Ex 1: MM Size: 4 GB
Cache Size: 1 MB
Block Size: 4 KB

1. P.A. bits' split?
2. Tag directory size?

Sol. MM Size = 4 GB

1 Byte	= 8 bits	
1 KB	= 1024 B(ytes) =	2^{10} B
1 MB	= 1024 KB =	2^{20} B
1 GB	= 1024 MB =	2^{30} B

Sol. MM Size = 4 GB = 2^2 x

1 Byte	= 8 bits	
1 KB	= 1024 B(ytes) =	2^{10} B
1 MB	= 1024 KB =	2^{20} B
1 GB	= 1024 MB =	2^{30} B

Sol. MM Size = 4 GB = $2^2 \times 2^{30}$ B = $2^{(2+30)}$ B = 2^{32} B

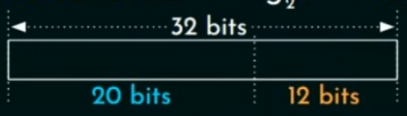
∴ No. of P.A. bits = $\log_2 2^{32}$ = 32

Block Size = 4 KB = $2^2 \times 2^{10}$ B = 2^{12} B

No. of Blocks in MM = $2^{32} / 2^{12}$ = 2^{20}

∴ Block number bits = $\log_2 2^{20}$ = 20

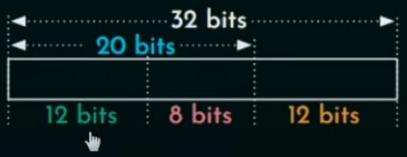
∴ Block offset = $\log_2 2^{12}$ = 12



Cache Size = 1 MB = 1×2^{20} B = 2^{20} B

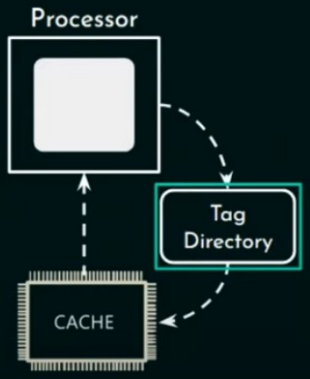
No. of Lines in Cache = $2^{20} / 2^{12}$ = 2^8

∴ Line number bits = $\log_2 2^8$ = 8



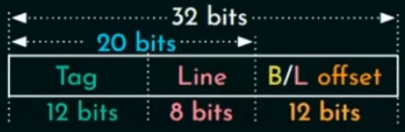
No. of Tag bits : P.A. bits - (Line no. bits + offset) = 32 - (8+12) = 12

Sol.



Tag directory:

- Keeps primarily the record of Tag bits, cache line-wise.
- No. of entries = No. of Cache lines.



No. of Lines in Cache = 2^8

No. of Tag bits = 12

Tag directory size = 2^8 x 12 bits = 3072 bits

Ex 2: MM Size: 256 MB
Cache Size: 512 KB

- No. of tag bits?

Sol. Tag bits: Identifies the MM block residing in the Cache Line.

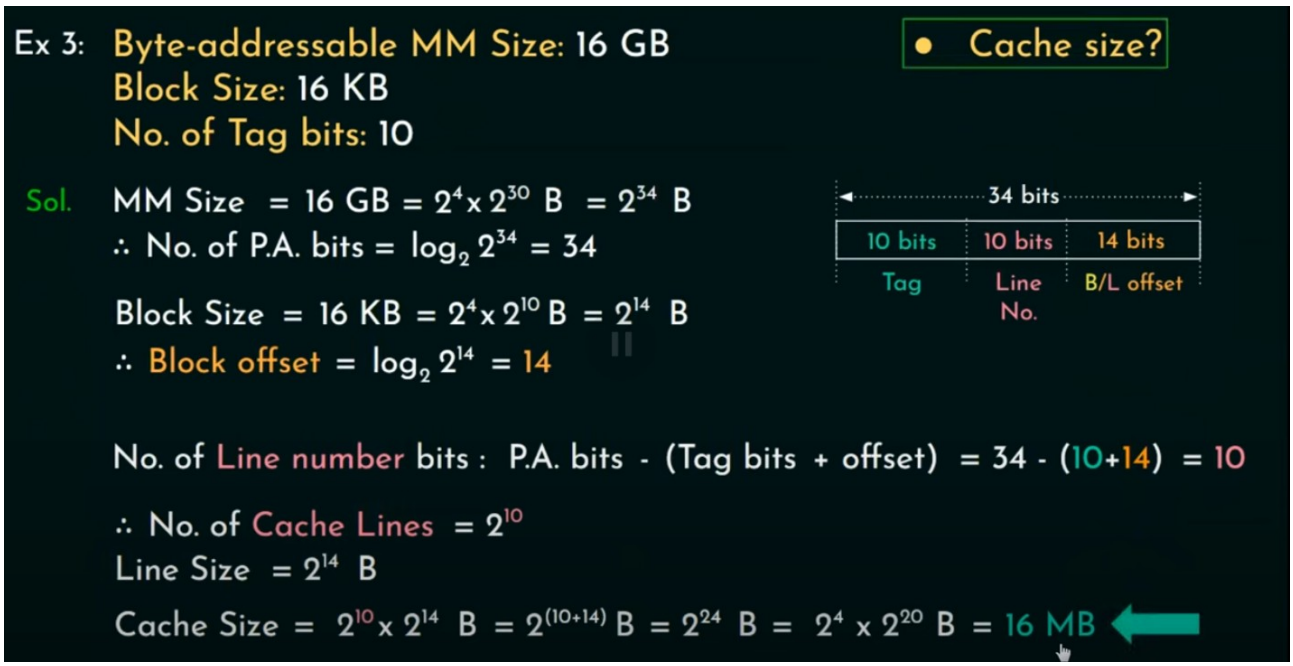
Block Size = Line Size

$\log_2$ (MM Size : Cache Size)

MM Size = 256 MB
$= 2^8 \times 2^{20}$ B
$= 2^{28}$ B

Cache Size = 512 KB
$= 2^9 \times 2^{10}$ B
$= 2^{19}$ B

$\therefore$ No. of Tag bits : $\log_2 (2^{28} / 2^{19}) = \text{Log}_2 2^{(28-19)}$
$= \text{Log}_2 2^9 = 9$



https://www.youtube.com/watch?v=OxaYvJquPe0