CS 3101 Computer Organization

Homework 6

**Due Date: Monday, November 26, 2018 at beginning of class**

Type your answers in a word processor, print and submit hardcopy in class. Do not handwrite.

***Show your steps to receive partial credit.***

1. Suppose a computer using direct mapped cache has 232 words of main memory, and a cache of 1024 blocks, where each cache block contains 32 words.

a. How many blocks of main memory are there?

232 / 25 = 227 blocks

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?

17 bits for Tag | 10 bits for Block | 5 bits for Offset

c. To which cache block will the memory reference 0003101A16 map?

Address: 000000000000000110001000000011010

Points to block 0010000000

1. Suppose a computer using fully associative cache has 224 words of main memory and a cache of 512 blocks, where each cache block contains 16 words.

a. How many blocks of main memory are there?

224 / 24 = 220 blocks

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?

20 bits for Tag | 4 bits for Offset

c. To which cache block will the memory reference 17042416 map?

Address: 000101110000010000100100

Points to any block within 170420 - 17042F

or

(000101110000010000100000 – 000101110000010000101111)

1. (**bonus question, 5 points**) Suppose a computer using set associative cache has 216 words of main memory and a cache of 128 blocks, and each cache block contains 8 words.

a. If this cache is 2-way set associative, what is the format of a memory address as seen by the cache, that is, what are the sizes of the tag, set, and offset fields?

7 bits for Tag | 6 bits for Set | 3 bits for Offset

b. If this cache is 4-way set associative, what is the format of a memory address as seen by the cache?

8 bits for Tag | 5 bits for Set | 3 bits for Offset