Ch 6 Page 392

Q1. Suppose a computer using direct mapped cache has $2^{20}$ bytes of byte-addressable main memory, and a cache of 32 blocks, where each cache block contains 16 bytes.

a) How many blocks of main memory are there?

b) What is the format of a memory address as seen by the cache, i.e., what are the sizes of the tag, block, and offset fields?

c) To which cache block will the memory address 0x0DB63 map?

Ans.

a) $2^{20}/2^4 = 2^{16}$

b) 20-bit addresses with 11 bits in the tag field, 5 in the block field, and 4 in the offset field

c) 0x0DB63 = 00001100101 10110 0111, which implies Block 22 (or block 0x16)

Q3. Suppose a computer using direct mapped cache has $2^{32}$ bytes of byte-addressable main memory and a cache size of 512 bytes, and each cache block contains 64 bytes.

a) How many blocks of main memory are there?

b) What is the format of a memory address as seen by cache, i.e., what are the sizes of the tag, block, and offset fields?

c) To which cache block will the memory address 0x13A4498A map?

Ans.

a) $2^{32}/2^6 = 2^{26}$

b) 32 bit addresses with 23 bits in the tag field, 3 in the block field, and 6 in the offset field (cache has 512 bytes, so has $2^9/2^6 = 2^3$ blocks)

c) 12A4498A = 0001 0111 1010 0100 0100 1001 1000 1010, which implies Block 6.

Q4. Suppose a computer using fully associative cache has $2^{16}$ bytes of byte-addressable main memory and a cache of 64 blocks, where each cache block contains 32 bytes.

a) How many blocks of main memory are there?

b) What is the format of a memory address as seen by the cache, i.e., what are the sizes of the tag and offset fields?

c) To which cache block will the memory address 0xF8C9 map?

Ans.

a) $2^{16}/2^5 = 2^{11}$

b) 16 bit addresses with 11 bits in the tag field and 5 in the offset field

c) Because it is associative cache, it can map anywhere.