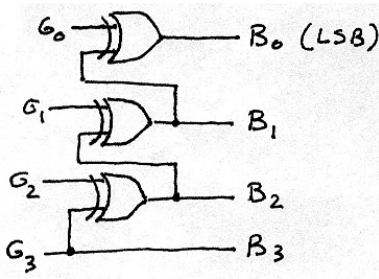


1) Answer The Following Questions

a) Convert $(257.0554)_8$ to base 16 and base 2

$$(257.0554)_8 = (010\ 101\ 111.000\ 101\ 101\ 100)_2 = (1010\ 1111.0001\ 0110\ 1100)_2 = (AF.16C)_{16}$$

b) Implement a 4-bit Gray to Binary code conversion circuit by using three 2-input XOR gates only.



$$B_n = G_n \text{ (MSB)}$$

$$B_i = G_i \oplus B_{i+1} \quad i=0, n-1$$

c) A 7-bit Hamming Code word 0010011 of 4 data bits and 3 parity bits is received through a transmission channel. Check this word for a possible 1-bit error and find out the original 4-bit data word put into the channel.

$$C_1 = \text{XOR of bits (1, 3, 5, 7)} = 0$$

$$C_2 = \text{XOR of bits (2, 3, 6, 7)} = 1$$

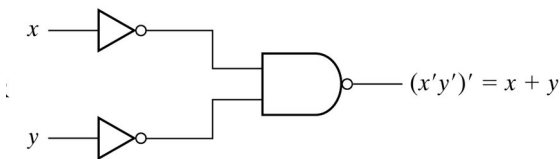
$$C_4 = \text{XOR of bits (4, 5, 6, 7)} = 0$$

$$\text{error bit position } C_4 C_2 C_1 = 010 = 2$$

$$\text{corrected code} = 0110011$$

$$\text{Data} = 1011$$

d) Implement a 2-input OR function with use of minimum number of INVERTERS and NAND gates. (Complements of inputs are not available)

e) How many $32K \times 8$ RAM chips are needed to provide a total memory capacity of 512 K bytes?

$$512 \text{ k byte} / 32 \text{ K byte} = 16 \text{ memory chip}$$

f) Convert the following function to canonical SOP form.

$$F(A, B, C) = AB + \bar{A}C + \bar{A}C$$

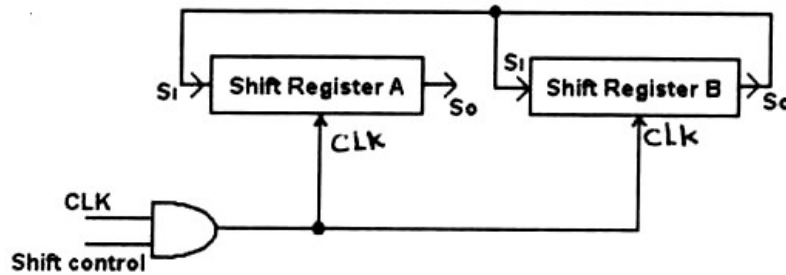
$$F(A, B, C) = A'B'C + A'BC + AB'C' + ABC' + ABC$$

$$F(A, B, C) = \sum (1, 3, 4, 6, 7)$$

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

2) Answer The Following Questions

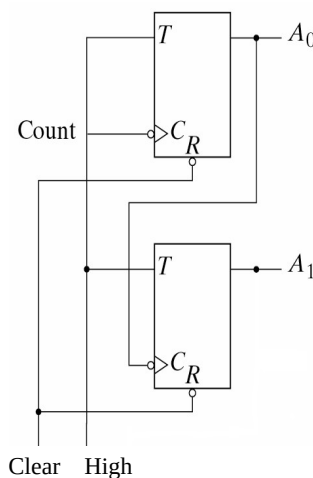
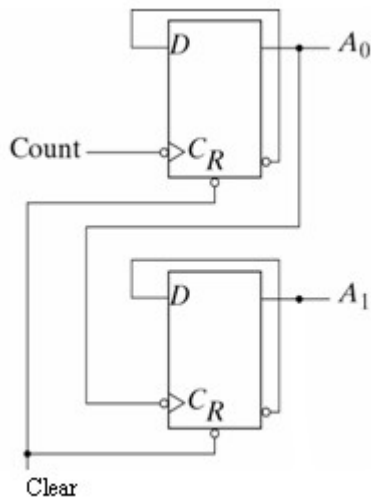
- a) Binary information is shifted and distributed through 4-bit shift registers A and B, when shift control is high (1). Write the contents of each shift register, after the application of 3 clock pulses. (Initial values of shift registers are A = 1100 and B = 1110)



3 clock darbesinden sonra A = 1101 ve B = 1101 olur

A = 1100	B = 1110
0110	0111
1011	1011
1101	1101

- b) A 2-bit binary counter is shown in the figure. Redraw this counter by using D type flip flop's

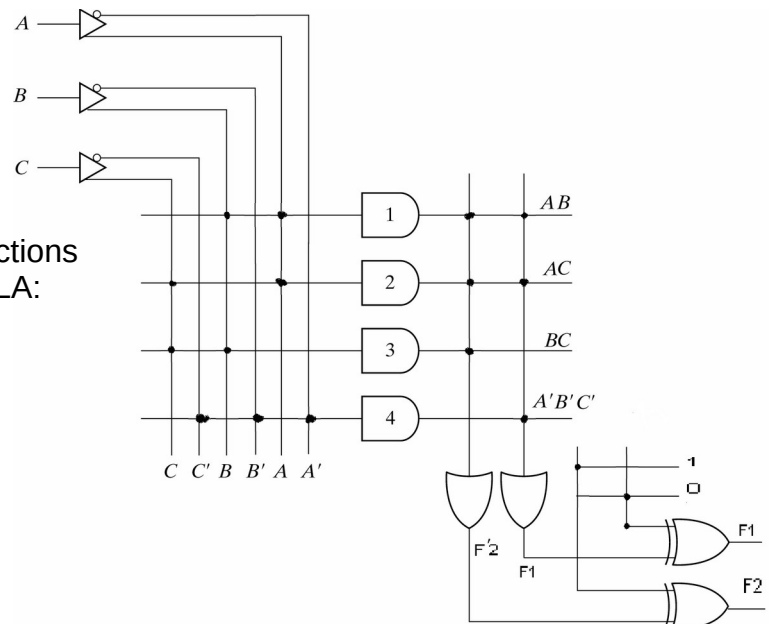


- 3) Implement the following two functions simultaneously with the given PLA:

$$F_1(A,B,C) = \sum (0,5,6,7)$$

$$F_2(A,B,C) = \sum (0,1,2,4)$$

A/BC	00	01	11	10
0	1	0	0	0
1	0	1	1	1



$$F1 = AB + AC + A'B'C'$$

$$F1 = (A'C + A'B + AB'C')'$$

A\BC	00	01	11	10
0	1	1	0	1
1	1	0	0	0

$$F2 = A'B' + A'C' + B'C'$$

$$F2 = (AB + AC + BC)'$$

- 4) Reduce the number of states in the following state table and find the reduced state table.

Şimdiki Durum	Gelecek Durum		Çıktı	
	x = 0	x = 1	x = 0	x = 1
a	f	b	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

5

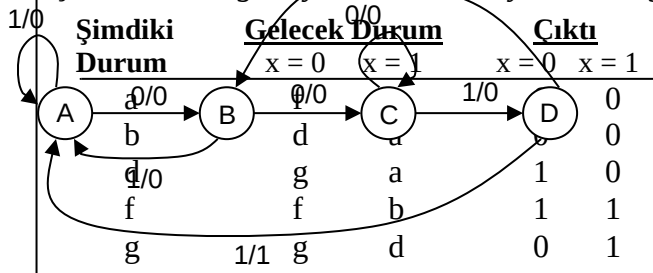
Verilen çizelgedeki durumları, aynı girdi dizilerine karşın, aynı çıktı dizileri üretip üretmediklerine bakarak denklik kümeleri içinde toparlarsak:

$$P_0 = (abcdefgh)$$

$$P_1 = (abce)(dh)(f)(g)$$

$$P_2 = (ac)(be)(dh)(f)(g)$$

Buluruz. Bu da verilen “sequential” devrenin kendisine denk olan 5 durumlu bir devreye indirgenebileceğini gösterir. Her küme içinden bir durum seçer ve gelecek durumlarla çıktıları buna göre yeniden düzenleyerek indirgenmiş çizelgeyi oluştururuz:



Design a sequential circuit as a Mealy machine, which detects the occurrence of each 0011 sequence, by using T type flip-flops as memory elements. First find the state diagram and use minimal number of states and combinational circuit elements. Show all of your design steps clearly. The machine must generate an output of 1, whenever the sequence received and 0 at all other times.

PS	NS		z	
	x=0	x=1	x=0	x=1
A	B	A	0	0
B	C	A	0	0
C	C	D	0	0
D	B	A	0	1

PS	NS		z	
	x=0	x=1	x=0	x=1
Q_2Q_1	q_2q_1	q_2q_1		
00	01	00	0	0
01	10	00	0	0
10	10	11	0	0
11	01	00	0	1

PS	NS		z	
	x=0	x=1	x=0	x=1
Q_2Q_1	T_2T_1	T_2T_1		
00	01	00	0	0
01	11	01	0	0
10	00	01	0	0
11	10	11	0	1

$x \backslash Q_2Q_1$	00	01	11	10
0	1	1	0	0
1	0	1	1	1

$$T_1 = (x' + Q_2 + Q_1)(x + Q_2')$$

$x \backslash Q_2Q_1$	00	01	11	10
0	0	1	1	0
1	0	0	1	0

$$T_2 = Q_1(x' + Q_2)$$

$$z = xQ_1Q_2$$

$x \backslash Q_2Q_1$	00	01	11	10
0	1	1	0	0
1	0	1	1	1

$$T_1 = x'Q_2' + xQ_2 + Q_2'Q_1$$

$x \backslash Q_2Q_1$	00	01	11	10
0	0	1	1	0
1	0	0	1	0

$$T_2 = x'Q_1 + Q_2Q_1$$

$$z = xQ_1Q_2$$

Points: Q1: 5p each, 30p total Q2: a) 10p b) 10p, 20p total
Q3: 20p Q4: 10p, Q5: 20p

Exam Duration : 100 minutes.