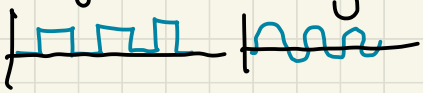
Lojik Devreler

Google Classroom = bljvucr

İşaretler → Dijital ve Analog



4 bit = nibble
2 byte = word

$$q = \frac{V_{max}}{2^n - 1}$$

q: çözünürlük, n: bit adeti

ÖR/ 4 bitlik bi DAC devresinin çıkış gerilim aralığı 0V ile 6V arasında. 0000 sayısal girişi 0V'a, 1111 6V'a karşılık geliyor

0000 | 0V
0001 | ?
0010 | 0,8 → 0,4

$$q = \frac{6V}{2^4 - 1} = \frac{6}{15} = 0,4$$

$q = 0,4$ → çözünürlük

Devamında binary to decimal, hexadecimal to decimal örnekleri çözdük

ÖR/ $(33)_{10} = (?)_2$

33 | 2
-32 | 16 | 2
1 | 0 | 8 | 2
0 | 4 | 2
0 | 2 | 2
0 | 1

LSB: 0, MSB: 1

100001

ÖR/ $(153.51)_8 = (?)_{10}$

8^2 8^1 8^0 8^{-1} 8^{-2}

$64 \times 1 + 8 \times 5 + 1 \times 3 = 107.\frac{41}{64}$

$\frac{5}{8} + \frac{1}{64}$

ÖR/ $(1001\,1100\,0011)_2 = (?)_{16}$

9 | 12 | 3

12 = C

$(9C3)_{16}$

Çıkarma işleminde

2's complement kullanılır

ters çevir +1 ekle

2's complement OR

```
 10011
-10100
-------
 00001
```

```
 10100  →  01011
              +  1
            -------
            01100
```

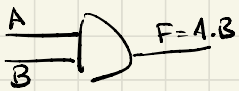
```
 10011
+01100
-------
 11111
```

Elde olsa sayı Pozitif olur
elde yok sayı negatif sayının
ne olduğunu anlamak için tekrar
2's complement yapacağız

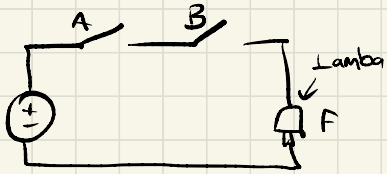
```
 00000
+    1
-------
 00001   → Sayımız -1
```

3 fazlalık Kodu, Aiken, Grey,

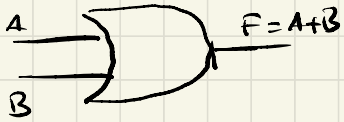
Ve (AND) işlemi



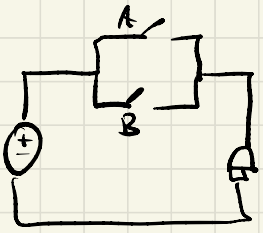
A	B	F=A.B
0	0	0
0	1	0
1	0	0
1	1	1



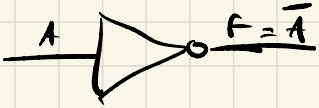
Veya (OR) işlemi



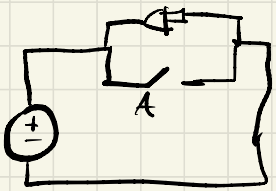
A	B	F=A+B
0	0	0
0	1	1
1	0	1
1	1	1



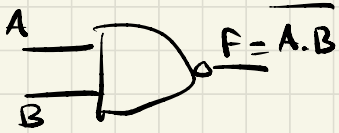
Tümleme işareti (NOT)



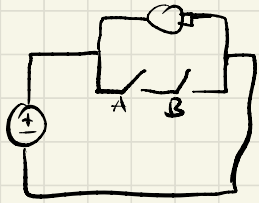
A	F=Ā
0	1
1	0



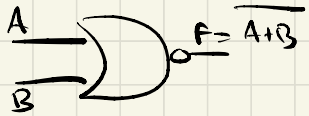
Tümleyen Ve işlemi (NAND)



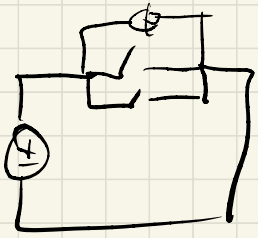
A	B	F=A.B
0	0	1
0	1	1
1	0	1
1	1	0



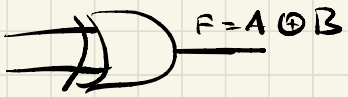
Tümleyen Veya işlemi (NOR)



A	B	F=A+B
0	0	1
0	1	0
1	0	0
1	1	0



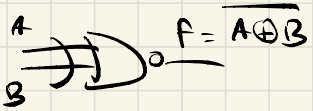
YA DA - ÖZEL VEYA (XOR)



$F = A \oplus B = \bar{A}B + A\bar{B}$

A	B	F = A⊕B
0	0	0
0	1	1
1	0	1
1	1	0

TYA DA - VEYA Değil (X NOR)



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

2. hafta Bitimi

3. hafta Başlangıcı

Slayttan devam et. H01 2

Sayfa 26'ya kadar

ÖR: $(\bar{A} + ABC)(A + \bar{C}) = ?$

OR: $\bar{A}\bar{B}\bar{C} + A(C\bar{D} + \bar{B}) = ?$

$\bar{A}\bar{B}\bar{C} + AC\bar{D} + A\bar{B}$

$\bar{B}(A + \bar{A}\bar{C}) + AC\bar{D}$

$\bar{B}(A + \bar{C}) + AC\bar{D}$

OR: $(A\bar{B} + C)(\bar{B}D + \bar{C}\bar{E}) + \overline{(AB + C)}$

$(x + \bar{x})\,\bar{x} + \cdot\overline{(AB + C)} + (\bar{B}D + \bar{C}\bar{E})$

$(\bar{A} + \bar{B} \cdot \bar{C})$ $(\bar{A} + B + C)$

$(\bar{A}\bar{B} + \bar{A}\bar{C})$

Minterm - Maxterm

X	Y	Z	F	
0	0	0	0	$\rightarrow X + Y + Z$
0	0	1	1	$\rightarrow \bar{X}\bar{Y}Z$
0	1	0	0	$\rightarrow X + \bar{Y} + Z$
0	1	1	1	$\rightarrow \bar{X}YZ$
1	0	0	0	$\rightarrow \bar{X} + Y + Z$
1	0	1	0	$\rightarrow \bar{X} + \bar{Y} + Z$
1	1	0	1	$\rightarrow X\bar{Y}Z$
1	1	1	1	$\rightarrow XYZ$

Sum of Product

$f(x,y,z) = M_1 + M_3 + M_6 + M_7$

$= \bar{x}\bar{y}z + \bar{x}yz + xy\bar{z} + xyz$

$F(x,y,z) = M_0 \cdot M_2 \cdot M_4 \cdot M_5$

$= (x+y+z)(x+\bar{y}+z)(\bar{x}+y+z)(\bar{x}+\bar{y}+z)$

Product of Sum

ÖR= $f(a,b,c) = ab + ac$

1-) Doğruluk Tablosu?

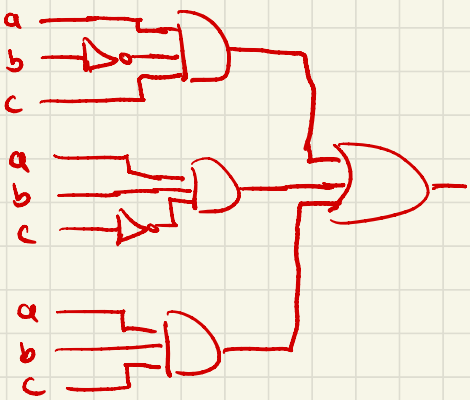
2-) min ve max terimleri yazılacak

3-) Lojik kapılarda minterm ve maxterm tasarımları yapılacak.

a	b	c	f	
0	0	0	0	$\rightarrow a+b+c$
0	0	1	0	$\rightarrow a+\bar{b}+\bar{c}$
0	1	0	0	$\rightarrow a+\bar{b}+c$
0	1	1	0	$\rightarrow a+\bar{b}+\bar{c}$
1	0	0	0	$\rightarrow \bar{a}+b+c$
1	0	1	1	$\rightarrow a\bar{b}c$
1	1	0	1	$\rightarrow ab\bar{c}$
1	1	1	1	$\rightarrow abc$

$f(a,b,c) = M_0 . M_1 . M_2 . M_3 . M_4$

$f(a,b,c) = m_5 + m_6 + m_7$



ÖR = $f(a,b,c,d) = \bar{c}d(a+b) + cd(a+b)$

$= (a+b)d$

a	b	c	d	F
0	0	0	0	0 → $a+b+c+d$
0	0	0	1	0 → $a+b+c+\bar{d}$
0	0	1	0	0 → $a+b+\bar{c}+d$
0	0	1	1	0 → $a+b+\bar{c}+\bar{d}$
0	1	0	0	
0	1	0	1	1 → $\bar{a}b\bar{c}d$
0	1	1	0	0 → $a+\bar{b}+\bar{c}+d$
0	1	1	1	1 → $\bar{a}bcd$
1	0	0	0	0 → $\bar{a}+b+c+d$
1	0	0	1	1 → $a\bar{b}\bar{c}d$
1	0	1	0	0 → $\bar{a}+b+\bar{c}+d$
1	0	1	1	1 → $ab\bar{c}d$
1	1	0	0	0 → $\bar{a}+\bar{b}+c+d$
1	1	0	1	1 → $ab\bar{c}d$
1	1	1	0	0 → $\bar{a}+\bar{b}+\bar{c}+d$
1	1	1	1	1 → $abcd$

$F(a,b,c,d) = M_5 + M_7 + M_9 + M_{11} + M_{13} + M_{15}$

$F(a,b,c,d) = M_0 \cdot M_1 \cdot M_2 \cdot M_3 \cdot M_4 \cdot M_6 \cdot M_8 \cdot M_{10} \cdot M_{12} \cdot M_{14}$

$\bar{c}d(a+b) + cd(a+b)$

$(b\bar{b})a\bar{c}d + b\bar{c}d + acd + bcd$

$a\bar{b}\bar{c}d + ab\bar{c}d + \bar{a}b\bar{c}d + a\bar{b}cd + abcd + \bar{a}bcd$

Literal → L = kaç değişken kullanıldığı yazılır

Gate → kapıların kaç girişle kullanıldığı

GN → " " " " ve not kapılarını ekle

$F = ABC + \bar{A}\bar{B}\bar{C}$

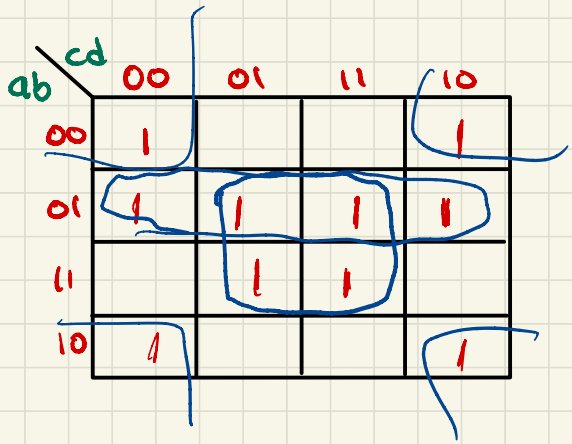
L = 6

G = 8

GN = 11

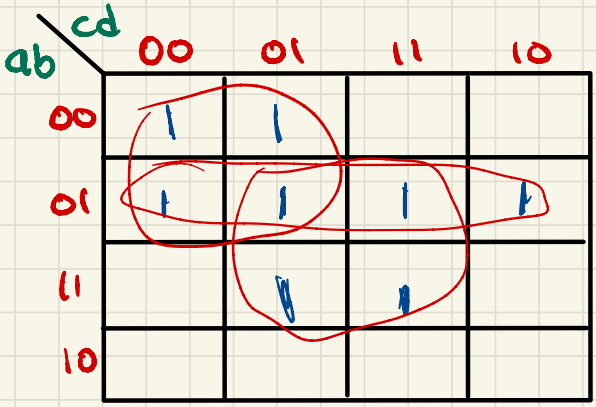
~ Karnaugh Maps ~

AYRIK Matematik ten bak.

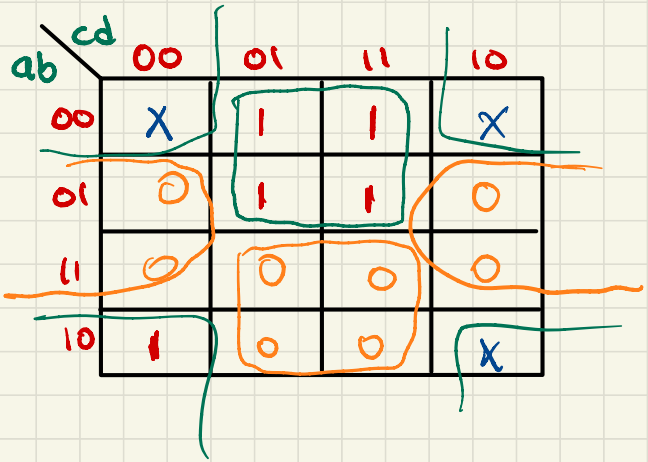


$x'z' \quad w'x \quad xz$

$b'd' + ab + bd$

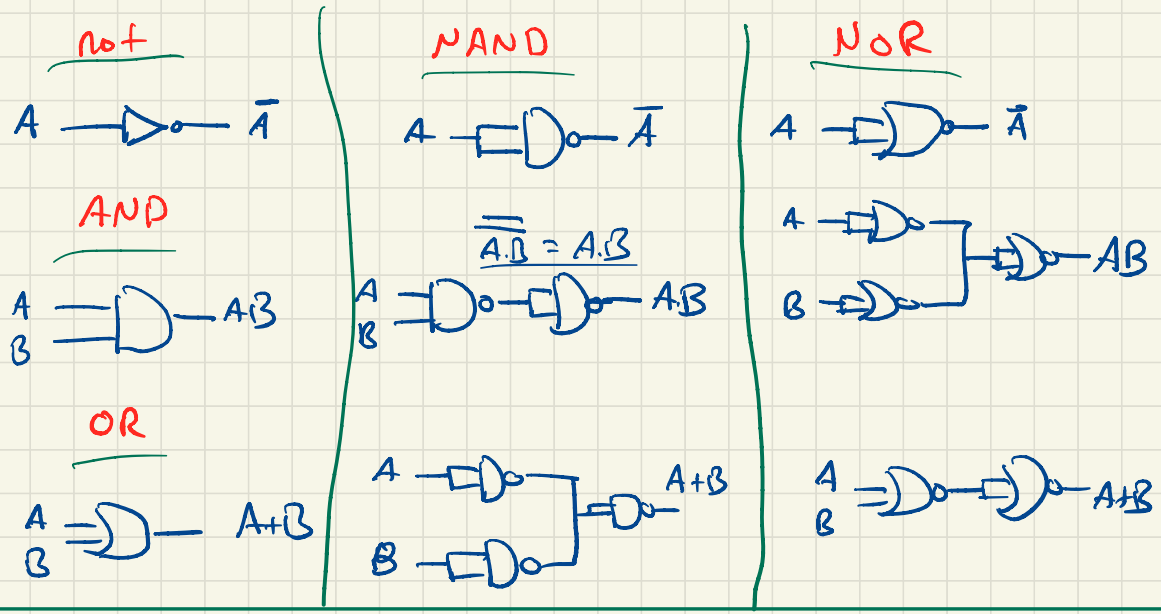


$\bar{a}\bar{c} + bd + \bar{a}b$



$a'd + b'd'$

● → maxterm



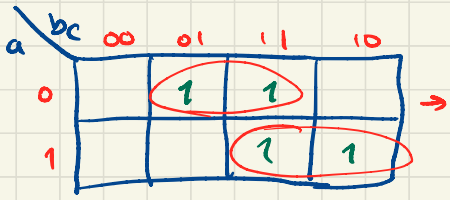
Ör $f(a,b,c) = \bar{a}\bar{b}c + \bar{a}bc + ab\bar{c} + abc$

① → indirgeyiniz K-Map

② → lojik diyagramı NAND ile gerçekleyiniz.

③ → " " NOR " "

① →



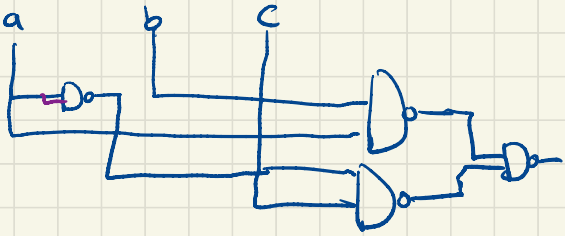
$f = \bar{a}c + ab \rightarrow \overline{\overline{(\bar{a}c)} + \overline{(ab)}}$

$\rightarrow \overline{(\bar{a}c)}.\overline{(ab)}$

$\bar{\bar{f}} = f$

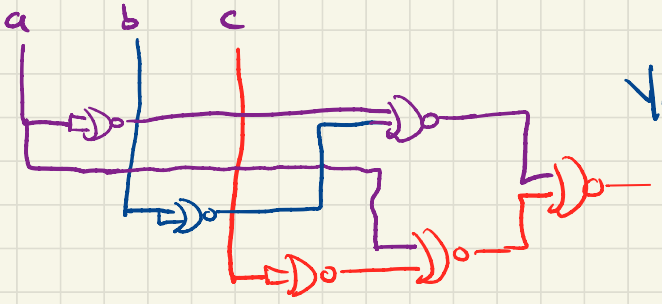
② →

$\overline{(\bar{a}c)}.\overline{(ab)}$



③

$\overline{(a+\bar{c}).(\bar{a}+\bar{b})} = \overline{(a+\bar{c})} + \overline{(\bar{a}+\bar{b})}$



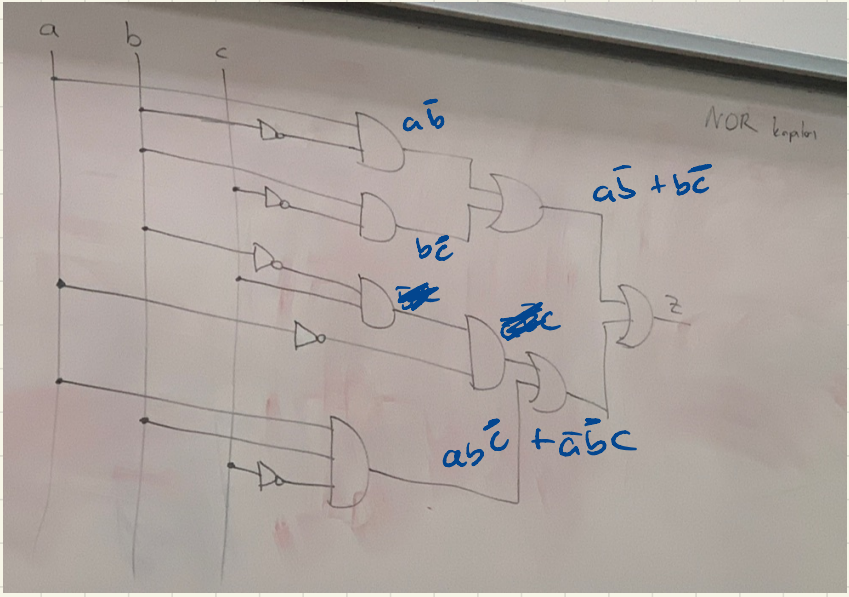
Yanlış olabilir !

ÖR

$f(a,b,c) = (a+b)(\bar{a}+c)$

① → Lojik diyagramını NOR ile gerçekleşiniz

$\bar{\bar{F}} \rightarrow \overline{\overline{(a+b)} + \overline{(\bar{a}+c)}}$



$F = ?$

$$f(a,b,c) = ab\bar{c} + \bar{a}\bar{b}c + a\bar{b} + b\bar{c}$$

ÖR

a	b	c	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

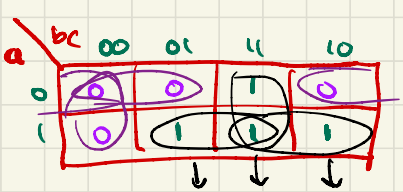
ⓐ SOP şeklinde z fonksiyonu(kırmızı)

ⓑ NAND

ⓒ NOR

ⓓ elemen karmaşıklığı açısından hangi tür tasarımın kullanılması gerektiğini kıyaslayınız.

ⓐ → $f(a,b,c) = \bar{a}bc + a\bar{b}c + ab\bar{c} + abc$



Minterm ← $ac + bc + ab$

$(a+b)(a+c)(b+c)$

↓

maxterm

$\bar{a}bc +$

$a+b+c$

(b) → $\bar{\bar{f}} = f$ $\quad \overline{(\bar{a}c)(\bar{b}c)(\bar{a}\bar{b})}$ → nand için

(c) → $\bar{\bar{f}} = f$ $\quad \overline{(\bar{a}+b)+(\bar{b}+c)+(\bar{a}+c)}$ → nor için

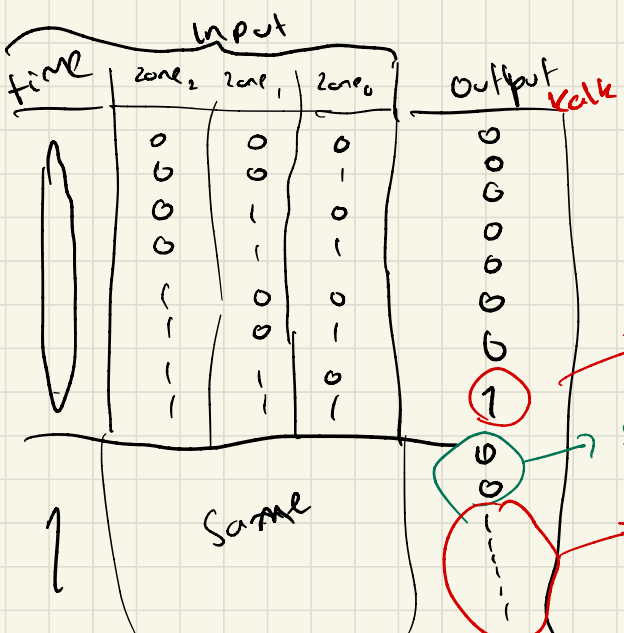
KOMBİNASYONSAL DEVRELER

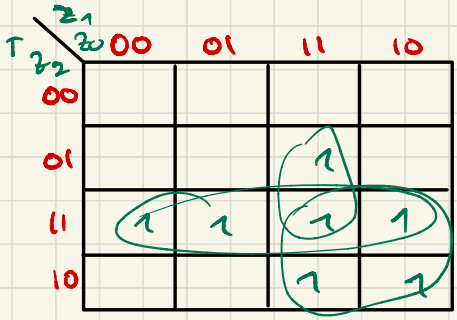
SORU Bir hava alanından şehir merkezine 20 dk'da bir helikopter seferi düzenlenmektedir. Helikopterlerde bulunan bir sayıcı değişkeni kadın helikoptere binen yolcuları saymaktadır. Helikopterler 7 kişiliktir. Helikopterlerin kalkması için

- Kalkış zamanı henüz gelmediyse helikopterin dolmuş olması
- " " geldiyse, içinde en az 2 yolcu olması gerekmekte

Pilotun kalkabilmesi için gerekli işareti verecek kombinasyonsal lojik devreyi tasarlayınız.

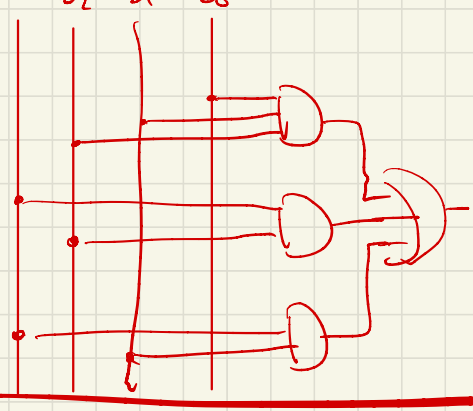
if zone = 7 ✓ time don't care ×
if zone ≥ 2 ✓ time care ✓





minterm

$$f_{kalk} = T_{z_2} + T_{z_1} + A_2 A_1 A_0$$



- (Toplama / Çıkarma) Aritmetik işlemler
  - Yarı toplayıcı devre
  - Tam toplayıcı devre
  - Yarı çıkarıcı
  - Tam çıkarıcı
  - Tam Toplama / Çıkarma Devresi
- Seçiciler
- Kod Çözücüler (Decoder - DEC)
- Kodlayıcılar (Encoder - ENC)
- Dağıtıcılar (Demux - Demultiplexer)
- ALU

Yarı Toplayıcı

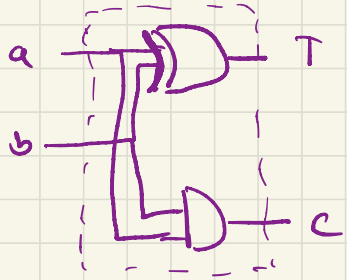
a	b	T	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

a \ b	0	1
0	0	1
1	1	0

$T = a \oplus b$

a \ b	0	1
0	0	0
1	0	1

$C = a \cdot b$



Tam Toplayıcı

Eg	a	b	T	C
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

T

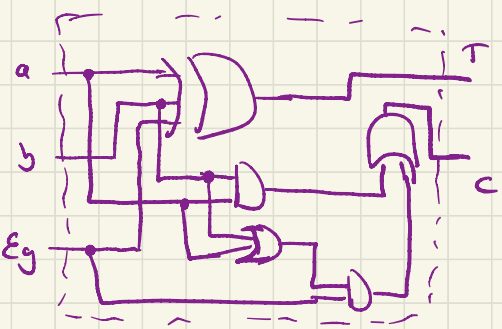
Eg \ ab	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$T = Eg \oplus a \oplus b$

C

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

$C = ab + Eg(b+a)$



Yarı Çıkarma

a	b	F	B
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

$F = a \oplus b$

$B = \bar{a} \cdot b$

35
-5
15

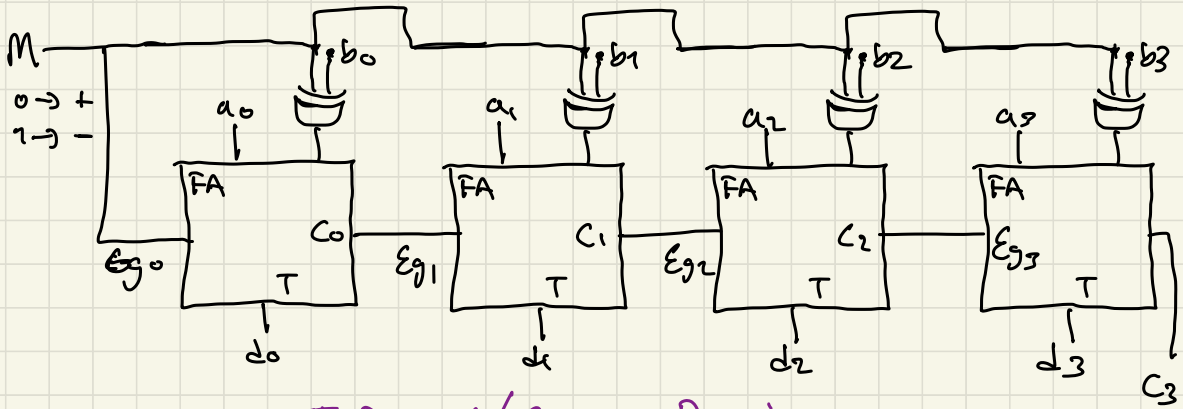
Tam Çıkarma

a	b	ε_g	F	B
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

$F = a \oplus b \oplus \varepsilon_g$

$B = b \cdot \varepsilon_g + \bar{a}\varepsilon_g + \bar{a}b$

$B = b\varepsilon_g + \bar{a}(\varepsilon_g + b)$



TOPLAMA / Çıkarma Devresi

4 girişli 1 çıkışlı deneye doğal BCD kodundaki sayıyı 2 veya 3 e tam bölünebiliyorsa logic 1 oluşturmak istiyor.

a) T.T = ?
b) Çıkış ifadesini indirgeyiniz.
c) Nand ile gerçekle

A_3	A_2	A_1	A_0	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1

a

$$F(\ ) = \bar{A}_3\bar{A}_2\bar{A}_1\bar{A}_0 + \bar{A}_3\bar{A}_2A_1\bar{A}_0 + \bar{A}_3A_2\bar{A}_1\bar{A}_0 + \bar{A}_3A_2A_1\bar{A}_0 + A_3\bar{A}_2\bar{A}_1\bar{A}_0$$

$$(A_3 + A_2 + A_1 + \bar{A}_0)(A_3 + \bar{A}_2 + A_1 + \bar{A}_0)(A_3 + \bar{A}_2 + \bar{A}_1 + \bar{A}_0)$$

A_3A_2 \ A_1A_0	00	01	11	10
00	1	0	1	1
01	1	0	0	1
11	x	x	x	x
10	1	1	x	x

$$F = \bar{A}_0 + A_3 + \bar{A}_2A_1$$

b

$$\bar{F} = \overline{\bar{A}_0 + A_3 + \bar{A}_2A_1}$$

$$\overline{(A_0\bar{A}_3)\cdot(\bar{A}_2A_1)}$$

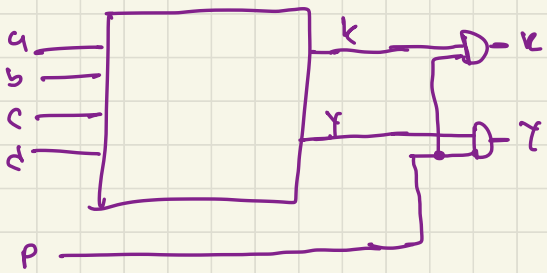
c

Bir oylamaya katılan 4 kişi kendilerinin önlerinde bulunan butona basarak belirtiyorlar. Teklifi kabul eden kişi butona basmaktadır. Salonda bulunan yeşil ve kırmızı olan 2 lamba ile

kabul = 0 veya 1 ise → kırmızı
" 2 2 " → her ikisi
" = 3 " 4 " → yeşil

a) T.T =?
b) Çöz devreyi

P	a	b	c	d	K	Y
0	0	0	0	0	1	0
	0	0	0	1	1	0
	0	0	1	0	1	0
	0	0	1	1	1	1
	0	1	0	0	1	0
	0	1	0	1	1	1
	0	1	1	0	1	1
	0	1	1	1	0	1
1	1	0	0	0	1	0
	1	0	0	1	0	1
	1	0	1	0	1	1
	1	0	1	1	0	1
	1	1	0	0	1	1
	1	1	0	1	0	1
	1	1	1	0	0	1
	1	1	1	1	0	1

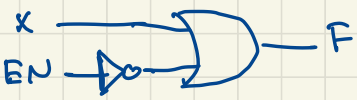


Yeşil

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

Enabling function

EN → 0 ise F → 0
EN → 1 ise F → X



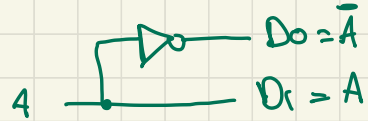
EN → 0 ise F → 1
EN → 1 ise F → X

Decoding

n = Input
m = Out put
> ise → $n \leq m \leq 2^n$

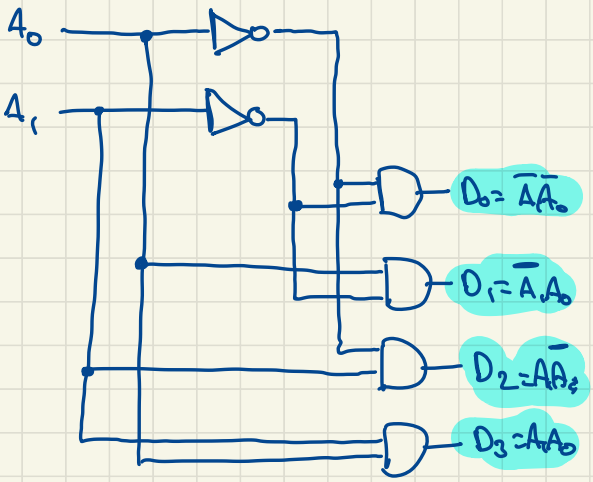
1-to-2 Line Decoder

A	D_0 D_1
0	1 0
1	0 1

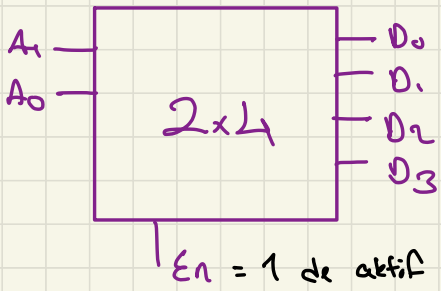


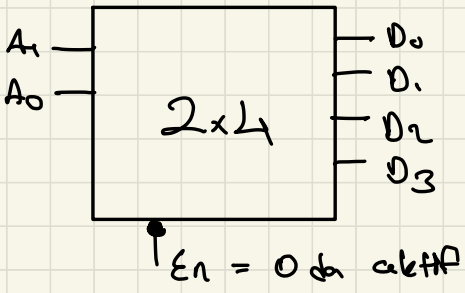
2-to-4-Line Decoder

A_1	A_0	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1



Decoder With Enable

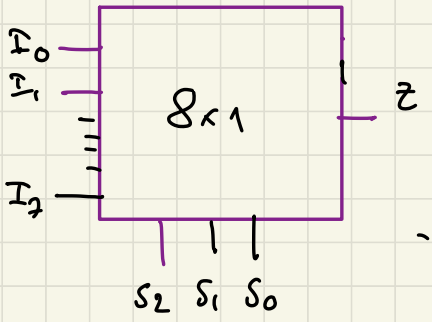


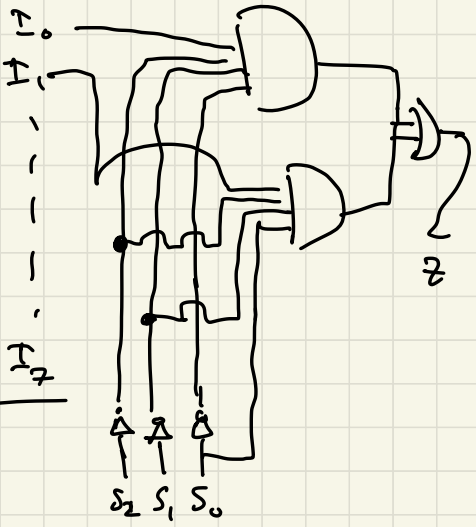


E_n	A_1	A_0	D_0	D_1	D_2	D_3
0	X	X	0	0	0	0
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	1	0
1	1	1	0	0	0	1

E_n	A_1	A_0	D_0	D_1	D_2	D_3
1	X	X	0	0	0	0
0	0	0	1	0	0	0
0	0	1	0	1	0	0
0	1	0	0	0	1	0
0	1	1	0	0	0	1

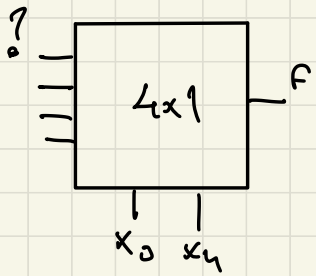
MUX





OR

X_1	X_2	X_3	X_4	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

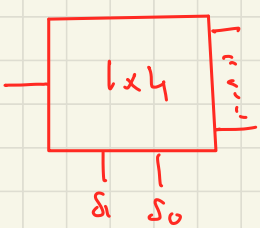


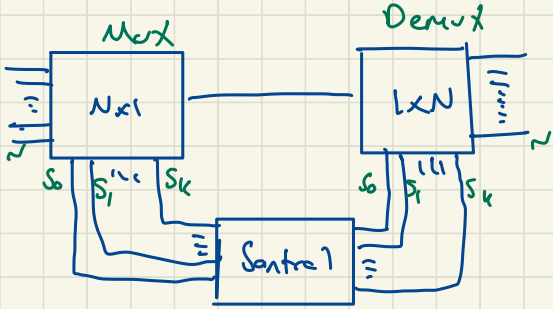
$$f = \bar{x}_1\bar{x}_2x_3 + \bar{x}_1x_2x_4 + x_1\bar{x}_2$$

$$f = \bar{x}_3\bar{x}_4(x_1\bar{x}_2) + \bar{x}_3x_4(\bar{x}_1x_2 + x_1\bar{x}_2) + x_3\bar{x}_4(\bar{x}_1\bar{x}_2 + x_1\bar{x}_2) + x_3x_4(\bar{x}_1 + \bar{x}_2)$$

i	x_3	x_4	I_i
0	0	0	$x_1\bar{x}_2$
1	0	1	$x_1 \oplus x_2$
2	1	0	$\bar{x}_2$
3	1	1	$\bar{x}_1 + \bar{x}_2$

- Dağıtıcılar (Demultiplexer - Demux)

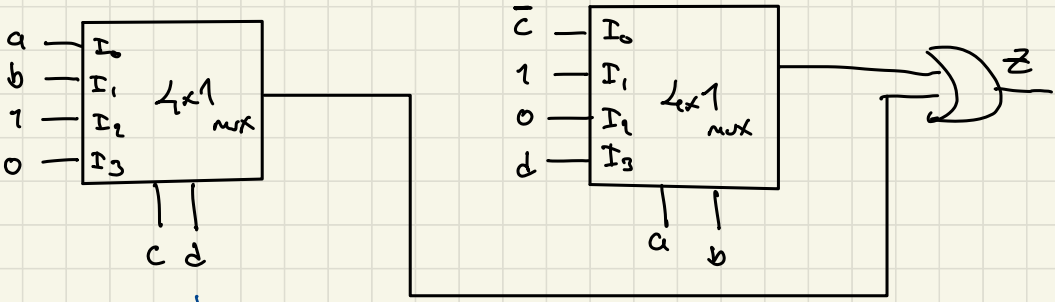




OR $f(c,b,a) = \sum(1,2,4,7)$

ÖR

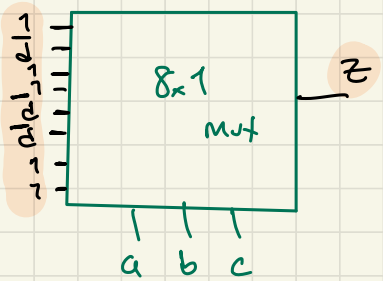
Soru = Doğruluk tablosunu oluşturunuz.



a	b	c	d	Z
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

ÖR

a, b, c seçme kolu ile 8x1 bir mux yapın



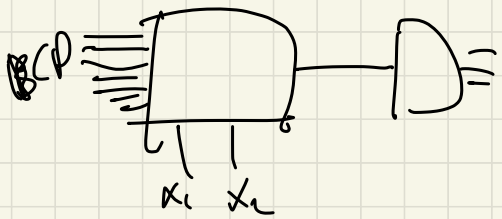
BCD aktarımı (0-9)

bir de eşlik biti var

BCD deki 1'leri tek yapan eşlik biti

$x_1 x_2$

Seçici mux ile gerçekleştirilebilir



X_4	X_3	X_2	X_1	Z
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

$\overline{X_4}$ and to X_4 or to X_3