

- LOGIC CIRCUIT -

(Sınav sorusu 2)

Çöz

(Sınav sorusu 1)

$$F_1(a,b,c,d) = (a'ab + c + d)' + (a + c')' + a'b$$

$$F_2(a,b,c,d) = abd + a'c' + a'bd$$

Realize F_1 using an active high decoder and an OR gate and realize F_2 using an active high decoder and NOR gate (active high decoder = Türkiyelemenis)

$$F_1 = ab'c'd' + a'c + a'b$$

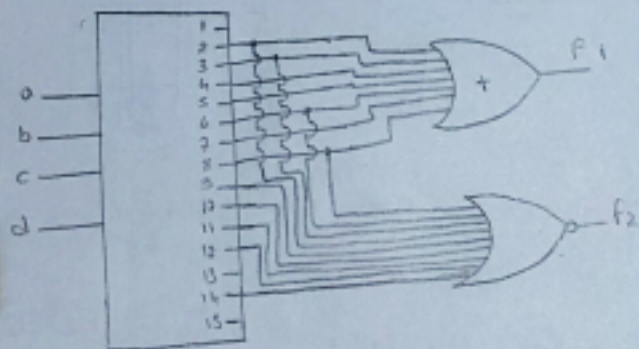
$$F_2 = abd + a'c' + a'bd$$

cd \ ab	00	01	11	10
00	0 ₀	1 ₄	0 ₁₂	1 ₃
01	0 ₁	1 ₅	0 ₁₃	0 ₉
11	1 ₃	1 ₅	0 ₁₃	0 ₁₁
10	1 ₃	1 ₆	0 ₁₄	0 ₁₀

$$F_1 = \sum m(2,3,4,5,6,7,8)$$

cd \ ab	00	01	11	10
00	1 ₀	1 ₄	0 ₁₂	0 ₈
01	1 ₁	1 ₅	1 ₁₃	0 ₉
11	0 ₃	1 ₇	1 ₁₅	0 ₁₁
10	0 ₂	0 ₆	0 ₁₄	0 ₁₀

$$F_2 = \sum m(2,3,6,8,9,10,11,12,13)$$



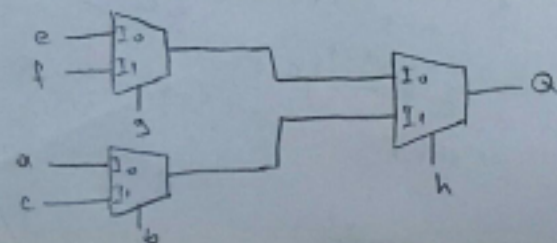
NOT: Türkiyelemenis \rightarrow Min - OR, Max - NOR
Türkiyelemenis \rightarrow Min - AND, Max - NAND

Çöz

(Sınav sorusu 2)

Using three of 2-to-1 MUX realize the following logic expression:

$$Q = h'(eg' + fg) + h(ab' + bc)$$



Çöz

Realize using MUX following logic expression:

$$F(a,b,c,d) = \sum m(1,2,4,5,7,8,10,11,12,14)$$

cd \ ab	00	01	11	10
00	0 ₀	1 ₄	1 ₁₂	1 ₈
01	1 ₁	1 ₅	0 ₁₃	0 ₉
11	0 ₃	1 ₇	0 ₁₅	1 ₁₁
10	1 ₂	0 ₆	1 ₁₄	1 ₁₀

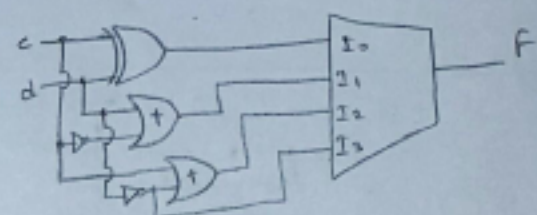
$$I_0 = c'd + cd' = c \oplus d$$

$$I_1 = c' + d$$

$$I_2 = d' + c$$

$$I_3 = d'$$

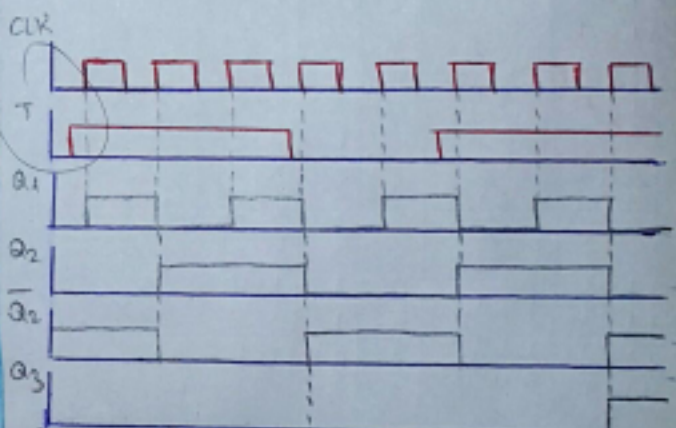
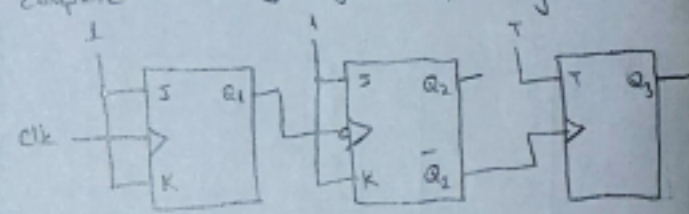
$$F(a,b,c,d) = a'b'(c'd + cd') + a'b(c' + d) + ab'(c + d') + abd$$



Çöz

(Sınav sorusu 3)

Schematic of a three FF circuit is given below. Complete the timing diagram. Initially $Q_1=Q_2=Q_3=0$



Q_1 'in clock'u CLK'nin yükselen kenarı
 Q_2 'nin clock'u Q_1 'in düşen kenarı
 Q_3 'ün clock'u Q_2 'nin yükselen kenarı

$$F(a,b,c,d) = \sum m(0,2,4,6,8,9,10,12,14)$$

MUX kullanarak aşağıda verilen ifadenin gerçekteştirilmesini.

cd \ ab	00	01	11	10
00	1 ₀	1 ₄	1 ₆	1 ₂
01	0 ₁	0 ₅	0 ₁₃	0 ₉
11	0 ₃	0 ₇	0 ₁₅	0 ₁₁
10	1 ₁₂	1 ₈	1 ₄	1 ₁₀

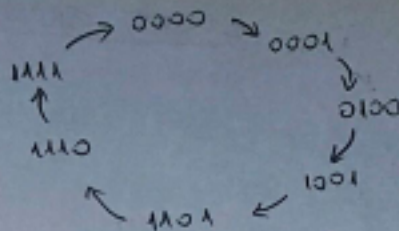
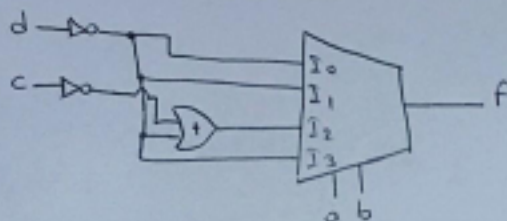
$$I_0 = d'$$

$$I_1 = d'$$

$$I_2 = d' + c'$$

$$I_3 = d'$$

$$F = a'b'd' + a'bd' + ab'(c'+d') + abd'$$



cd \ ab	00	01	11	10
00	0	1	X	X
01	0	X	0	0
11	X	X	1	X
10	X	X	0	X

$$T_A = A'B + CD$$

cd \ ab	00	01	11	10
00	0	0	X	X
01	1	X	1	1
11	X	X	0	X
10	X	X	1	X

$$D_B = A'0 + AC' + AD'$$

cd \ ab	00	01	11	10
00	0	0	X	X
01	0	X	1	0
11	X	X	0	X
10	X	X	X	X

$$S_C = BC'D$$

cd \ ab	00	01	11	10
00	X	X	X	X
01	X	X	0	X
11	X	X	1	X
10	X	X	0	X

$$R_C = CD$$

cd \ ab	00	01	11	10
00	1	1	X	X
01	X	X	X	X
11	X	X	X	X
10	X	X	1	X

$$J_0 = 1$$

cd \ ab	00	01	11	10
00	X	X	X	X
01	1	X	1	0
11	X	X	1	X
10	X	X	X	X

$$K_0 = A' + B$$

b) Determine that the designed counter is a self-starting one or not.

$$\Rightarrow 0010 \rightarrow T = 1.0 + 1.0 = 0 \quad D = 1.0 + 0.0 + 0.1 = 0$$

$$A = 0 \quad B = 0$$

$$S = 0.0.0 = 0 \quad C = 1 \quad J = 1 \quad K = 1.0 = 1 \quad D = 1$$

$$R = 1.0 = 0$$

$$0010 \rightarrow 0011$$

$$\Rightarrow 0011 \rightarrow T = 1.0 + 1.1 = 1 \quad D = 1.1 + \dots = 1$$

$$A = 1 \quad B = 1$$

$$S = 0.0.1 = 0 \quad C = 0 \quad J = 1 \quad K = 1 + 0 = 1 \quad D = 0$$

$$R = 1.1 = 1$$

$$0011 \rightarrow 1100$$

$$\Rightarrow 0101 \rightarrow T = 1 + 0.1 = 1 \quad D = 1.1 + \dots = 1$$

$$A = 1 \quad B = 1$$

$$S = 1.1.1 = 1 \quad C = 1 \quad J = 1 \quad K = 1 + 1 = 1 \quad D = 0$$

$$R = 0.1 = 0$$

$$0101 \rightarrow 1110$$

A B C D	A' B' C' D'	T _A	D _A	S _C R _C	J ₀ K ₀
0000	0001	0	0	0 X	1 X
0001	0100	0	1	0 X	X 1
0010	0101	X	X	X X	X X
0011	0110	X	X	X X	X X
0100	0111	X	X	X X	X X
0101	1000	X	X	X X	X X
0110	1001	X	X	X X	X X
0111	1010	X	X	X X	X X
1000	1011	X	X	X X	X X
1001	1100	X	X	X X	X X
1010	1101	X	X	X X	X X
1011	1110	X	X	X X	X X
1100	1111	X	X	X X	X X
1101	0000	0	1	0 X	X 0
1110	0001	0	1	0 X	X 1
1111	0010	0	1	0 X	X X
1111	0011	0	1	0 X	X X

a	a'	S	R	Q	Q'	T	D
0	0	0	X	0	0	0	0
0	1	1	X	0	1	1	1
1	0	X	1	1	0	1	0
1	1	X	0	1	1	0	1

$$\Rightarrow 0110 \rightarrow T = 1.1 + 1.0 = 1 \quad D = 1.0 + 0.0 + 0.1 = 0$$

$$A = 1 \quad B = 0$$

$$\left. \begin{array}{l} S = 1.0.0 = 0 \\ R = 1.0 = 0 \end{array} \right\} C = 1 \quad \left. \begin{array}{l} J = 1 \\ K = 1 + 1 = 1 \end{array} \right\} D = 1$$

$$0110 \rightarrow 1011$$

$$\Rightarrow 0111 \rightarrow T = 1.1 + 1.1 = 1 \quad D = 1.1 + \dots = 1$$

$$A = 1 \quad B = 1$$

$$\left. \begin{array}{l} S = 1.0.1 = 0 \\ R = 1.1 = 1 \end{array} \right\} C = 0 \quad \left. \begin{array}{l} J = 1 \\ K = 1 + 1 = 1 \end{array} \right\} D = 0$$

$$0111 \rightarrow 1100$$

$$\Rightarrow 1000 \rightarrow T = 0.0 + \dots = 0 \quad D = 0.0 + 1.1 + 1.1 = 1$$

$$A = 1 \quad B = 1$$

$$\left. \begin{array}{l} S = 0.1.0 = 0 \\ R = 0.0 = 0 \end{array} \right\} C = 0 \quad \left. \begin{array}{l} J = 1 \\ K = 0 + 0 = 0 \end{array} \right\} D = 1$$

$$1000 \rightarrow 1101$$

$$\Rightarrow 1010 \rightarrow T = 0.0 + 1.0 = 0 \quad D = 0.0 + 1.0 + 1.1 = 1$$

$$A = 1 \quad B = 1$$

$$\left. \begin{array}{l} S = 0.0.0 = 0 \\ R = 1.0 = 0 \end{array} \right\} C = 1 \quad \left. \begin{array}{l} J = 1 \\ K = 0 + 0 = 0 \end{array} \right\} D = 1$$

$$1010 \rightarrow 1111$$

$$\Rightarrow 1011 \rightarrow T = 0.0 + 1.1 = 1 \quad D = 0.0 + 0 + 0 = 0$$

$$A = 0 \quad B = 0$$

$$\left. \begin{array}{l} S = 0 \\ R = 1.1 = 1 \end{array} \right\} C = 0 \quad \left. \begin{array}{l} J = 1 \\ K = 0 + 0 = 0 \end{array} \right\} D = 1$$

$$1011 \rightarrow 0001$$

$$\Rightarrow 1100 \rightarrow T = 0 + 0 = 0 \quad D = 0 + 1 + 1 = 1$$

$$A = 1 \quad B = 1$$

$$\left. \begin{array}{l} S = 0 \\ R = 0 \end{array} \right\} C = 0 \quad \left. \begin{array}{l} J = 1 \\ K = 0 + 1 = 1 \end{array} \right\} D = 1$$

$$1100 \rightarrow 1101$$

$$0010 \rightarrow 0011$$

$$0011 \rightarrow 1100$$

$$0101 \rightarrow 1110$$

$$0110 \rightarrow 1011$$

$$0111 \rightarrow 1100$$

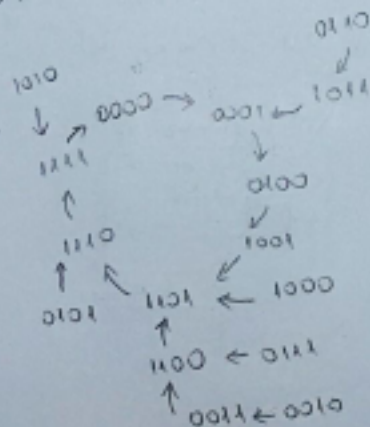
$$1000 \rightarrow 1101$$

$$1010 \rightarrow 1111$$

$$1011 \rightarrow 0001$$

$$1100 \rightarrow 1101$$

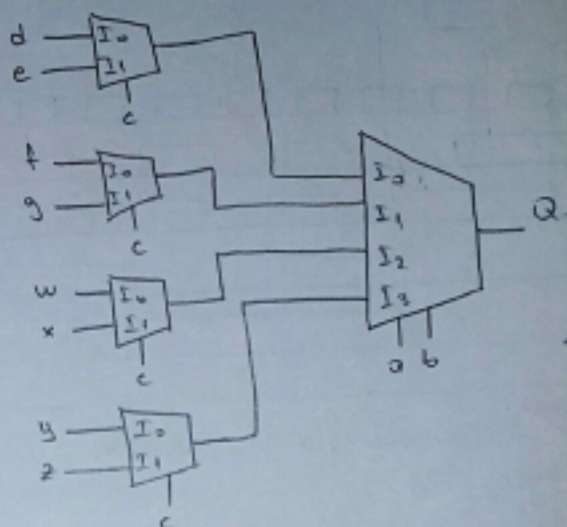
* Kendi kendine başlar



2001

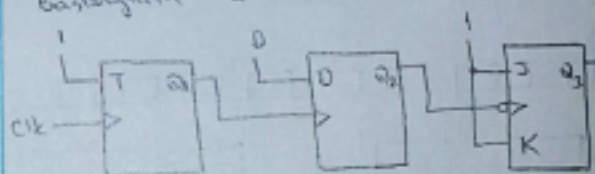
Özet adet 2-ye-1 mux ve bir adet 4-e-1 mux kullanarak aşağıdaki fonksiyonu gerçekleştiriniz.

$$Q = a'b'(c'd + ce) + a'b(c'f + cf) + ab'(c'g + cg) + ab(c'h + ch)$$

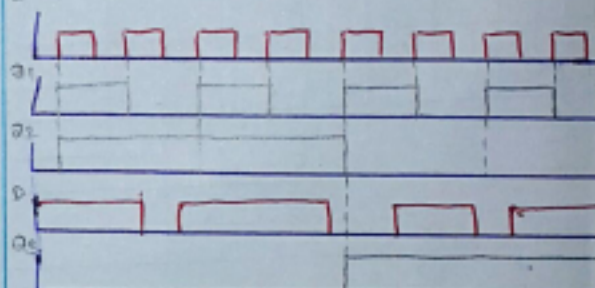


2001

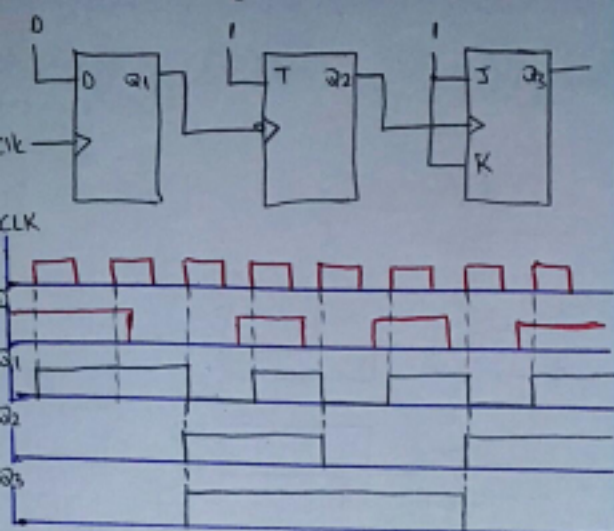
Aşağıda verilen devrenin zaman diyagramını çiziniz. Başlangıçta $Q1 = Q2 = Q3 = 0$ 'dir.



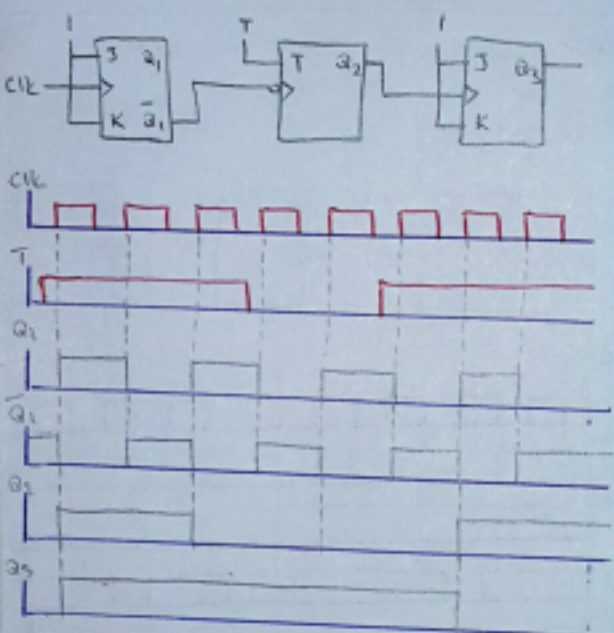
CLK



Çöz Aşağıda verilen Flip Flop devresinin, devreye ilişkin zamanlama diyagramını çiziniz. Başlangıçta $Q_1 = Q_2 = Q_3 = 0$ 'dır.



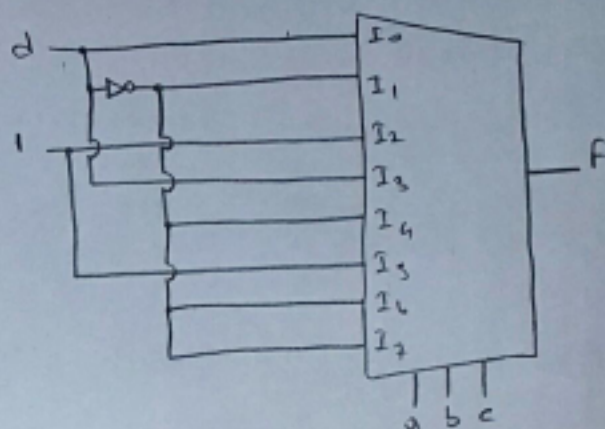
Çöz Aşağıda verilen Flip Flop devresinin, devreye ilişkin zamanlama diyagramını çiziniz. Başlangıçta $Q_1 = Q_2 = Q_3 = 0$ 'dır.



Çöz $F(a, b, c, d) = \sum m(1, 2, 4, 3, 7, 8, 10, 11, 12, 14)$
Select 3 control inputs a, b and c

$$F = a'b'c'd + a'b'cd' + a'bc'd' + a'bc'd + a'bcd + ab'c'd' + ab'cd + abc'd' + abcd$$

$$F = a'b'c'd + a'b'cd' + a'bc'(d'+d) + a'bcd + ab'c'd' + ab'c(d'+d) + abc'd' + abcd$$



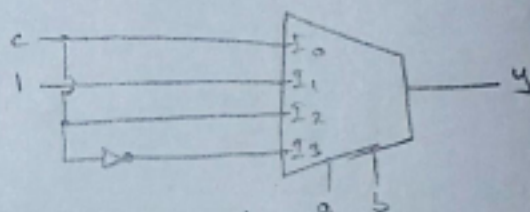
Çöz $y(a, b, c) = \sum m(1, 2, 3, 5, 6)$

Select 2 control inputs a and b

$$y = a'b'c + a'bc' + a'bc + ab'c + abc'$$

$$y = a'b'c + a'b(c'+c) + ab'c + abc'$$

$$y = a'b'c + a'b + ab'c + abc'$$



II. Yal (Karna ile)

c \ ab	00	01	11	10
0	0	1	1	0
1	1	1	0	0

$$I_0 = c$$

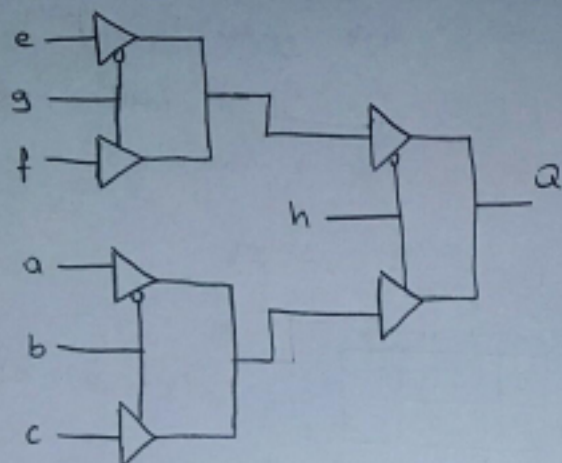
$$I_1 = 1$$

$$I_2 = c$$

$$I_3 = c'$$

Çöz 6 adet three-state-buffer kullanarak aşağıdaki logic ifadeyi gerçekleştiriniz.

$$Q = h'(eg' + fg) + h(ab' + bc)$$



Çöz

4-e-1 mux kullanarak aşağıdaki logic fonksiyonu gerçekleştiriniz. a ve b'yi kontrol değişkeni olarak seçiniz.

$$\begin{aligned} F(a,b,c,d) &= a'b' + a'bc + a'bd + a'b'cd + ab'c'd \\ &= a'b' + a'b(c+d') + ab'(c+d+c'd) \\ &= a'b' + a'b(c+d) + ab'd \end{aligned}$$

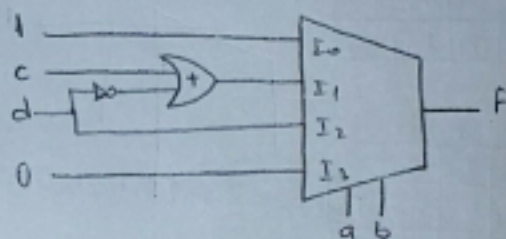
ab	I ₀	I ₁	I ₂	I ₃
00	1	1	0	0
01	1	0	0	1
11	1	1	0	1
10	1	1	0	0

$$I_0 = 1$$

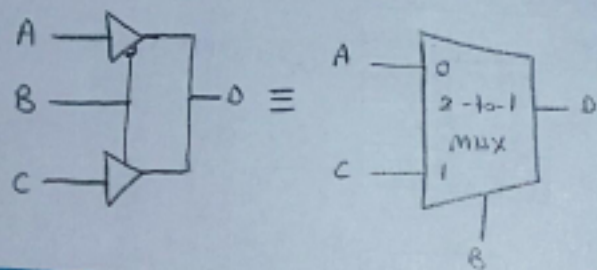
$$I_1 = c+d'$$

$$I_2 = d$$

$$I_3 = 0$$



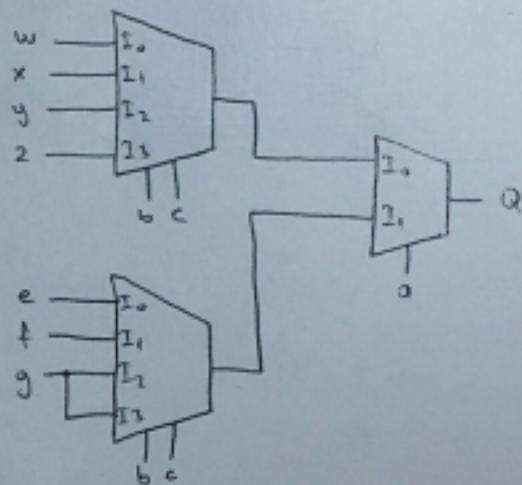
* Three State Buffers



Çöz

İki adet 4-e-1 mux ve bir adet 2-ye-1 mux kullanarak aşağıdaki logic ifadeyi gerçekleştiriniz.

$$Q = a'(b'c'w + b'cx + b'c'y + b'cz) + a(b'c'e + b'cf + b'c'g + bcg)$$

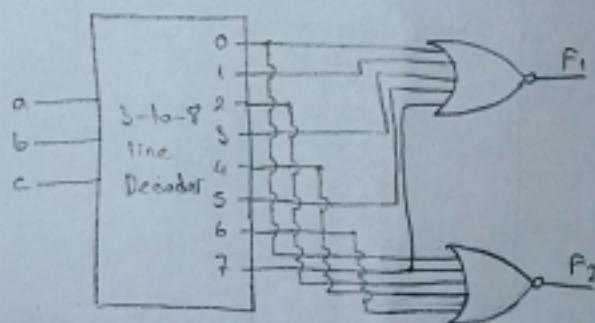


Çöz

İki tane NOR kapısı ve uygun bir decoder kullanarak aşağıda verilen iki logic fonksiyonu gerçekleştiriniz.

$$F_1(a,b,c) = \pi M(0,1,3,5,7)$$

$$F_2(a,b,c) = \pi M(0,2,4,6,7)$$



Soru Aşağıda verilen logic ifadeleri citası
 tanımlanmış (ataak) bir decoder, bir AND
 kapısı ve bir NAND kapısı kullanarak
 gerçekleştiriniz.

$$F_1(a, b, c, d) = (a+b+c+d)(a+b')$$

$$F_2(a, b, c, d) = ab'c'd + ac$$

$$a(b+b') = a$$

$$F_1 = a + ab' + ab + b'b' + ac + cb' + ad + b'd$$

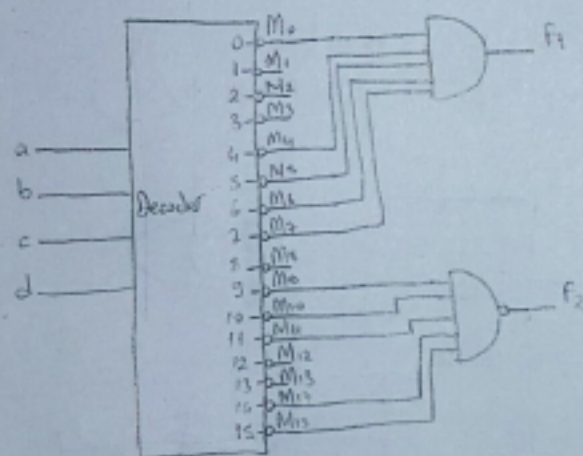
$$F_1 = a + ac + cb' + ad + b'd$$

cd \ ab	00	01	11	10
00	0	0	1	1
01	1	0	1	1
11	1	0	1	1
10	1	0	1	1

$$F_1 = \sum m(0, 4, 5, 6, 7)$$

cd \ ab	00	01	11	10
00	0	0	0	0
01	0	0	0	1
11	0	0	1	1
10	0	0	1	1

$$F_2 = \sum m(9, 10, 11, 14, 15)$$



* Terslenmiş Kod Çıkıcıda çıktılar minterm
 cinsindendir. Bu durumda OR kapısı çıktı olarak
 kullanılır. Eğer fonksiyon maxterm cinsinden
 veritirse NOR kapısı kullanılır.

* Terslenmiş Kod Çıkıcıda çıktılar maxterm
 cinsindendir. Bu durumda AND kapısı çıktı
 olarak kullanılır. Eğer fonksiyon minterm
 cinsinden veritirse NAND kapısı kullanılır.

Soru F_1 ve F_2 'ye ait ifadeler veritir. F_1
 ifadesini uygun citası tanımlanmış
 kod çıkıcı (decoder) ve OR kapısı kulla-
 narak, F_2 ifadesini uygun citası tanımlan-
 mış kod çıkıcı (decoder) ve NOR
 kapısı kullanarak gerçekleştiriniz.

$$F_1(a, b, c, d) = (a'+c+d)' + (a+b'+c')' + a'b$$

$$F_2(a, b, c, d) = ab + a'c'd' + a'b$$

$$F_1 = a'c'd' + a'bc + a'b$$

cd \ ab	00	01	11	10
00	0	1	1	1
01	0	1	0	0
11	0	1	0	1
10	0	1	0	1

$$F_1 = \sum m(4, 5, 6, 7, 8, 12)$$

cd \ ab	00	01	11	10
00	1	1	1	0
01	0	1	1	0
11	0	1	1	0
10	0	1	1	0

$$F_2 = \sum m(1, 2, 3, 5, 9, 10, 11)$$

