Theory Questions

- Which of L1 or L2 cache is faster? Which is smaller? Why is it smaller?
- What are the three fields in a direct mapped cache address? How are they used to access a word located in cache?
- How does associative memory differ from regular memory? Which is more expensive and why?
- Explain how fully associative cache is different from direct mapped cache.

Exercise 1a: Direct Mapped Cache

A computer using direct mapped cache has 2^{20} words of main memory and a cache of 32 blocks, with each block containing 16 words.

a. How many blocks of main memory are there?
b. What is the format of a memory address as seen by the cache, that is, what are the sizes of the tag, block, and word fields?
c. To which cache block will $\texttt{0DB63}_{16}$ map?

Exercise 1b: Direct Mapped Cache

Suppose a computer using direct mapped cache has 2^{32} 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?
b. What is the format of a memory address as seen by the cache, that is, what are the sizes of the tag, block, and word fields?
c. To which cache block will the memory reference $\texttt{000063FA}_{16}$ map?

Exercise 2a: Fully Associative Cache

A computer with 2^{24} words of memory and a cache with 128 blocks, where each cache block contains 64 words.

a. How many blocks of main memory are there?
b. What is the format of a memory address as seen by the cache, that is, what are the sizes of the tag and word fields?

c. To which cache block does $01D872_{16}$ map?

Exercise 2b: Fully Associative Cache

Suppose a computer using fully associative cache has 2^{16} words of main memory and a cache of 64 blocks, where each cache block contains 32 words.

a. How many blocks of main memory are there?
b. What is the format of a memory address as seen by the cache, that is, what are the sizes of the tag and word fields?
c. To which cache block will the memory reference $F8C9_{16}$ map?