CSCI 2330 – Associative Caching Exercises

1. Consider an associative cache of effective size **C** bytes (i.e., the number of data bytes the cache can hold), where **S** is the number of sets, **E** is the number of lines per set, and **B** is the block size in bytes. Write an expression for E in terms of S, B, and C.

2. Consider a cache with (S, E, B) = (8, 2, 4), an 8-bit word size, and the partial contents shown below. In this cache, a single LRU bit indicates which line in each set was least recently used (LRU): if the LRU bit is 0, then the 1st line is LRU, while if the LRU bit is 1, then the 2nd line is LRU. For each of the following memory operations, indicate whether a cache hit or miss occurs, as well as any updates to the affected cache set. Consider each operation from the same starting contents shown below.

        a. Read 11100100 (Value: 9)

        b. Read 11100000 (Value: 17)

        c. Read 01100100 (Value: 7)

        d. Write 01000100 (Value: 10)

        e. Write 01100000 (Value: 2)

Set #	LRU	V	D	Tag	Data (4 Bytes)	V	D	Tag	Data (4 Bytes)
0	1	0	0	111	4	1	0	001	17
1	0	1	1	111	9	1	0	010	5
2				...	...			...	...
3									
4									
5									
6									
7									

3. Decide which word correctly completes the following statement (and explain why):

      "In a cache that has at least 2 cache sets, two adjacent memory blocks (e.g., the blocks of addresses [64-67] and [68-71], respectively) **[must / might / cannot]** *be stored in the same cache set."*

You might find sketching an example helpful.