

# Assignment 2

## Cache Simulator

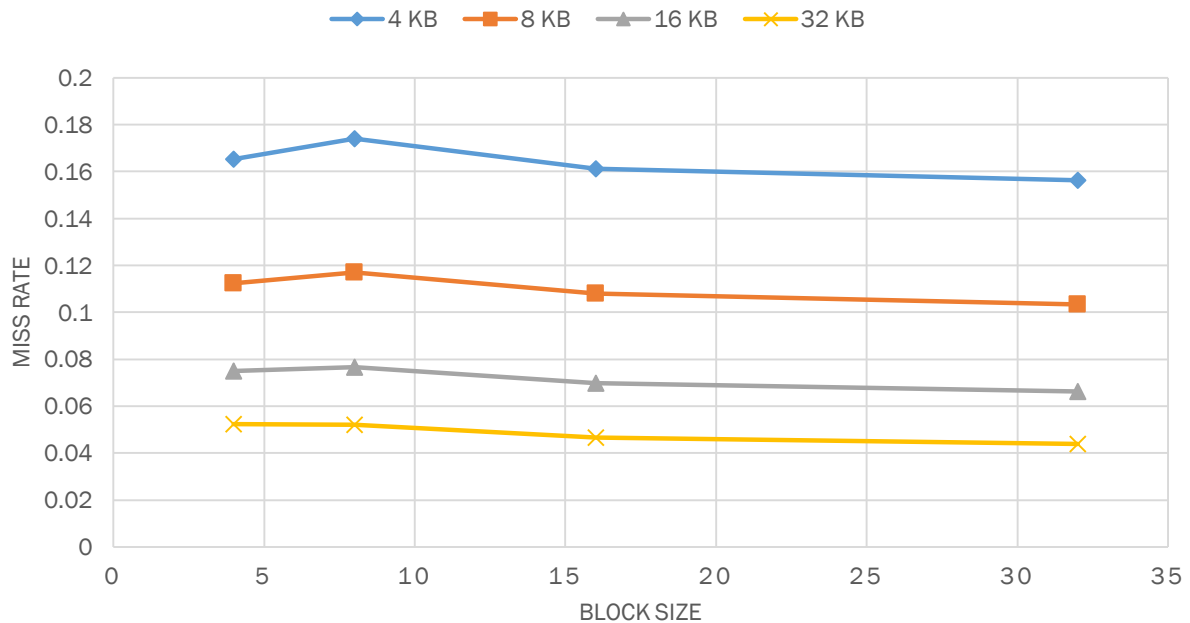
We use `gcc_ld_trace.txt` as an address trace file, then compare the results of using direct mapped cache and N-way associativity cache.

### Direct Mapped Cache

The following table shows the result of simulating miss rate of a direct mapped cache for each block size and cache size:

Block Size (Bytes)	Cache Size (Kilobytes)			
	4	8	16	32
4	0.1652205	0.1124015	0.0750335	0.0524565
8	0.1739270	0.1168930	0.0767215	0.0520580
16	0.1612690	0.1079250	0.0699200	0.0466270
32	0.1562175	0.1032850	0.0662515	0.0440765

To illustrated further, we can plot the data as the following graph:



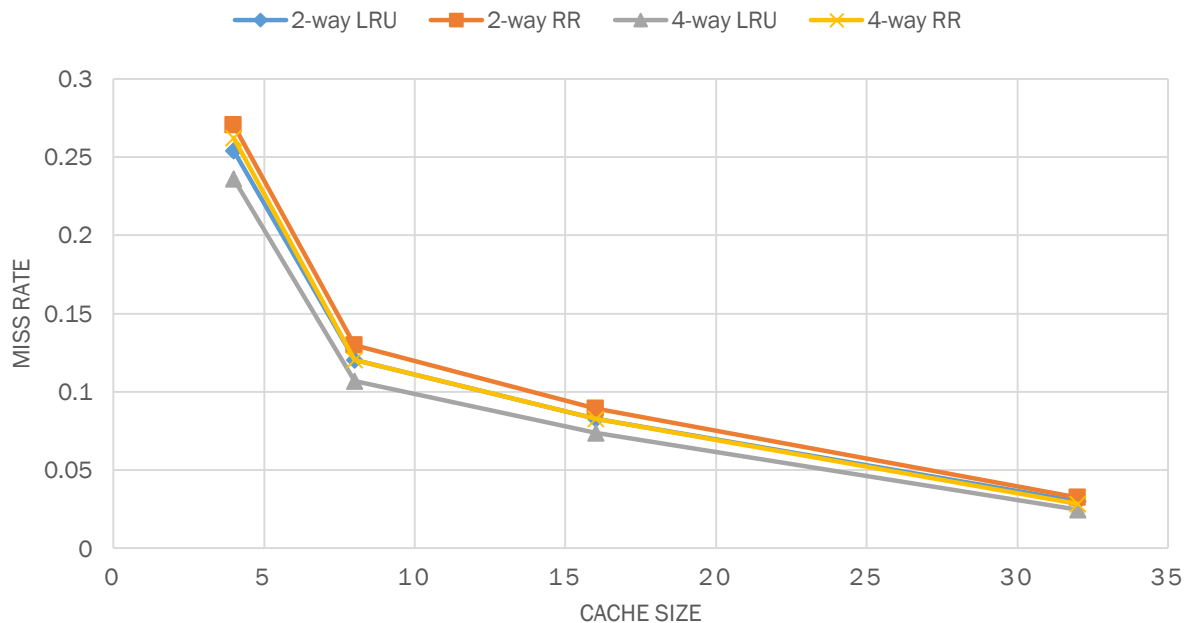
Notice that larger cache size results in lower miss rate. Also, larger block size tends to result in lower miss rate, except for the relatively small block size.

## N-way Associativity Cache

The following table shows the result of simulating miss rate of a N-way associativity cache for each cache size, different N-way number, and different replacement algorithms—Least Recently Used (LRU) and Round Robin (RR):

Cache Size (Kilobytes)	Two-way		Four-way	
	LRU	RR	LRU	RR
4	0.2541485	0.270585	0.236161	0.262436
8	0.1202065	0.129931	0.106765	0.120445
16	0.0827775	0.089164	0.073867	0.0827515
32	0.030219	0.032631	0.0247545	0.028333

To illustrated further, we can plot the data as the following graph:



As we can see from the graph, that larger cache size results in lower miss rate. Also, larger block size tends to results in lower miss rate, except for the small block size, and miss rate of four-ways associative is a little bit lower than two-ways in both Least Recently Used and Round Robin algorithm, but the comparison between each algorithm, miss rate of Least Recently Used is smaller than Round Robin.

## Source Code

- Direct Mapped  
<https://gist.github.com/neungkl/80046b9b3268174753106de3beebb69d#file-direct-mapped-c>
- Least Recently Used  
<https://gist.github.com/neungkl/80046b9b3268174753106de3beebb69d#file-least-recently-used-c>
- Round Robin  
<https://gist.github.com/neungkl/80046b9b3268174753106de3beebb69d#file-round-robin-c>