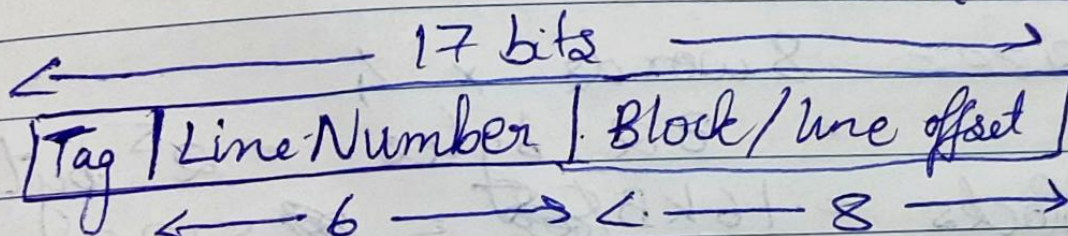


U19CS076

## Tutorial - Cache Memory

- ① Cache memory size = 16 KB  
Block / Frame / line size = 256 bytes =  $2^8$  bytes  
Main memory size = 128 KB  
 $= 2^7$  KB  
 $= 2^{17}$  bytes



$$\begin{aligned}\text{No. of lines in cache} &= \frac{\text{Cache memory}}{\text{Line size}} \\ &= 16 \text{ KB} / 256 = 2^{14} / 2^8 \\ &= 2^6 \text{ lines}\end{aligned}$$

$$\Rightarrow \text{No. of bits in line no} = 6 \text{ ~~bytes~~ bits}$$

$$\begin{aligned}\Rightarrow \text{No. of tag bits} &= 17 - (8 + 6) \\ &= 3 \text{ bits}\end{aligned}$$



(2) Cache memory = 512 KB  
 $= 2^9 \text{ KB} = 2^{19} \text{ bytes}$

Block size = line size = 1 KB =  $2^{10} \text{ bytes}$

No. of bits in tag = 7

No. of bits in block = 10

No. of lines =  $2^{19} / 2^{10} = 2^9 \text{ lines}$

$\Rightarrow$  9 bits in line number

Total no. of bits in physical address  
 $= 7 + 9 + 10$   
 $= 26 \text{ bits}$

Size of main memory =  $2^{26} \text{ bytes}$   
 $= 2^6 \times 2^{20} \text{ bytes}$   
 $= 64 \text{ MB}$

(3) Block size = 8 words  $\times$  4  
 $= 32 \text{ bytes} = 2^5 \text{ bytes}$   
 No. of blocks =  $\frac{16 \text{ KB}}{32 \text{ bytes}} = \frac{512 \text{ B}}{2} = 256 = 2^8$   
 No. of bits for SET field = 8  
 Block = 5  
 Tag bits =  $32 - 5 - 8$   
 $= 19 \text{ bits}$

(4)  $256 \text{ KB} = 256 \times 8 \times 1024 \text{ bits}$   
 $32 \text{ KB} = 32 \times 1024 \text{ bits}$

No. of RAM chips req =  $\frac{256 \times 8 \times 1024}{32 \times 1024}$



$$= \underline{\underline{64}} \text{ chips}$$

⑤ Block size = 1KB =  $2^{10}$  bytes

$$\text{No. of bits in block offset} = 10 \text{ bits}$$

$$\text{No. of lines in cache} = \frac{512 \text{ KB}}{1 \text{ KB}} = 512 \text{ lines}$$

$$\text{No. of sets in cache} = \frac{512}{8} = 64 \text{ sets} = 2^6$$

So, no. of bits in set = 6

$$\text{No. of tag bits} = 7$$

$$\begin{aligned} \text{Bits in physical address} &= 7 + 6 + 10 \\ &= 23 \text{ bits} \end{aligned}$$

$$\begin{aligned} \text{Size of main memory} &= 2^{23} \text{ bytes} \\ &= 2^3 \times 2^{20} \text{ bytes} \\ &= \underline{\underline{8 \text{ MB}}} \end{aligned}$$