① Consider a direct mapped cache with 64 blocks and a block size of 16 bytes. Find the cache block number which will contain memory address 1204

Main memory block number = $\frac{1204}{16} \approx 75$

∴ Cache block number = 75 mod 64 = 11 ← Ans.

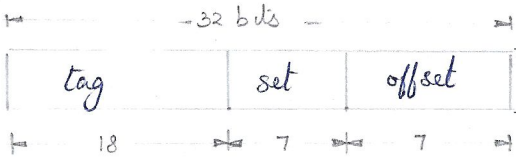
② Consider a 4-way set associative cache with 64 KB capacity and 128 byte lines. The system containing the cache uses 32 bit addresses

Sizes (in bytes): 2^{16} (cache), 2^{7} (block), 2^{32} (main memory) ; k = 4

i) Number of blocks = $\frac{\text{cache size}}{\text{block size}}$ = 512

ii) Number of sets = $\frac{\text{no. of blocks}}{k}$ = 128.

iii) Number of tag entries = k = 4



iv) Offset field size = $\log_2$ (block size) = 7 bits

v) Set field size = $\log_2$ (no. of sets) = 7 bits

vi) Tag field size = total − offset − set = 18 bits

③ A processor has 36 bit virtual addresses, 30 bit physical addresses and 2 KB pages. How many bits are required for the virtual and physical page number

Page size = $2 \times 2^{10} = 2^{11}$ bytes

Virtual size = $2^{36}/2^{11} = 2^{25}$ bytes ∴ virtual page no. needs 25 bits

Physical size = $2^{30}/2^{11} = 2^{19}$ bytes ∴ physical frame no. needs 19 bits

④ How many RAM chips (512 K x 1 bit) are needed for 8 MB memory. Draw block diag.

Main memory size = $8 \times 2^{20} \times 8 = 2^{26}$ bits ∴ address bus needs 26 lines

RAM chip size = $512 \times 2^{10} \times 1 = 2^{19}$ bits ∴ each chip needs 19 lines

No. of RAM chips = $2^{26}/2^{19} = 128$

CS → chip select
R/$\bar{W}$ → read select