ENSC 254 - Lab 4 Report

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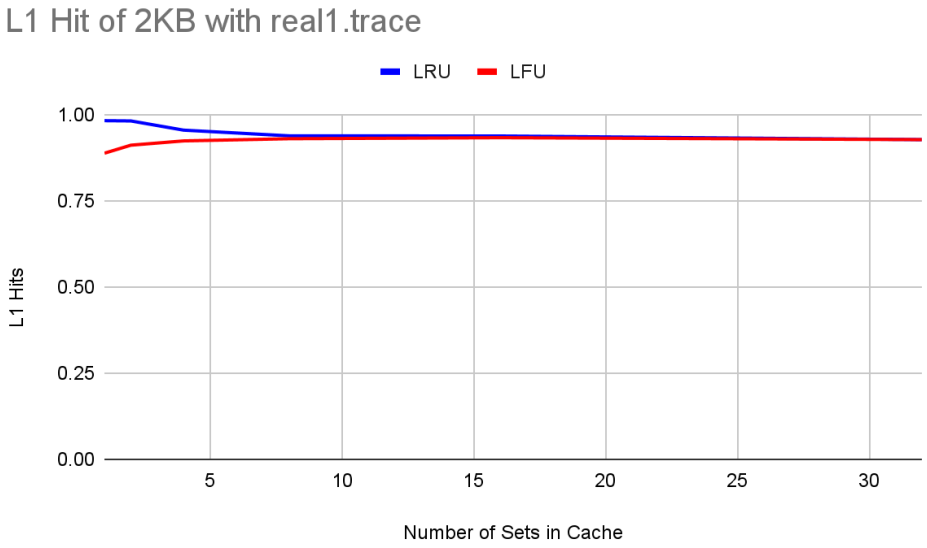
Tables and Graphs for cache hit rate of each possible cache set:

2KB for *real1.trace*:

Number of Sets in Cache	Cache Associativity	L1 Hit Rate (LRU)	L1 Hit Rate (LFU)
1	32	98.21%	88.78%
2	16	98.13%	91.10%
4	8	95.46%	92.34%
8	4	93.81%	92.97%
16	2	93.77%	93.27%
32	1	92.71%	92.71%

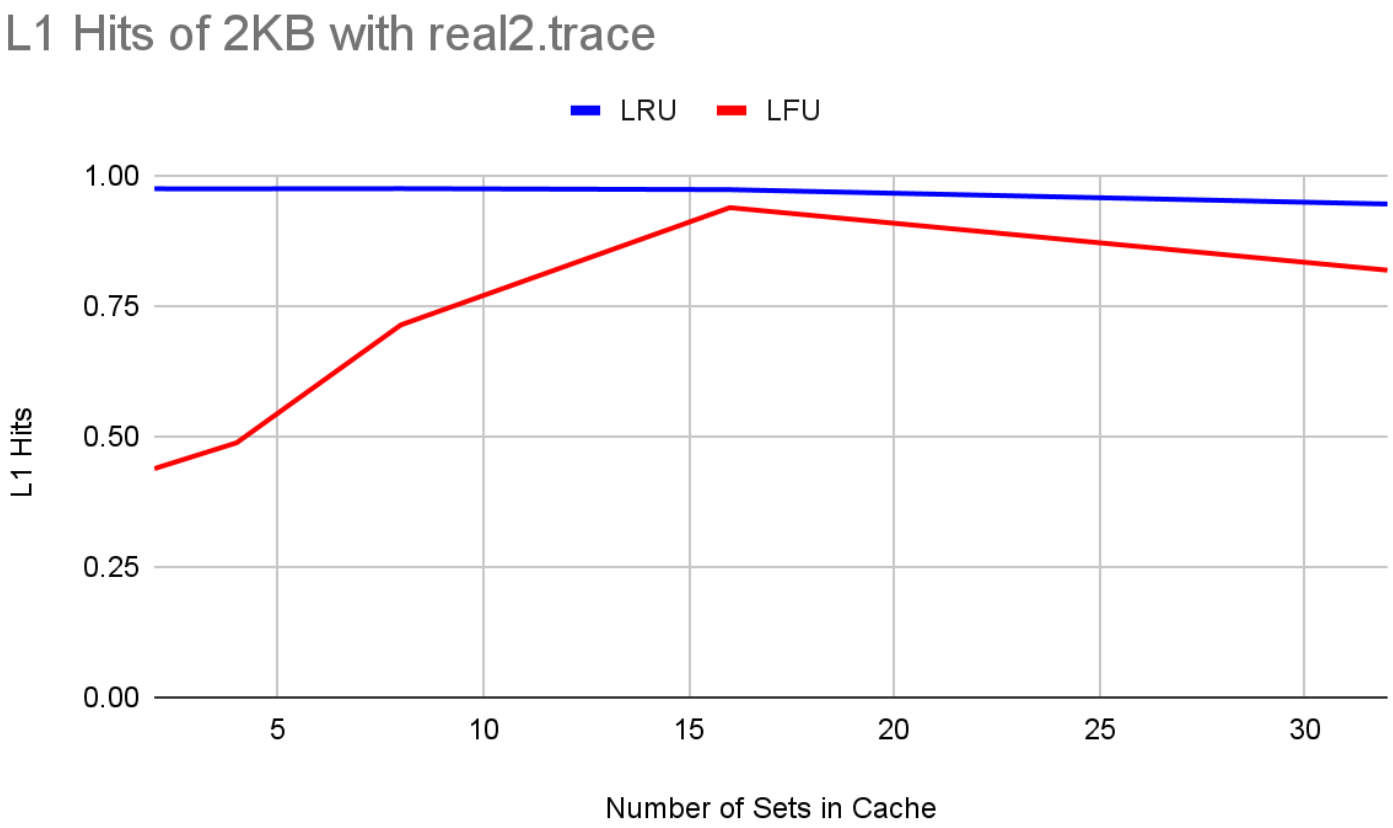


Explanation of results (2KB for real1.trace):

As the set size increases, the hit rate increases initially because larger sets (higher associativity) reduce conflict misses. However, too many sets (lower associativity) can also increase misses, which explains why the cache hit rate decreases again. Based on the data above, the best cache to select for CSIZE = 2KB with *real1.trace* is an LRU cache with a set size of 1 and a cache associativity of 32 lines per set.

2KB for *real2.trace*:

Number of Sets in Cache	Cache Associativity	L1 Hit Rate (LRU)	L1 Hit Rate (LFU)
1	32	97.41%	43.81%
2	16	97.40%	48.76%
4	8	97.44%	71.35%
8	4	97.24%	93.80%
16	2	94.49%	81.82%
32	1	90.24%	90.24%

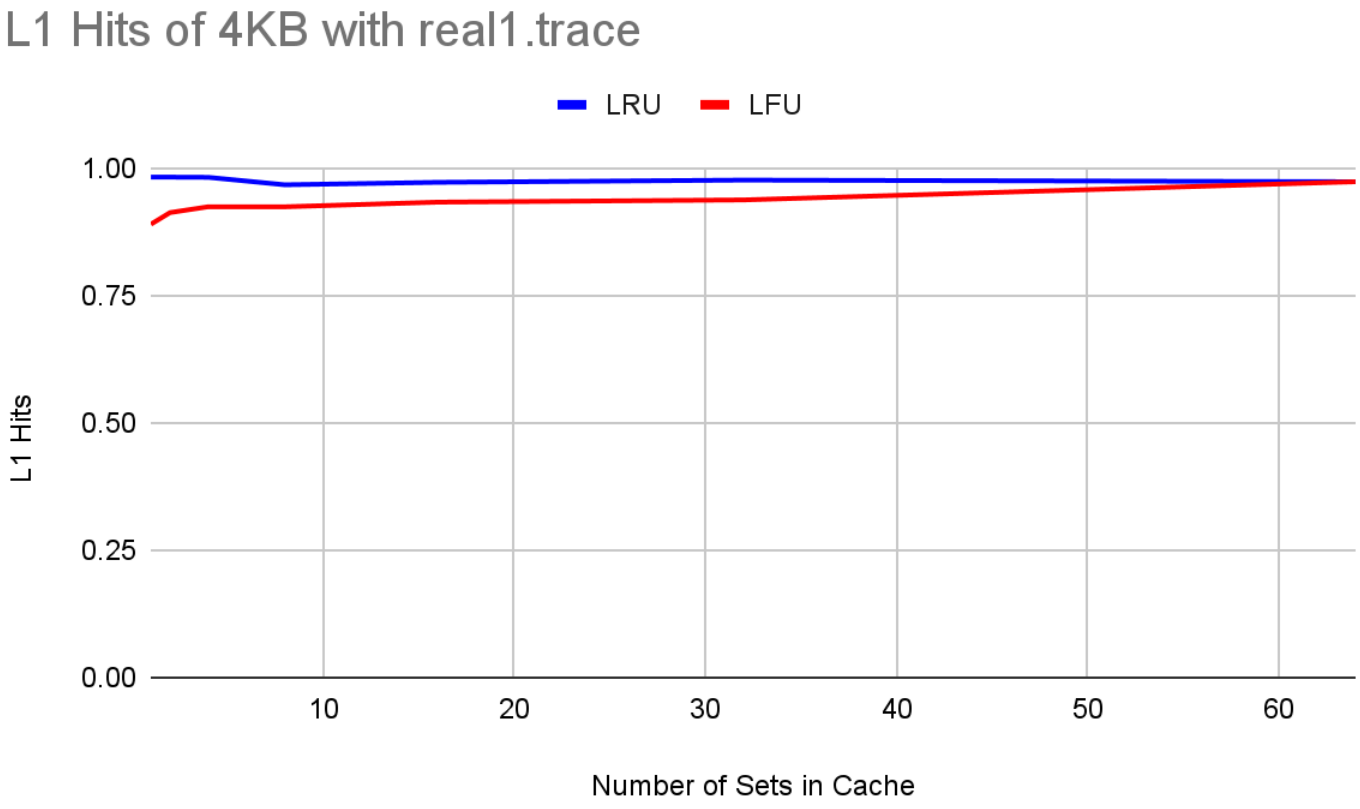


Explanation of results (2KB for real2.trace):

The same trend appears for *real2.trace*, where the hit rate increases with increasing set size at first, then decreases again when associativity drops too low. Similarly, the best cache to select for CSIZE = 2KB with *real2.trace* is an LRU cache with a set size of 4 and a cache associativity of 8 lines per set.

4KB for *real1.trace*:

Number of Sets in Cache	Cache Associativity	L1 Hit Rate (LRU)	L1 Hit Rate (LFU)
1	64	98.21%	88.97%
2	32	98.21%	91.25%
4	16	98.17%	92.40%
8	8	96.71%	92.99%
16	4	97.19%	93.30%
32	2	97.63%	93.74%
64	1	97.31%	97.31%

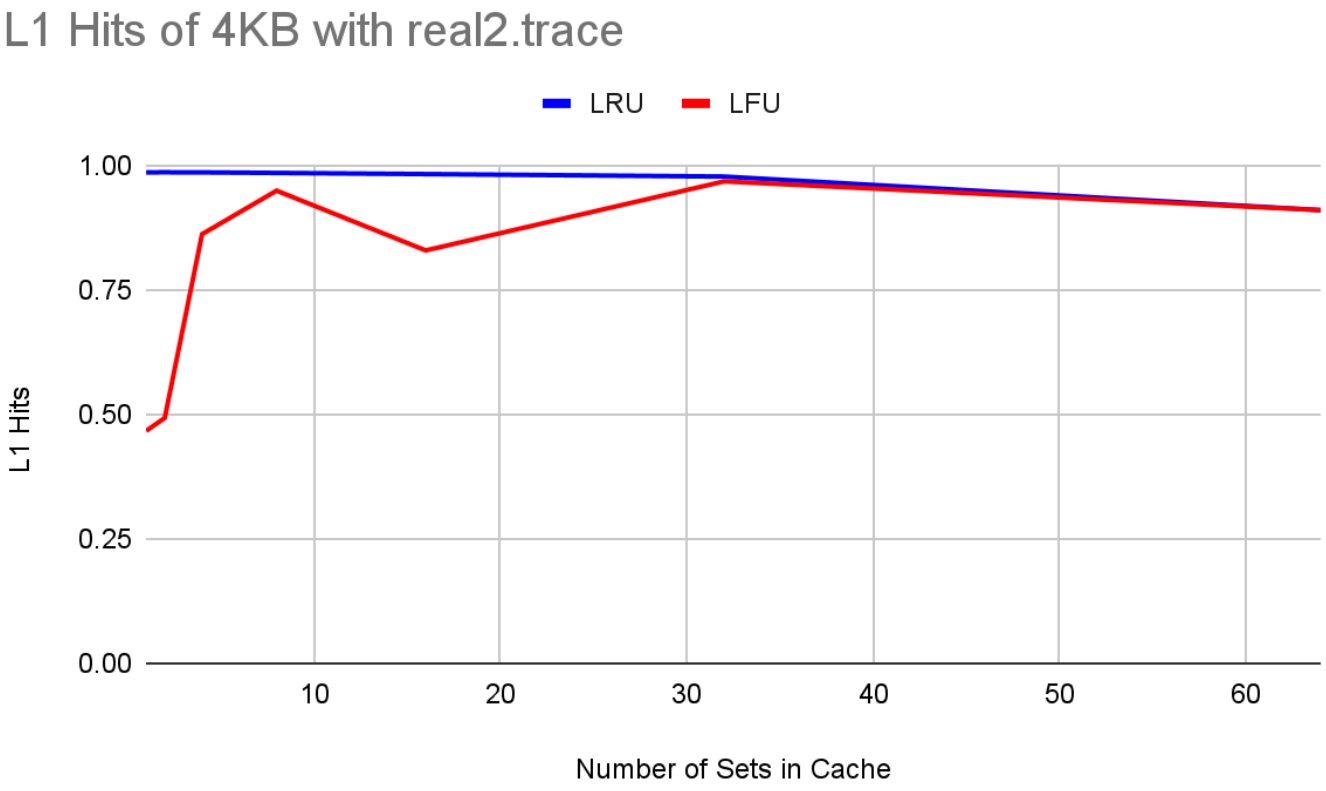


Explanation of results (4KB for real1.trace):

For CSIZE = 4KB with *real1.trace*, the graph exhibits the same pattern with the increasing then decreasing hit rate, but shows a similar pattern to the graph of L1 hits with a CSIZE of 2 KB with *real1.trace*. The best cache to select is an LRU cache with a set size of 1 and a cache associativity of 64 lines, or a set size of 2 and associativity of 32 lines per set since both provide the same cache hit.

4KB for *real2.trace*:

Number of Sets in Cache	Cache Associativity	L1 Hit Rate (LRU)	L1 Hit Rate (LFU)
1	64	98.58%	46.66%
2	32	98.59%	49.28%
4	16	98.57%	86.16%
8	8	98.46%	94.90%
16	4	98.23%	82.90%
32	2	97.73%	96.76%
64	1	90.99%	90.99%



Explanation of results (4KB for real2.trace):

One observation found in the plots between *real1.trace* and *real2.trace* is that the initial gap between these two graphs is larger compared to the gaps between the plots of 2KB and 4KB with *real1.trace.* Otherwise, the plot stays consistent with the trend of increasing then decreasing seen with the last 3 plots and shows a similar plot to the *real2.trace* for 2KB. The best configuration to select for CSIZE = 4KB with *real2.trace* is an LRU cache with a set size of 2 and a cache associativity of 32 lines per set.

Summary:

The differences between LRU and LFU caches are how they handle evictions. LFU prioritizes the least frequently accessed data while LRU prioritizes the least recently accessed data. Based on the tables and graphs above, LRU consistently gives a higher hit rate for these traces because it matches typical memory access patterns better. The best cache configuration overall for CSIZE = 2KB would be an LRU cache with a set size of 1 and associativity of 32 lines per set, while for CSIZE = 4KB the most ideal cache would be an LRU type cache with a set size of 2 and associativity of 32 lines per set.