

* Set - Associative.

Byte - Addressable M.M size = 256 MB

Cache size = 1 MB

Block size = 128 B

2-way set - Associative.

P.A split

Tag directory size

No. of Comparator
needed

Step 1:

$$P.A.S = \log_2(M.M. \text{ size})$$

$$= \log_2(2^8 \times 2^{20})$$

$$= \log_2(2^{28})$$

$$\boxed{P.A. = 28 \text{ bit}}$$

Step 2:

No. of block in M.M

$$= \log_2 \left(\frac{M.M. \text{ size}}{\text{Block size}} \right)$$

$$= \log_2 \left(\frac{2^{28}}{2^7} \right)$$

$$= \log_2(2^{21})$$

$$\boxed{\text{Blocks in MM} = \frac{2^{21}}{2}}$$

Step 3:

No. of Block in Cache

$$= \log_2 \left(\frac{\text{Size of cache}}{\text{Size of block}} \right)$$

$$= \log_2 \left(\frac{2^{20}}{2^7} \right)$$

$$= \log_2 (2^{13})$$

$$\boxed{\text{Cache lines} = 2^{13}}$$

Step 4:

Block of word offset = $\log_2 (\text{Size of Block})$

$$= \log_2 (2^7)$$

$$\boxed{\text{word offset} = 7 \text{ bit}}$$

Step 5:

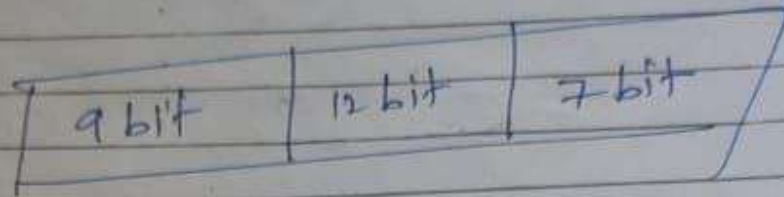
Set offset \Rightarrow

$$\text{Total no. of set} = \log_2 \left(\frac{\text{No. of Cache line}}{\text{Set length i.e. k}} \right)$$

$$= \log_2 \left(\frac{2^{13}}{2^1} \right)$$

$$\boxed{\text{Set offset} = 12 \text{ bit}}$$

$$\begin{aligned}\text{Step 6} &= \text{P.A bit} - \text{Set offset} - \text{word offset} \\ &= 28 - 7 - 12 \\ &= 9 \text{ bit}\end{aligned}$$



Step 7

Tag directory size

$$= \text{No. of lines in cache} \times \text{Tag bit size}$$

$$= 2^{13} \times 9$$

$$= 73728 \text{ bits}$$

Step 8.

$$\begin{aligned}\text{No. of comparators} &= 2 \times 9 \text{ bit} \\ &= \text{comparators}\end{aligned}$$