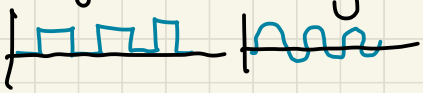
# Lojik Devreler

# 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 | ? → 0,4 |
| 0010 | 0,8 |

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

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 ↓ ... MSB ↓

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
```

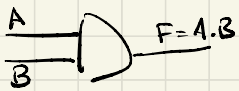
```
  10011
+ 01100
-------
  11111
```

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

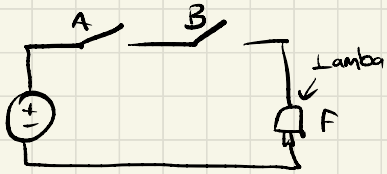
```
  00000
+     1
-------
  00001   → Sayımız -1
```

3 fazlalık Kodu, Aiken, Grey,

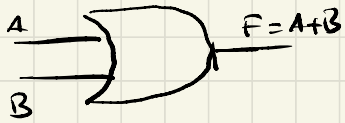
## Ve (AND) işlemi



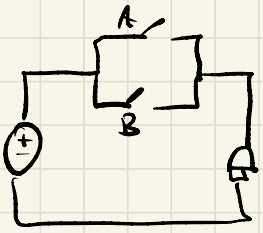

| A | B | F=A.B |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |



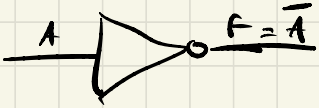

## Veya (OR) işlemi



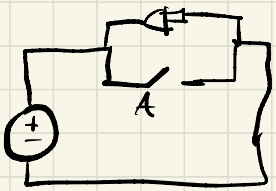

| A | B | F=A+B |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |



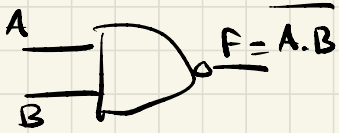

## Tümleme işareti (NOT)



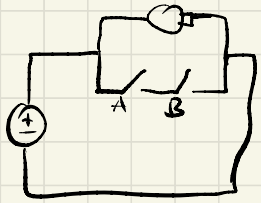

| A | F=Ā |
|---|---|
| 0 | 1 |
| 1 | 0 |



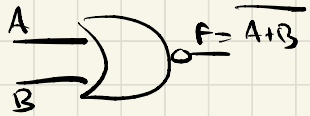

## Tümleyen Ve işlemi (NAND)



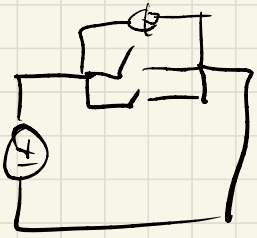

| A | B | F=$\overline{A.B}$ |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |



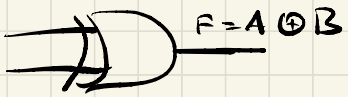

## Tümleyen Veya işlemi (NOR)




| A | B | F=$\overline{A+B}$ |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |



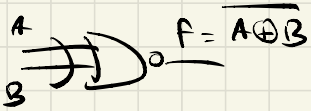
## YA DA - ÖZEL VEYA (XOR)



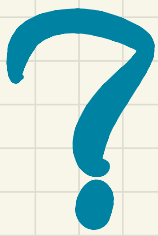

$F = A \oplus B = \bar{A}B + A\bar{B}$

| 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. H012

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

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

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

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

## 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?

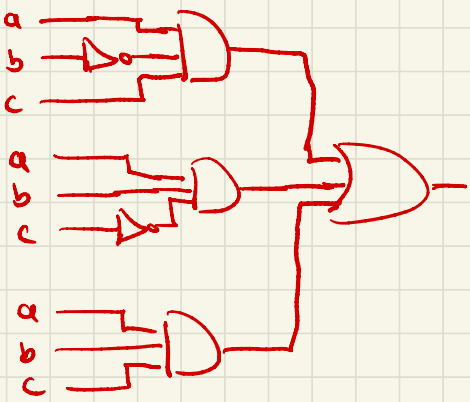
2-) min ve max terimleri yazılacak

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 | $\bar{a}+b+c+d$ |
| 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 | $a\bar{b}cd$ |
| 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

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

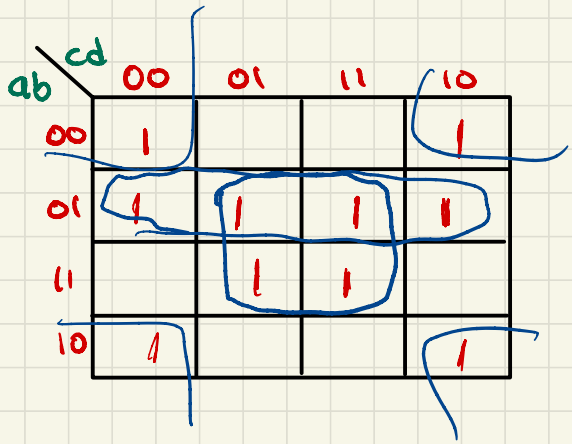
L = 6

G = 8

GN = 11

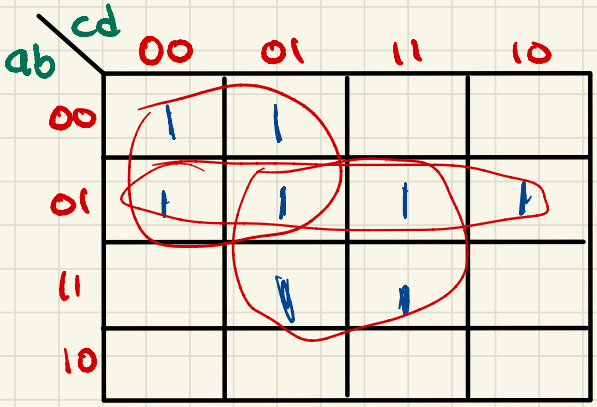
~ Karnaugh Maps ~

# AYRIK Matematik ten bak.

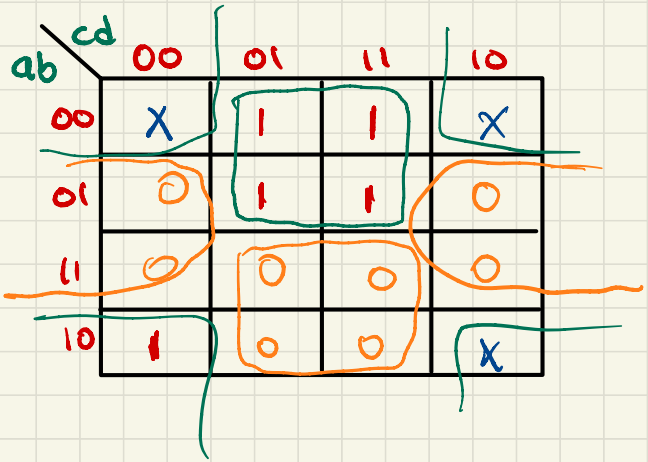



$x'z' \quad w'x \quad xz$

$b'd' + ab + bd$




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



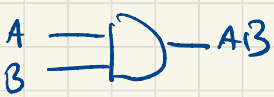

$a'd + b'd'$

● → maxterm

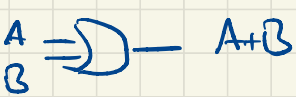
---

not

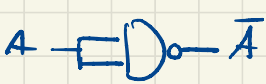

AND



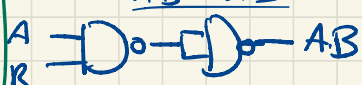

OR

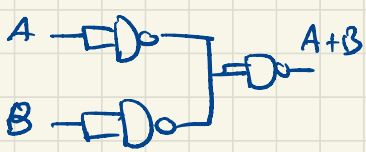



NAND

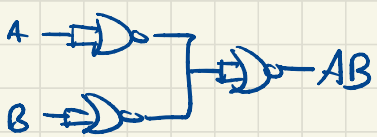


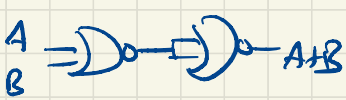

$\overline{A.B} = A.B$




NOR


---

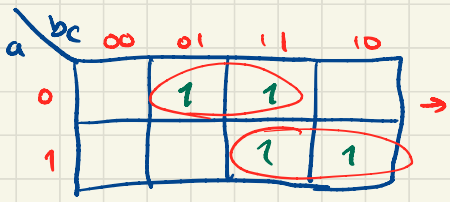
Ör $f(a,b,c) = \bar{a}\bar{b}c + \bar{a}bc + ab\bar{c} + abc$

① → indirgeyiniz K-Map

② → lojik diyagramı NAND ile gerçekleyiniz.

③ → " " NOR " "

① →

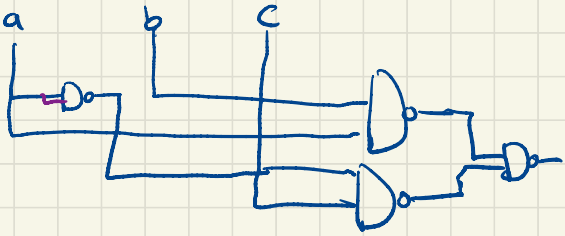



$f = \bar{a}c + ab \rightarrow \overline{\overline{(\bar{a}c)} + \overline{(ab)}}$

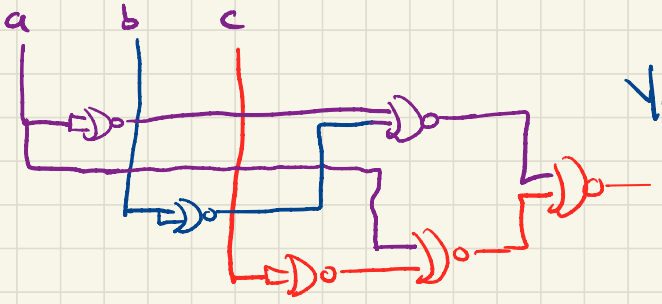
$\rightarrow \overline{(\bar{a}c)}.\overline{(ab)}$

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

② → $\overline{(\bar{a}c)}.\overline{(ab)}$




③ $\overline{(a+\bar{c}).(\bar{a}+\bar{b})} = \overline{(a+\bar{c})} + \overline{(\bar{a}+\bar{b})}$



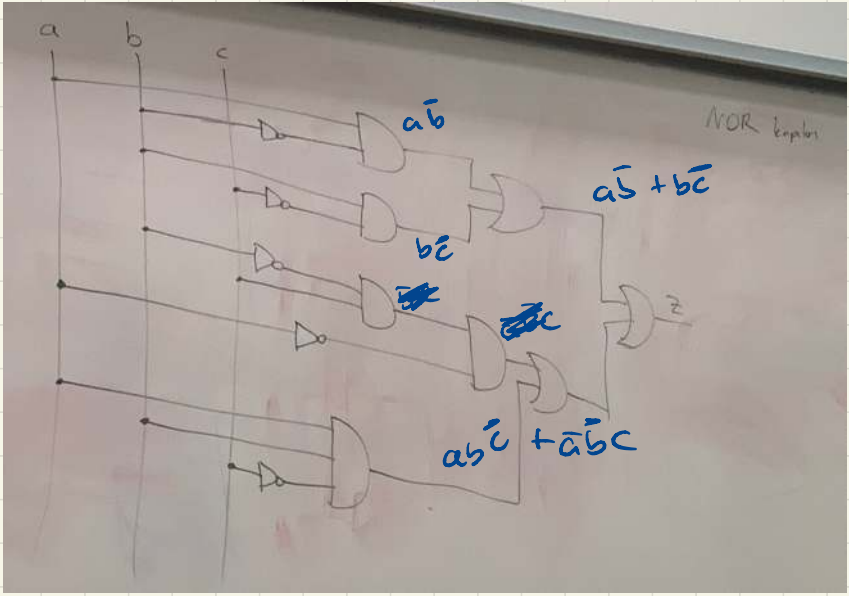

Yanlış olabilir! ☺

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 |

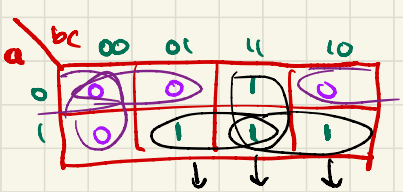
ⓐ SOP şeklinde z fonksiyonu(kırmızı)

ⓑ 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

# KOMBİNAZONSAL DEVRELER

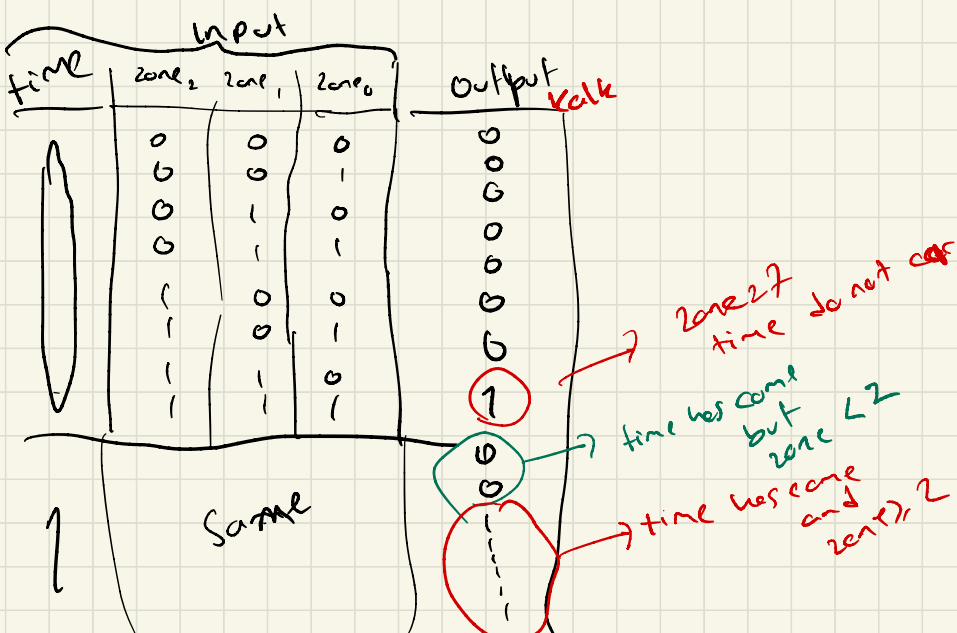
**SORU**

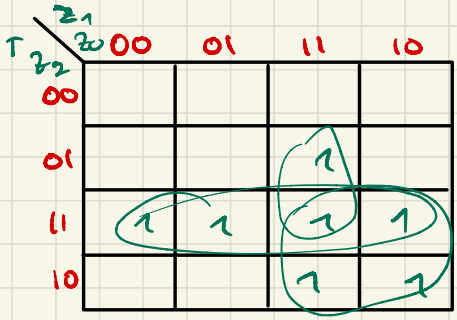
Bir hava alanından şehir merkezine 20 dk'da bir helikopter seferi düzenlenmektedir. Helikopterlerde bulunan bir sayıcı doğal yapılı kodda helikoptere binen yolcuları saymaktadır. helikopterler 7 kişiliktir. Helikopterlerin kalkması için

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

Pilotun kalkabilmesi için gerekli işareti verecek kombinazonsal lojik devreyi tasarlayınız.

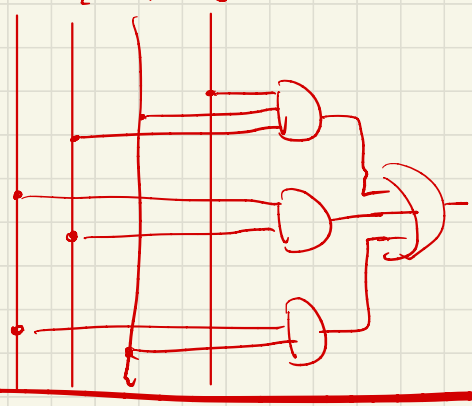
if zone = 7 ✓ time don't care ×
if zone ≥ 2 ✓ time care ✓






minterm

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




---

- (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

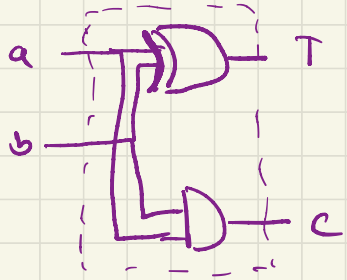
| a | b | T | C |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |

| 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

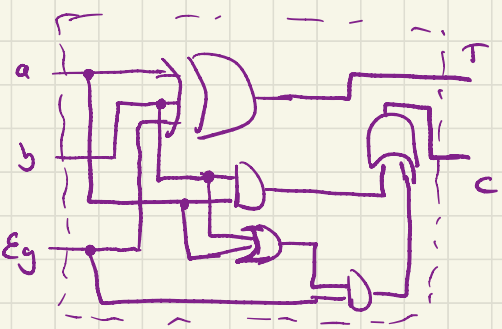
| Eg \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 |

$T = Eg \oplus a \oplus b$

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

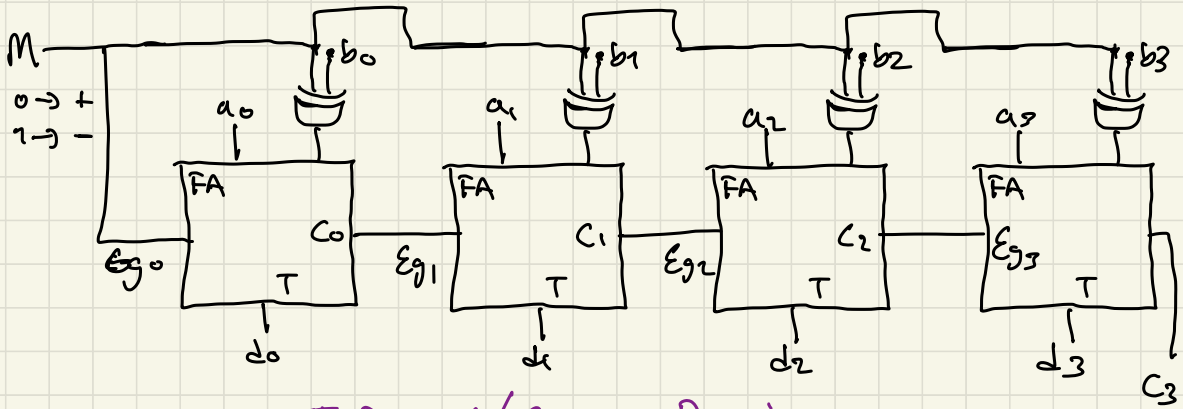
# Tam Çıkarma

| a | b | $\varepsilon_g$ | 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 tedir.

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 |

$$F(\ ) = \bar{A}_3\bar{A}_2\bar{A}_1\bar{A}_0 + \bar{A}_3\bar{A}_2A_1\bar{A}_0 + \bar{A}_3\bar{A}_2A_1A_0 + \bar{A}_3A_2\bar{A}_1\bar{A}_0 + \bar{A}_3A_2A_1\bar{A}_0 + A_3\bar{A}_2\bar{A}_1A_0$$

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

a

$$\bar{F} = \overline{\overline{\bar{A}_0 + A_3} + \overline{\bar{A}_2 A_1}}$$

$$(A_0\bar{A}_3) \cdot (\overline{\bar{A}_2 A_1})$$

c

| $A_3A_2$ \ $A_1A_0$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 0 | 1 | 1 |
| 01 | 1 | 0 | 0 | 1 |
| 11 | X | X | X | X |
| 10 | 1 | 1 | X | X |

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

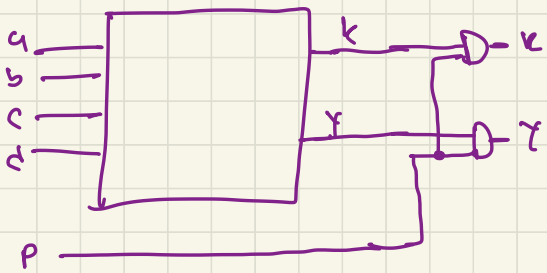
b

Bir oylamaya katılan 4 kişi kararlarını 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 |

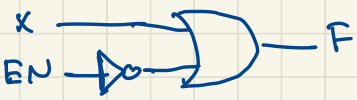



Yeşil

| 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

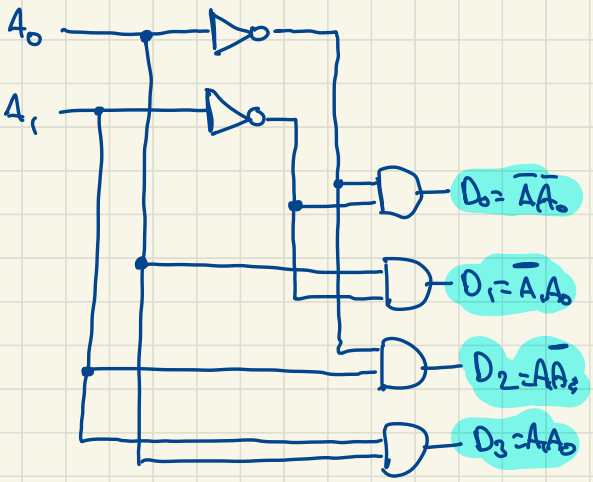
n = Input
m = Out put
> ise → $n \leq m \leq 2^n$

### 1-to-2 Line Decoder

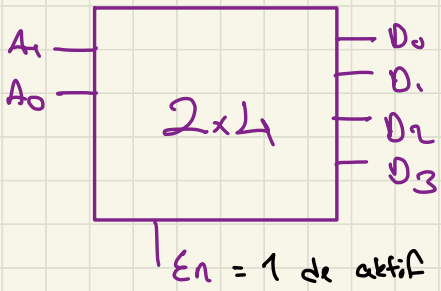
| A | $D_0$ $D_1$ |
|---|---|
| 0 | 1 0 |
| 1 | 0 1 |

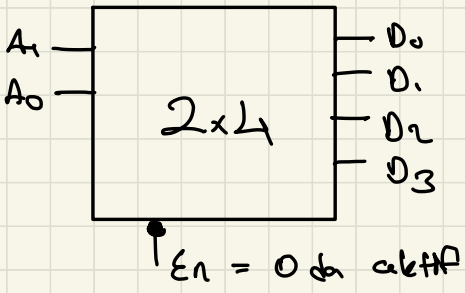

### 2-to-4-Line Decoder

| $A_1$ | $A_0$ | $D_0$ | $D_1$ | $D_2$ | $D_3$ |
|---|---|---|---|---|---|
| 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

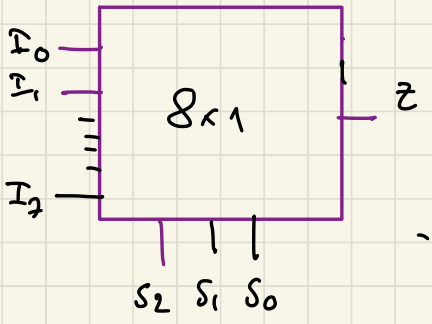


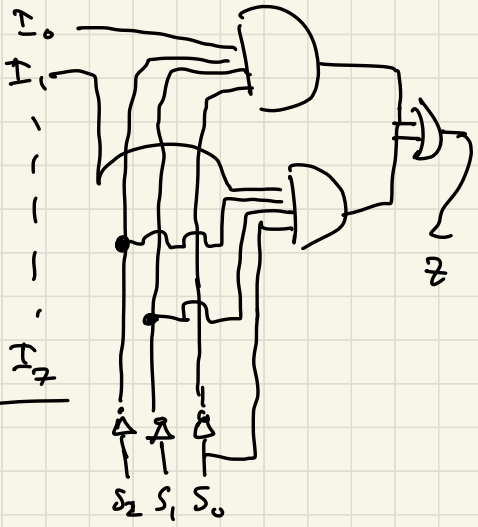




| $E_n$ | $A_1$ | $A_0$ | $D_0$ | $D_1$ | $D_2$ | $D_3$ |
|---|---|---|---|---|---|---|
| 0 | X | X | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 |

| $E_n$ | $A_1$ | $A_0$ | $D_0$ | $D_1$ | $D_2$ | $D_3$ |
|---|---|---|---|---|---|---|
| 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 |

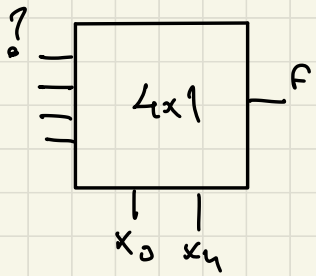
## MUX




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 |

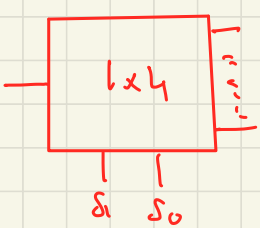


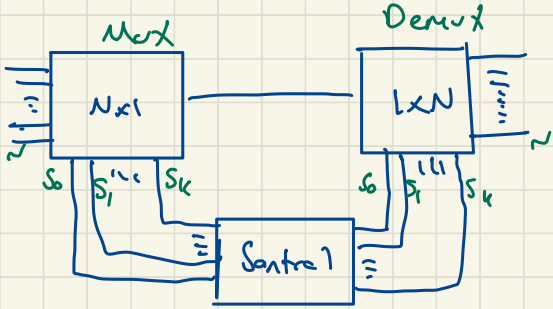

$$f = \bar{x}_1\bar{x}_2x_3 + \bar{x}_1x_2x_4 + x_1\bar{x}_2$$

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

| 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 )

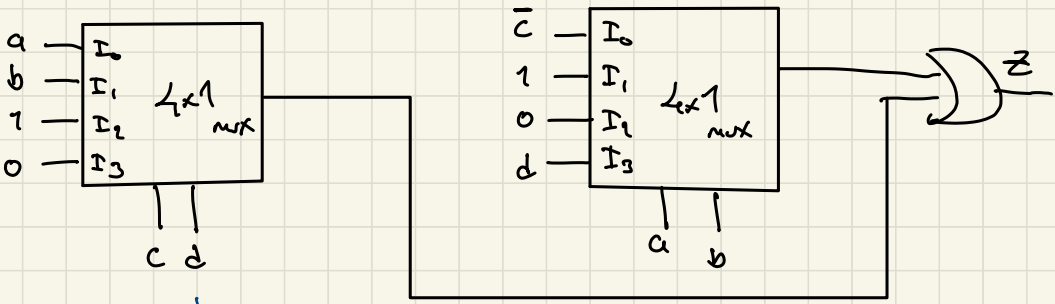



OR $f(c,b,a) = \sum(1,2,4,7)$

ÖR

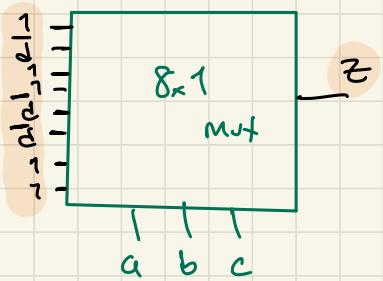
Soru = Doğruluk tablosunu oluşturunuz.




| 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



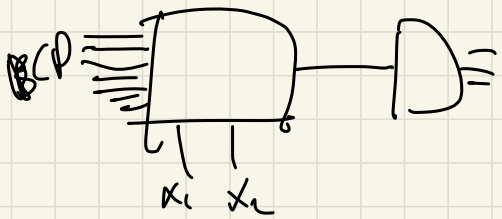

BCD aktarımı (0-9)

bir de eşlik biti var

BCD deki 1'leri tek yapan eşlik biti

$x_1 x_2$

Seçici mux ile gerçekle




| $X_4$ | $X_3$ | $X_2$ | $X_1$ | $Z$ |
|---|---|---|---|---|
| 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 $X_3$