 30, 31)$$

7

(b) Given the following three partitions on the set {a, b, c, d, e, f, g, h, i, j, k}

$$\pi_1 = \{\overline{a, b, c}\,;\ \overline{d, e}\,;\ \overline{f}\,;\ \overline{g, h, i}\,;\ \overline{j, k}\}$$

$\pi_2 = \{\overline{a,\ b};\ \overline{c,\ g,\ h};\ \overline{d,\ e,\ f};\ \overline{i,\ j,\ k}\}$

$\pi_3 = \{\overline{a,\ b,\ c,\ f};\ \overline{d,\ e};\ \overline{g,\ h,\ i,\ j,\ k}\}$

(i) Find $\pi_1 + \pi_2$ and $\pi_1 \cdot \pi_2$

(ii) Find $\pi_1 + \pi_3$ and $\pi_1 \cdot \pi_3$ 6

OR

2. (a) Minimize the function using tabulation method :

$f(w, x, y, z) = \Sigma m(0, 1, 2, 5, 7, 8, 9, 10, 13, 15)$. 7

(b) In an examination there are three problems A, B and C. In the following tabulation are the percentage of the students who received credit for solving one or more problems :

A : 40	A, B : 12	A, B, C : 4
B : 30	A, C : 8	
C : 30	B, C : 6	

What percent of the students received no credit at all for solving any of the three problems ? Use a Venn diagram. 6

3. (a) Decompose the function :

$f(w, x, y, z) = \Sigma m(1, 3, 6, 10, 13, 15)$ about variables y and z by matrix method. 7

(b) Determine whether the function is symmetric or not :

$f(w, x, y, z) = \Sigma m(0, 3, 5, 10, 12, 15)$. 7

OR

4. (a) Decompose the function by employing the Expansion theorem and expanding function about the variables x and y :

$f(w, x, y, z) = \Sigma m(0, 2, 3, 7, 9, 10, 11, 14)$. 7

(b) Design a minimal three output contact network to realize the functions shown below. Ten transfer contacts should be sufficient :

$T_1(w, x, y, z) = \Sigma m(0, 1, 2, 4, 8)$

$T_2(w, x, y, z) = \Sigma m(3, 5, 6, 9, 10, 12)$

$T_3(w, x, y, z) = \Sigma m(7, 11, 13, 14, 15)$ 7

5. (a) Determine whether the function

$f(x_1, x_2, x_3, x_4) = \Sigma m(0, 1, 3, 4, 5, 6, 7, 12, 13)$ is a threshold function and if it is, find a weight threshold vector. 7

(b) Explain capabilities and limitations of threshold logic. 4

(c) What is unate function ? 2

OR

6. (a) Given the switching function :

$f(x_1, x_2, x_3, x_4) = \Sigma m(2, 3, 6, 7, 10, 12, 14, 15)$.

find a minimal threshold logic realization. 10

(b) Explain Elementary property of threshold element. 3

7. Design Moore circuit for sequence 1001 in which overlapping is allowed. Implement the function using JK flip flop. 14

OR

8. Design an asynchronous sequential circuit with two inputs x_1 and x_2 and one output z. The initial input state is $x_1 = x_2 = 0$. The circuit output is to be 1 if and only if the input state is $x_1 = x_2 = 1$ and the preceding input state is $x_1 = 0$, $x_2 = 1$. 14

9. (a) For the machine given in the table below, find the equivalent partitions and a corresponding reduced machine in standard form :

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

7

(b) Draw the homing tree and find the shortest homing sequence and the response of machine to homing sequence :

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

6

OR

10. (a) For the machine given below design an autonomous clock :

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

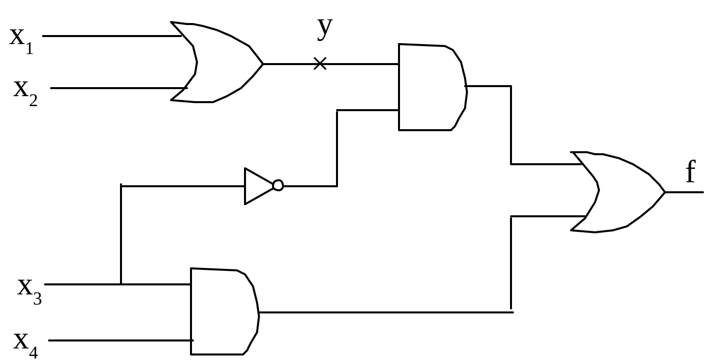
7

(b) Construct an Adaptive distinguishing experiment for the machine given below :

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

6

11. (a) For the following combinational circuit, detect s-a-0 and s-a-1 at x_3 by Boolean difference :



7

(b) Explain in brief advantages and limitations of path sensitizing method for fault detection. 6

OR

12. (a) Find 'a' test and 'b' test for the combinational logic circuit which realizes the function :

$f(w, x, y, z) = \overline{w}\,\overline{y} + \overline{y}z + wxz + xy\overline{z}$. 7

(b) What are Hazards ? Explain different types of Hazards that occur in digital circuit. 6