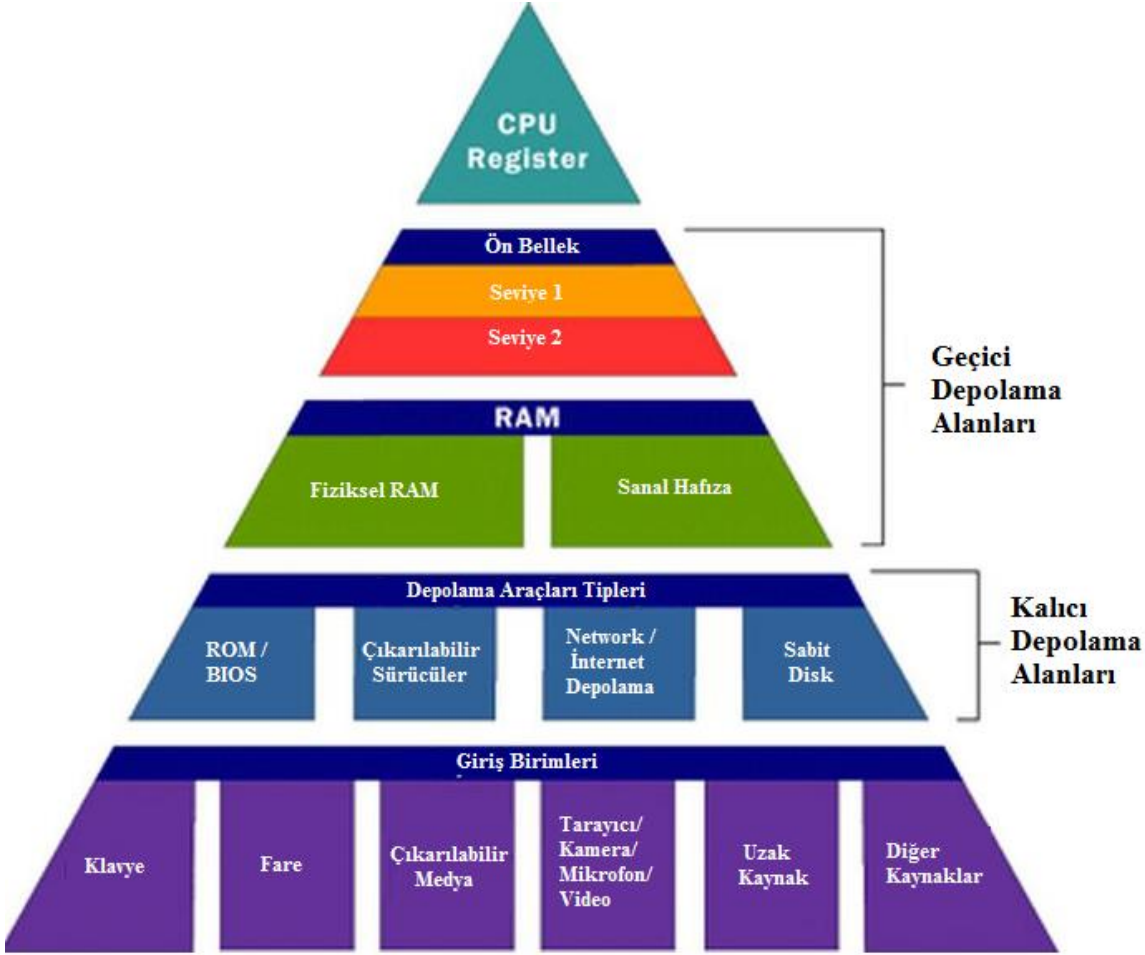
Mikroişlemci Sistemleri

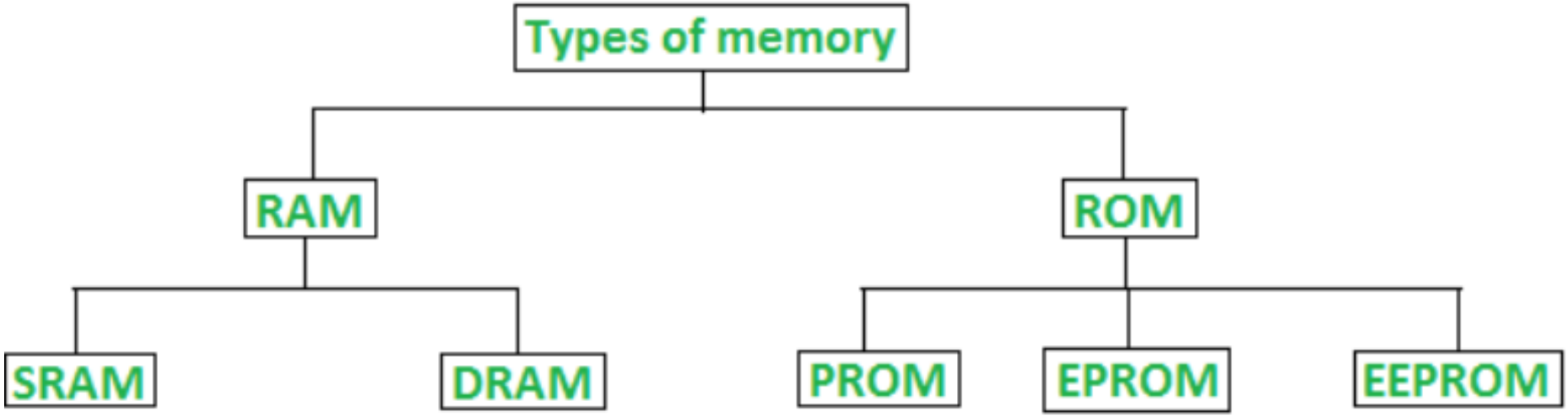
#10 Bellek

YTÜ-CE

Ders-14 Konular

- Hafıza Birimleri
  - ROM
    - Masked ROM
    - PROM
    - EPROM
    - EEPROM
    - Flash Memory
  - RAM
    - SRAM
    - DRAM
- Adres Çözümleme
- 8086 - Hafıza Birimleri Arayüzü
- Örnekler


CPU
Register
Ön Bellek
Seviye 1
Seviye 2
RAM
Fiziksel RAM
Sanal Hafıza
Geçici
Depolama
Alanları
Depolama Araçları Tipleri
ROM /
BIOS
Çıkarılabilir
Sürücüler
Network /
İnternet
Depolama
Sabit
Disk
Kalıcı
Depolama
Alanları
Giriş Birimleri
Klavye
Fare
Çıkarılabilir
Medya
Tarayıcı/
Kamera/
Mikrofon/
Video
Uzak
Kaynak
Diğer
Kaynaklar



PROM (Programmable read-only memory)

EPROM (Erasable Programmable read only memory)

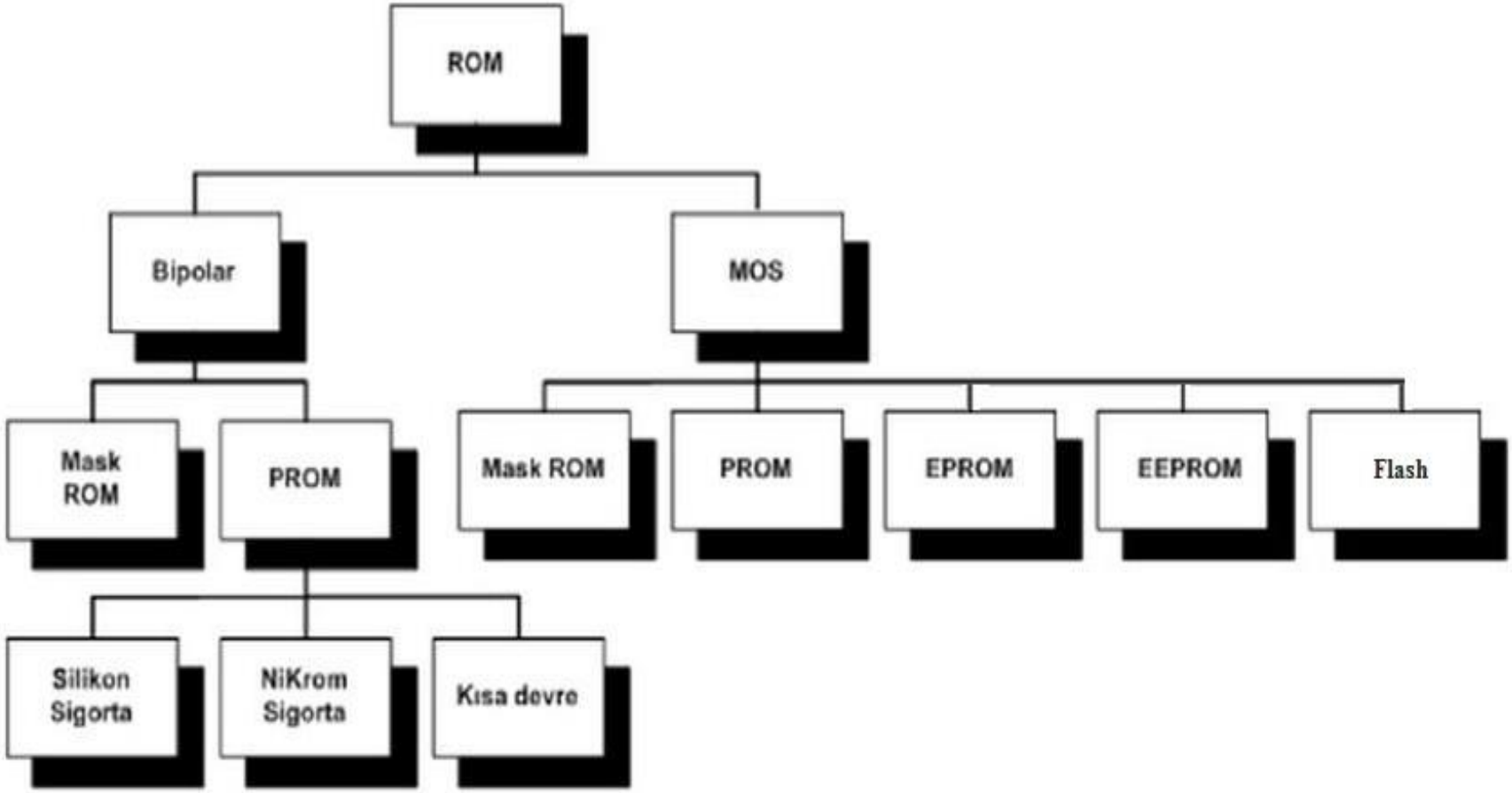
EEPROM (Electrically erasable programmable read only memory)

Masked ROM

Flash Memory

https://www.geeksforgeeks.org/random-access-memory-ram-and-read-only-memory-rom/

RAM	ROM
1. Temporary Storage.	1. Permanent storage.
2. Store data in MBs.	2. Store data in GBs.
3. Volatile.	3. Non-volatile.
4.Used in normal operations.	4. Used for startup process of computer.
5. Writing data is faster.	5. Writing data is slower.


ROM
Bipolar
MOS
Mask ROM
PROM
Mask ROM
PROM
EPROM
EEPROM
Flash
Silikon Sigorta
NiKrom Sigorta
Kısa devre

ROM (Read Only Memory)

- ROM hafıza birimi çalışması sırasında sadece okunabilir
- ROM ➔ non-volatile : enerjisi kesildiğinde verisi kaybolmaz
- 8086 reset vektöründe bir ROM yerleşiktir

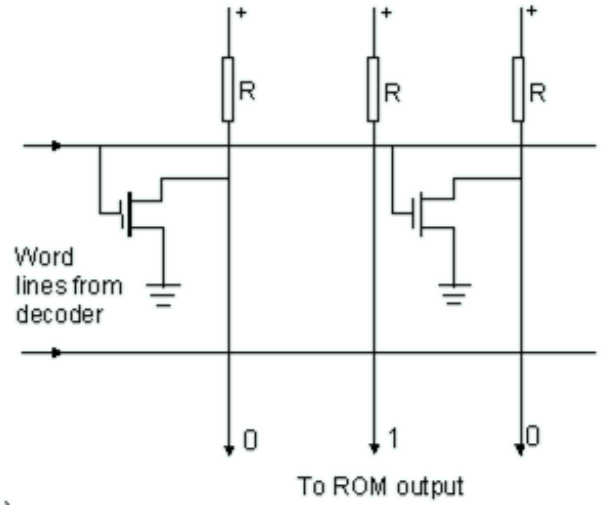
- The reset vector for the 8086 processor is at physical address FFFF0h (16 bytes below 1 MB). The value of the CS register at reset is FFFFh and the value of the IP register at reset is 0000h to form the segmented address FFFFh:0000h, which maps to physical address FFFF0h.[1]

ROM Çeşitleri

- Masked ROM
- PROM (programmable read-only memory)
- EPROM (erasable programmable read-only memory)
- EEPROM (electrically erasable programmable read-only memory)
- Flash Memory

Masked ROM

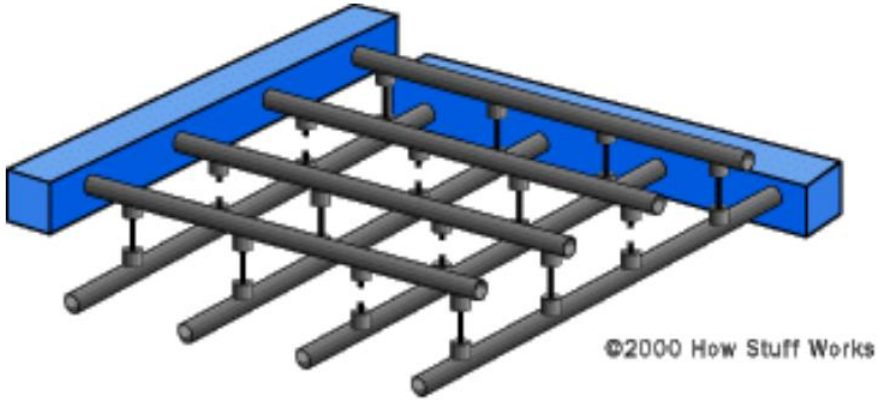
- Üretim aşamasında programlanır
- Kullanıcı tarafından yeniden programlanamaz
- Yüksek miktarda üretim için uygun maliyettedir



Uses – They are used in network operating systems, server operating systems, storing of fonts for laser printers, sound data in electronic musical instruments .

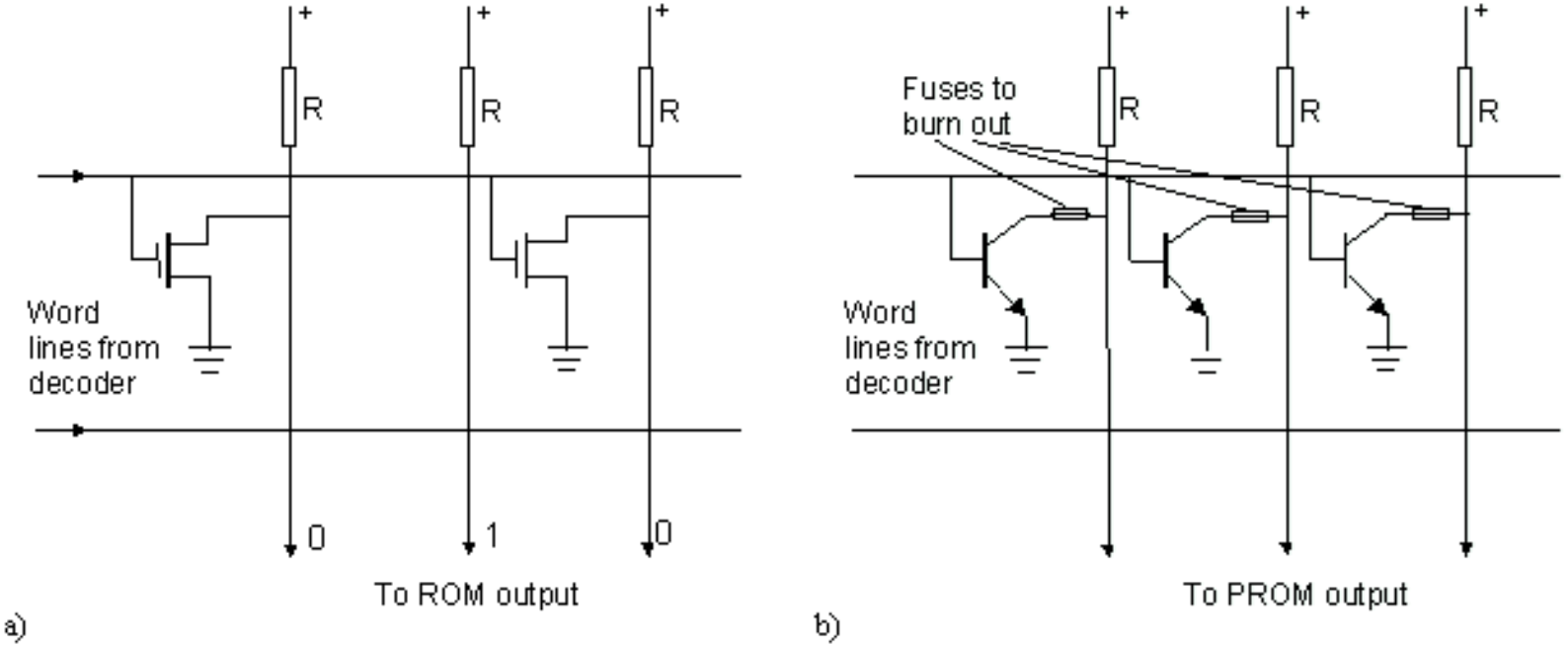
PROM

- Sigorta (fuse) link teknolojisi kullanır
- Kullanıcı tarafından 1 kere programlanabilir
- OTP (one time programmable) olarak da isimlendirilir



PROM

Uses – They have several different applications, including cell phones, video game consoles, RFID tags, medical devices, and other electronics.

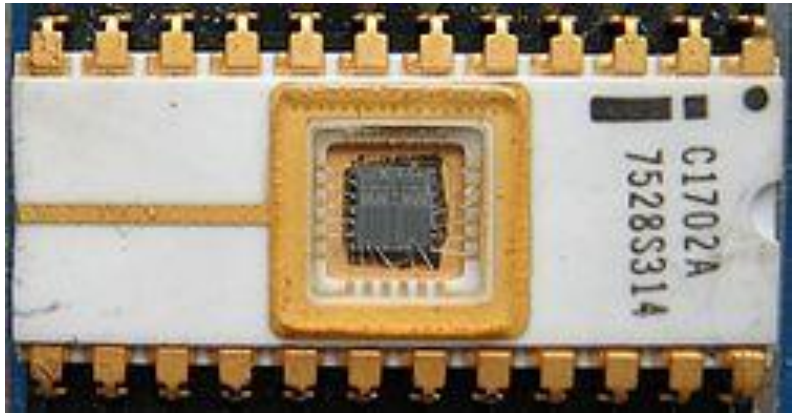


Implementation of: a) mask programmable ROM, b) field programmable PROM

EPROM

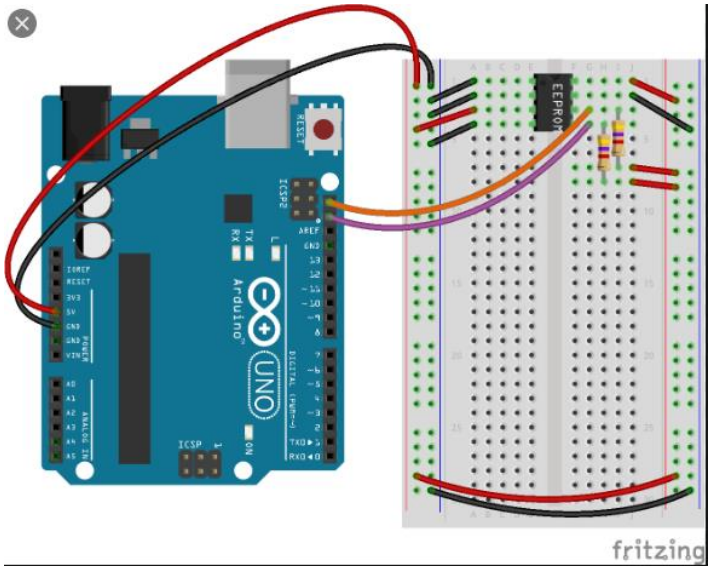
- Kullanıcı tarafından çok defa silinip yazılabilir
- Silme işleminde tüm içerik silinir
- Silme işlemi UV ışık altında 15-20 dk tutularak yapılır

Uses – Before the advent of EEPROMs, some micro-controllers, like some versions of Intel 8048, the Freescale 68HC11 used EPROM to store their program .

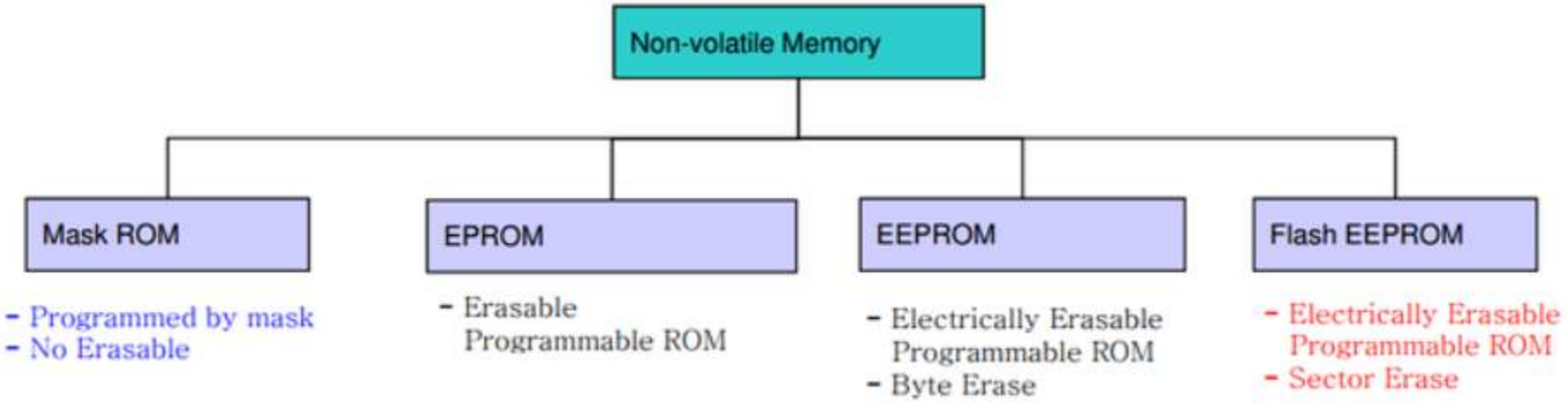


EEPROM

- Devrede programlanabilir
- Byte seviyesinde tekil silme imkanı var



Uses – It is used for storing the computer system BIOS.



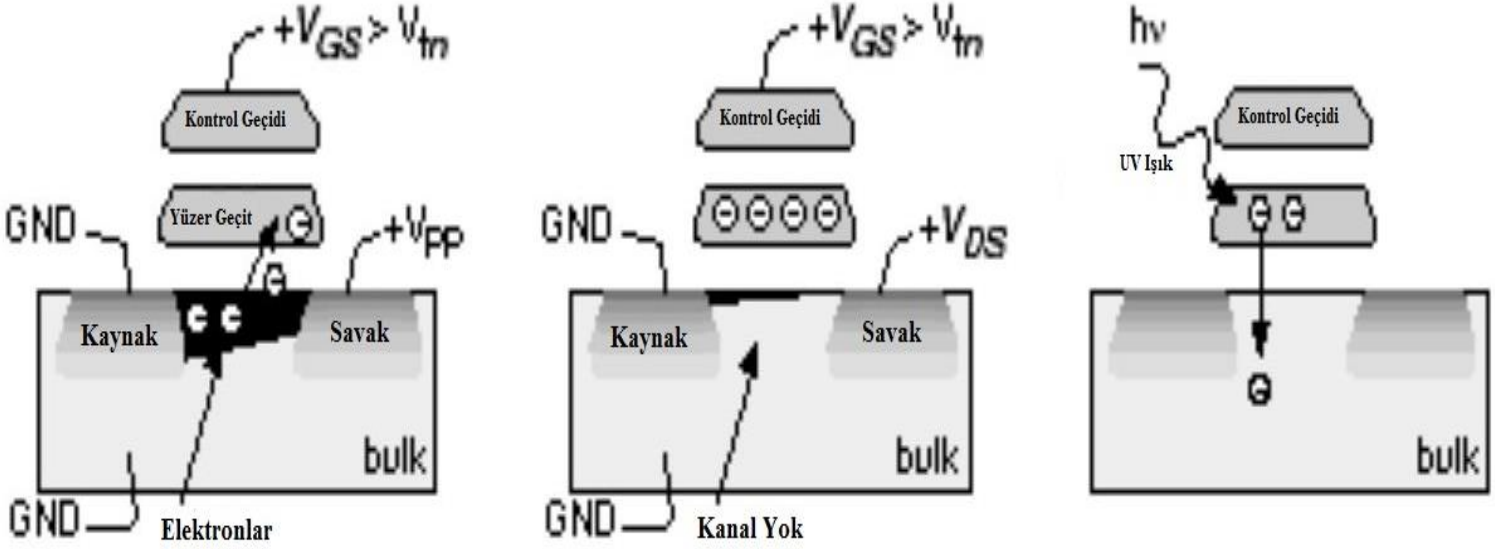
EPROM (Erasable Programmable ROM)
FAMOS (Floating Gate Avalanche injection MOS)

EEPROM (Electrically Erasable PROM)
FLOTOX (Floating Gate Oxide Tunnelling)

https://m.blog.naver.com/PostView.nhn?blogId=beahey&logNo=220375952430&proxyReferer=https:%2F%2Fwww.google.com%2F

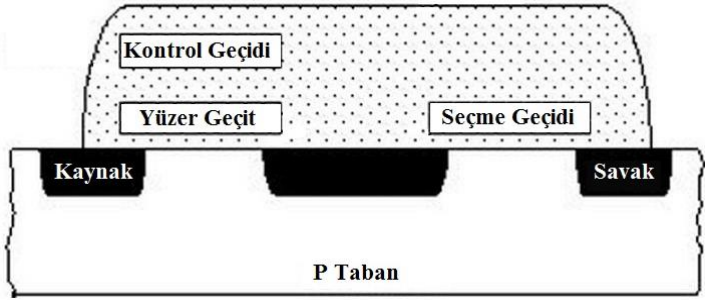
EPROM (Erasable Programmable ROM)

FAMOS (Floating Gate Avalanche injection MOS)



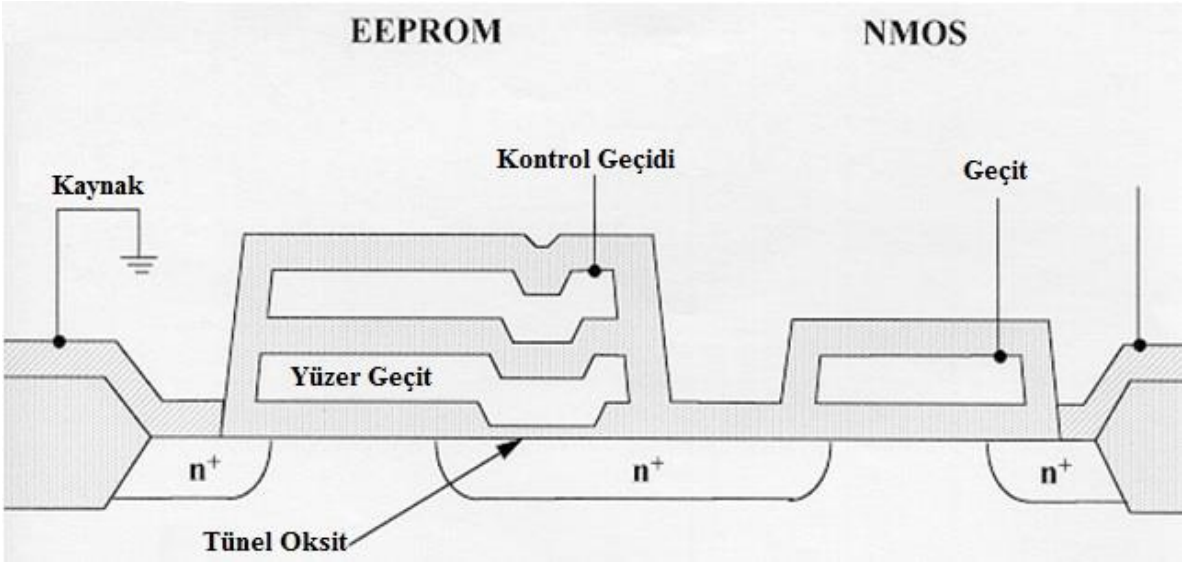
EEPROM (Electrically Erasable PROM)

FLOTOX (Floating Gate Oxide Tunnelling)



Verilen uzun yıllar kalıcı bir şekilde saklanmasını sağlayan yüzer geçidin yüklenmesi için bazı yük enjeksiyon mekanizmaları şu şekildedir:

I.)Sıcak Elektron Enjeksiyonu
II.)Fowler-Nordheim Tünelleme Etkisi
III.)Polyoksit İletimi

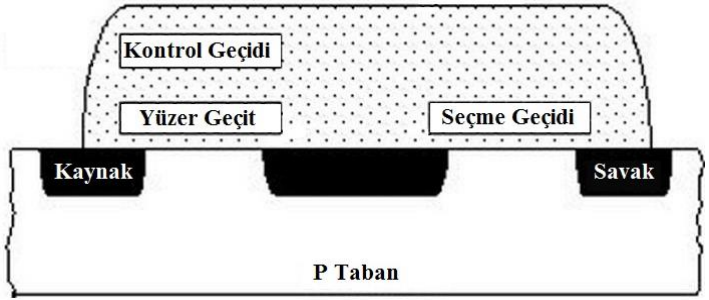


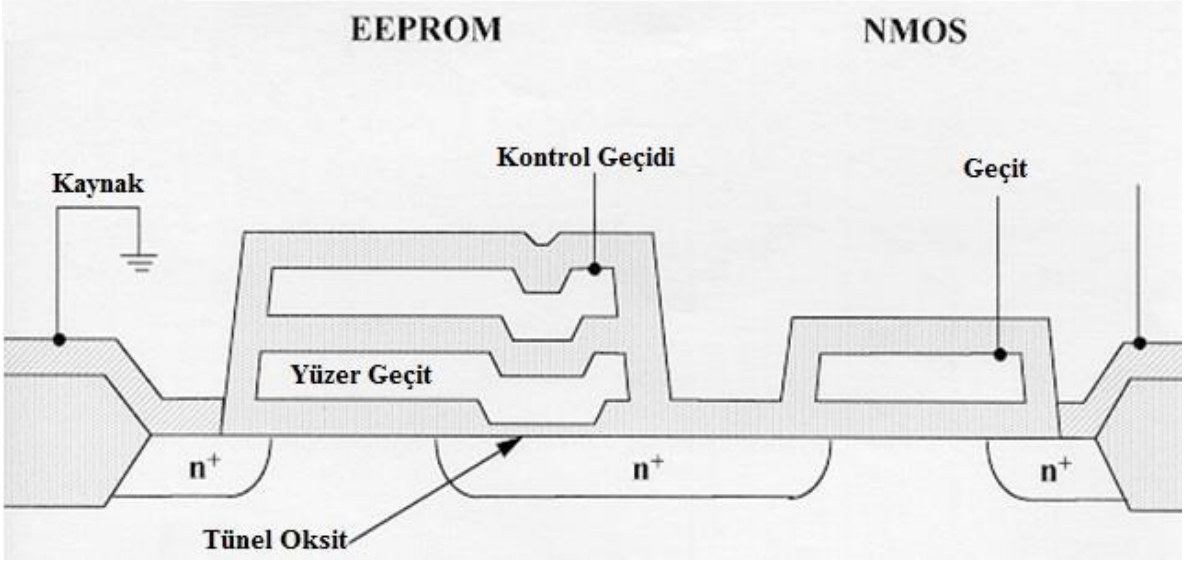
EEPROM (Electrically Erasable PROM)

FLOTOX (Floating Gate Oxide Tunnelling)

II.)Fowler-Nordheim Tünelleme Etkisi

Elektronların metal veya yarıiletken maddeden bir dielektrik maddeye yayılımı güçlü bir **elektrik alan** altında mümkündür. Bu yöntemde de elektronların elektrik alan esasına bağlı olarak tünellenmesi söz konusudur. Fowler-Nordheim tünelleme yöntemi Quantum mekaniği esaslarına dayanır.

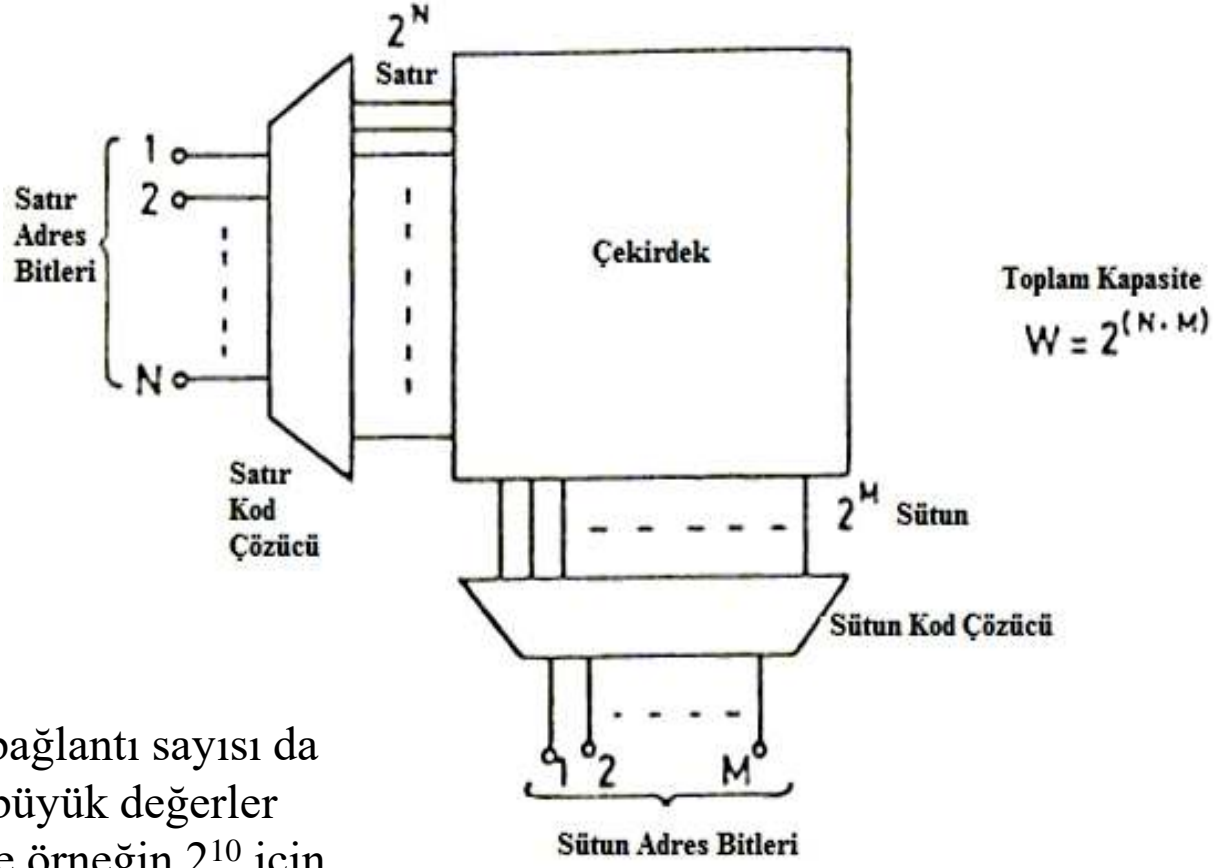




Flash ROM

- Yığın olarak silinebilir
- EEPROM göre daha az esnektir

Uses – Many modern PCs have their BIOS stored on a flash memory chip, called as flash BIOS and they are also used in modems as well.



M ve N değerleri arttığında bağlantı sayısı da son derece artacaktır. 5'den büyük değerler karmaşık olarak öngörülür ve örneğin 2^{10} için (M=N=10) 1024 satır ve sütun ortaya çıkacaktır

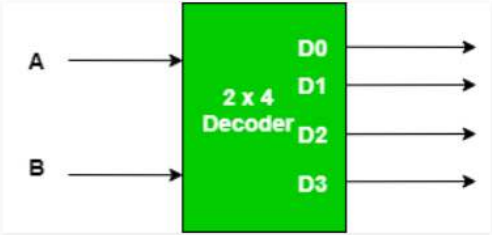
4x4 ROM

To understand how to program a ROM, consider a 4 x 4 ROM, which means that it has total of 4 addresses at which information is stored, and each of those addresses has a 4-bit information, which is permanent and must be given as the output, when we access a particular address . The following steps need to be performed to program the ROM –

Inputs		Outputs			
X	Y	A	B	C	D
0	0	0	0	1	1
0	1	1	1	0	0
1	0	1	1	1	1
1	1	0	1	1	1

4x4 ROM

Generally, for a 2^k x n ROM, a k x 2^k decoder is used



4x4 ROM

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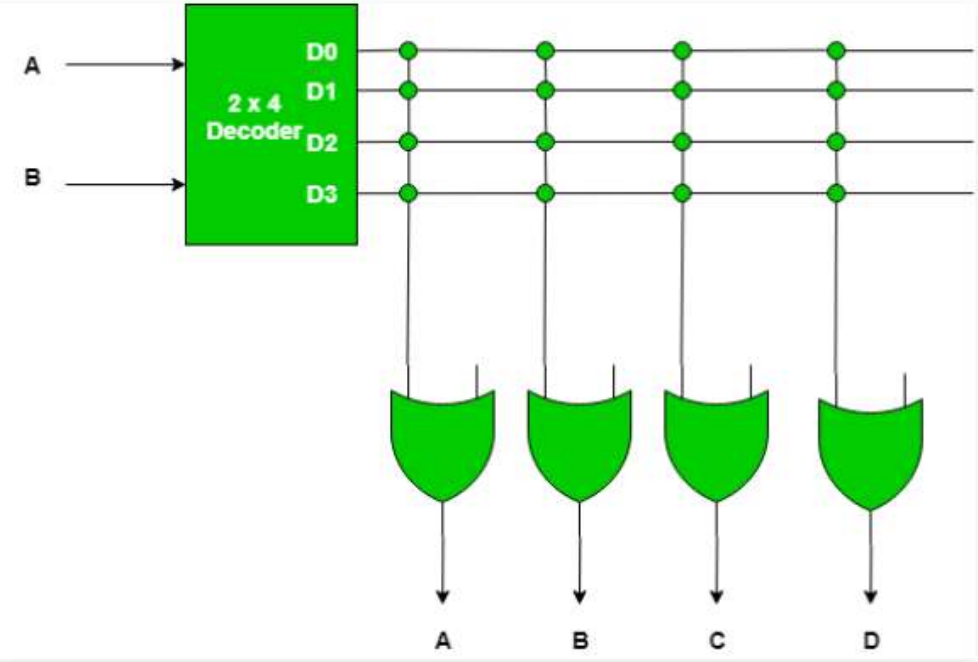
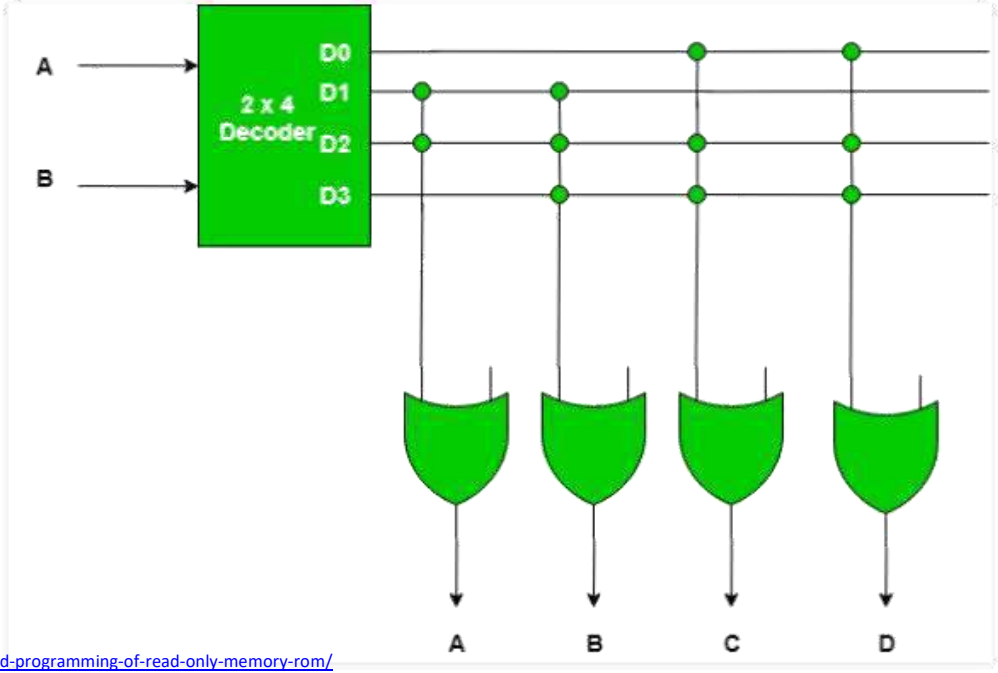


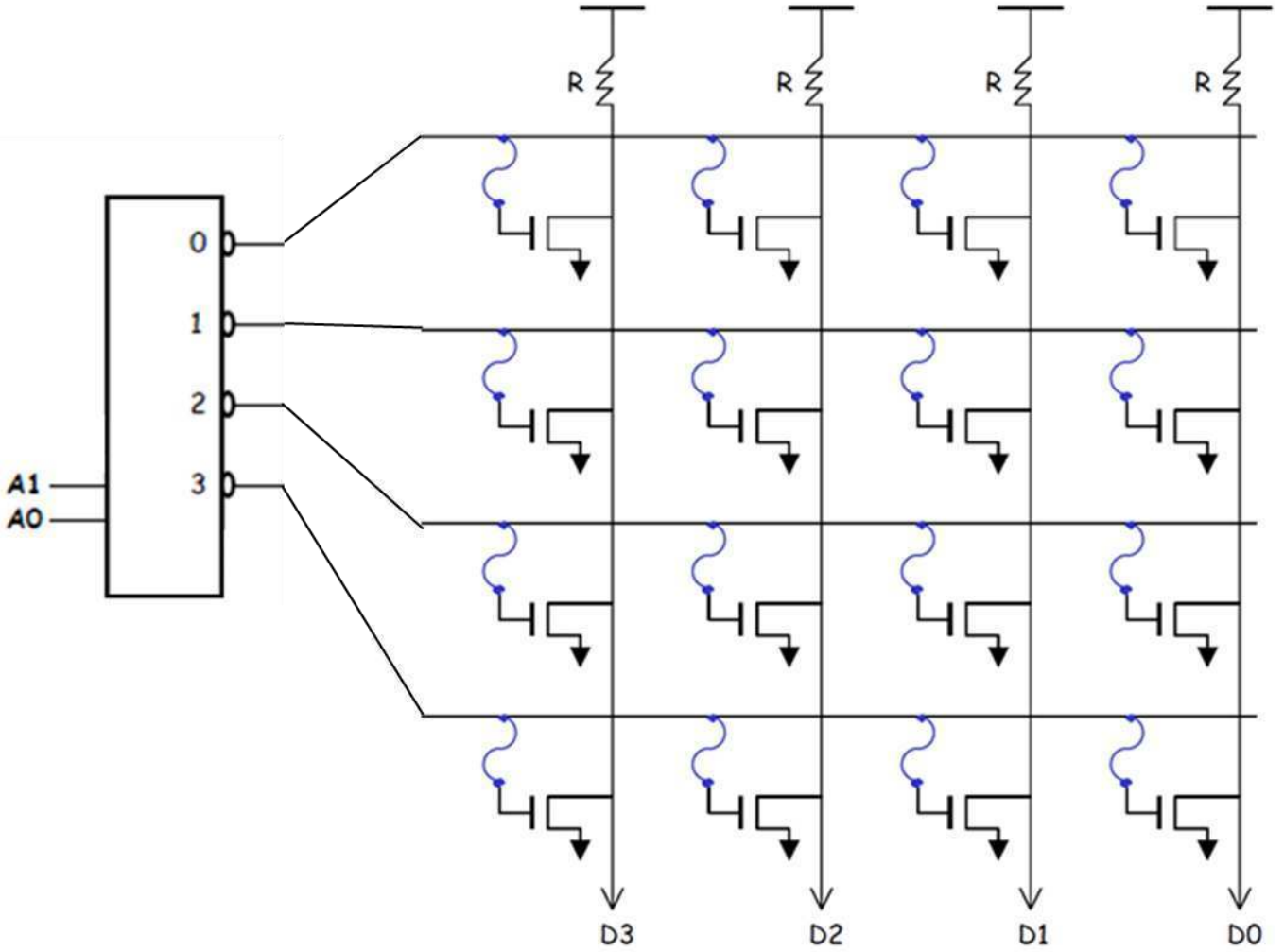
4x4 ROM

Inputs		Outputs			
X	Y	A	B	C	D
0	0	0	0	1	1
0	1	1	1	0	0
1	0	1	1	1	1
1	1	0	1	1	1



https://www.geeksforgeeks.org/classification-and-programming-of-read-only-memory-rom/

4x4 ROM



4x4 ROM Program:

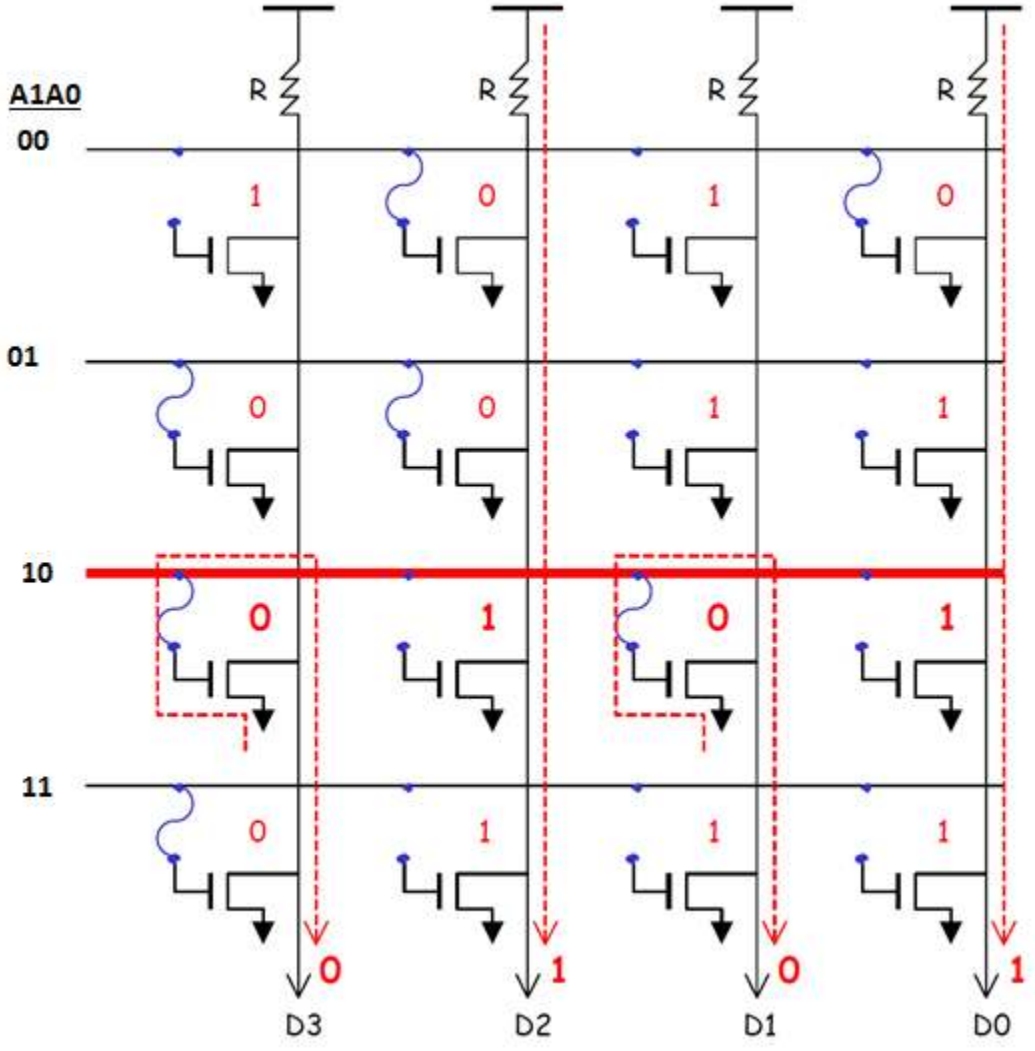
Adr./Data

0 – A

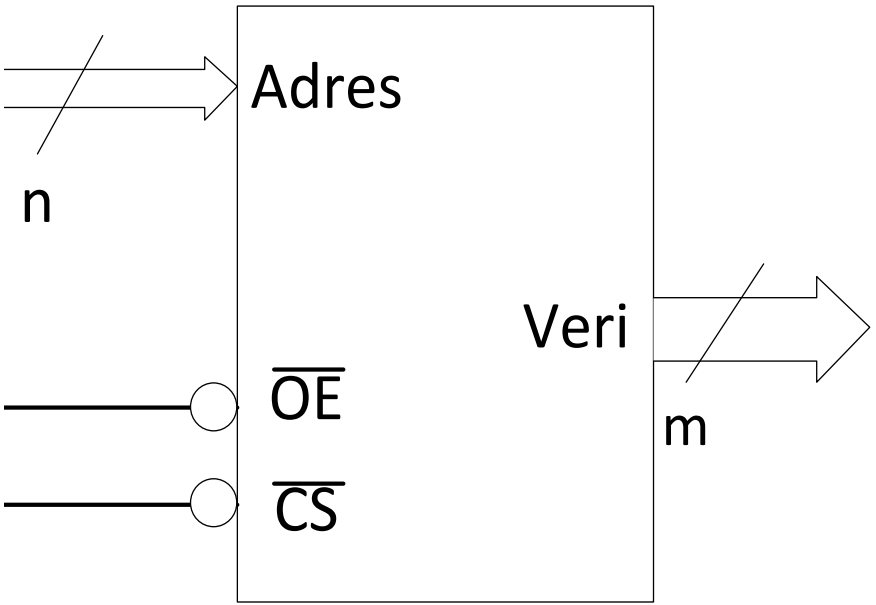
1 – 3

2 – 5

3 – 7



ROM Blok Diyagram



2^n x m kapasiteli ROM

$\overline{OE} \leftrightarrow \overline{RD}$

$\overline{CS} \leftrightarrow$ Adres çözümleme

RAM (Random Access Memory)

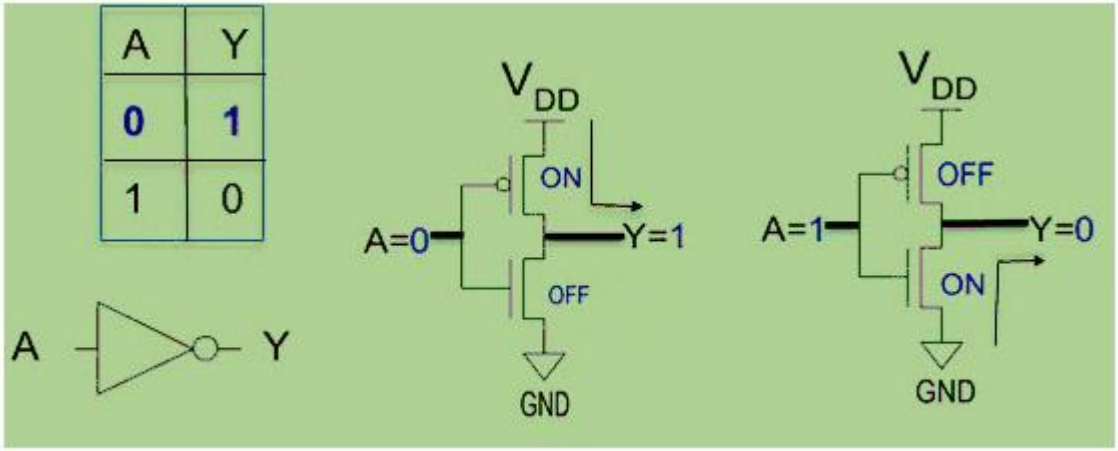
- RAM → volatile memory
- Hızlı okuma ve yazma
- Bilgisayarda «main memory» olarak kullanılır
- Random access vs. sequential access

RAM Çeşitleri

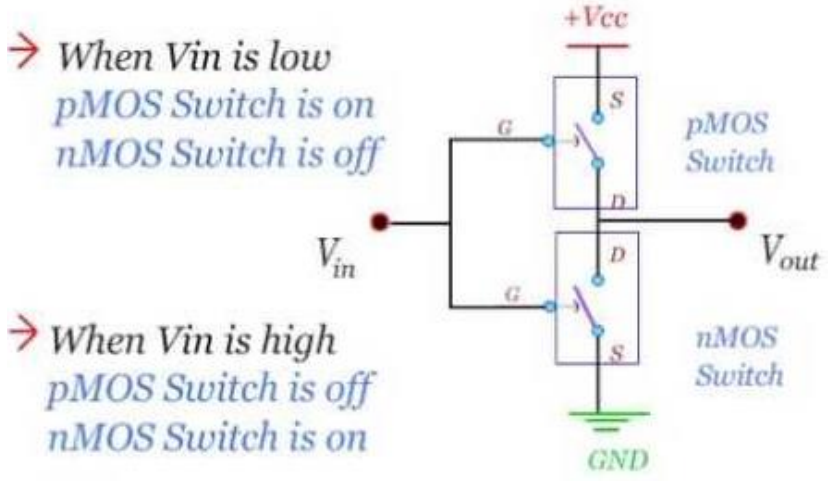
- SRAM (static random access memory)
- DRAM (dynamic random access memory)

SRAM

- SRAM çapraz eşleştirilmiş değil kapıları kullanır.
- Hafıza bölgesine yeni bir veri yazılana kadar enerjisi mevcut olduğu sürece veriyi saklar



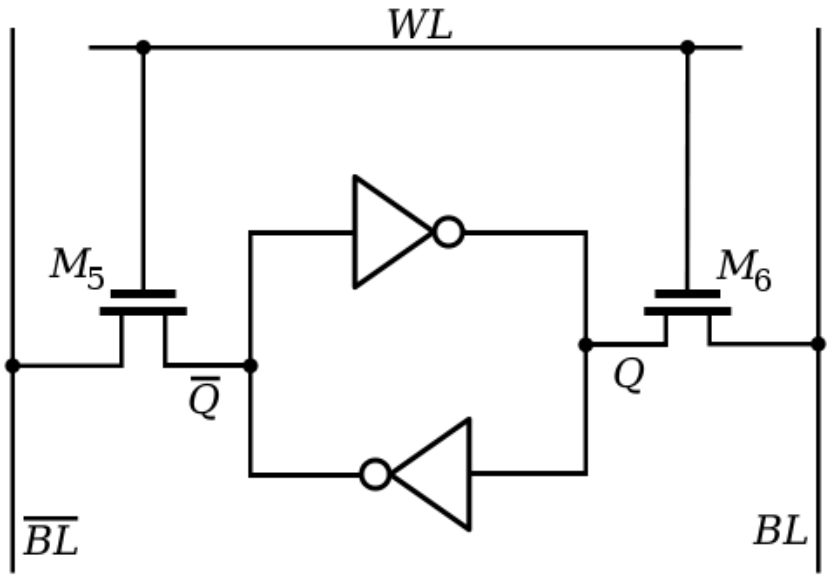
CMOS Inverter

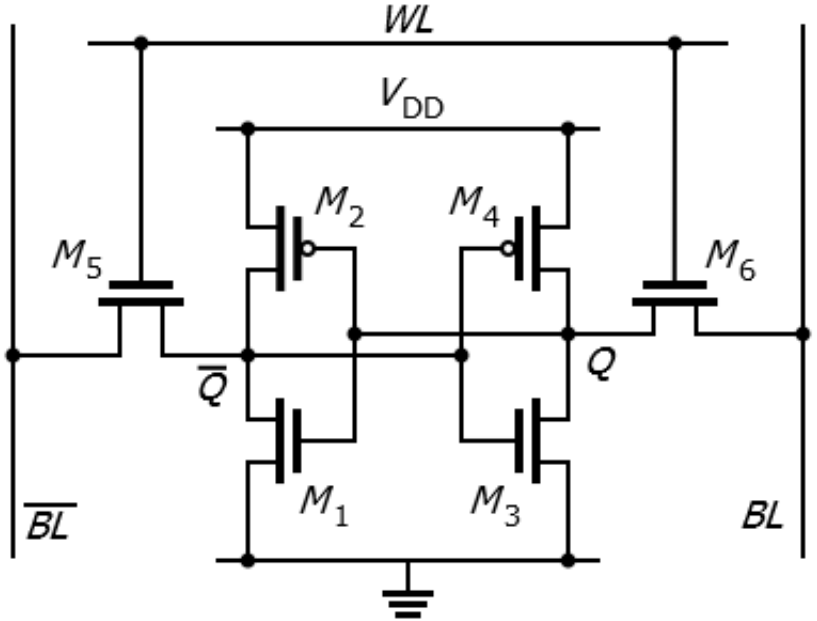


https://www.elprocus.com/cmos-working-principle-and-applications/

https://www.youtube.com/watch?v=yr_zMMDFmrM

SRAM Hücresi

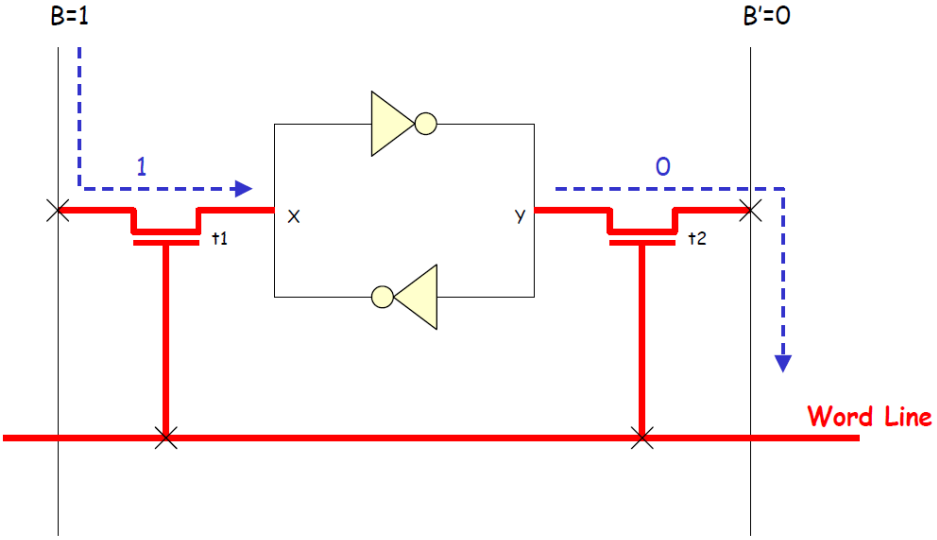


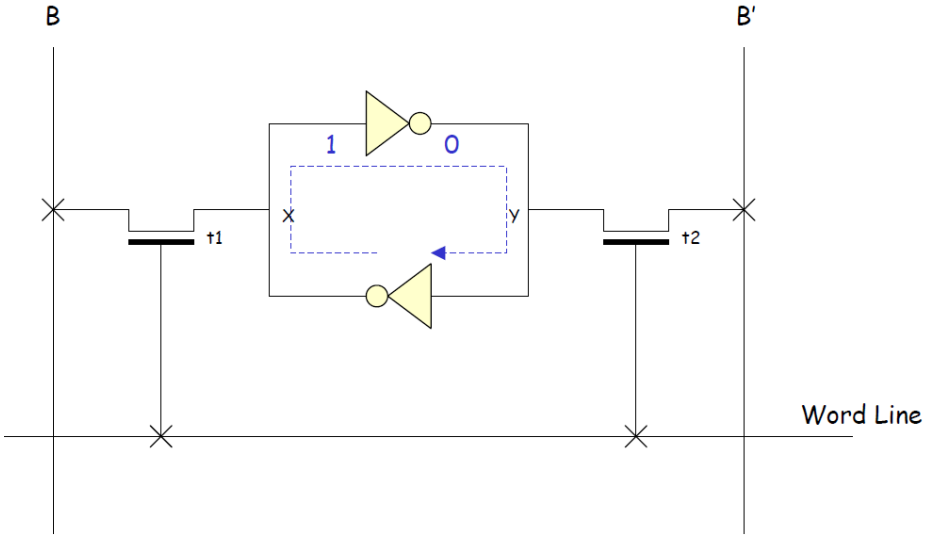


WL: word line (adres), BL: bit line (data)

SRAM – 1 Yazma Mantığı

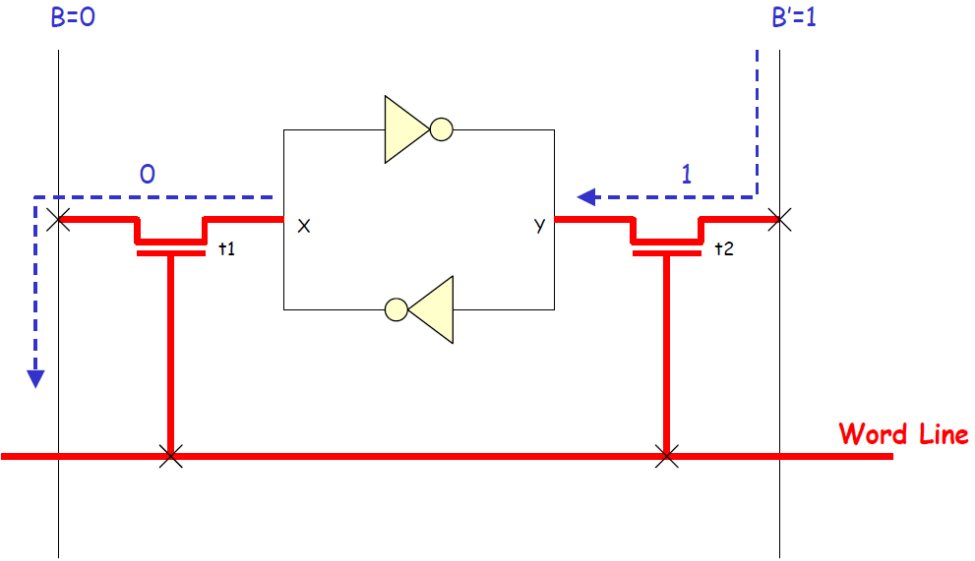
- BL=1 and $\overline{BL}$=0
- WL=1

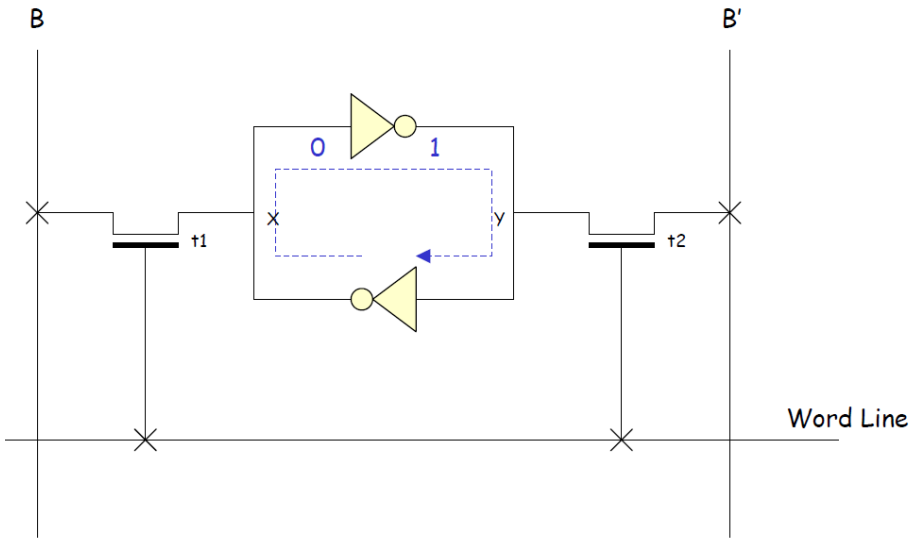




SRAM – 0 Yazma Mantığı

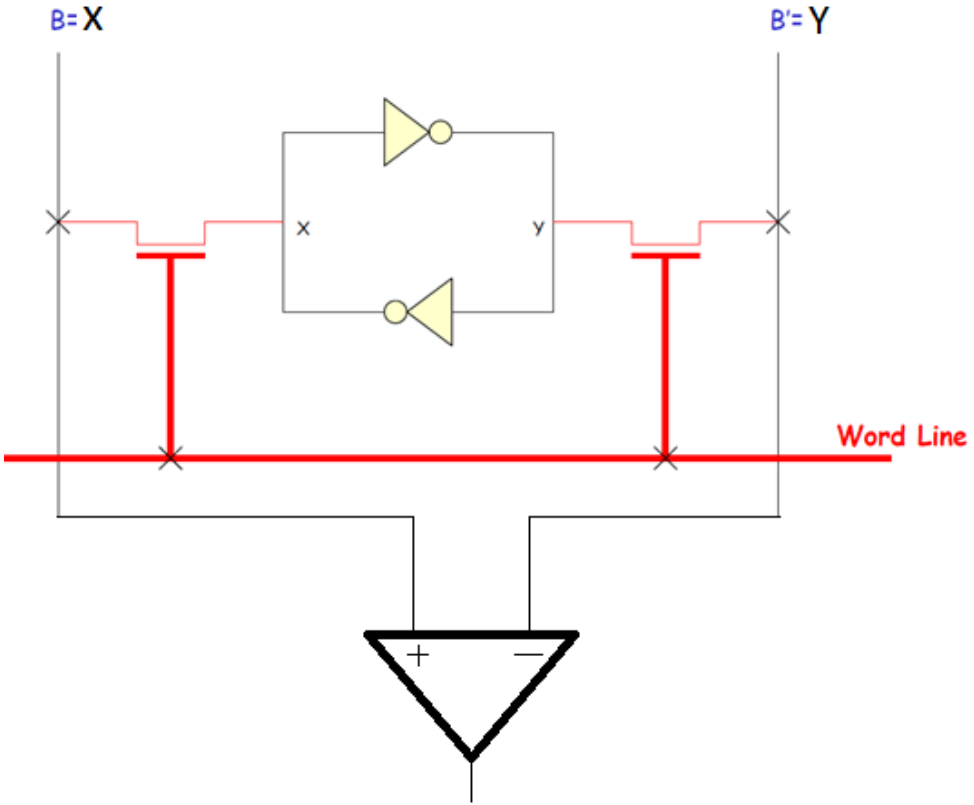
- BL=0 and $\overline{BL}$=1
- WL=1



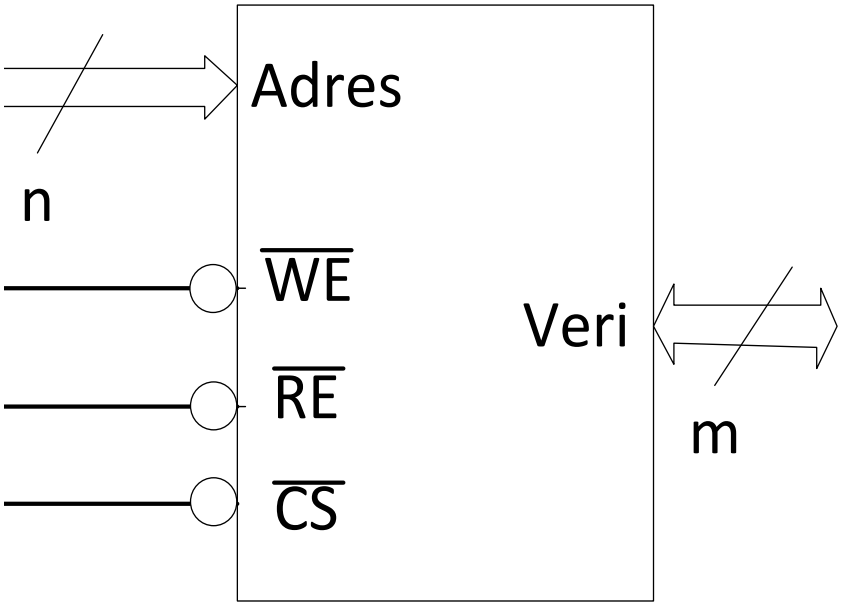


SRAM – Okuma Mantığı

- WL=1



SRAM Blok Diyagram



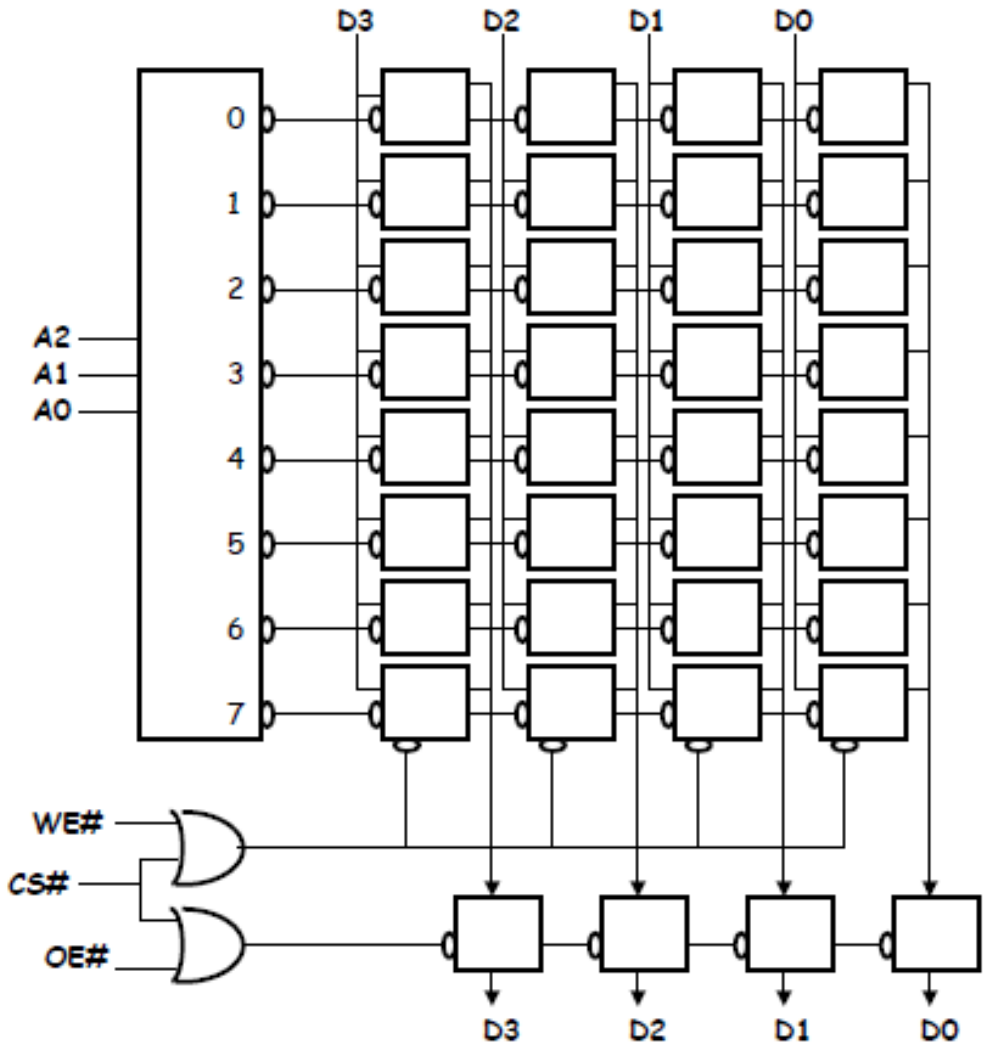
2^n x m kapasiteli SRAM

$\overline{RE} \leftrightarrow \overline{RD}$

$\overline{WE} \leftrightarrow \overline{WR}$

$\overline{CS} \leftrightarrow$ Adres çözümleme

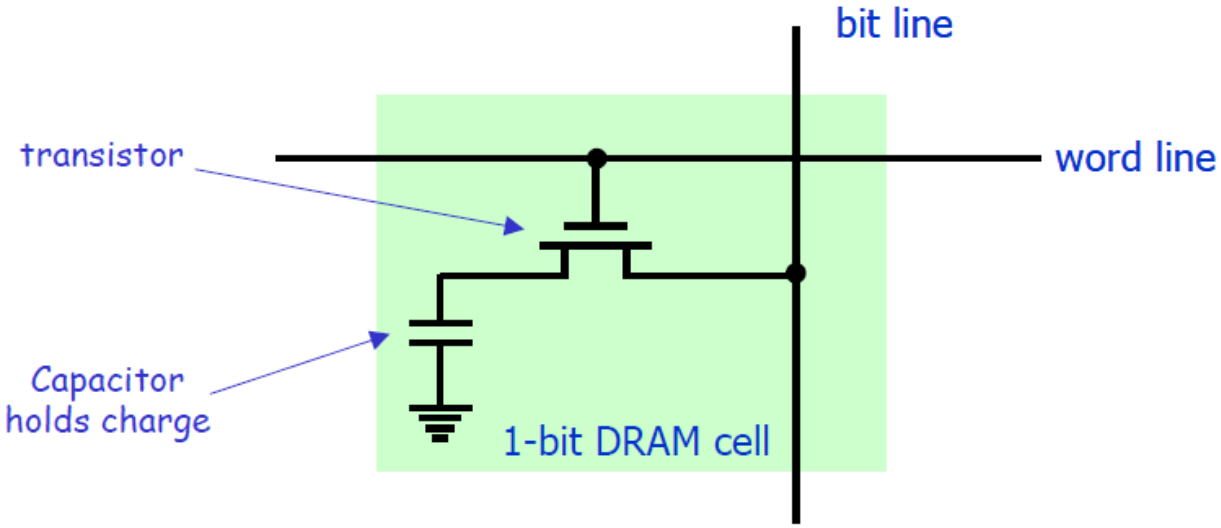
SRAM İç Yapısı



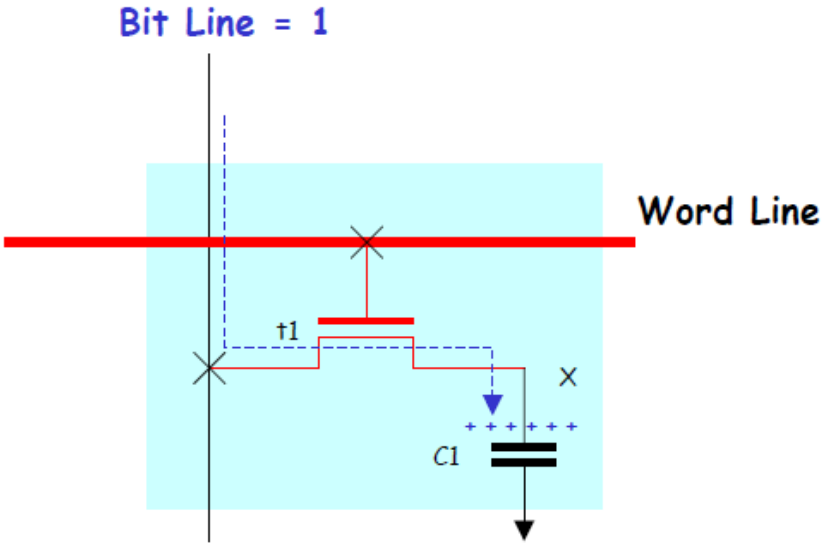
DRAM

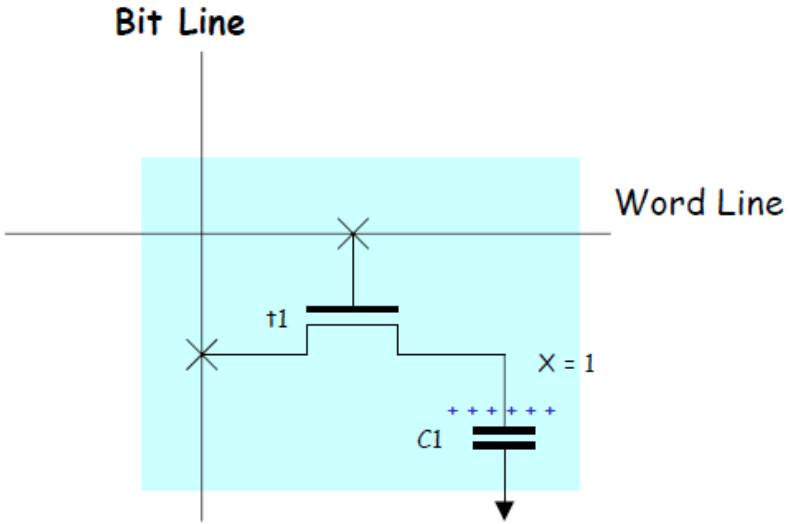
- Kapasite + Transistor çiftlerinden oluşur
- Tuttuğu lojik değer belirli aralıklarla güncellenmek zorundadır
- Her bir hücresi SRAM’a göre entegrede 4 kat daha az yer kaplar
- 0 değeri kayıpsız saklanır, 1 değeri güncellenmezse kaybedilir

DRAM Hücresi

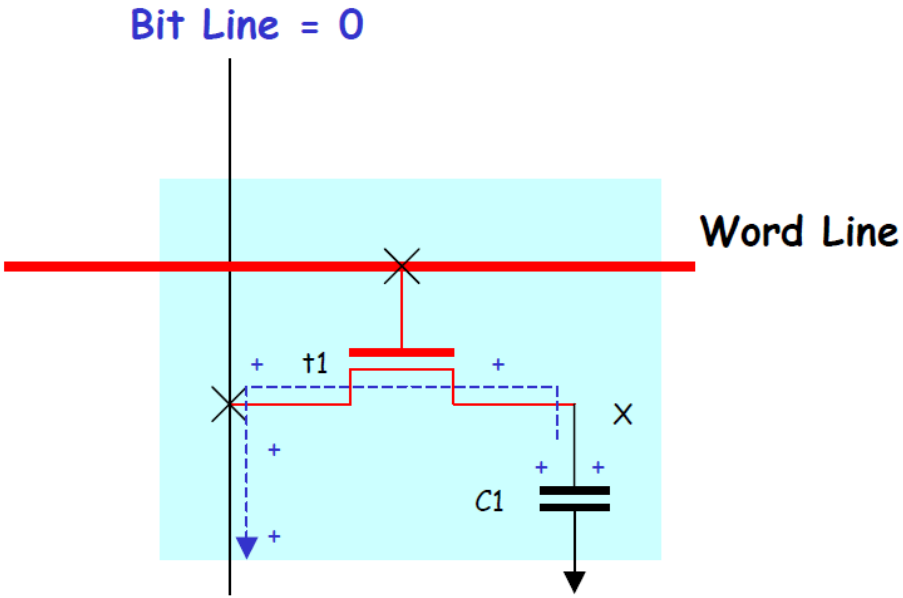


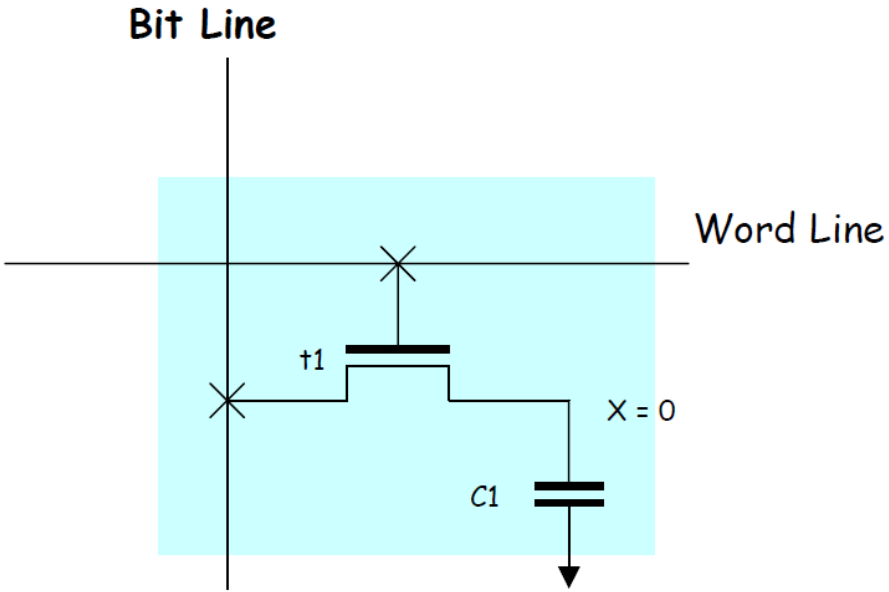
DRAM – 1 Yazma Mantığı



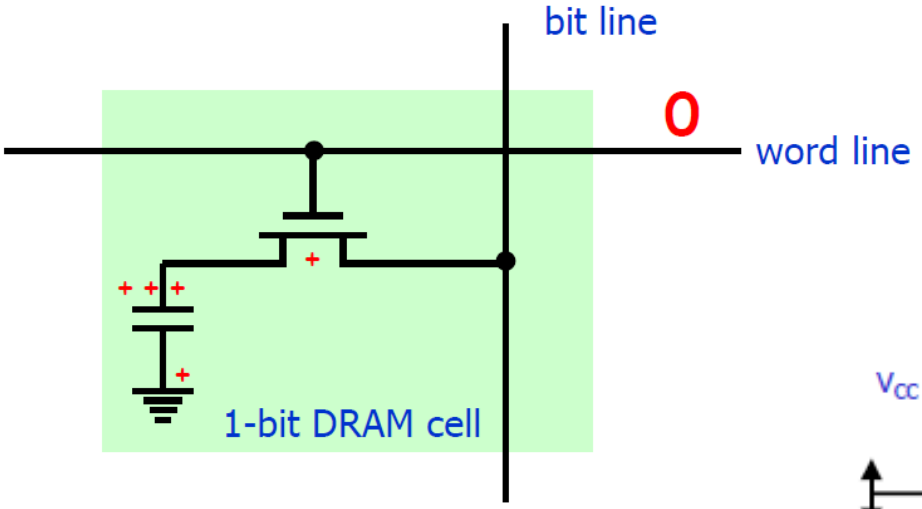


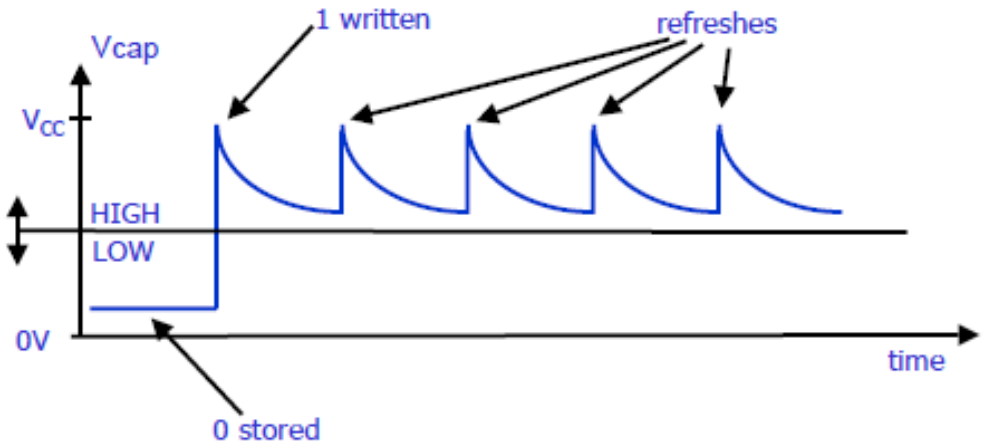
DRAM – 0 Yazma Mantığı



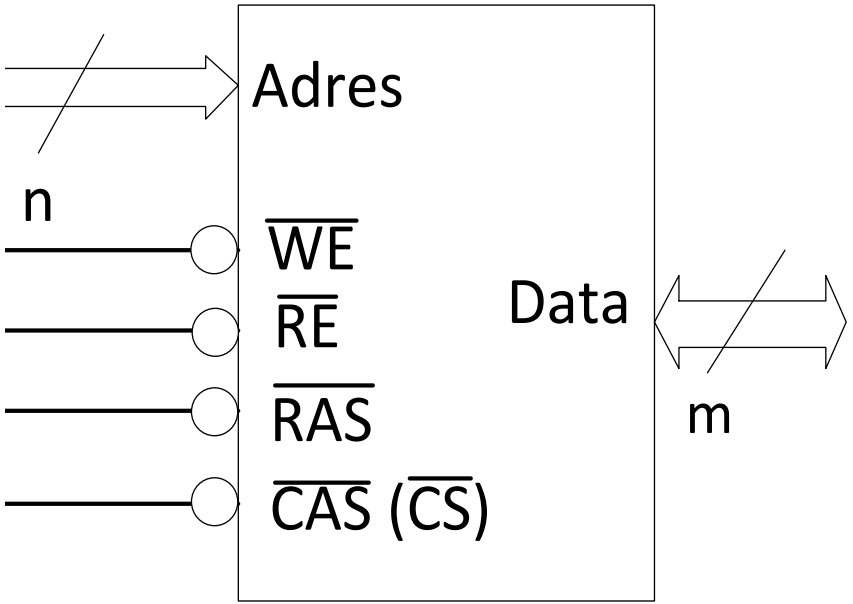


DRAM - Güncelleme





DRAM Blok Diyagramı



2^{2n} x m kapasiteli DRAM

$\overline{RE} \leftrightarrow \overline{RD}$

$\overline{WE} \leftrightarrow \overline{WR}$

$\overline{RAS}$: row select

$\overline{CAS}$ $(\overline{CS})$: column select

DRAM İç Yapısı

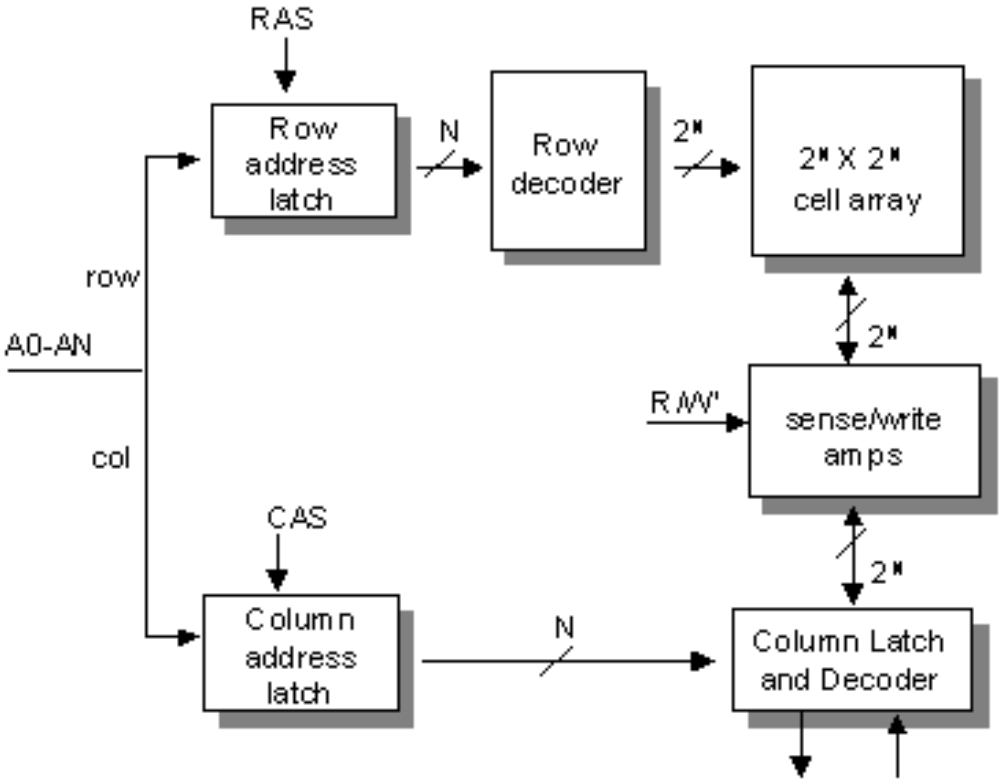


Figure 2. Hardware Diagram of Typical DRAM ($2^N \times 2^N \times 1$)

http://www.cs.cmu.edu/~cjc/course/15740-report.htm

DRAM	SRAM
1. Constructed of tiny capacitors that leak electricity.	1.Constructed of circuits similar to D flip-flops.
2.Requires a recharge every few milliseconds to maintain its data.	2.Holds its contents as long as power is available.
3.Inexpensive.	3.Expensive.
4. Slower than SRAM.	4. Faster than DRAM.
5. Can store many bits per chip.	5. Can not store many bits per chip.
6. Uses less power.	6.Uses more power.
7.Generates less heat.	7.Generates more heat.
8. Used for main memory.	8. Used for cache.

https://www.geeksforgeeks.org/random-access-memory-ram-and-read-only-memory-rom/

A computer has 2048 MB of RAM.

How many GB of RAM does the computer have?

a.) 2 b.) 4 c.) 6 d.) 8

A computer has 2048 MB of RAM.

How many GB of RAM does the computer have?

a.) 2 b.) 4 c.) 6 d.) 8

(a) Question 8 (a) tells you that a computer has 2048 MB of RAM and then asks how many Gigabytes it has. To answer this correctly you need to know that 1 Gigabyte = 1024 megabytes.

2048 / 1024 = 2

Answer

2 Gigabytes (GB)

Explain **three** ways that RAM is different to ROM.

1 .....

.....

.....

2 .....

.....

.....

3 .....

.....

.....

Explain **three** ways that RAM is different to ROM.

Answers

- RAM is Volatile, ROM is non-volatile
- RAM is temporary, ROM is (semi) permanent
- RAM normally has a larger capacity that ROM
- RAM can be edited ROM cannot be edited // RAM can be read from and written to, ROM can only be read from.

The table contains three statements about RAM or ROM.

Tick (✓) to show whether each statement describes **RAM** or **ROM**.

Statement	RAM (✓)	ROM (✓)
Stores the programs and data that are currently in use		
Used to boot up the computer when power is turned on		
Contents are retained when power is turned off		

a.)

RAM (✓)	ROM (✓)
✓	✓
✓	

b.)

RAM (✓)	ROM (✓)
	✓
✓	
	✓

c.)

RAM (✓)	ROM (✓)
✓	
	✓
	✓

d.)

RAM (✓)	ROM (✓)
	✓
✓	✓
	✓

The table contains three statements about RAM or ROM.

Tick (✓) to show whether each statement describes **RAM** or **ROM**.

Statement	RAM (✓)	ROM (✓)
Stores the programs and data that are currently in use		
Used to boot up the computer when power is turned on		
Contents are retained when power is turned off		

c.)

Statement	RAM (✓)	ROM (✓)
Stores the programs and data that are currently in use	✓	
Used to boot up the computer when power is turned on		✓
Contents are retained when power is turned off		✓

Circle the storage category that includes both RAM and ROM.

a.) Primary

b.) Secondary

c.) Off-line

Circle the storage category that includes both RAM and ROM.

a.) Primary

Explain what is meant by off-line storage.

.....

.....

.....

.....

Explain what is meant by off-line storage.

- Non-volatile storage
- Storage that can be disconnected/removed from the computer
- Any suitable example
- Must be (physically) connected to computer to obtain stored data
- Used to store files as a backup

https://www.bitsofbytes.co/exam-questions---memory--storage.html

Which of the following retains its data even after the computer is switched off?

- ROM
- RAM
- REM

Which of the following retains its data even after the computer is switched off?

- ROM
- RAM
- REM

✓ Correct

ROM retains its data when the computer is switched off.

What does RAM stand for?

- Random accessible memory
- Random access memory
- Random allowable memory

What does RAM stand for?

- Random accessible memory
- Random access memory
- Random allowable memory

✓ Correct

RAM stands for **random access memory**.

What is a computer's main internal backing store?

- CD-ROM
- ROM
- Hard disk

What is a computer's main internal backing store?

- CD-ROM
- ROM
- Hard disk

✓ Correct

The **hard disk** is a computer's main internal backing store.

https://www.bbc.co.uk/bitesize/guides/z7rk7ty/test

3. Static memory holds data as long as _____
a) AC power is applied
b) DC power is applied
c) Capacitor is fully charged
d) High Conductivity

3. Static memory holds data as long as _____
a) AC power is applied
b) DC power is applied
c) Capacitor is fully charged
d) High Conductivity
View Answer

Answer: b
Explanation: In any semiconductor equipment, AC power can't be supplied directly. So, static memory holds the data as long as DC power is applied.

5. In dynamic memory, CCD stands for _____

a) Charged Count Devices

b) Change Coupled Devices

c) Charge Coupled Devices

d) Charged Compact Disk

5. In dynamic memory, CCD stands for _____

a) Charged Count Devices

b) Change Coupled Devices

c) Charge Coupled Devices

d) Charged Compact Disk

View Answer

Answer: b

Explanation: In dynamic memory, CCD stands for Charge Coupled Devices.

6. Volatile memory refers to _____

a) The memory whose loosed data is achieved again when power to the memory circuit is removed

b) The memory which looses data when power to the memory circuit is removed

c) The memory which looses data when power to the memory circuit is applied

d) The memory whose loosed data is achieved again when power to the memory circuit is applied

6. Volatile memory refers to _____
a) The memory whose loosed data is achieved again when power to the memory circuit is removed
b) The memory which looses data when power to the memory circuit is removed
c) The memory which looses data when power to the memory circuit is applied
d) The memory whose loosed data is achieved again when power to the memory circuit is applied

View Answer

Answer: b
Explanation: Volatile means 'liable to change rapidly' and volatile memory refers to the memory which looses data rapidly when power to the memory circuit is removed. Thus, it looks after it's data as long as it is powered. Non-volatile means 'not volatile' and non-volatile memory refers to the memory which retains the data even if there is a break in the power supply.

13. By which technology, semiconductor memories are constructed?
a) PLD
b) LSI
c) VLSI
d) Both LSI and VLSI

13. By which technology, semiconductor memories are constructed?
a) PLD
b) LSI
c) VLSI
d) Both LSI and VLSI
View Answer

Answer: d
Explanation: Generally, semiconductor memories are constructed using Large Scale Integration (LSI) or Very Large Scale Integration (VLSI) because these are made up of NMOS, CMOS, BJT etc.

3. The full form of EEPROM is _____
a) Erasable Electrically Programmable ROMs
b) Electrically Erasable Programmable ROMs
c) Electrically Erasable Programming ROMs
d) Electrically Erasable Programmed ROMs

3. The full form of EEPROM is _____
a) Erasable Electrically Programmable ROMs
b) Electrically Erasable Programmable ROMs
c) Electrically Erasable Programming ROMs
d) Electrically Erasable Programmed ROMs
View Answer

Answer: b
Explanation: The full form of EEPROM is Electrically Erasable Programmable ROMs. In EPROM (Erasable Programmable ROMs), the ROM is cleared by exposing it to UV radiation and also it's a tedious process. Whereas, in EEPROM, the ROM can be cleared electrically and thus is less time consuming and more efficient.

8. What is the major difference between DRAM and SRAM?
a) Dynamic RAMs are always active; static RAMs must reset between data read/write cycles
b) SRAMs can hold data via a static charge, even with power off
c) The only difference is the terminal from which the data is removed—from the FET Drain or Source
d) DRAMs must be periodically refreshed

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b) SRAMs can hold data via a static charge, even with power off
c) The only difference is the terminal from which the data is removed—from the FET Drain or Source
d) DRAMs must be periodically refreshed
View Answer

Answer: d
Explanation: DRAMs must be periodically refreshed so that it can store the new information. DRAMs are slower compared to SRAMs as the access time for SRAM is less than that of DRAM.

13. Which type of ROM has to be custom built by the factory?
a) EEPROM
b) Mask ROM
c) EPROM
d) PROM

13. Which type of ROM has to be custom built by the factory?
a) EEPROM
b) Mask ROM
c) EPROM
d) PROM
View Answer

Answer: b
Explanation: All types of ROM are programmable and can be programmed as per requirement but the mask ROM is always programmed for specific application and it can't be reprogrammed. PROM stands for Programmable Read Only Memory in which the ROM can be externally programmed by the user. EPROM stands for Erasable Programmable Read Only Memory, where the ROM and be cleared and re-programmed.

5. The total storage capacity of 16 * 8 ROM is _____

a) 8 bits

b) 16 bits

c) 128 bits

d) 64 bits

5. The total storage capacity of 16 * 8 ROM is _____

a) 8 bits

b) 16 bits

c) 128 bits

d) 64 bits

View Answer

Answer: c

Explanation: ROM stands for Read Only Memory in which data is stored permanently and wherefrom data can only be read and rarely modified. The total storage capacity of 16 * 8 ROM is 128 bits (i.e. 16 * 8 = 128).

5. The bit capacity of a memory that has 2048 addresses and can store 8 bits at each address is _____

a) 4096

b) 16384

c) 32768

d) 8129

bits.

5. The bit capacity of a memory that has 2048 addresses and can store 8 bits at each address is _____

a) 4096

b) 16384

c) 32768 bits.

d) 8129

View Answer

Answer: b

Explanation: 1 address can store 8 bits. Therefore, total capacity of a memory having n addresses = 8 * n.
Therefore, for 2048 addresses,
total capacity of a memory = 2048 * 8 = 16384 bits.

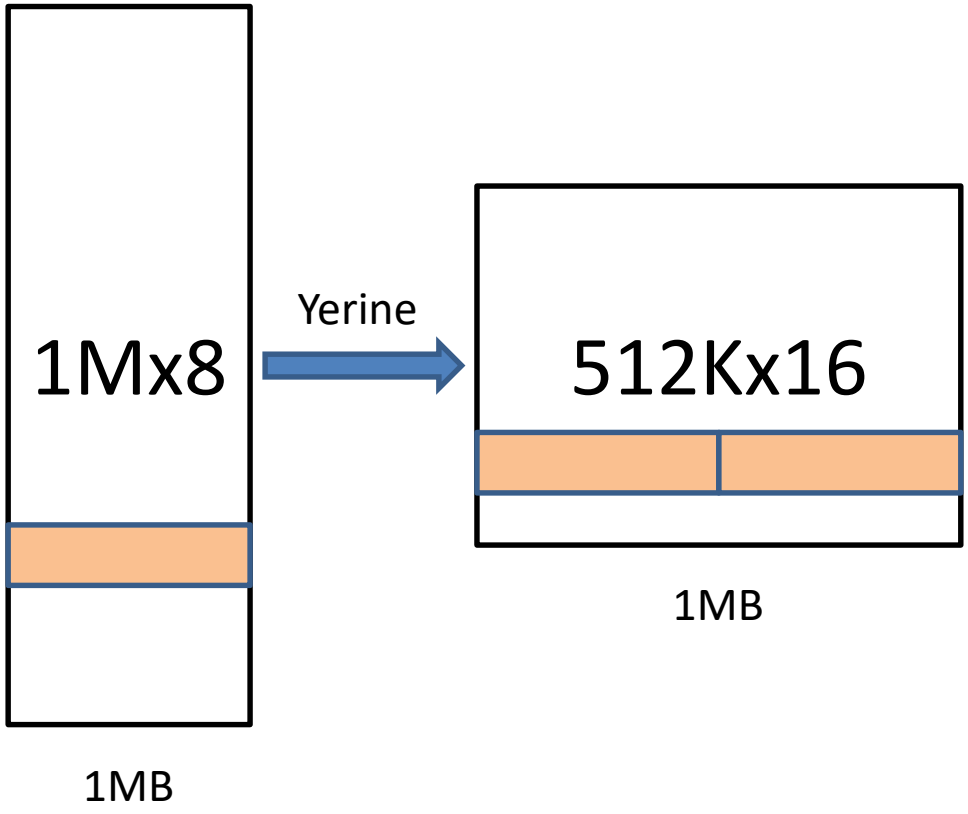
3. The DRAM stores its binary information on _____
a) MOSFET
b) Transistor
c) Capacitor
d) BJT

3. The DRAM stores its binary information on _____
a) MOSFET
b) Transistor
c) Capacitor
d) BJT
View Answer

Answer: c
Explanation: Capacitor has high storing capability only, so DRAM stores its binary information in the form of electric charges on capacitors. However, DRAM takes more time time to access data.

8086 Adres Uzayı

- 20 uç ile $2^{20} = 1\text{M}$ hafıza gözü adreslenebilir
- Hafıza birimi → birim kapasite 1 byte (8 veri ucu)



8086 Adres Uzayı

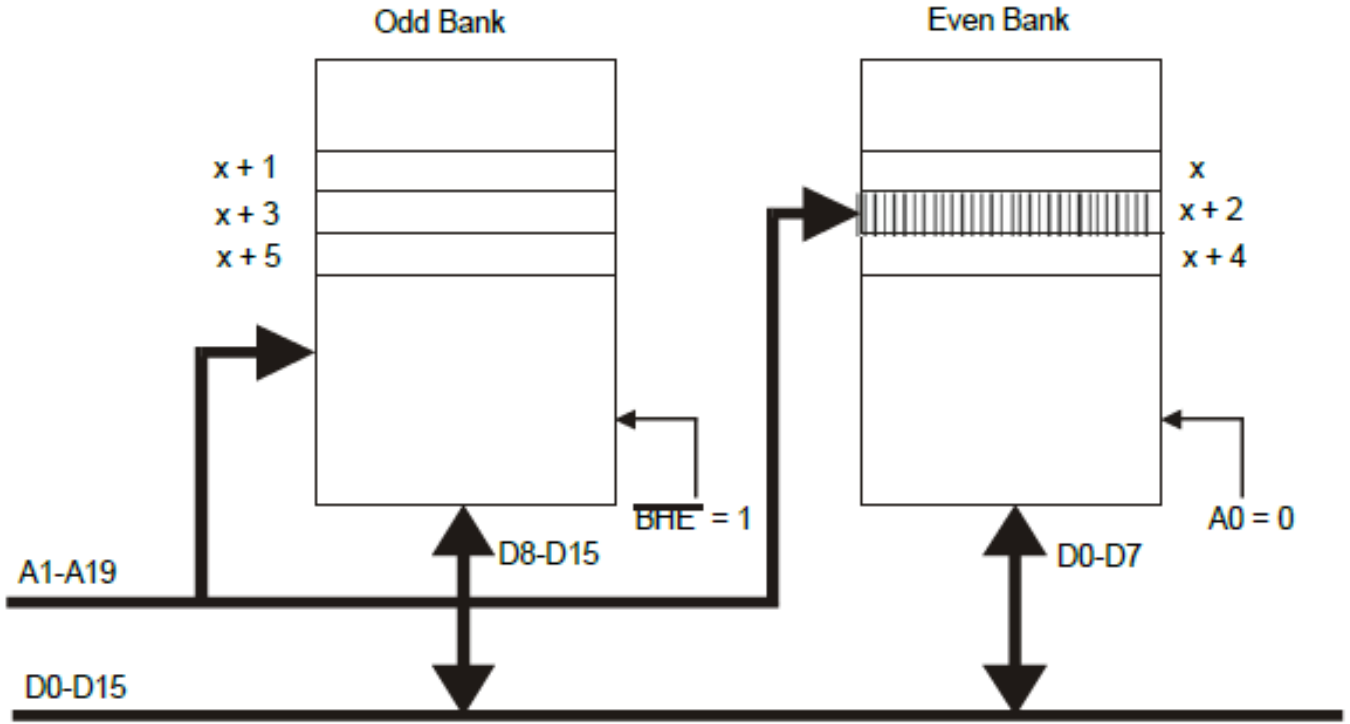
- 8086 → 20 adres ucu, 16 veri ucu var
- Hafıza birimleri → 8 veri ucuna sahip
- 8086 → çift adresten 8 bitlik

  tek adresten 8 bitlik

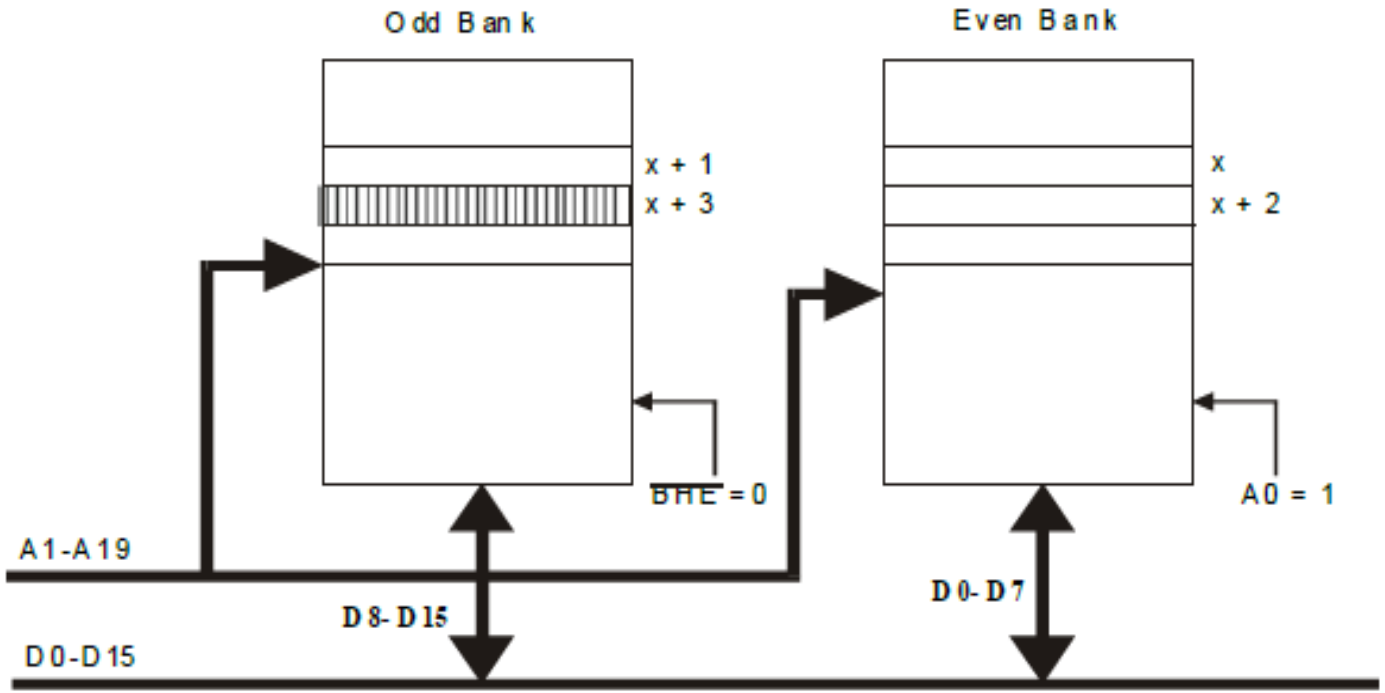
  çift adresten 16 bitlik *tek adresten 16 bitlik?*

  işlemleri bir okuma/yazma çevriminde yapmayı desteklemeli

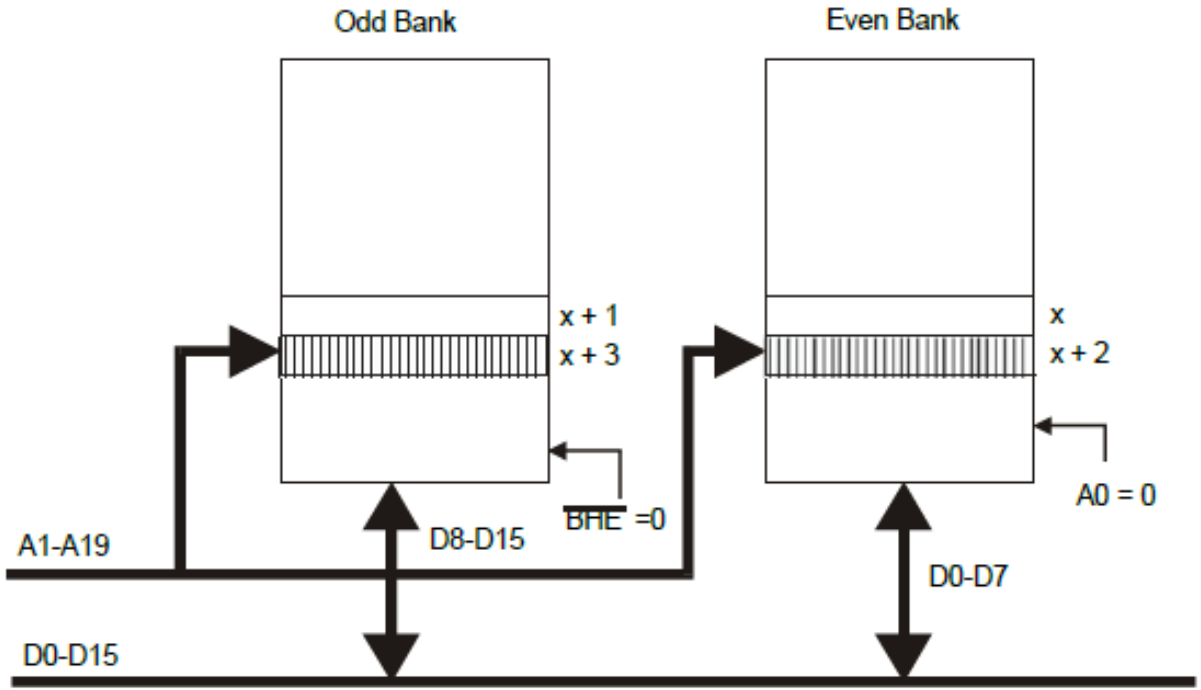
8086 Adres Uzayı – çift adresten 8 bit işlem



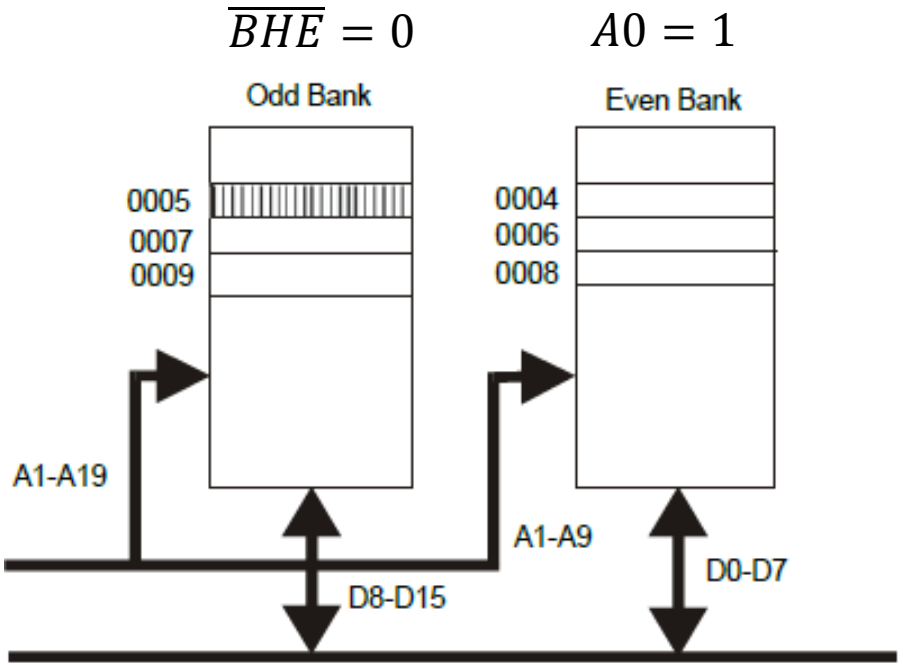
8086 Adres Uzayı – tek adresten 8 bit işlem

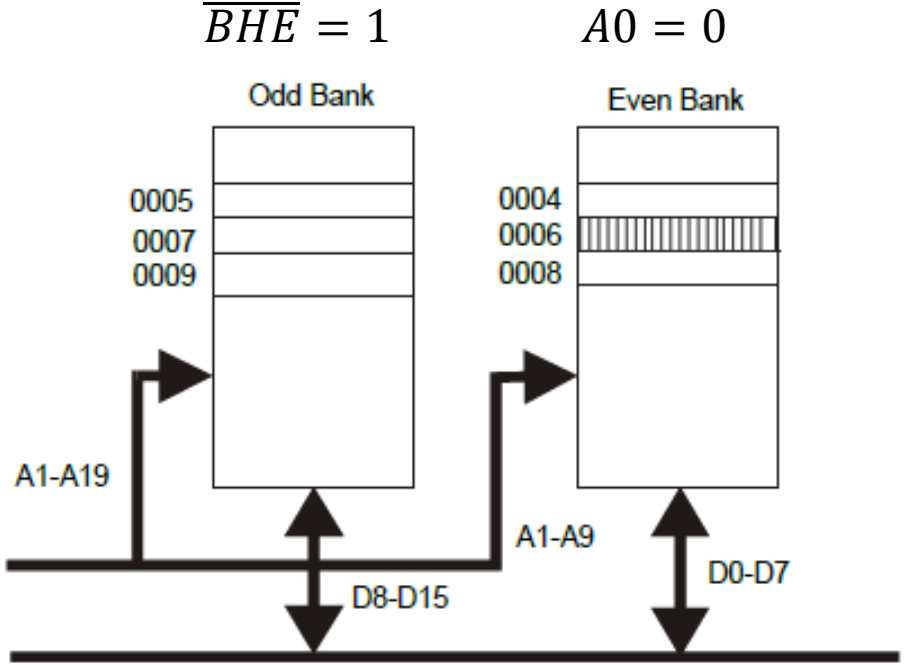


8086 Adres Uzayı – çift adresten 16 bit işlem



8086 Adres Uzayı – tek adresten 16 bit işlem

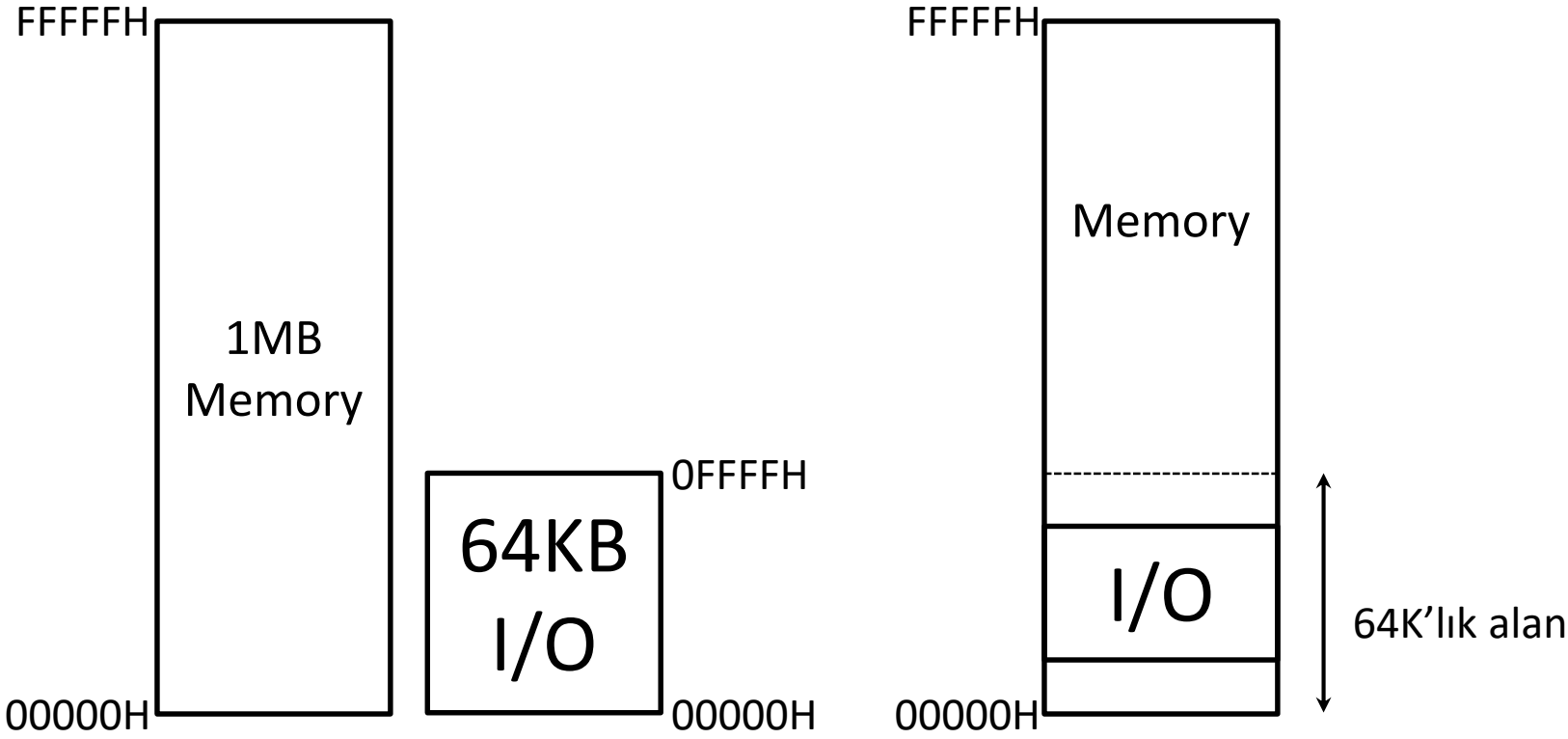




Adres Çözümleme

- Hafıza ve I/O çipleri ortak veri ve adres yollarını kullanır
- Bir seferde yola veri çıkan tek bir çip sağlamak için ADRES ÇÖZÜMLEME kullanılır
- Hafıza ve I/O çipleri sadece belirli adres aralıklarına yerleştirmek için ADRES ÇÖZÜMLEME (AÇ) gereklidir

Isolated I/O – Memory Mapped I/O



ISOLATED I/O	MEMORY MAPPED I/O
Memory and I/O have separate address space	Both have same address space
All address can be used by the memory	Due to addition of I/O addressable memory become less for memory
Separate instruction control read and write operation in I/O and Memory	Same instructions can control both I/O and Memory

ISOLATED I/O	MEMORY MAPPED I/O
In this I/O address are called ports.	Normal memory address are for both
More efficient due to separate buses	Lesser efficient
Larger in size due to more buses	Smaller in size
It is complex due to separate separate logic is used to control both.	Simpler logic is used as I/O is also treated as memory only.

https://www.geeksforgeeks.org/memory-mapped-i-o-and-isolated-i-o/

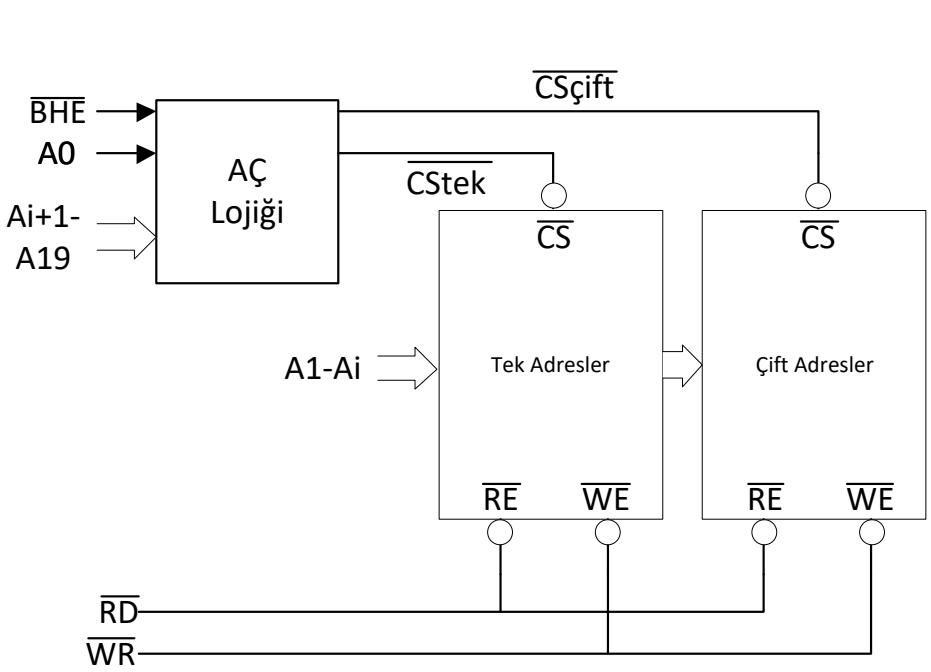
Adres Çözümleme (AÇ)

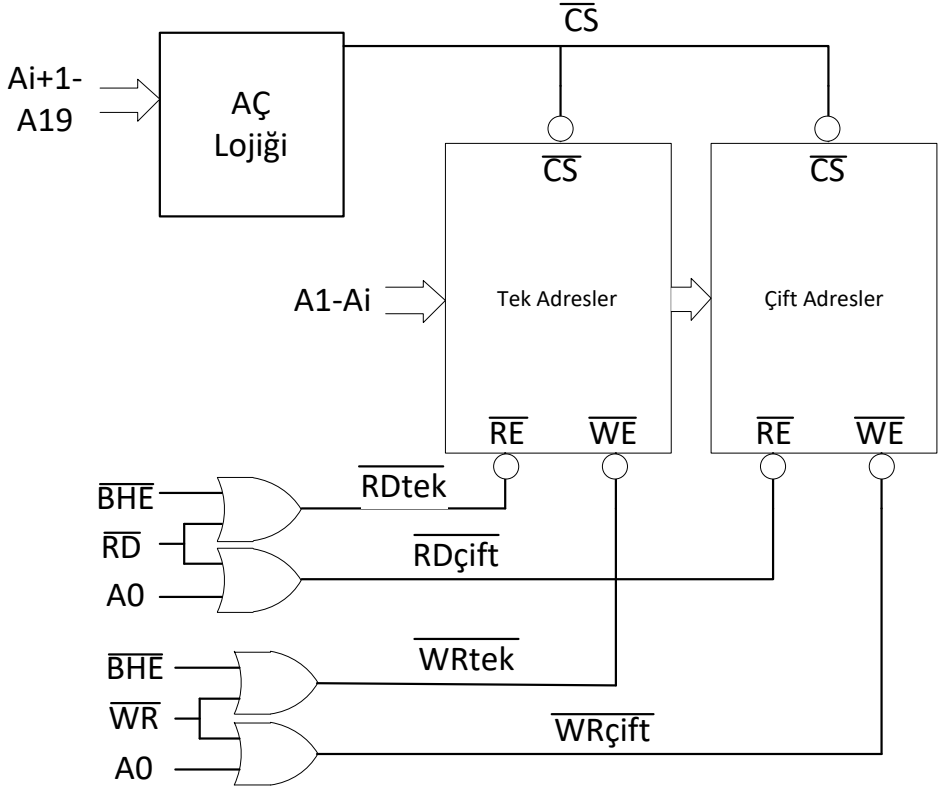
- AÇ lojiği ile hafıza birimi için $\overline{CS}$ işareti üretilir
- A1-Ai hafıza biriminin adres uçlarına bağlanır
- A(i+1)-A19 uçları AÇ lojiğine girdi olur
- $M/\overline{IO}$ ucu AÇ'de kullanılırsa → isolated I/O
- $M/\overline{IO}$ ucu AÇ'de kullanılmazsa → memory mapped I/O
- A0, $\overline{BHE}$ AÇ'de kullanılırsa → seperate bank decoder yöntemi
- A0, $\overline{BHE}$; $\overline{RD}$, $\overline{WR}$ işaretleri ile birleştirilerek kullanılıyorsa → seperate bank strobe yöntemi

Seperate Bank Decoder – Seperate Bank Strobe

- Seperate Bank Decoder : Verilen adres aralığına giren çift ve tek adresler için ayrı ayrı $\overline{CS}$ üretilir
- Seperate Bank Strobe : Verilen adres aralığı için $\overline{CS}$ üretilir, çift ve tek adresler için ayrı okuma/yazma işaretleri üretilir

Seperate Bank Decoder – Seperate Bank Strobe





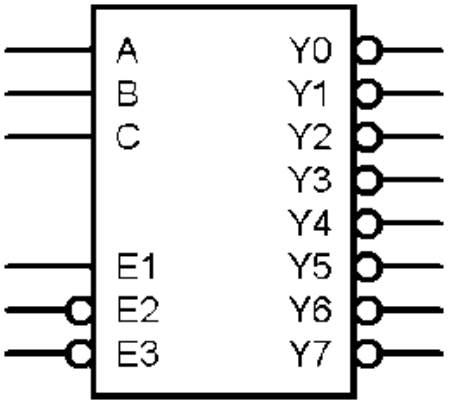
Adres Çözümleme

- AÇ lojiği için
  - Çok girişli NAND kapısı
  - Dekoder entegresi
  - PAL, PLD (programlanabilir lojik elemanlar)

Adres Çözümleme – 3x8 decoder (74138)

INPUTS						OUTPUTS								SELECTED OUTPUT
ENABLE			SELECT											
$E1$	$\overline{E2}$	$\overline{E3}$	C	B	A	$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$	$\overline{Y4}$	$\overline{Y5}$	$\overline{Y6}$	$\overline{Y7}$	
L	X	X	X	X	X	H	H	H	H	H	H	H	H	NONE
X	X	H	X	X	X	H	H	H	H	H	H	H	H	NONE
X	H	X	X	X	X	H	H	H	H	H	H	H	H	NONE
H	L	L	L	L	L	L	H	H	H	H	H	H	H	$\overline{Y0}$
H	L	L	L	L	H	H	L	H	H	H	H	H	H	$\overline{Y1}$
H	L	L	L	H	L	H	H	L	H	H	H	H	H	$\overline{Y2}$
H	L	L	L	H	H	H	H	H	L	H	H	H	H	$\overline{Y3}$
H	L	L	H	L	L	H	H	H	H	L	H	H	H	$\overline{Y4}$
H	L	L	H	L	H	H	H	H	H	H	L	H	H	$\overline{Y5}$
H	L	L	H	H	L	H	H	H	H	H	H	L	H	$\overline{Y6}$
H	L	L	H	H	H	H	H	H	H	H	H	H	L	$\overline{Y7}$

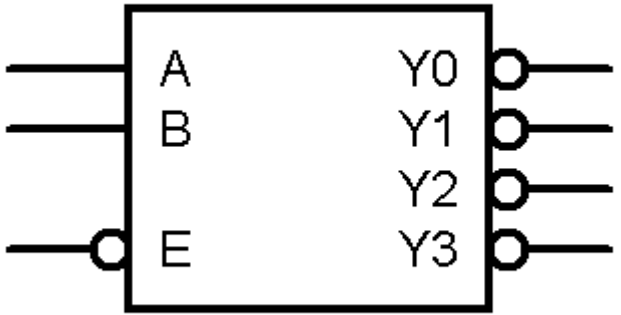
X : Don’t Care, L : Low, H : High



Adres Çözümleme – 2x4 decoder (74139)

INPUTS			OUTPUTS				SELECTED OUTPUT
ENABLE	SELECT						
$\overline{E}$	B	A	$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$	
H	X	X	H	H	H	H	NONE
L	L	L	L	H	H	H	$\overline{Y0}$
L	L	H	H	L	H	H	$\overline{Y1}$
L	H	L	H	H	L	H	$\overline{Y2}$
L	H	H	H	H	H	L	$\overline{Y3}$

X : Don’t Care, L : Low, H : High

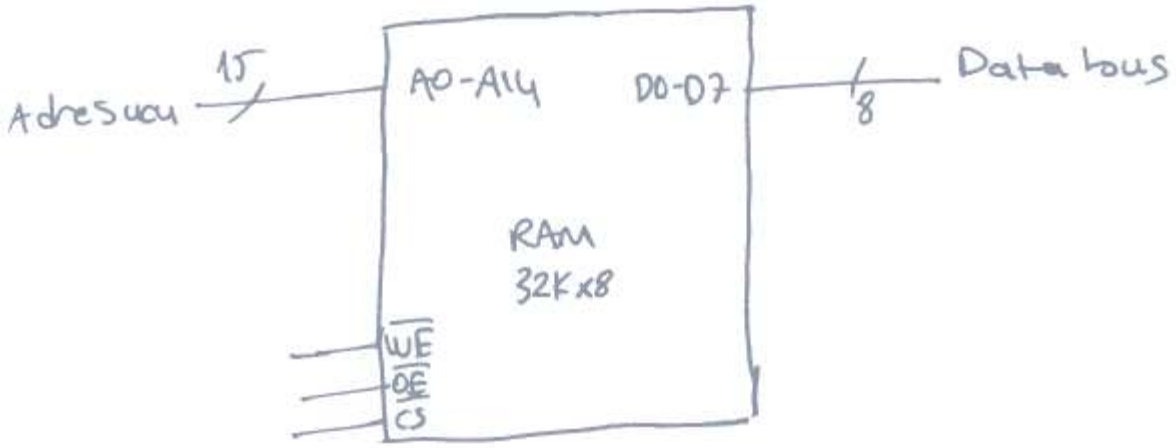


: 62256 RAM (32K x8) : 15 adres ucu var.

4 adet 62256 RAM kullanarak 00000H adresinden başlayarak 128K Byte'lik bir alana RAM yerleştirin.

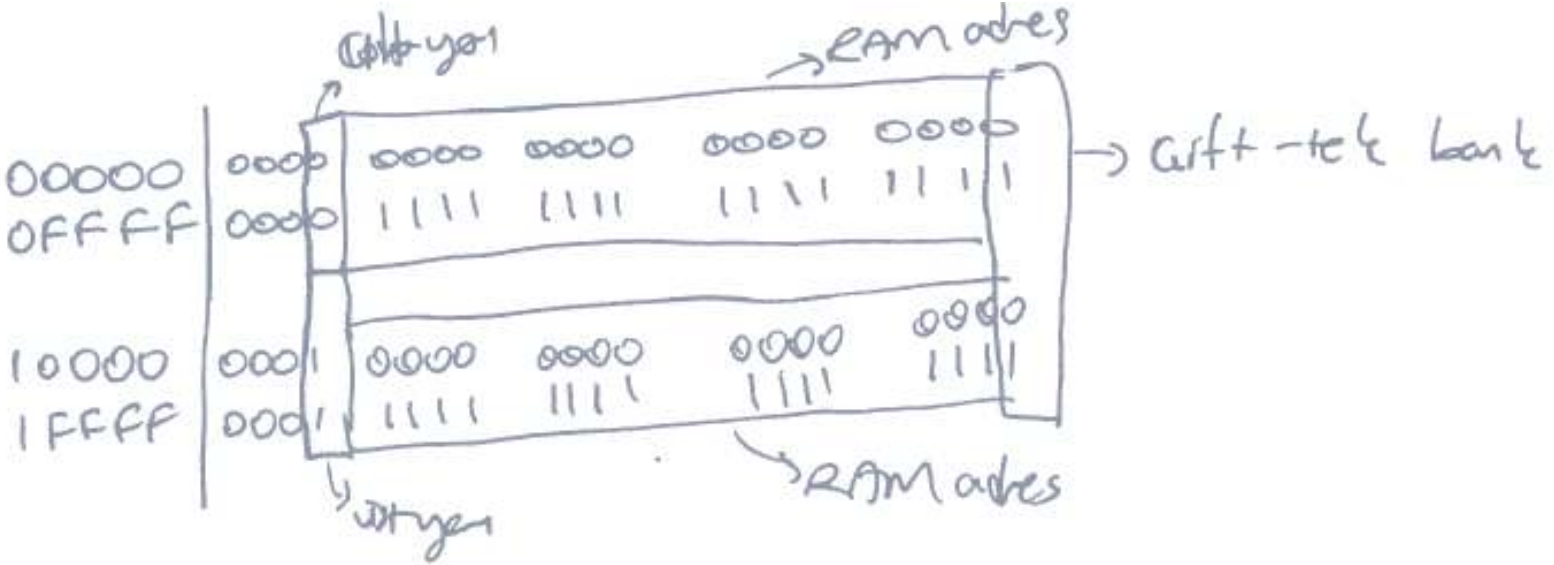
: 62256 RAM (32K x8) : 15 adres ucu var.

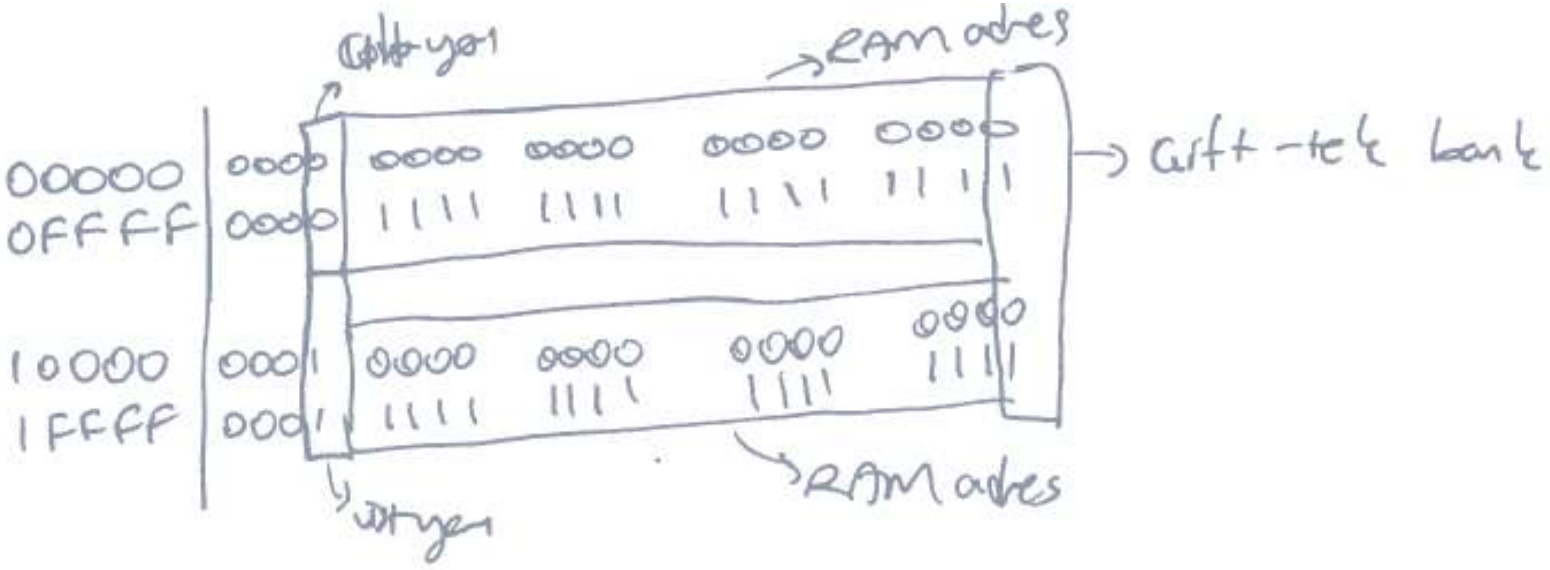
4 adet 62256 RAM kullanarak 00000H adresinden başlayarak 128K Byte'lik bir alana RAM yerleştirin.

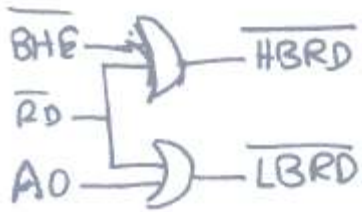


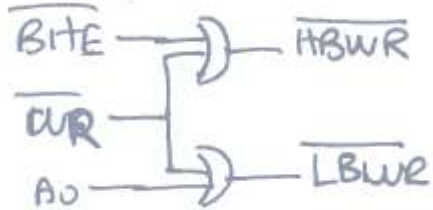
$2^7 \cdot 2^{10}$
128KB

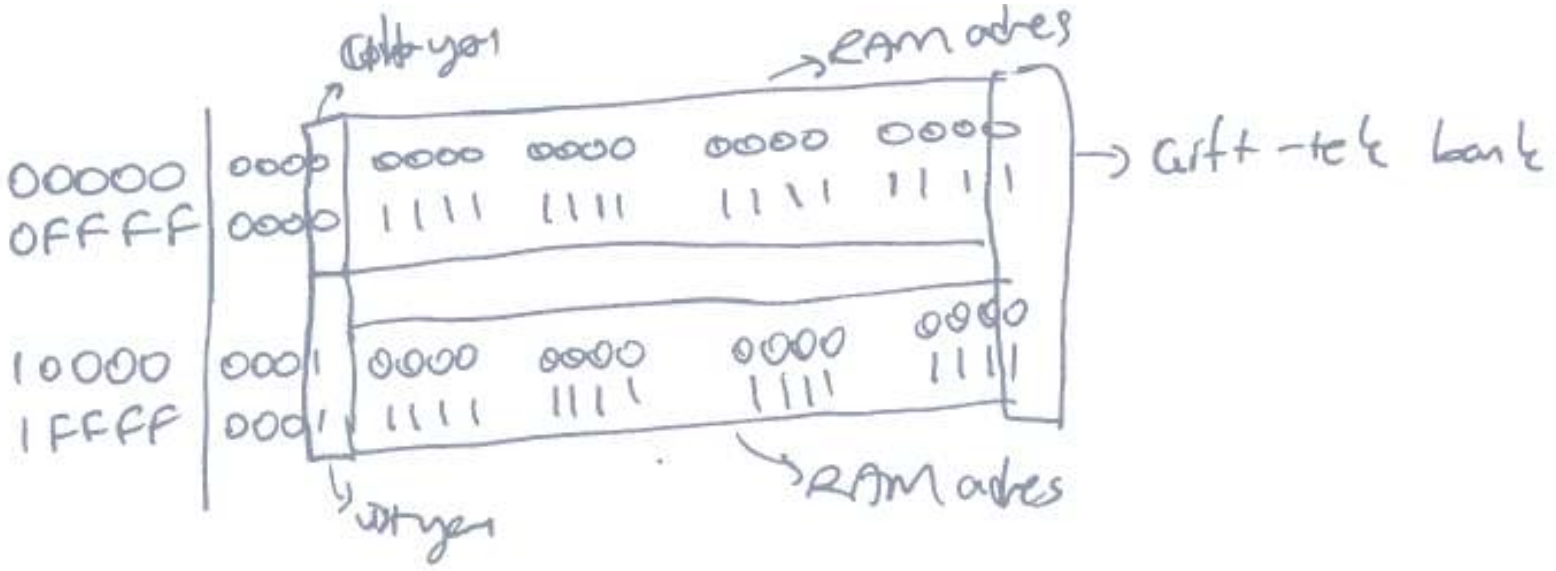
00000H ⟶ 1ffffH

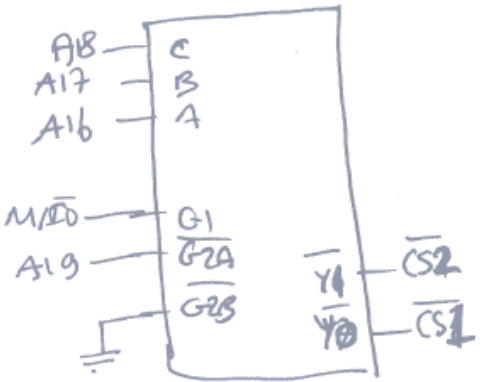


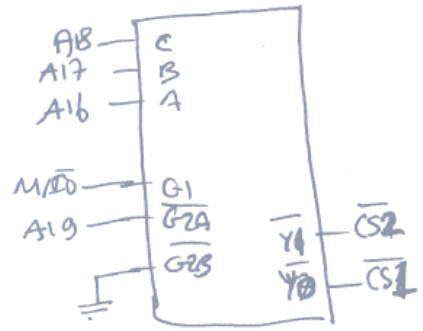

00000
0FFFF
10000
1FFFF
RAM adres
RAM adres

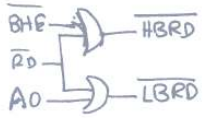

BHE
RD
A0
HBRD
LBRD

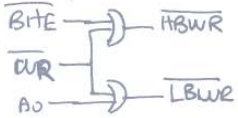

BHE
WR
A0
HBWR
LBWR

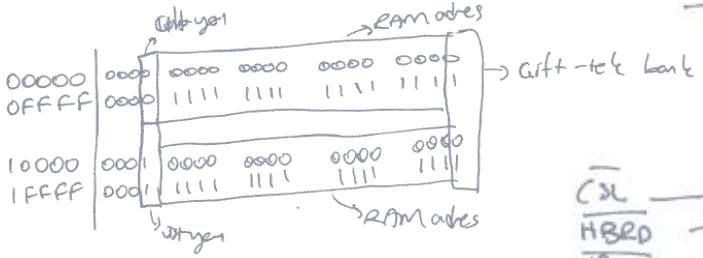

Address
RAM addres
Data
RAM addres
00000
0FFFF
10000
1FFFF

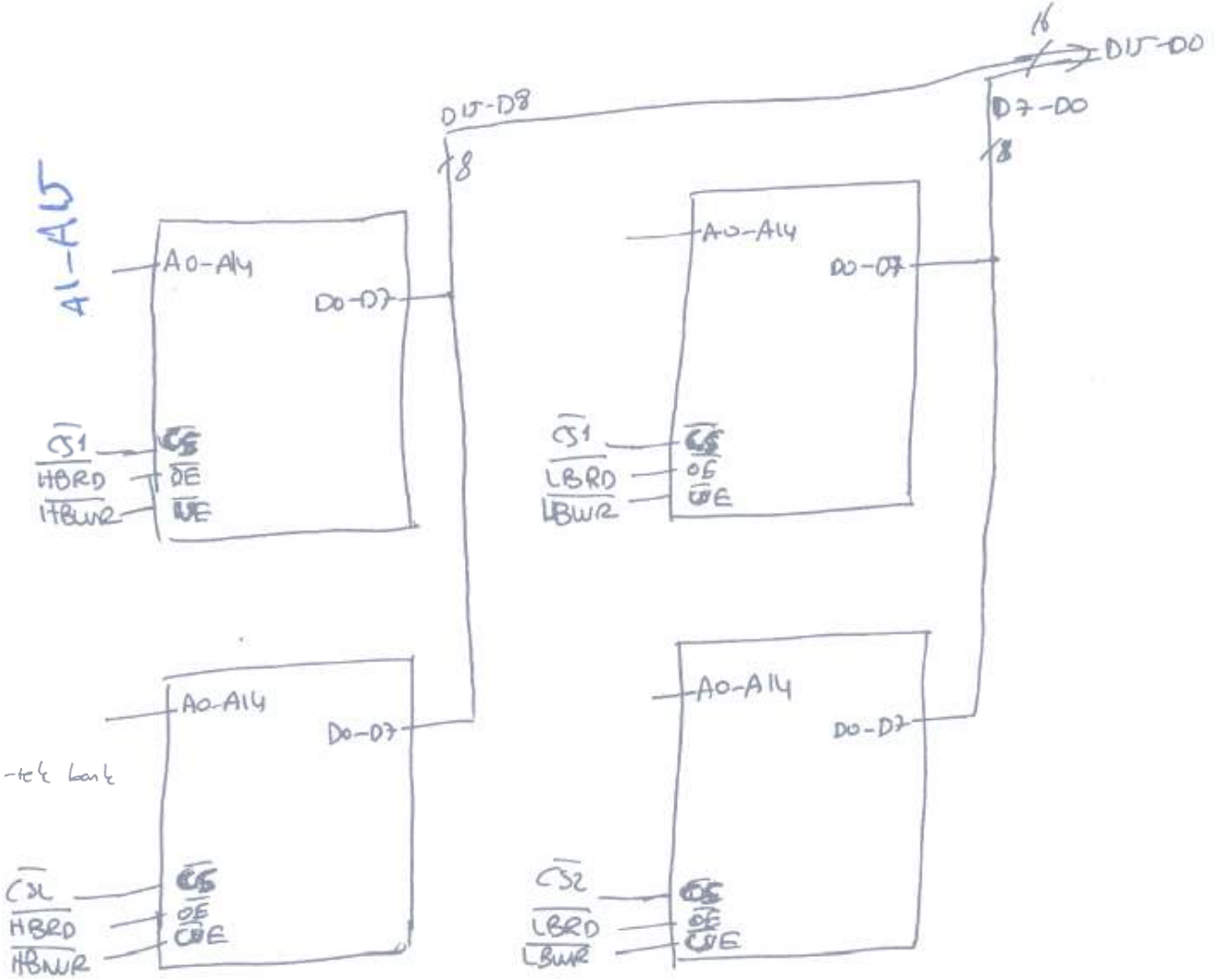

A18
A17
A16
M/IO
A19
C
B
A
G1
G2A
G2B
Y1
Y0
CS2
CS1


A18
A17
A16
M/IO
A19
C
B
A
G1
G2A
G2B
Y1
Y0
CS2
CS1


BHE
RD
A0
HBRD
LBRD


BHE
WR
A0
HBWR
LBWR


00000
0FFFF
10000
1FFFF
RAM adres
Left-left Bank
RAM adres


16
D15-D0
D15-D8
D7-D0
8
8
A1-A15
A0-A14
D0-D7
CS1
HBRD
HBWR
OE
WE
LBRD
LBWR
CS2

2) 8086 mikroişlemci sisteminin bellek uzayına 00000H adresinde itibaren 128KB'lık alana 32K×8 kapasiteli SRAM'lerden oluşan RAM bloğu ve bitiş adresi FFFFFH olan 128KB'lık alana 64K×8 kapasiteli EPROM'lardan oluşan ROM bloğu yerleştirilmek isteniyor. *(40 puan)*

a) RAM ve ROM bloklarının başlangıç ve bitiş adreslerini belirtin. *(10 puan)*

b) Kullanılan SRAM ve EPROM'ların adres ucu sayılarını belirtin. *(5 puan)*

c) İstenen RAM ve ROM bloklarını oluşturmak için kaçar adet SRAM ve EPROM kullanılması gerektiğini bulun. *(5 puan)*

d) RAM ve ROM bloklarının bellek uzayında yerleşimini sağlayan adres çözümleme devresini tek bir 3×8 dekoder kullanarak gerçekleyin ve mikroişlemciden hafıza birimlerine giden tüm uç bağlantılarını çizerek gösterin. *(20 puan)*

Not: SRAM entegresinde bulunan uçlar: D7-D0 (Veri yolu), Adres yolu, $\overline{CS}$, $\overline{OE}$, $\overline{WE}$
EPROM entegresinde bulunan uçlar: D7-D0 (Veri yolu), Adres yolu, $\overline{CS}$, $\overline{OE}$,

2) 8086 mikroişlemci sisteminin bellek uzayına 00000H adresinde itibaren 128KB'lık alana 32K×8 kapasiteli SRAM'lerden oluşan RAM bloğu ve bitiş adresi FFFFFH olan 128KB'lık alana 64K×8 kapasiteli EPROM'lardan oluşan ROM bloğu yerleştirilmek isteniyor. *(40 puan)*

a) RAM ve ROM bloklarının başlangıç ve bitiş adreslerini belirtin. *(10 puan)*

(a) Herbir blok kapasitesi 128KB olduğundan

$128K = 2^7 \cdot 2^{10} \Rightarrow$ 17 uç değişimi

17 bit { 00000H → 1FFFFH } RAM bloğu başlangıç ve bitiş adresleri

16 × 16 × 16 × 16 × 2 =

131072

2^17 =

131072

Enter decimal number:

131071 10

Convert | Reset | Swap

Hex number:

1FFFF 16

2) 8086 mikroişlemci sisteminin bellek uzayına 00000H adresinde itibaren 128KB'lık alana 32K×8 kapasiteli SRAM'lerden oluşan RAM bloğu ve bitiş adresi FFFFFH olan 128KB'lık alana 64K×8 kapasiteli EPROM'lardan oluşan ROM bloğu yerleştirilmek isteniyor. *(40 puan)*

a) RAM ve ROM bloklarının başlangıç ve bitiş adreslerini belirtin. *(10 puan)*

(a) Herbir blok kapasitesi 128KB olduğundan

$128K = 2^7 \cdot 2^{10} \Rightarrow$ 17 uç değişimi

17 bit { 00000H → 1FFFFH } RAM bloğu başlangıç ve bitiş adresleri

17 bit { FFFFFH → E0000H } ROM bloğu başlangıç ve bitiş adresleri

2) 8086 mikroişlemci sisteminin bellek uzayına 00000H adresinde itibaren 128KB'lık alana 32K×8 kapasiteli SRAM'lerden oluşan RAM bloğu ve bitiş adresi FFFFFH olan 128KB'lık alana 64K×8 kapasiteli EPROM'lardan oluşan ROM bloğu yerleştirilmek isteniyor. *(40 puan)*

a) RAM ve ROM bloklarının başlangıç ve bitiş adreslerini belirtin. *(10 puan)*

b) Kullanılan SRAM ve EPROM'ların adres ucu sayılarını belirtin. *(5 puan)*

(b) SRAM: $32K \times 8$

$2^5 \cdot 2^{10} \Rightarrow$ 15 adres ucu

EPROM: $64K \times 8$

$2^6 \cdot 2^{10} \Rightarrow$ 16 adres ucu

2) 8086 mikroişlemci sisteminin bellek uzayına 00000H adresinde itibaren 128KB'lık alana 32K×8 kapasiteli SRAM'lerden oluşan RAM bloğu ve bitiş adresi FFFFFH olan 128KB'lık alana 64K×8 kapasiteli EPROM'lardan oluşan ROM bloğu yerleştirilmek isteniyor. *(40 puan)*

a) RAM ve ROM bloklarının başlangıç ve bitiş adreslerini belirtin. *(10 puan)*

b) Kullanılan SRAM ve EPROM'ların adres ucu sayılarını belirtin. *(5 puan)*

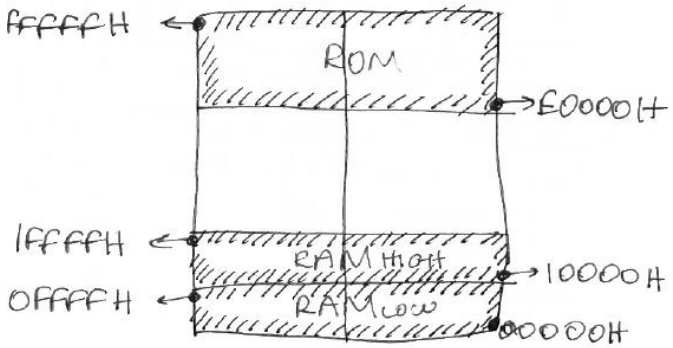
c) İstenen RAM ve ROM bloklarını oluşturmak için kaçar adet SRAM ve EPROM kullanılması gerektiğini bulun. *(5 puan)*

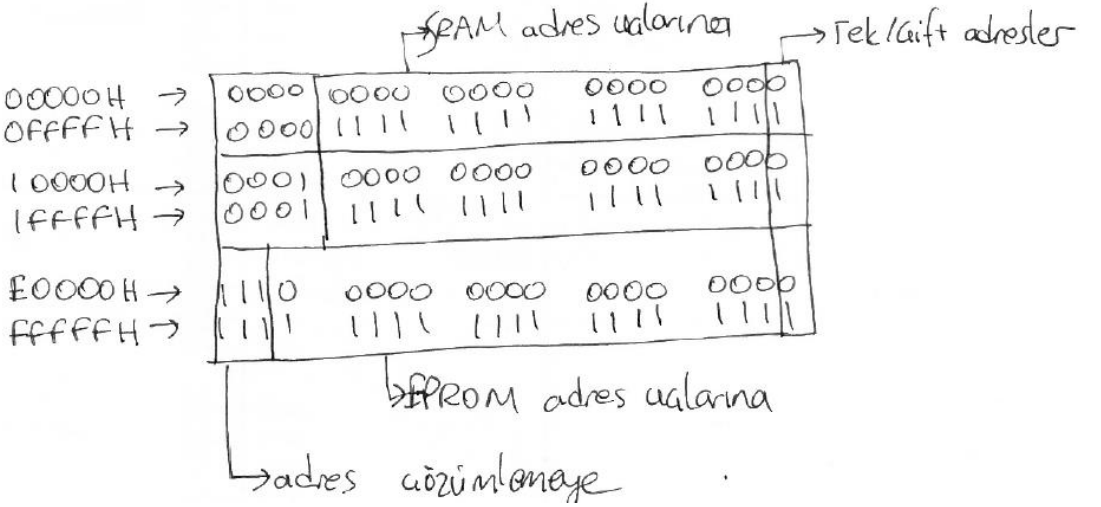
(c) $\frac{128KB}{32K \times 8} = 4$ adet SRAM

$\frac{128KB}{64K \times 8} = 2$ adet EPROM

d) RAM ve ROM bloklarının bellek uzayında yerleşimini sağlayan adres çözümleme devresini tek bir 3×8 dekoder kullanarak gerçekleyin ve mikroişlemciden hafıza birimlerine giden tüm uç bağlantılarını çizerek gösterin. *(20 puan)*

(d) Tek dekoder kullanılacağı için çift / tek adres ayrımı $\overline{RD}$, $\overline{WR}$ ile A0, $\overline{BHE}$ birleştirilerek yapılabilir.



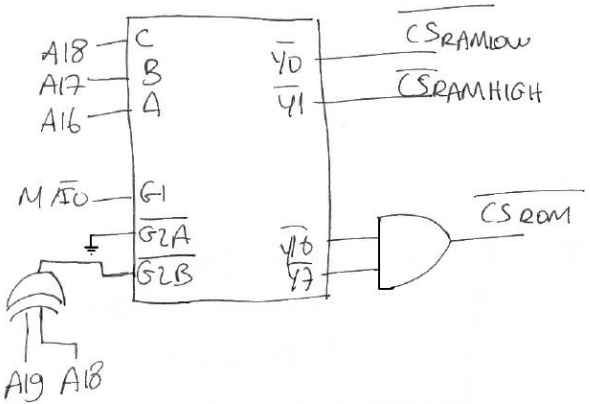


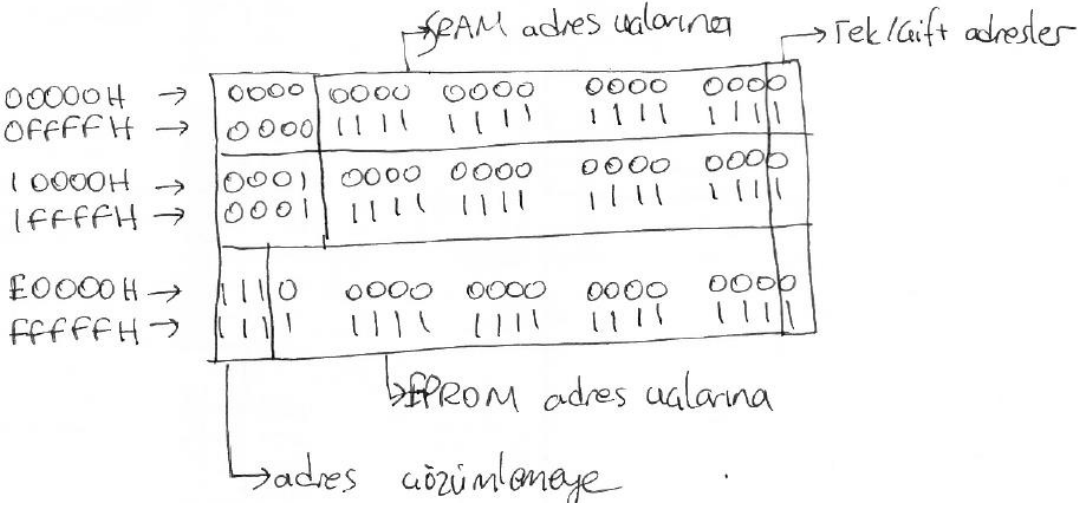
d) RAM ve ROM bloklarının bellek uzayında yerleşimini sağlayan adres çözümleme devresini tek bir 3×8 dekoder kullanarak gerçekleyin ve mikroişlemciden hafıza birimlerine giden tüm uç bağlantılarını çizerek gösterin. *(20 puan)*

RAM$_{LOW}$ ve RAM$_{HIGH}$ için 4 uç adres çözümlemeye
ROM için 3 uç adres çözümlemeye

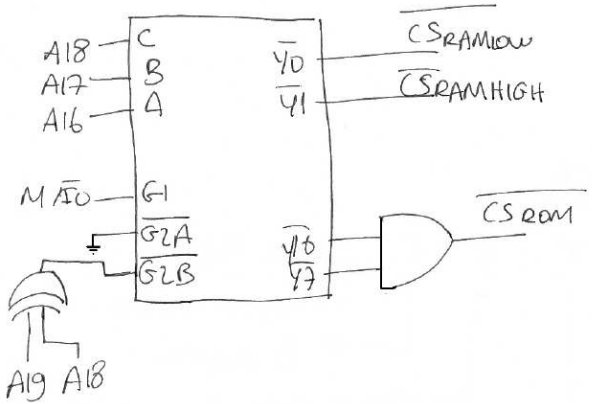
} 4 adet seçici uca ihtiyaç var.
3x8 dekoderde 3 seçim ucu olduğu için
A19-A18'in ilgilenilen hafıza bloklarında
her zaman aynı değeri almasından
faydalanarak sanal 4 seçim ucu
oluşturulabilir.

d) RAM ve ROM bloklarının bellek uzayında yerleşimini sağlayan adres çözümleme devresini tek bir 3×8 dekoder kullanarak gerçekleyin ve mikroişlemciden hafıza birimlerine giden tüm uç bağlantılarını çizerek gösterin. *(20 puan)*



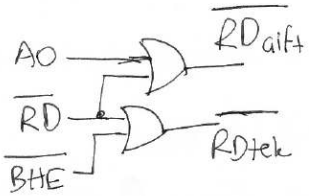


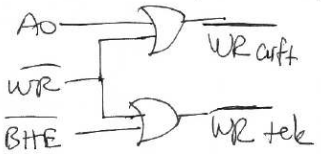
d) RAM ve ROM bloklarının bellek uzayında yerleşimini sağlayan adres çözümleme devresini tek bir 3×8 dekoder kullanarak gerçekleyin ve mikroişlemciden hafıza birimlerine giden tüm uç bağlantılarını çizerek gösterin. *(20 puan)*

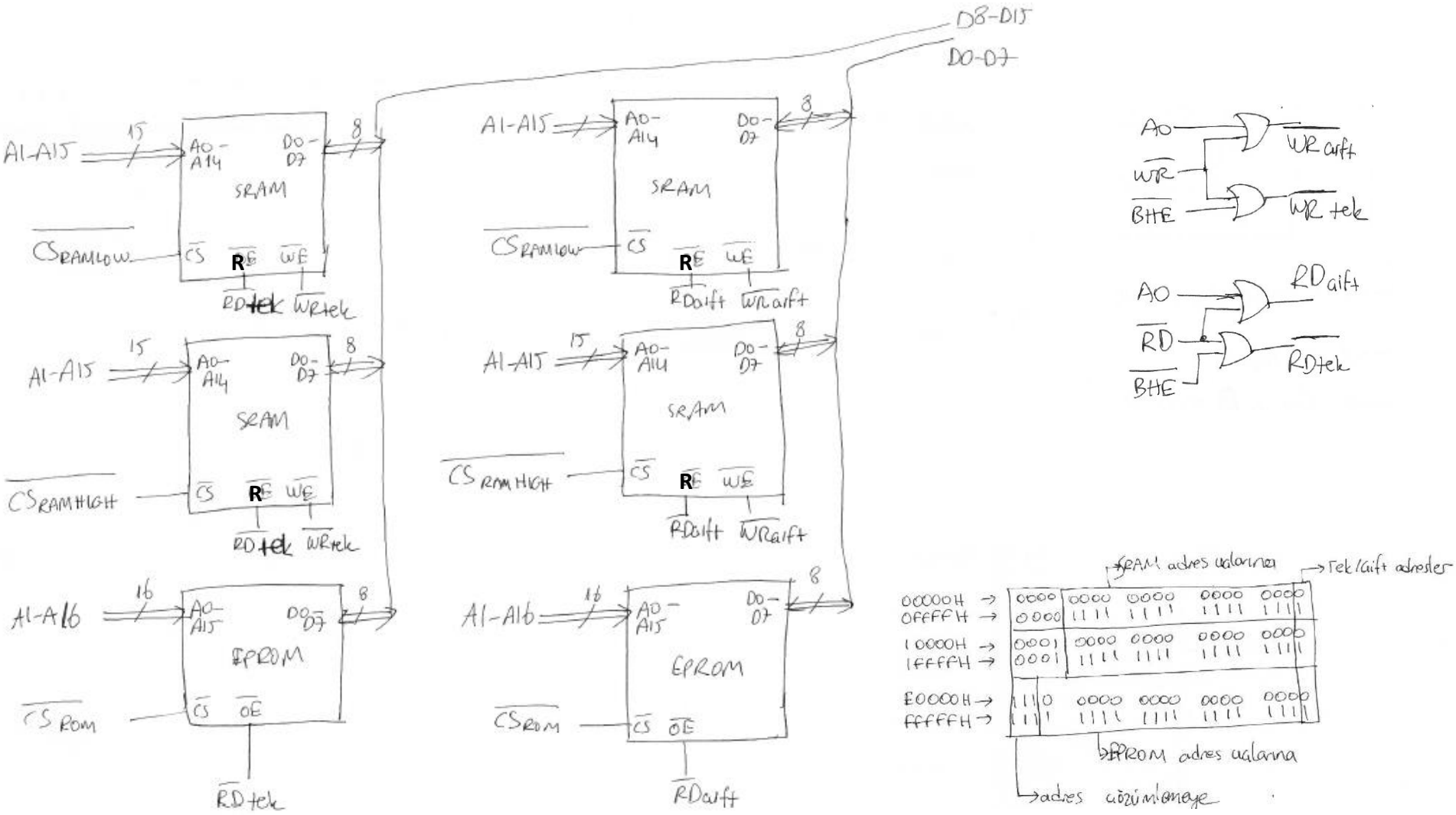


A19 ve A18 xor'lanarak aktif 0 enable ucuna verilerek, bu iki uçun aynı olduğu durumlarda $\overline{CS}$ üretilecek şekilde bir ayarlama yapılmış olur.

$\overline{Y6}$ ve $\overline{Y7}$ çıkışlarının anded'lenmesi ile A16'nın 0 ve 1 olduğu her iki durumda da $\overline{CS}_{ROM}$ üretilebilmesi sağlanmıştır.






D8-D15
D0-D7
A1-A15
15
A0-A14
D0-D7
8
SRAM
CS RAMLOW
CS
RE
WE
RD tek
WR tek
CS RAMHIGH
RD aift
WR aift
A1-A16
16
A0-A15
EPROM
CS ROM
OE
A0
WR
BHE
RD
00000H
0FFFFH
10000H
1FFFFH
E0000H
FFFFFH
SRAM adres ualanma
Tek/aift adresler
EPROM adres ualanma
adres cözümleme