

Direct : $MMS = T + L + W$
Associative : $MMS = T + W$

→ Main Memory Byte adreslenebilir
 → A adet birim, 2^A tane adres mevcuttur

TB = Tag bits

LB = Line bits

MMS = Main Memory Size

CS = Cache Memory Size

BS = Block Size

	MMS	CS	BS	TB	LB
a)	128 KB	16 KB	256 B	3	6
b)	32 GB	32 KB	1 KB	20	5
c)	128 MB	512 KB	1 KB	8	9
d)	16 GB	4 KB	4 KB	10	12

$$\frac{CS}{BS} = \text{Line}$$

BS = word bit

$$MMS = T + L + W$$

a) $128 \text{ KB} = 2^7$? = 17 bit

$$\frac{CS}{BS} = \frac{16 \cdot 2^{10}}{256} = \frac{2^{14}}{2^8} = 2^6 \quad b = \text{Line bit}$$

$$BS = 2^8 \rightarrow \text{word bit}$$

$$b + 6 = 14 \quad 17 - 14 = 3 \rightarrow \text{Tag bit}$$

Tag	Line	Word
3	6	8

17 bit

b) $MMS = T + L + W$

$$2^5, 2^{30} = 2^{35}$$

$$CS = 2^5, 2^{10} = 2^{15}$$

$$BS = 2^{10} = \text{word}$$

$$\frac{CS}{BS} = \text{Line}$$

$$\frac{2^{15}}{2^{10}} = 2^5$$

$$\text{Line} = 5$$

$$\text{word} = 10$$

$$35 = 5 + 10 + \text{Tag}$$

$$\text{Tag} = 20$$

c) $MMS = T + L + W$

$$BS = \text{word}$$

$$\frac{CS}{BS} = \text{Line}$$

$$CS = 2^9, 2^{10}$$

$$BS = 2^{10}$$

$$\text{word} = 10$$

$$\text{Line} = 9$$

$$10 + 9 + 8 = MMS$$

$$27 = MMS$$

$$2^{27} = MMS$$

d) $MMS = T + L + W$

$$\frac{CS}{BS} = \text{Line}$$

$$BS = \text{word}$$

$$2^4, 2^{30} = 2^{34} = MMS$$

$$2^2, 2^{10} = 2^{12} = \text{word}$$

$$\frac{x}{2^{12}} = \text{Line}$$

$$10 + L + 12 = 34$$

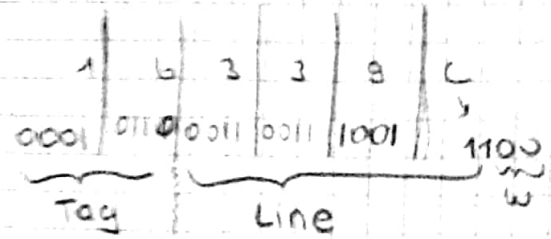
$$22 + L = 34$$

$$L = 12$$

Adres Çözümleme

Direct Mapping

T	L	W
8	14	2



a) $MMS = 16MB = 2^4 \cdot 2^{20} = 2^{24} B$

$CS = 64KB = 2^6 \cdot 2^{10} = 2^{16} B$

$BS = 4B \quad \frac{CS}{BS} = \text{Line} = \frac{2^{16}}{2^2} = 14$

$MMS = T + L + W$

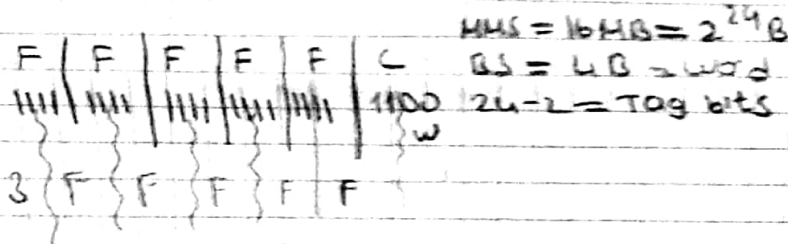
$24 = T + 14 + 2$

$T = 8$

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b) Associative Mapping



$MMS = 16MB = 2^{24} B$

$BS = 4B = 2^2 \text{ word}$

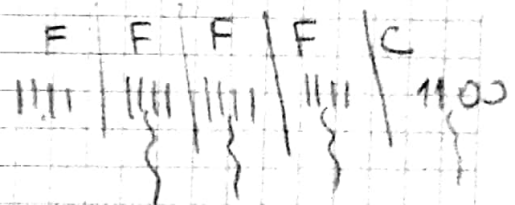
$24 - 2 = \text{Tag bits}$

T	W
22	2

2 Set Associative

c) $4B = 2^2 \text{ word}$

$\text{Line} = \frac{64KB}{4B} = \frac{2^6 \cdot 2^{10}}{2^2} = 2^{14}$



T	Set	W
9	13	2

1 set 2 line

? 2^{14} line

$? = 2^{13} \text{ set}$

13 = set number

$24 - 13 - 2 = 9 \text{ Tag bits}$

$$\text{main memory} = 128 \text{ KB} = 2^7 \cdot 2^{10}$$

$$\text{Cash Size} = 8 \text{ KB} = 2^3 \cdot 2^{10}$$

$$\text{Block Size} = 16 \text{ B} = 2^4$$

$$\frac{\text{CS}}{\text{BS}} = \text{Line}$$

$$\text{BS} = \text{word}$$

Direct Mapping

$$\text{MMS} = T + L + W$$

$$17 = T + 9 + 4$$

$$T = 4$$

$$\frac{2^{13}}{2^4} = 2^9 \Rightarrow \text{Line} = 9$$

$$\text{BS} = 2^4 \Rightarrow \text{word} = 4$$

Fully Associative

$$\text{MMS} = T + W$$

$$17 = T + 4$$

$$T = 13$$

16 way Set Associative

$$\text{MMS} = T + S + W$$

$$17 = T + S + 4$$

$$\frac{2^{13}}{2^4} = 2^9 (\text{line})$$

$$\frac{2^9}{2^4} = 2^5 \Rightarrow \text{set} = 5$$

$$17 = T + 5 + 4$$

$$T = 8$$

Adres Çözümleme

Direct Mapping

$$HMS = 16MB = 2^4 \cdot 2^{10} \cdot 2^{10} = 2^{24}$$

$$CS = 64KB = 2^6 \cdot 2^{10} = 2^{16}$$

$$BS = 4B \quad (\text{word})$$

$$16 - 2 = 14$$

$$HMS = T + L + W$$

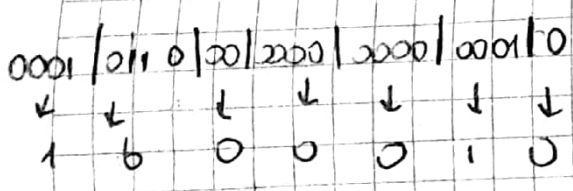
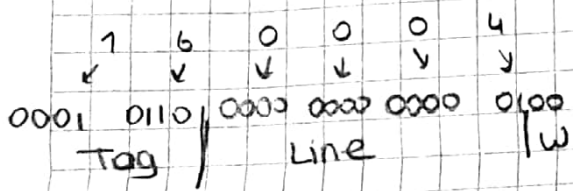
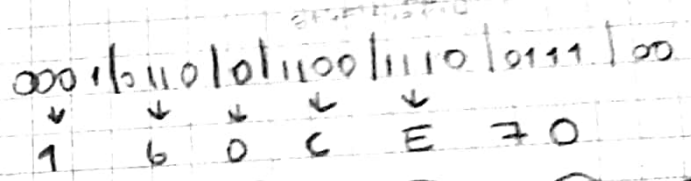
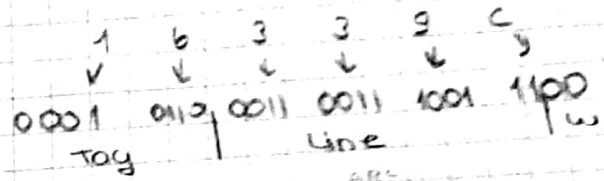
↓
8

↓
14

↓
2

Tag	Line	Word
8	14	2

24 bit

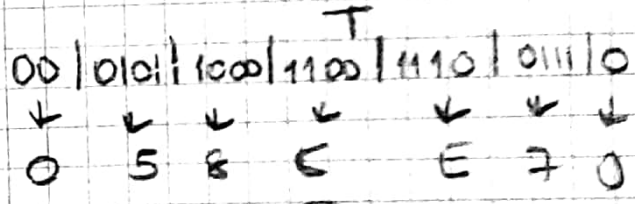
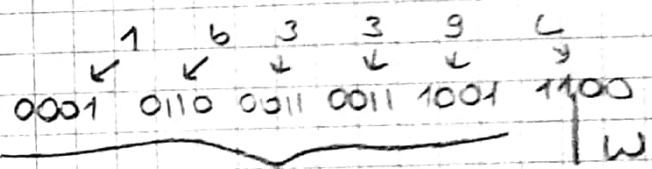


Associative Mapping

$$HMS = 2^{24}$$

$$BS = 2^2$$

T	W
22	2



① Aşağıda verilen tablodaki başlıklar için gerekli hesaplamaları yapınız? Adres yapılarını çiziniz?

$$MMS = T + L + W$$

$$\frac{CS}{BS} = \text{Line}$$

$$BS = \text{word}$$

$$\frac{CS}{BS} = \frac{2^4 \cdot 2^{10}}{2^8} = 2^6 \Rightarrow 6 = \text{line}$$

$$17 = T + L + W \quad T = 3$$

	MMS	CS	BS	TB	LB	
✓a)	128 KB 2^{17}	16 KB $2^4 \cdot 2^{10}$	256 B 2^8	3	6	Main memory
✓b)	32 GB $2^5 \cdot 2^{30}$	32 KB $2^5 \cdot 2^{10}$	1 KB 2^{10}	20	5	byte adreslenebilir
✓c)	128 MB	512 KB $2^9 \cdot 2^{10}$	1 KB 2^{10}	8	8 → 9	
d)	16 GB $2^4 \cdot 2^{30}$	4 KB	4 KB $2^2 \cdot 2^{10}$	10	12	TB = Tag bits LB = Line bits

MMS: Main memory size - Ana hafıza boyutu

CS: Cache memory size - Cache hafıza boyutu

BS: Block size - Ana hafıza blok boyutu

Ana hafıza için aynı anda okunabilir yada yazılabilir bit sayısıdır. Transfer birimi olarak da adlandırılır.

Bu değer bir kelime (word - 32 bit) veya adreslenebilir hafızaya eşit olmak zorunda değildir.

Genellikle ana hafıza bir kelimeden büyük transfer birimine sahiptir ve blok olarak adlandırılır.

Adreslenebilir birim: Bazı sistemlerde adreslenebilir birim bir kelime iken, bazılarında ise byte seviyesinde olabilmektedir. A adet bit ile 2^A tane adres mevcuttur.

④ Byte adreslenebilir hafıza için kaç bit kullanılmalıdır?

$$128 \text{ KB} = 2^? \quad ? = 17 \text{ bit}$$

$$\frac{CS}{BS} = \frac{16 \text{ KB}}{256 \text{ B}} = \frac{2^{14}}{2^8} = 2^6 \rightarrow \text{line bits}$$

$$BS = 256 = 2^8 \rightarrow \text{word bits}$$

Tag	Line	Word
3	6	8

$$17 - 6 - 8 = 3 \text{ tag bit}$$

$$17 \text{ bit}$$

⑤ 32 GB = $2^?$? = 35 bit

$$\frac{CS}{BS} = \frac{32 \text{ KB}}{1 \text{ KB}} = \frac{2^{15}}{2^{10}} = 2^5 \rightarrow \text{line bits}$$

$$BS = 1 \text{ KB} = 2^{10} \rightarrow \text{word bits}$$

Tag	Line	Word
20	5	10

$$35 - 5 - 10 = 20$$

$$35 \text{ bit}$$

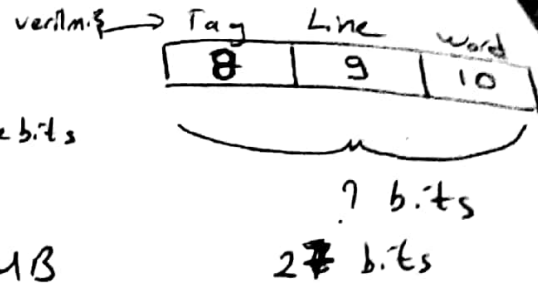
①

②

1 KB = $2^{10} \rightarrow$ word bits

$\frac{CS}{BS} = \frac{512 KB}{1 KB} = \frac{2^{14}}{2^{10}} = 2^4 \rightarrow$ line bits

$2^{27} = 128 MB$



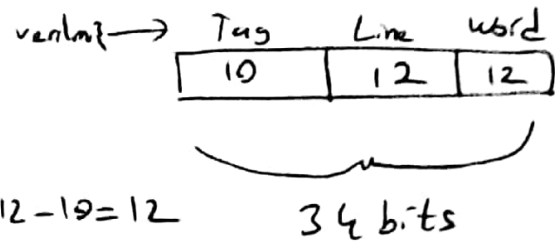
②

④

16 GB = 2^{34}

4 KB = $2^{12} \rightarrow$ word bits

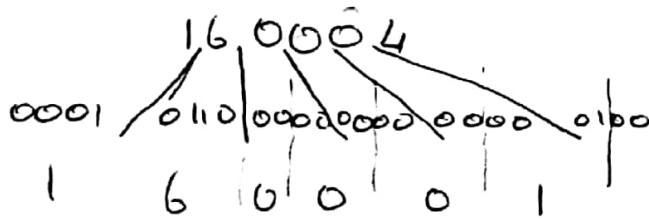
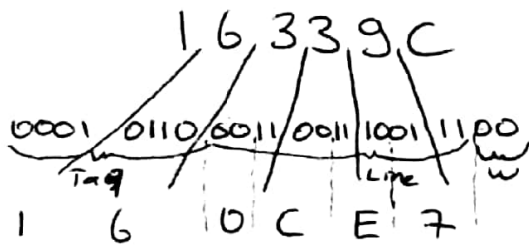
$34 - 12 - 10 = 12$



Adres 6820 mleme

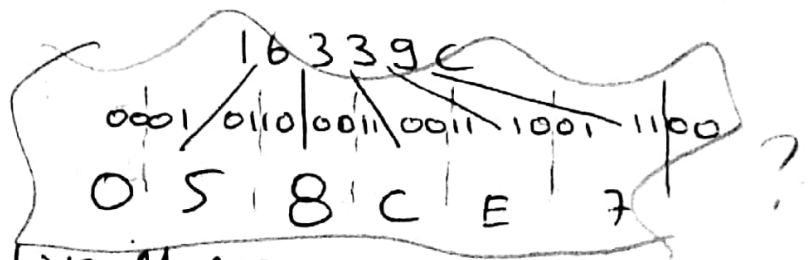
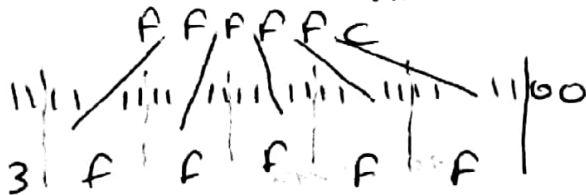
MMS = T + L + W

— Direct Mapping

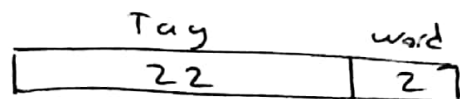


— Associative Mapping

MMS = T + W



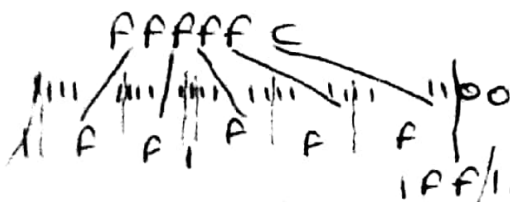
16 MB = 2^7 ? = 24 bit
BS = 4B $2^2 = 2$ word bit
24 - 2 = 22 Tag bits



— 2 Way Set Associative Mapping

4B = $2^2 \rightarrow$ word bits

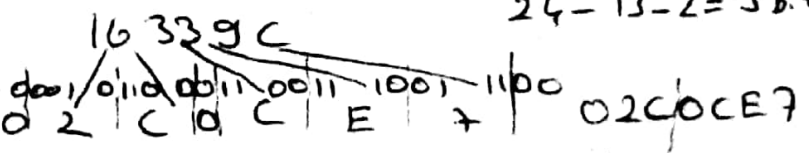
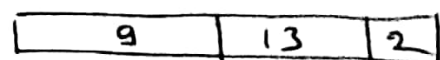
Lines = $\frac{64 KB}{4B} = \frac{2^{14}}{2^2} = 2^{12}$



1 set \times 2 line
? \times 2^{14} line

? = $2^{13} \rightarrow$ Set numbers
Tag

24 - 13 - 2 = 9 bits



MS
128KB

CS
16KB

BS
256B

Tag

Set A.M

2 way

$256B = 2^8 \rightarrow \text{word bits}$

$128KB = 2^? \quad ? = 17$

$$\text{Lines} = \frac{CS}{BS} = \frac{16KB}{256B} = 2^6$$

Tag	Set	Word
4	5	8

17 bits

$$17 - 13 = 4$$

1 set \times 2 lines
? \times 2^6 lines

$$? = 2^5 \rightarrow \text{set bits}$$