Fully associative mapping

In fully associative mapping,

- A block of main memory can be mapped to any freely available cache line.
- This makes fully associative mapping more flexible than direct mapping.
- A replacement algorithm is needed to replace a block if the cache is full.

PRACTICE PROBLEMS BASED ON FULLY ASSOCIATIVE MAPPING-

Problem-01:

Consider a fully associative mapped cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find-

1. Number of bits in tag
2. Tag directory size

Solution-

Given-

- Cache memory size = 16 KB
- Block size = Frame size = Line size = 256 bytes
- Main memory size = 128 KB

We consider that the memory is byte addressable.

Number of Bits in Physical Address-

We have,

Size of main memory

= 128 KB

= 2^{17} bytes

Thus, Number of bits in physical address = 17 bits

Number of Bits in Block Offset-

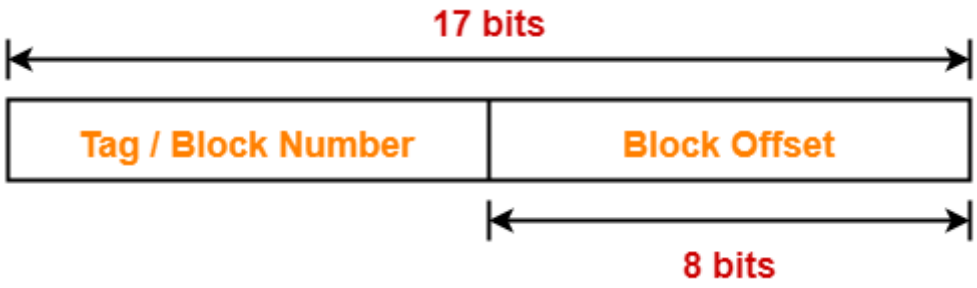
We have,

Block size

= 256 bytes

= 2^8 bytes

Thus, Number of bits in block offset = 8 bits



Number of Bits in Tag-

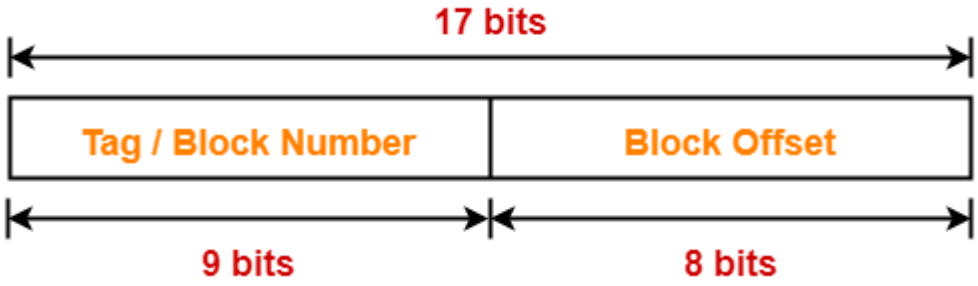
Number of bits in tag

= Number of bits in physical address – Number of bits in block offset

= 17 bits – 8 bits

= 9 bits

Thus, Number of bits in tag = 9 bits



Number of Lines in Cache-

Total number of lines in cache

= Cache size / Line size

= 16 KB / 256 bytes

= 2^{14} bytes / 2^{8} bytes

= 2^{6} lines

Tag Directory Size-

Tag directory size

= Number of tags x Tag size

= Number of lines in cache x Number of bits in tag

= 2^{6} x 9 bits

= 576 bits

= 72 bytes

Thus, size of tag directory = 72 bytes