KARNO

Sınav Çalışması

ÖR=> $F(x,y) = \Sigma m(1,3)$ en sade boolean ifadesini yazın.

X \ Y	0	1
0	0	1
1	0	1

X	Y	F		
0	0	0	m_0	$\rightarrow x'y'$
0	1	1	$\boxed{m_1}$	$\rightarrow x'y$
1	0	0	m_2	$\rightarrow xy'$
1	1	1	$\boxed{m_3}$	$\rightarrow xy$

$\Sigma m(1,3) = m_1 + m_3$

$= x'y + xy$

$= y(x'+x)$

$= y$

ÖR=> $F(x,y) = \Sigma m(1,2,3)$ en sade boolean ifadesini yazın.

X \ Y	0	1
0	0	1
1	1	1

F_1

F_2

$F = F_1 + F_2$

$= (m_1 + m_3) + (m_2 + m_3)$

$= (x'y + xy) + (xy' + xy)$

$= y + x$

ÖR=> $F(x,y,z) = \Sigma m(2,3,4,5)$ en sade boolean ifadesini yazın.

X \ YZ	00	01	11	10
0	0	1	1	1
1	1	1	7	6

F_1

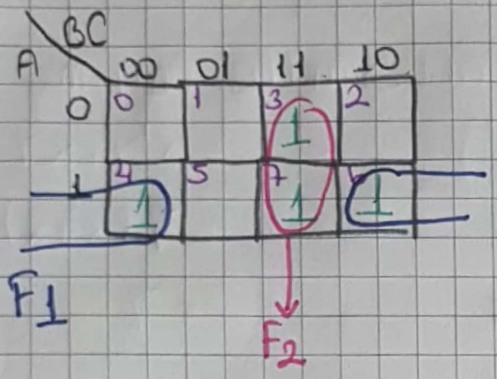
F_2

X	Y	Z	F	
0	0	0	0	m_0
0	0	1	0	m_1
0	1	0	1	$\boxed{m_2}$ $\rightarrow x'yz'$
0	1	1	1	$\boxed{m_3}$ $\rightarrow x'yz$
1	0	0	1	$\boxed{m_4}$ $\rightarrow xy'z'$
1	0	1	1	$\boxed{m_5}$ $\rightarrow xy'z$
1	1	0	0	m_6
1	1	1	0	m_7

$F = F_1 + F_2$

$= x'y + xy'$

ÖR => $F(A,B,C) = \Sigma m(3,4,6,7)$ en sade boolean ifadesini yazın.

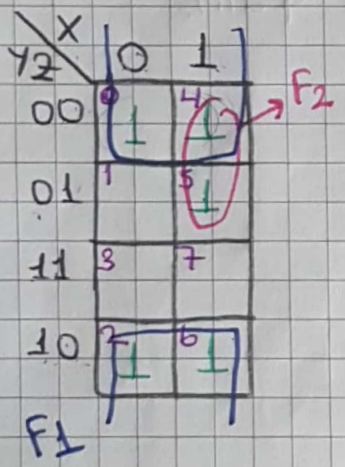


$F = F_1 + F_2$

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

$= AC' + BC$

ÖR => $F(x,y,z) = \Sigma m(0,2,4,5,6)$ en sade boolean ifadesini yazın.



$F = F_1 + F_2$

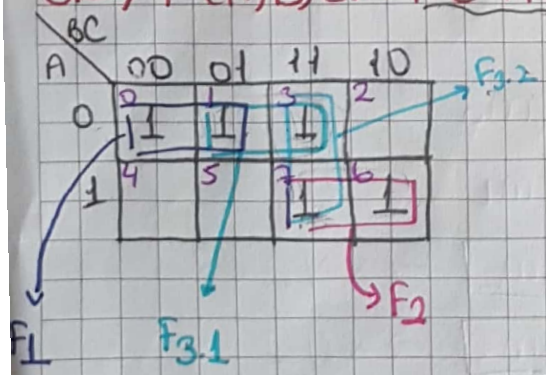
$= (m_0 + m_2 + m_4 + m_6) + (m_4 + m_5)$

$= (x'y'z' + x'yz' + xy'z' + xyz') + (xy'z' + xy'z)$

$= z' + xy'$

$y'z' + yz' + xy' = z'(\overset{1}{y + y'}) + xy'$

ÖR => $F(A,B,C) = A'C + AB + A'B'C'$ ifadesinin en sade halini k.map ile bulun.



Genişletelim

$\underbrace{A'BC}_{3} + \underbrace{A'B'C}_{1} + \underbrace{ABC'}_{6} + \underbrace{ABC}_{7} + \underbrace{A'B'C'}_{0}$

$F_1 \Rightarrow m_0 + m_1 = A'B'C' + A'B'C = A'B'$

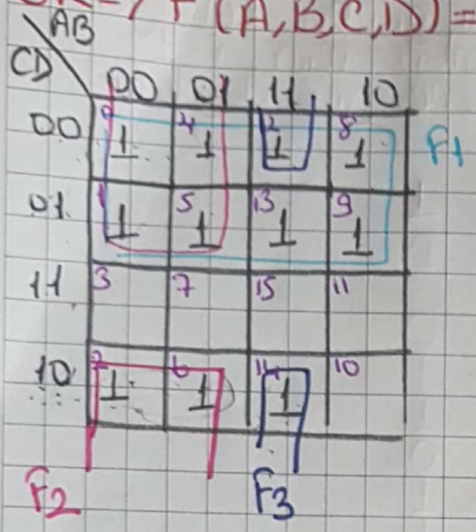
$F_2 \Rightarrow m_6 + m_7 = ABC' + ABC = AB$

$F_3 \Rightarrow (m_1 + m_3) + (m_3 + m_7) = A'C + BC$

$F = A'B' + AB + A'C$

$F = A'B' + AB + BC$

ÖR => $F(A,B,C,D) = \Sigma m(0,1,2,4,5,6,8,9,12,13,14)$ en sade halini bulun



$F_2 = m_2 + m_6 + m_0 + m_4 + m_1 + m_5 = A'D'$

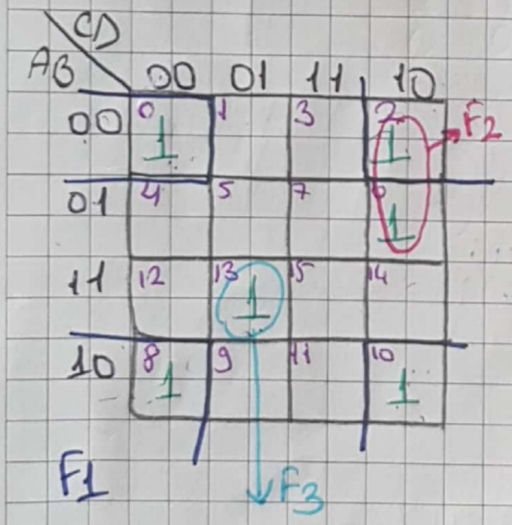
$F_1 = C'$

$F_3 = m_{12} + m_{14} = ABC'D' + ABCD' = ABD'$

$F = C' + A'D' + ABD'$

$F = C' + D'(A' + AB) = C' + A'D' + BD'$

ÖR => $F(A,B,C,D) = \Sigma m(0,2,6,8,10,13)$



$F_1 = m_0 + m_2 + m_8 + m_{10} = B'D'$

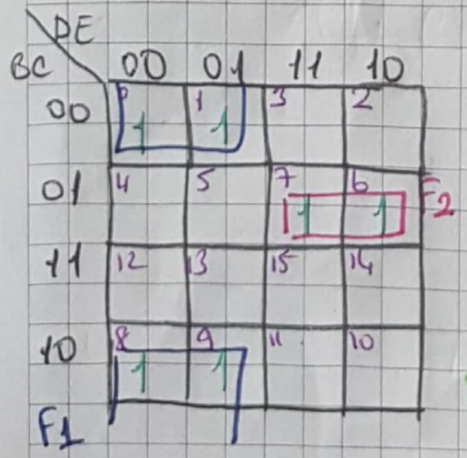
$F_2 = m_2 + m_6 = A'B'CD' + A'BCD' = A'CD'$

$F_3 = ABC'D$

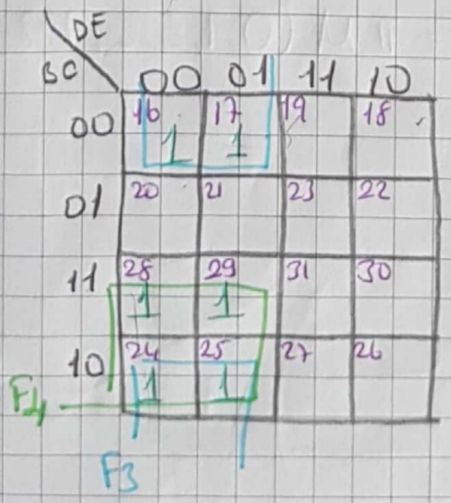
$F = B'D' + A'CD' + ABC'D$

ÖR => $F(A,B,C,D,E) = \Sigma m(0,1,6,7,8,9,16,17,24,25,28,29)$

A=0



A=1



$F_1 = m_0 + m_1 + m_8 + m_9$

$F_2 = m_7 + m_6$

$F_3 = m_{16} + m_{17} + m_{24} + m_{25}$

$F_4 = m_{24} + m_{25} + m_{28} + m_{29}$

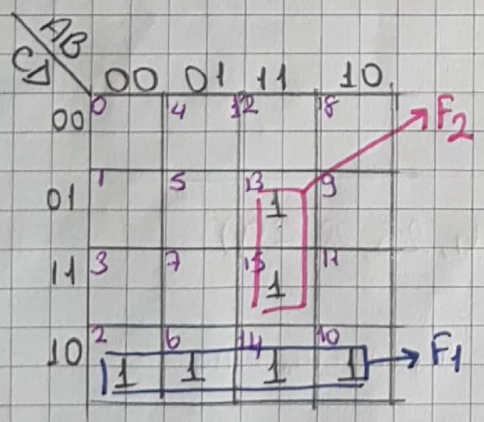
$F = F_1 + F_2 + F_3 + F_4 = A'C'D' + A'B'CD + AC'D' + ABD'$

$= C'D' + A'B'CD + ABD'$

ÖR=> 6-3-1-1 BCD kodu digitleri için hatalı girisleri belirleyen devre tasarlayınız. Çeçeri olmayan kod kombinasyonları için F=1 doğru kodlar için F=0 olduğunu varsayın. (4 tane giriş değişkeni olacaktır. (A, B, C, D)

8	4	2	1		
A	B	C	D	F	
0	0	0	0	0	
0	0	0	1	0	
0	0	1	0	1	m_2
0	0	1	1	0	
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	1	m_6
0	1	1	1	0	
1	0	0	0	0	
1	0	0	1	0	
1	0	1	0	1	m_{10}
1	0	1	1	0	
1	1	0	0	0	
1	1	0	1	1	m_{13}
1	1	1	0	1	m_{14}
1	1	1	1	1	m_{15}

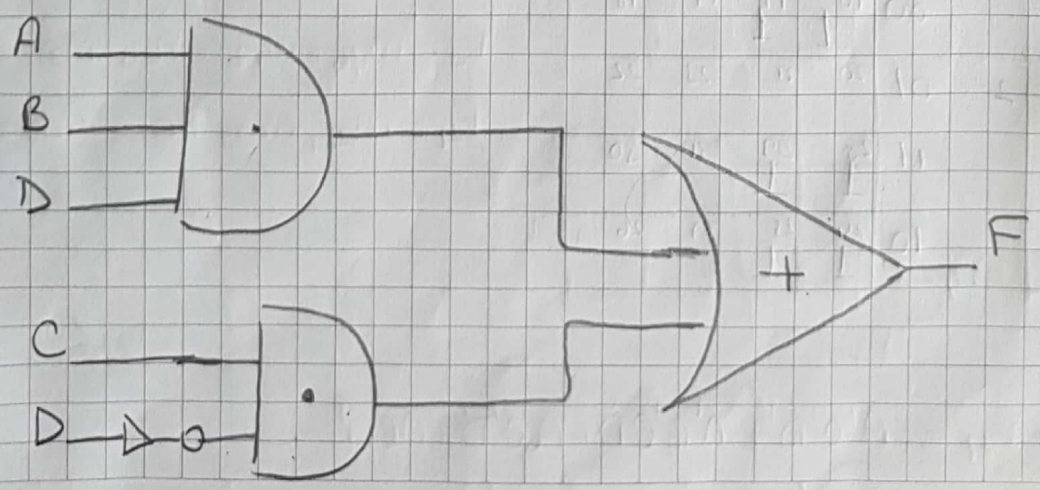
	6	3	1	1
	A	B	C	D
0	0	0	0	0
1	0	0	0	1
2	0	0	1	1
3	0	1	0	0
4	0	1	0	1
5	0	1	1	1
6	1	0	0	0
7	1	0	0	1
8	1	0	1	1
9	1	1	0	0



$$F = F_1 + F_2$$
$$= CD' + ABD$$

$$F = \Sigma m(2, 6, 10, 13, 14, 15)$$

$$F = \Pi M(0, 1, 3, 5, 7, 8, 9, 11)$$

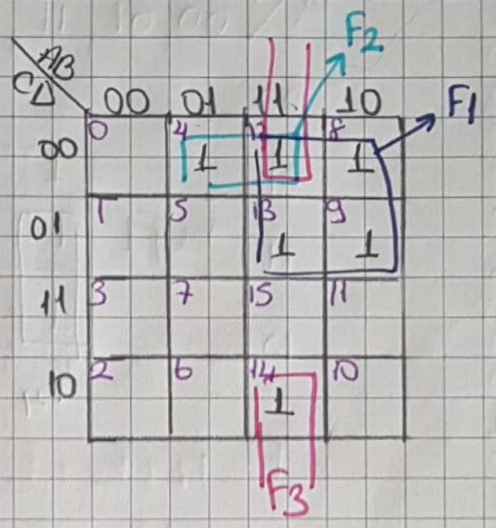


ÖR=> iki bitlik iki sayıyı karşılaştıran bir devre tasarlayınız. X>Y ise devre 1 çıktısı, eğer X≤Y ise 0 çıktısı veriyor. Temel lojik kapılar kullanarak devreyi tasarlayın.

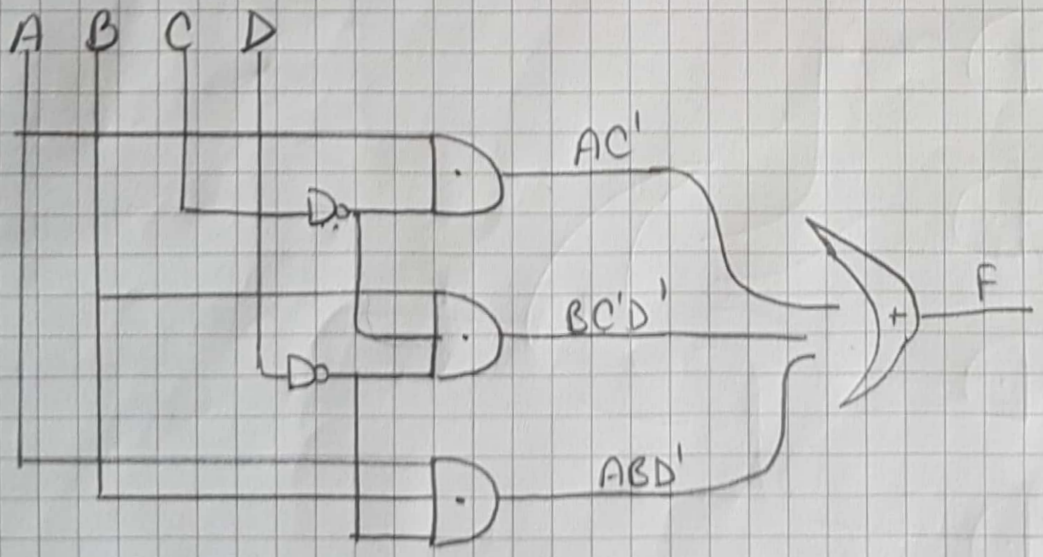
$X = AB \quad Y = CD$

$X > Y$ çıktı 1
$X \leq Y$ çıktı 0

8	4	2	1		
A	B	C	D	F	
0	0	0	0	0	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	1	m_4
0	1	0	1	0	
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	1	m_8
1	0	0	1	1	m_9
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	1	m_{12}
1	1	0	1	1	m_{13}
1	1	1	0	1	m_{14}
1	1	1	1	0	

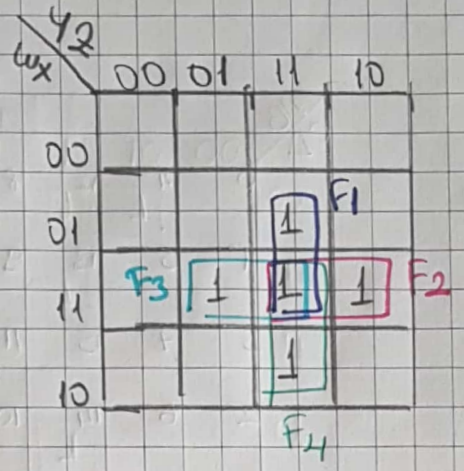


$$F = F_1 + F_2 + F_3$$
$$= AC' + BC'D' + ABD'$$



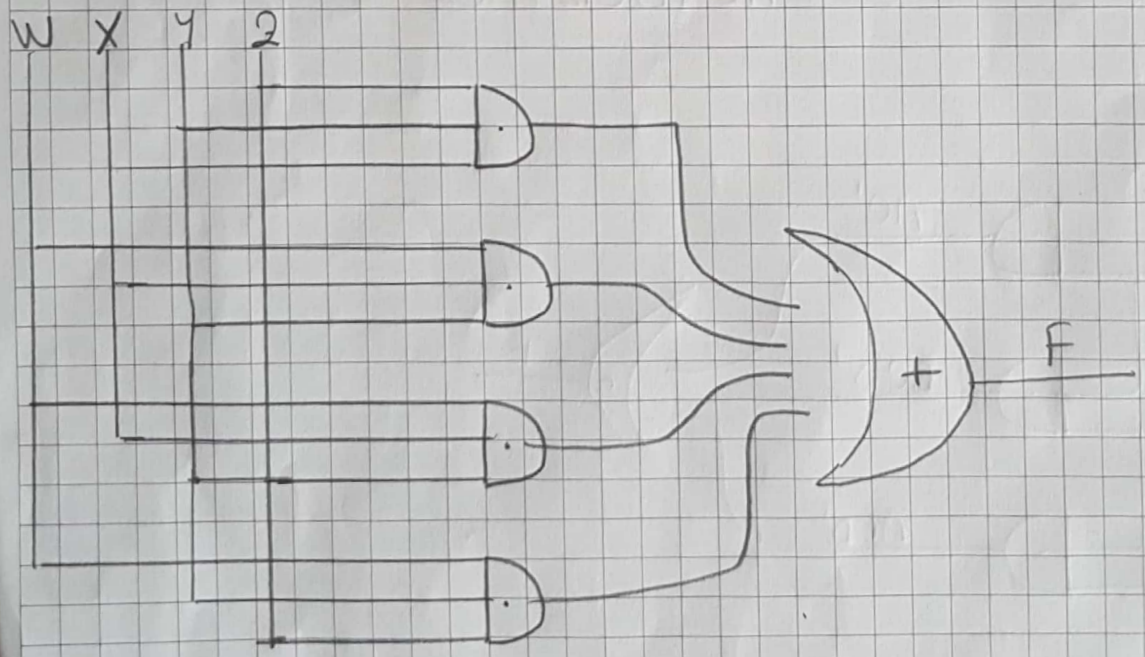
ÖR => 3 ve 4 girişli bir devrede girişin içerdiği 1'lerin sayısı 0'ların sayısından çok ise çıkış 1 olmakta, diğer durumlarda ise 0 olmaktadır. Devrenin doğruluk tablosunu oluşturup boolean ifadesini yazınız. Devreyi tasarlayın.

W	X	Y	Z	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1



$F = F_1 + F_2 + F_3 + F_4$

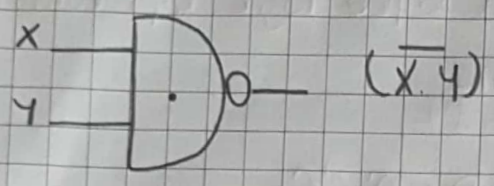
$= XYZ + WXY + WXZ + WYZ$



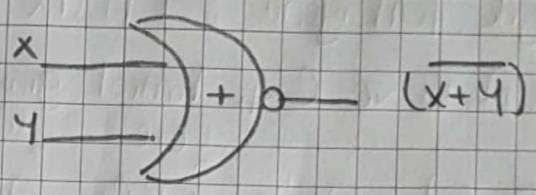
25.11.19

NAND ve NOR KAPILARI

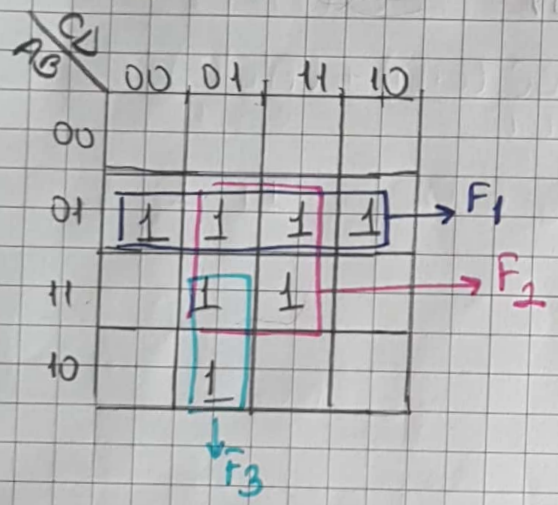
Nand → not and



NOR → not or

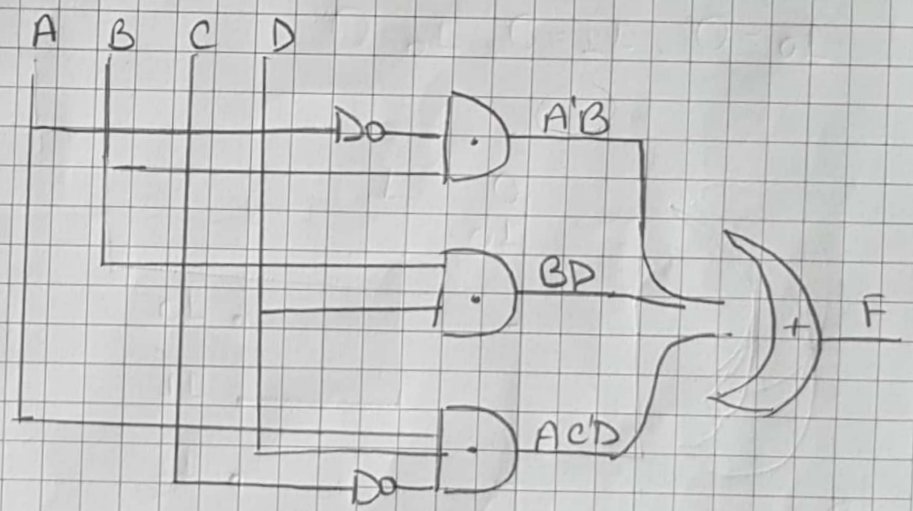


ÖR=> $F(A,B,C,D) = \Sigma m(4,5,6,7,9,13,15)$ ifadesini iki basamaklı AND-OR ve NAND-NAND devreleri ile gerçekleştiriniz.



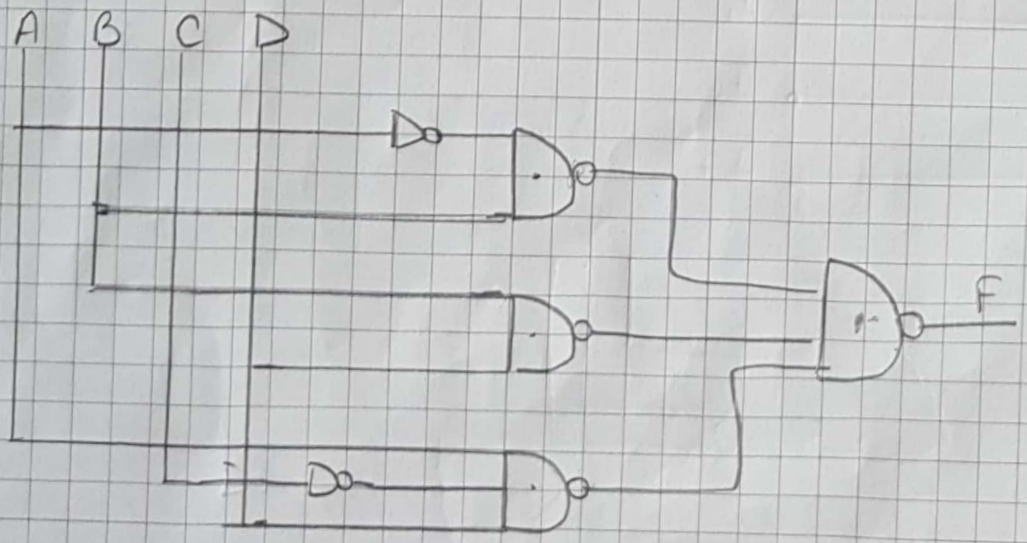
$F = F_1 + F_2 + F_3$

$F = A'B + BD + AC'D$



$F = \overline{\overline{A'B + BD + AC'D}}$

$F = \overline{(\overline{A'B}) \cdot (\overline{BD}) \cdot (\overline{AC'D})}$



SINAV => Multiplexers

Aşağıdaki lojik fonksiyonu 8-1 MUX ve minimum sayıda lojik kapı kullanarak gerçekleştiriniz. A, B ve C'yi kontrol girişi olarak seçiniz.

$$F(A,B,C,D,E) = AB'DE + BCE + A'CD + AB'CD + A'B'C$$

$(E+E')$ $(A+A')$ $(B+B')$

$$F = \underline{AB'CDE} + AB'C'DE + ABCE + \underline{A'BCE} + \underline{A'BCD} + \underline{A'B'CD} + \underline{AB'CD} + \underline{A'B'C}$$

$$= AB'C(DE+D) + AB'C'DE + ABCE + A'BC(E+D) + A'B'C(D+1)$$

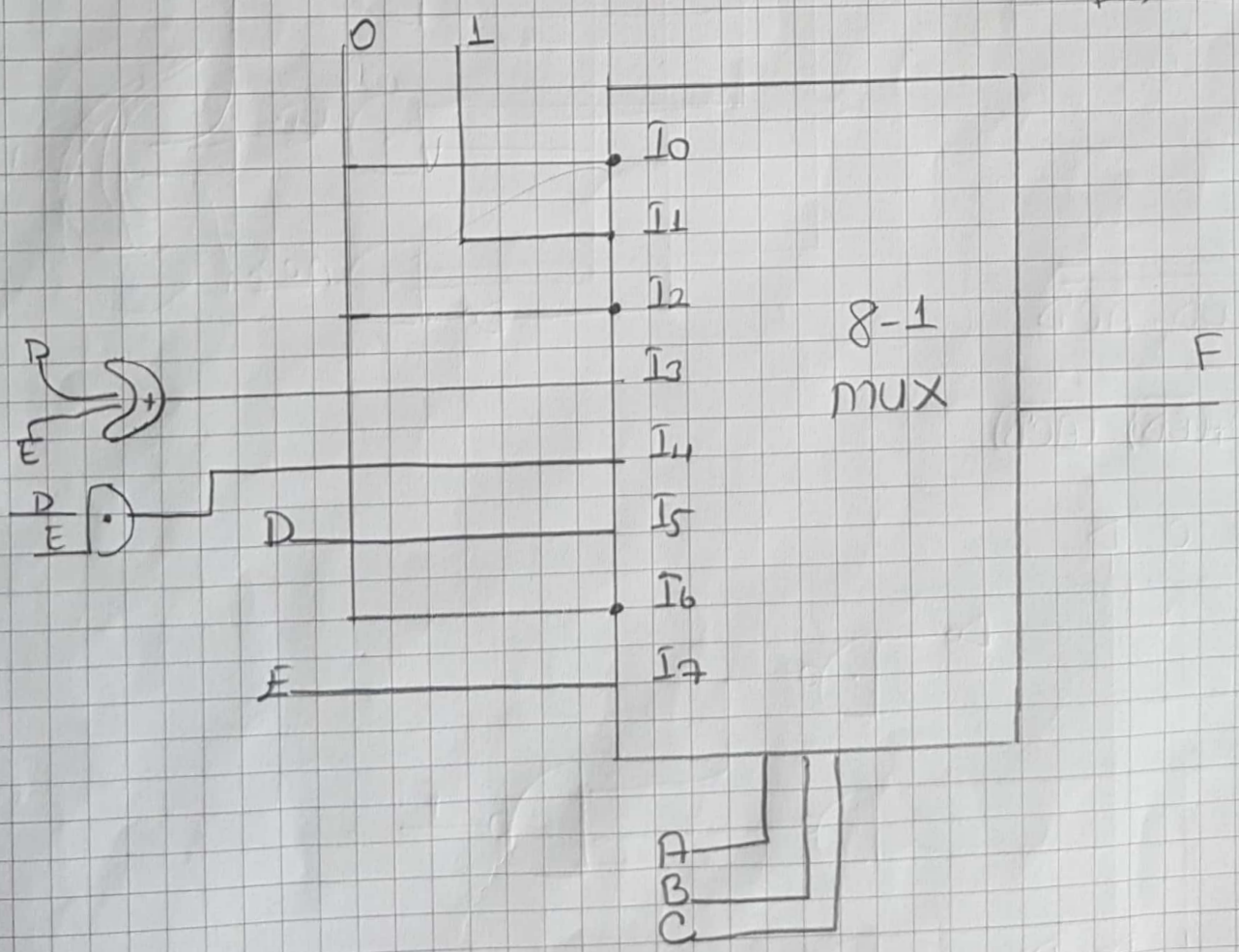
$$= AB'C(D) + (AB'C')(DE) + ABC(E) + A'BC(E+D) + (A'B'C)$$

101 100 111 011 001

$I_5 = D$ $I_4 = DE$ $I_7 = E$ $I_3 = E+D$ $I_1 = 1$

$I_0 = 0$, $I_2 = 0$, $I_6 = 0$

$D(E+1)$



ÖR => Multiplexers

Aşağıdaki lojik fonksiyonu (denklemi) 4-e-1 MUX ve en az (minimum sayıda) lojik kapı kullanarak gerçekleştirin. A ve B yi kontrol girişleri olarak seç.

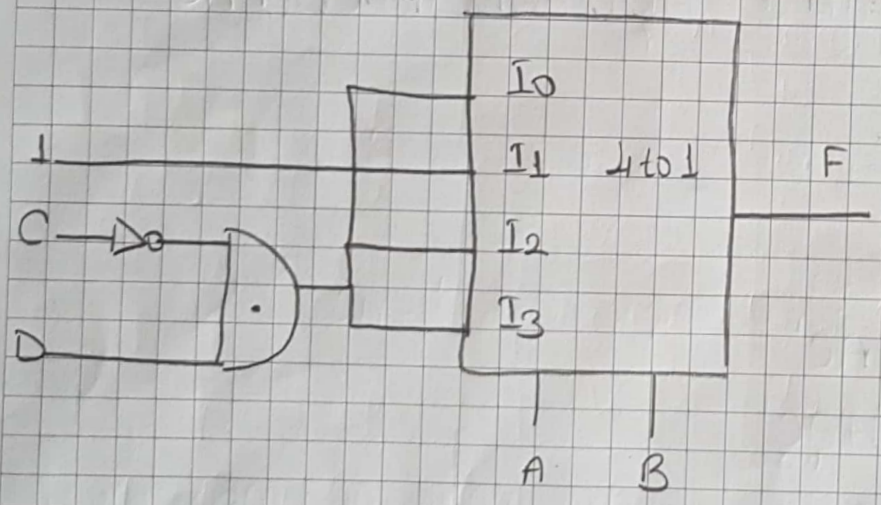
$$F(A,B,C,D) = A'BC + C'D + A'B$$

$$F = A'BC + C'D(A+A')(B+B') + A'B$$

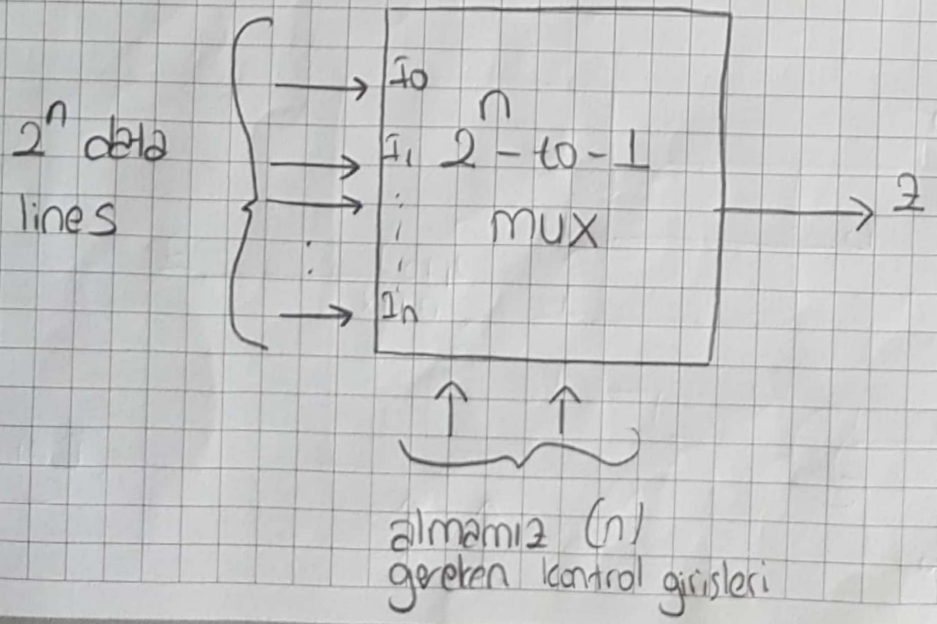
$$= A'BC + ABC'D + A'BC'D + AB'C'D + A'B'C'D + A'B$$

$$= \underset{0\ 1}{A'B}\,\cancel{(C + C'D + 1)} + \underset{1\ 1}{ABC'D} + \underset{1\ 0}{AB'C'D} + \underset{0\ 0}{A'B'C'D}$$

$\boxed{I_1 = 1}$ $\boxed{I_3 = C'D}$ $\boxed{I_2 = C'D}$ $\boxed{I_0 = C'D}$



Multiplexers Genel Formu



Multiplexers 2^4 → MAXTERM

ÖR ⇒ $F(A,B,C,D) = \Pi M(2,6,11)$ devresini

a) 4 to 1 mux ile A ve C'yi kontrol girişi alınarak gerçekleştiriniz.
b) 8 to 1 " " A, B ve C " " " " "

8 A	4 B	2 C	1 D	F	
0	0	0	0	1	→ $I_0 = 1$
0	0	0	1	1	
0	0	1	0	0	$I_1 = D$
0	0	1	1	1	
0	1	0	0	1	$I_2 = 1$
0	1	0	1	1	
0	1	1	0	0	$I_3 = D$
0	1	1	1	1	
1	0	0	0	1	$I_4 = 1$
1	0	0	1	1	
1	0	1	0	1	$I_5 = D'$
1	0	1	1	0	
1	1	0	0	1	$I_6 = 1$
1	1	0	1	1	
1	1	1	0	1	$I_7 = 1$
1	1	1	1	1	

BD \ AC	00	01	11	10
00	0: 1	2: 0	10: 1	8: 1
01	1: 1	3: 1	11: 0	9: 1
11	5: 1	7: 1	15: 1	13: 1
10	4: 1	6: 0	14: 1	12: 1
	I_0	I_1	I_3	I_2

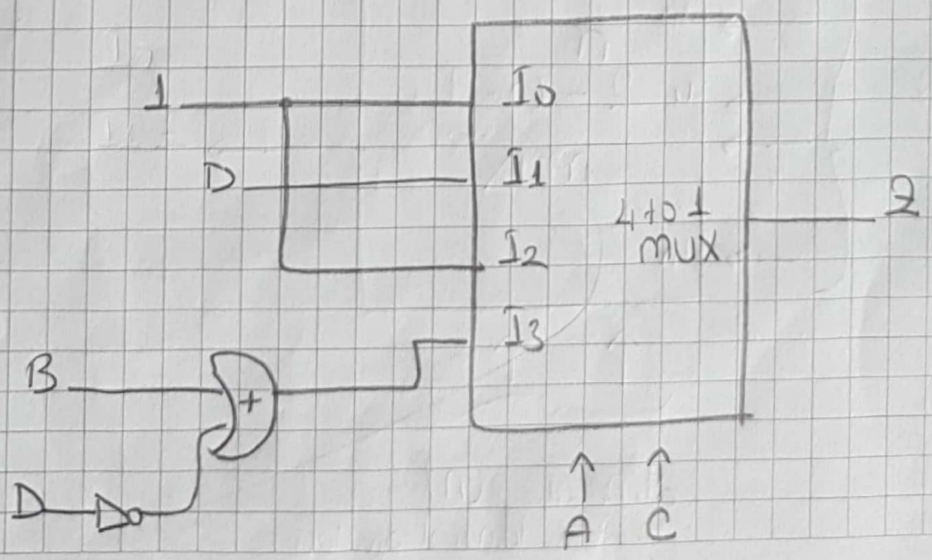
$= A'C' + A'CD + ABC + ACD' + AC'$

a) A ve C kontrol girişi alınarak;

$= A'C' + A'CD + ACB + ACD' + AC'$

$= \underset{0\,0}{A'C'} + \underset{0\,1}{A'CD} + \underset{1\,1}{AC}(B+D') + \underset{1\,0}{AC'}$

$\boxed{I_0 = 1}$ $\boxed{I_1 = D}$ $\boxed{I_3 = B + D'}$ $\boxed{I_2 = 1}$



Devamı →

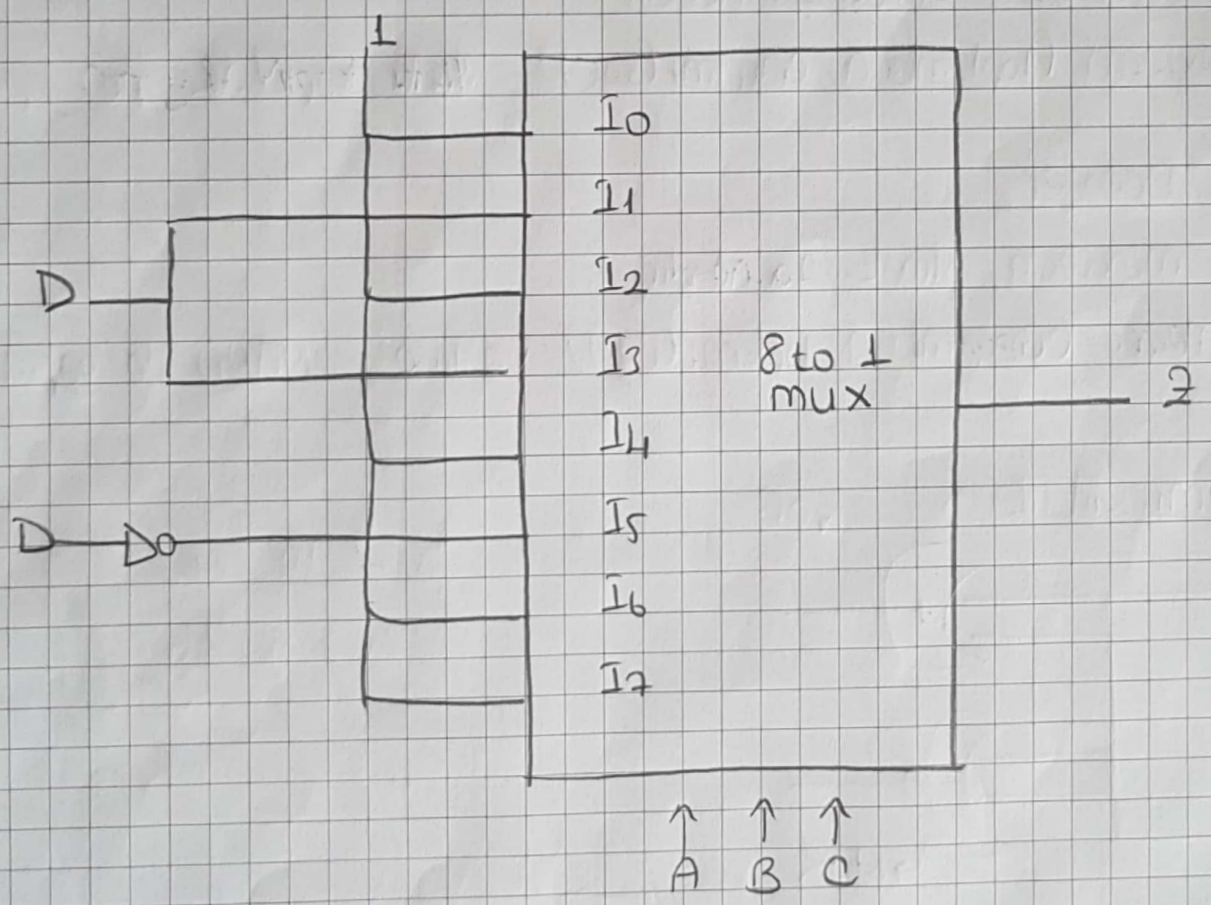
b) A, B ve C kontrol girişi alınarak;

$= A'C' + A'CD + ABC + ACD' + AC'$

$= A'B'C' + A'BC' + A'B'CD + A'BCD + ABC + ABCD' + AB'CD' + ABC' + AB'C'$

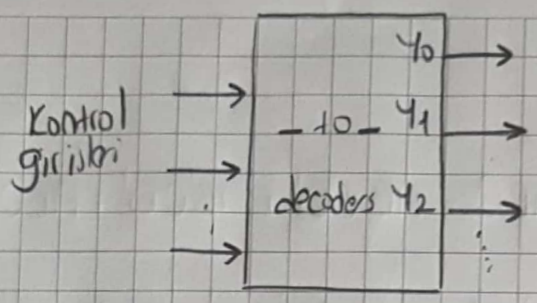
$= A'B'C' + \underset{0\,1\,0}{A'BC'} + \underset{0\,0\,1}{A'B'CD} + \underset{0\,1\,1}{A'BCD} + ABC(1+D') + \underset{1\,0\,1}{AB'CD'} + ABC' + AB'C'$

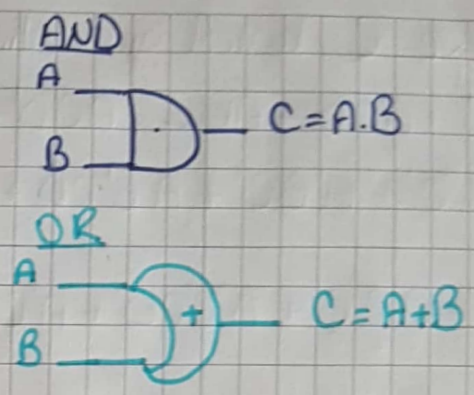
$\boxed{I_0 = 1}$ $\boxed{I_2 = 1}$ $\boxed{I_1 = D}$ $\boxed{I_3 = D}$ $\boxed{I_7 = 1}$ $\boxed{I_5 = D'}$ ✓ $\boxed{I_6 = 1}$ $\boxed{I_4 = 1}$



Decoders

ters=tümleyen





Terslenmemiş Decoder

→ Çıktılar minterm olmak zorundadır.

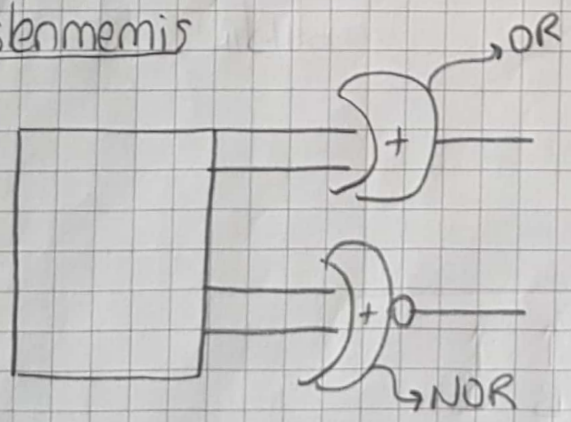
→ Eğer maxterm (toplamların çarpımı (SOP)) verilirse NOR ile yapın.

Terslenmiş Decoder

→ Çıktılar maxterm olmak zorundadır.

→ Eğer minterm (çarpımların toplamı (POS)) verilirse NAND ile yapın.

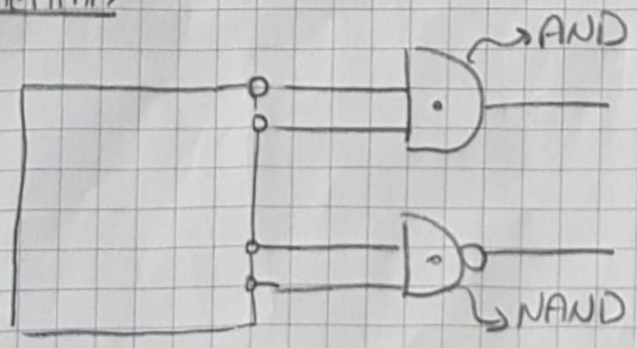
Terslenmemiş



2 to 4

4 to 16

Terslenmiş



terslenmiş

SINAV => Aşağıdaki lojik fonksiyonları çıkışı tümleyenlenmiş decoder, bir AND ve bir NAND lojik kapıları kullanarak gerçekleştirin.

$F_1(A,B,C,D) = AB'D + CD + A'D'$ → minterm (Çarpımların toplamı SOP)

$= AB'D(C+C') + CD(A+A')(B+B') + A'D'(B+B')(C+C')$

AB \ CD	00	01	11	10
00	1 (0)	(1)	1 (3)	1 (2)
01	1 (4)	(5)	1 (7)	1 (6)
11	(12)	(13)	1 (15)	(14)
10	(8)	1 (9)	1 (11)	(10)

$A' = 0$, $A = 1$ } 1 koyarken

$F_1 = \Sigma m(0,2,3,4,6,7,9,11,15)$

*terslenmiş decoder olduğundan minterm $\boxed{\text{NAND}}$ ile çıkar.

$F_2(A,B,C,D) = (A'+C+D)(B'+D')$ → maxterm (toplamların çarpımı POS)

$= (A'+C+D+BB')(B'+D'+AA'+CC')$

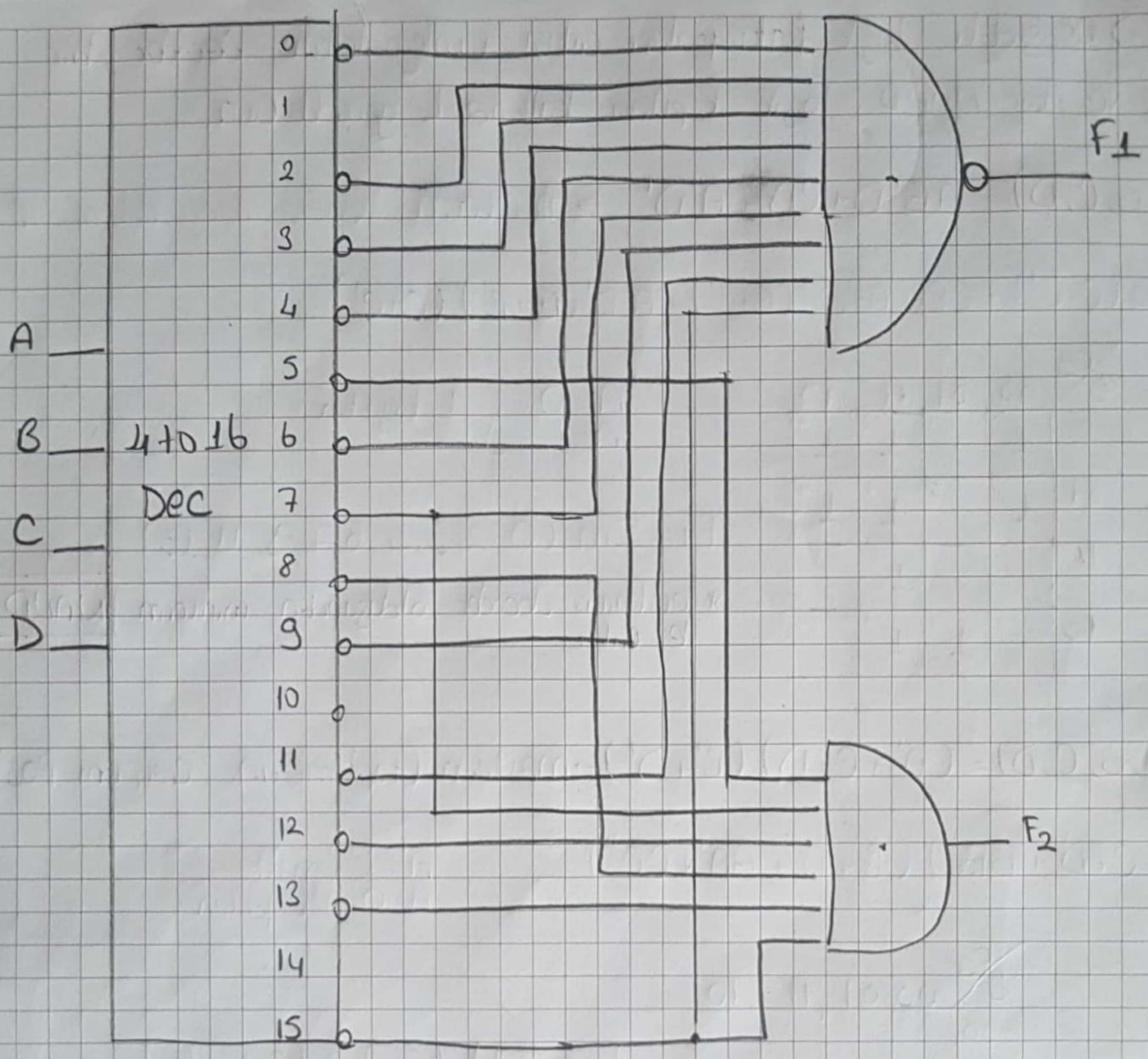
$A' = 1$, $A = 0$ } sıfır koyarken

AB \ CD	00	01	11	10
00	(0)	(1)	(3)	(2)
01	(4)	0 (5)	0 (7)	(6)
11	0	0	0	
10	0			

$F_2 = \Pi M(5,7,8,12,13,15)$

(AND)

→


A
B
C
D
4 to 16
Dec
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
F1
F2