DIRECT MAPPED CACHES

2. Direct mapped caches:- In this a given main memory block can be placed in one and only one place in the cache. Fig6. Shows an example of a direct – mapped cache. For simplicity, the example again uses a 256 block x 8 byte cache and a 16 bit main memory address. The main memory in the fig. has 256 rows x 32 columns, still fielding 256 x 32 = 8192 = 2^{13} total blocks as before. Notice that the main memory address is partitioned into 3 fields. The word field still specifies the word in the block. The group field specifies which of the 256 cache locations the block will be in, if it is indeed in the cache. The tag field specifies which of the 32 blocks from main memory is actually present in the cache. Now the cache address is composed of the group field, which specifies the address of the block location in the cache and the word field, which specifies the address of the word in the block. There is also valid bit specifying whether the information in the selected block in valid.
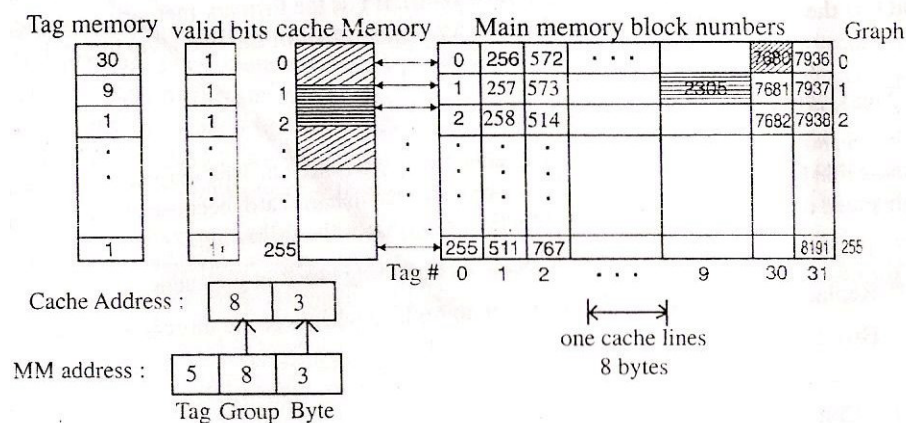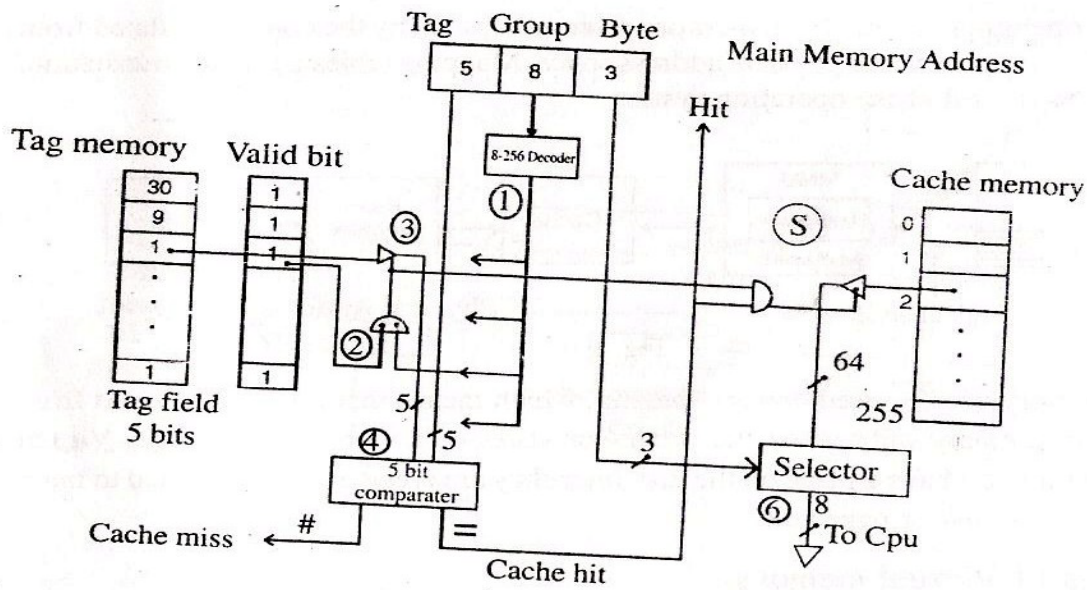

Fig 6. Direct mapped cache.

The fig.6 shows block 7680, from group 0 of MM placed in block location 0 of the cache and the corresponding tag set to 30. Similarly MM block 259 is in MM group 2, column 1, it is placed in block location 2 of the cache and the corresponding tag memory entry is 1.

The tasks required of the direct – mapped cache in servicing a memory request are shown in fig7.

The fig. shows the group field of the memory address being decoded 1) and used to select the tag of the one cache block location in which the block must be stored if it is the cache. If the valid bit for that block location is gated (2), then that tag is gated out, (3) and compared with the tag of the incoming memory address (4), A cache hit gates the cache block out (5) and the word field selects the specified word from the block (6), only one tag needs to be compared, resulting in considerably less hardware than in the associative memory case.

The direct mapped cache has the advantage of simplicity, but the obvious disadvantage that only a single block from a given group can be present in the cache at any given time.