CSCI-UA.0201
Computer System Organization
Homework Assignment 3

1) [5 points] Consider a computer system that has a cache with 4096 blocks. Each block can store 16 bytes. What will be the value stored in the \textit{TAG} field of the cache block that holds the memory block containing the address 0xABCDEF (This hexadecimal number gives you a hint on the address length):

(i) if it is a direct-mapped cache

(ii) if it is a 16-way set-associative cache

(iii) if it is fully associative

2. Consider a small 2-way set associative cache with a total of 32 blocks and a block size of 256 bytes. The cache uses LRU replacement policy. Assume that the cache is initially empty. The CPU accesses the following memory locations, in that order: 0x55c88, 0x55774, 0x5479c, 0x54c00, 0x55784, 0x56c80, 0x56718, 0x54738.

(a) [3 points] How the address is split to do cache lookup?

(b) [8 points] For each memory reference, indicate whether it will result in hit or miss and, if miss, indicate the type of miss (compulsory, capacity, or conflict)

(c) [1 point] From your solution in part (b) above, what is the hit rate of the cache?

(d) [3 points] Assume the memory access latency is 10 cycles and the cache, mentioned in this problem, has an access latency of 3 cycles. Also assume the hit rate you calculated in part (c) above. Did this system benefit from having a cache? Justify

3. Almost all programs need external libraries.
   (a) [1 point] In how many places can needed libraries be added to your code?
   (b) [3 points] What are these places?
   (c) [6 points] For each one of those places, state one advantage and one disadvantage.