

CO200 – COA. Tutorial 8.

Duration: 60 minutes. Max:

27 – Oct – 2016

1. Consider a system with a 1024B main memory with a 256B cache supporting 16B cache blocks. The following addresses are sent in a sequence to the cache: 100, 200, 104, 110, 204, 208, 320, 400, 324, 350. What is the hit ratio at the end of the accesses? (Fully Associative)

$$\text{Number of cache blocks} = \frac{256}{16} = 16$$

Address	Hit or Miss
100	Miss
200	Miss
104	Hit
110	Hit
204	Hit
208	Miss
320	Miss
400	Miss
324	Hit
350	Miss

$$\text{Hit ratio} = \frac{4}{10} = 0.4$$

2. Consider a system with a 4GB main memory with a 64KB cache supporting 64B cache blocks. What is the address range of Block No. 11? (Fully Associative)

0X000002C0 to 0X000002FF

3. 128KB cache contains 64B cache lines. The main memory address is 32b. Each cache line stores 2 bits: Valid and Dirty. What is the size of the bookkeeping (block numbers + flags) bits in the cache?(Fully Associative)

$$\text{Number of cache blocks} = \frac{128 \times 1024}{64} = 2048 = 2^{11}$$

Block offset = 6 bits

Tag = 32-6 = 26 bits

2 bits: Valid and Dirty

26+2= 28 bits

Size of the bookkeeping bits in the cache = $28 \times 2^{11} = 56 \text{ kb}$

4. Consider a 64KB cache, with 128B cache lines using 24b addresses. The cache keeps 3 flags per block. What is the size of the metadata in (a) Two -way Set Associative (b) Direct Mapped cache

$$\text{(a) Number of cache blocks} = \frac{64 \times 2^{10}}{128} = 512 = 2^9$$

Index = 8 bits

Block offset = 7 bits

Tag=24-8-7= 9 bits

3 flags

Tag = 9+3 = 12 bits

Size of metadata = $12 \times 2^9 = 6 \text{ kb}$

(b) Index = 9 bits

Block offset = 7 bits

Tag = 24-9-7 = 8 bits

3 flags

Tag = 8+3 = 11 bits

Size of metadata = $11 \times 2^9 = 5.5 \text{ kb}$

5. Consider a 128KB DM cache with 64B cache lines using a 32b address. In the address: 0xDEADBEEF, what are the binary values of the Tag, Index and Block offset fields?

$$\text{Number of cache blocks} = \frac{128 \times 2^{10}}{64} = 2^{11}$$

Block offset = 6bits

Index = 11bits

Tag = 15 bits

Tag 110111101010110

Index 11011111011

Block offset 101111