CS224

Section No.: 1

Spring 2021

Lab No.: 6

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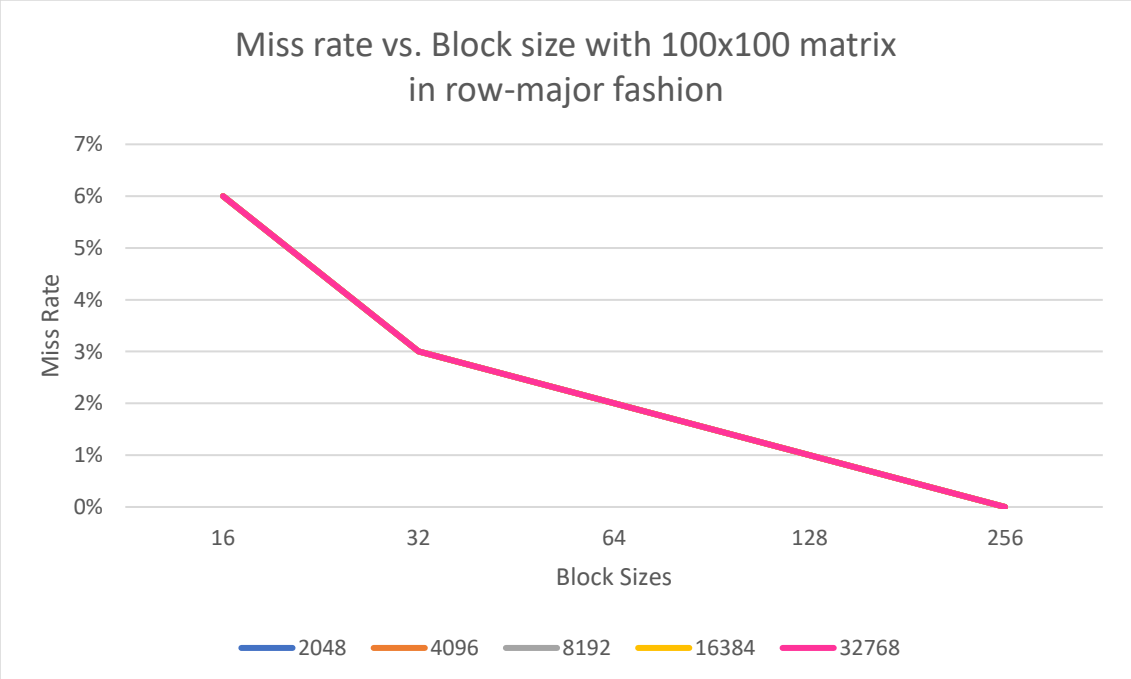
Lab Work Report

Part 2.a:

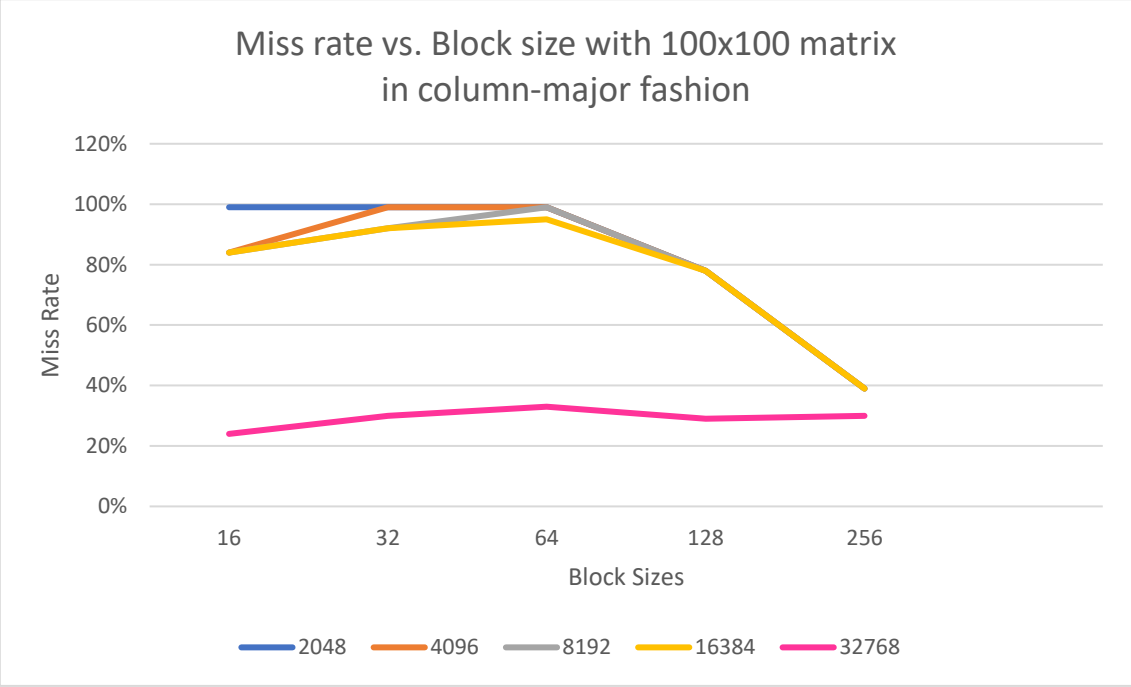
Row-major average for 100x100 matrix:

	Block size				
Cache size	16	32	64	128	256
2048	Miss rate: %6 # of misses: 630	Miss rate: %3 # of misses: 317	Miss rate: %2 # of misses: 159	Miss rate: %1 # of misses: 80	Miss rate: %0 # of misses: 41
4096	Miss rate: %6 # of misses: 630	Miss rate: %3 # of misses: 317	Miss rate: %2 # of misses: 159	Miss rate: %1 # of misses: 80	Miss rate: %0 # of misses: 41
8192	Miss rate: %6 # of misses: 630	Miss rate: %3 # of misses: 317	Miss rate: %2 # of misses: 159	Miss rate: %1 # of misses: 80	Miss rate: %0 # of misses: 41
16384	Miss rate: %6 # of misses: 630	Miss rate: %3 # of misses: 317	Miss rate: %2 # of misses: 159	Miss rate: %1 # of misses: 80	Miss rate: %0 # of misses: 41
32768	Miss rate: %6 # of misses: 630	Miss rate: %3 # of misses: 317	Miss rate: %2 # of misses: 159	Miss rate: %1 # of misses: 80	Miss rate: %0 # of misses: 41



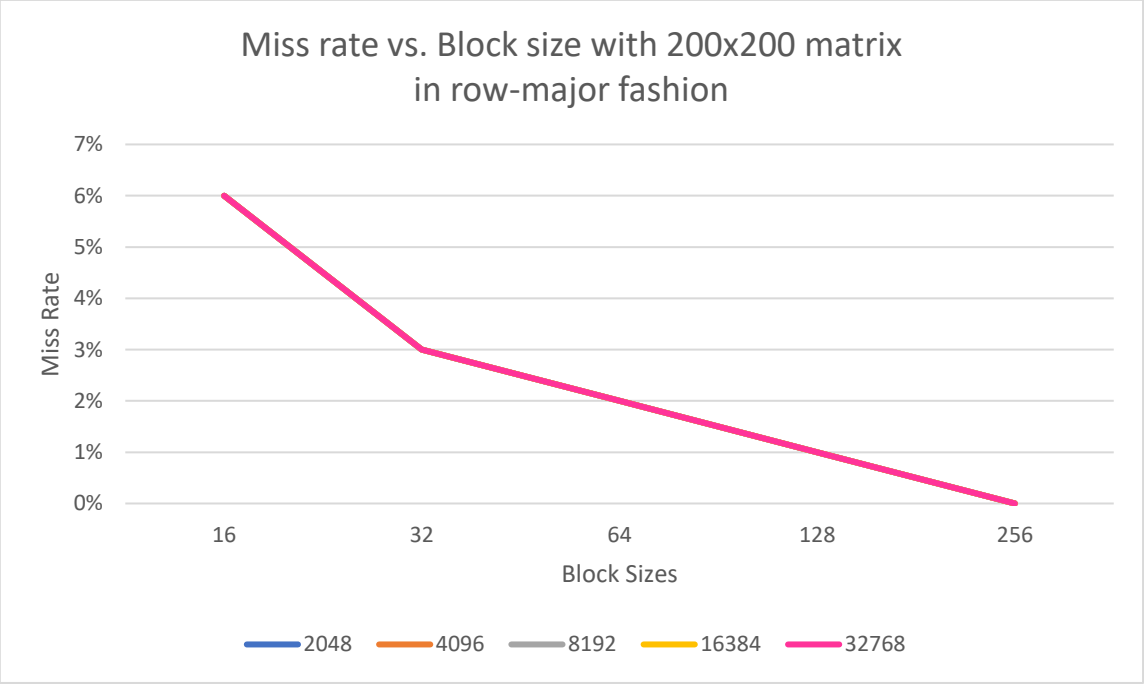
Column-major average for 100x100 matrix:

	Block size				
Cache size	16	32	64	128	256
2048	Miss rate: %99 # of misses: 10004	Miss rate: %99 # of misses: 10003	Miss rate: %99 # of misses: 10002	Miss rate: %78 # of misses: 7817	Miss rate: %39 # of misses: 3917
4096	Miss rate: %84 # of misses: 8468	Miss rate: %99 # of misses: 10003	Miss rate: %99 # of misses: 10002	Miss rate: %78 # of misses: 7817	Miss rate: %39 # of misses: 3917
8192	Miss rate: %84 # of misses: 8468	Miss rate: %92 # of misses: 9235	Miss rate: %99 # of misses: 10002	Miss rate: %78 # of misses: 7817	Miss rate: %39 # of misses: 3917
16384	Miss rate: %84 # of misses: 8468	Miss rate: %92 # of misses: 9235	Miss rate: %95 # of misses: 9618	Miss rate: %78 # of misses: 7817	Miss rate: %39 # of misses: 3917
32768	Miss rate: %24 # of misses: 2445	Miss rate: %30 # of misses: 3024	Miss rate: %33 # of misses: 3313	Miss rate: %29 # of misses: 2882	Miss rate: %14 # of misses: 1457



Row-major average for 200x200 matrix:

	Block size				
Cache size	16	32	64	128	256
2048	Miss rate: %6 # of misses: 2505	Miss rate: %3 # of misses: 1254	Miss rate: %2 # of misses: 627	Miss rate: %1 # of misses: 314	Miss rate: %0 # of misses: 158
4096	Miss rate: %6 # of misses: 2505	Miss rate: %3 # of misses: 1254	Miss rate: %2 # of misses: 627	Miss rate: %1 # of misses: 314	Miss rate: %0 # of misses: 158
8192	Miss rate: %6 # of misses: 2505	Miss rate: %3 # of misses: 1254	Miss rate: %2 # of misses: 627	Miss rate: %1 # of misses: 314	Miss rate: %0 # of misses: 158
16384	Miss rate: %6 # of misses: 2505	Miss rate: %3 # of misses: 1254	Miss rate: %2 # of misses: 627	Miss rate: %1 # of misses: 314	Miss rate: %0 # of misses: 158
32768	Miss rate: %6 # of misses: 2505	Miss rate: %3 # of misses: 1254	Miss rate: %2 # of misses: 627	Miss rate: %1 # of misses: 314	Miss rate: %0 # of misses: 158



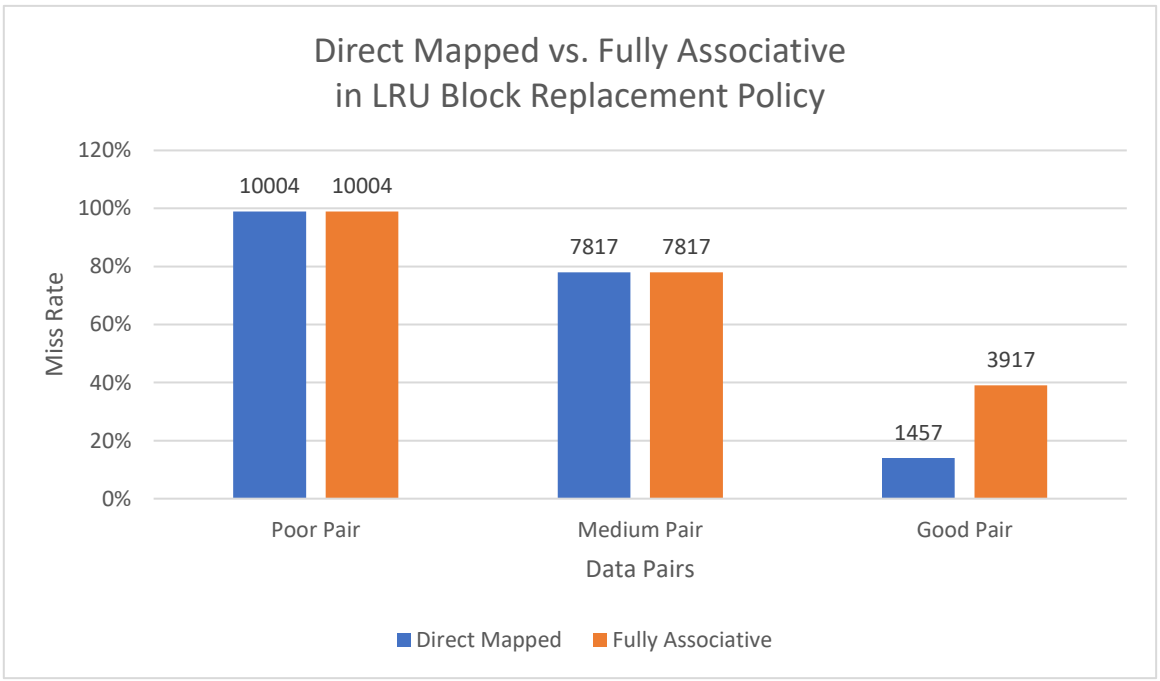
Column-major average for 200x200 matrix:

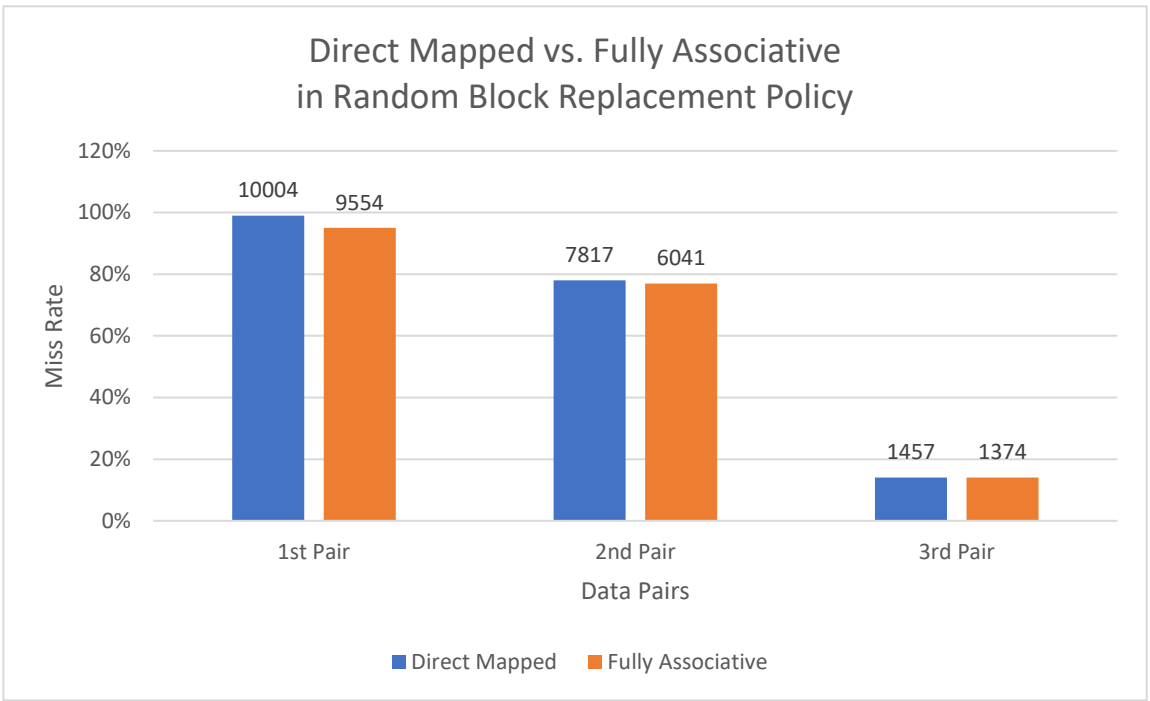
	Block size				
Cache size	16	32	64	128	256
2048	Miss rate: %100 # of misses: 40004	Miss rate: %100 # of misses: 40003	Miss rate: %100 # of misses: 40002	Miss rate: %100 # of misses: 40001	Miss rate: %78 # of misses: 31265
4096	Miss rate: %100 # of misses: 40002	Miss rate: %100 # of misses: 40003	Miss rate: %100 # of misses: 40002	Miss rate: %100 # of misses: 40001	Miss rate: %78 # of misses: 31265
8192	Miss rate: %82 # of misses: 32836	Miss rate: %100 # of misses: 40002	Miss rate: %100 # of misses: 40002	Miss rate: %100 # of misses: 40001	Miss rate: %78 # of misses: 31265
16384	Miss rate: %82 # of misses: 32836	Miss rate: %91 # of misses: 36419	Miss rate: %95 # of misses: 38210	Miss rate: %100 # of misses: 40001	Miss rate: %78 # of misses: 31265
32768	Miss rate: %82 # of misses: 32836	Miss rate: %91 # of misses: 36419	Miss rate: %95 # of misses: 38210	Miss rate: %98 # of misses: 39105	Miss rate: %78 # of misses: 31265

Part 2.b

I got my data from 100x100 matrix column-major results which are:

Pair No.	1 (Poor)	2 (Medium)	3 (Good)
Block Size	16	128	256
Cache Size	2048	8192	32768
Miss Rate	%99	%78	%14
# of Misses	10004	7817	1457



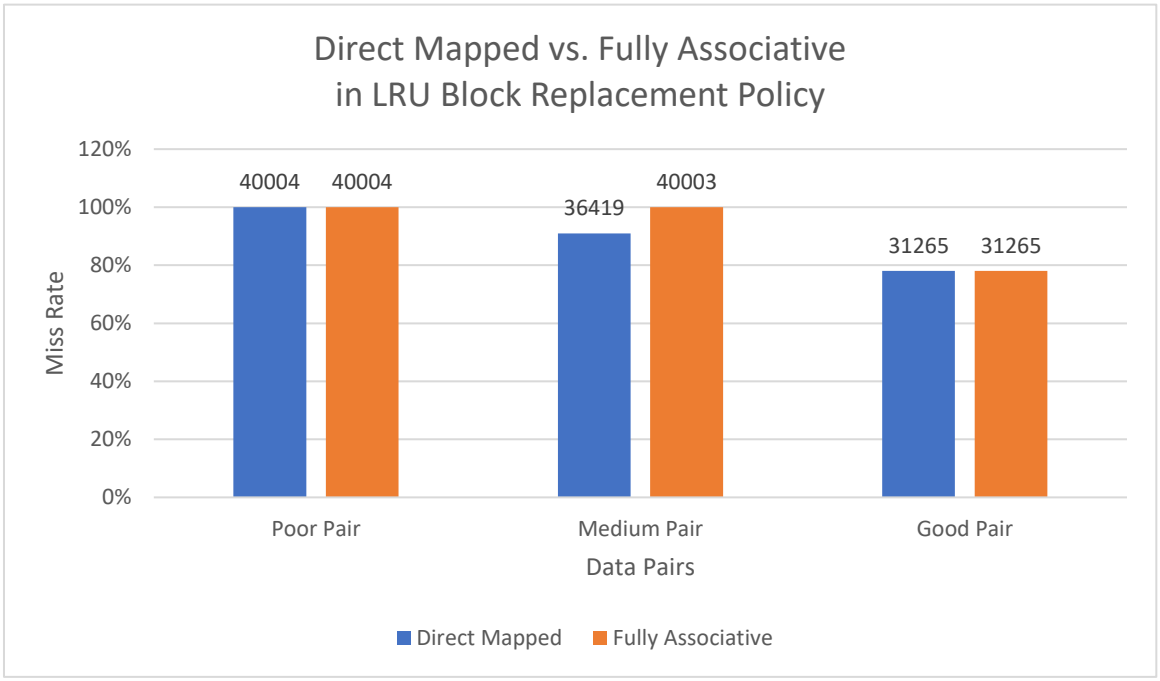


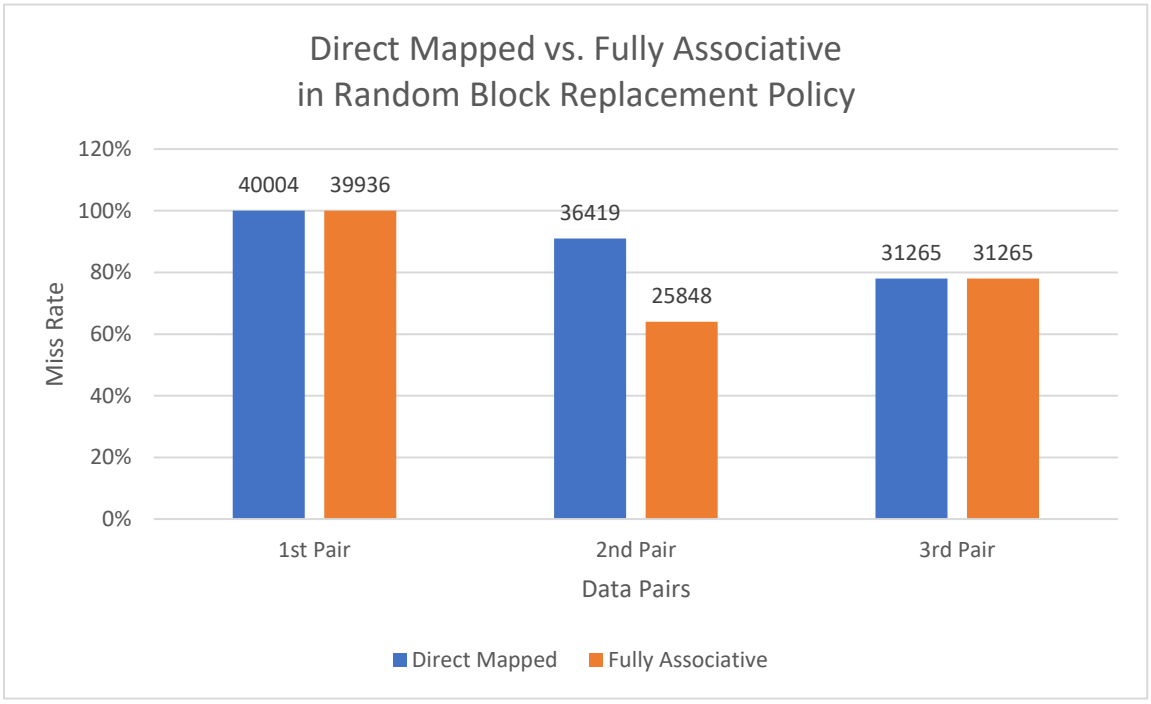
In first graph with LRU policy, we can see that in poor and medium hit rate, fully associative architecture didn't make any change. However, in good hit rate, it makes slightly worse.

In second graph with Random policy, we can see that architecture affected all rates in a slightly positive way.

I got my data from 200x200 matrix column-major results which are:

Pair No.	1 (Poor)	2 (Medium)	3 (Good)
Block Size	16	32	256
Cache Size	2048	16384	2048
Miss Rate	%100	%91	%78
# of Misses	40004	36419	31265





In first graph with LRU policy, we can see that in poor and good hit rate, fully associative architecture didn't make any change. However, in medium hit rate, it makes slightly worse.

In second graph with Random policy, we can see that architecture affected poor pair in a positive way slightly but it affected medium pair very well.

My theory about these changes is that, LRU policy replaces a data that will be used in the future, even if it is the least recently used data. Because of this, cache misses data. It is similar in random policy too. However it is not always the same. Sometimes, data that will be used next is replaced but sometimes another data replaced instead. Miss values are close because randomly replaced data will be used too, not now but later. Therefore, misses happen less with random policy.

Part 2.c:

Results for 100x100 matrix:

Results for good rate:

Set size	2	4	8	16
Miss rate	%21	%36	%39	%39
# of misses	2165	3581	3917	3917

Results for medium rate:

Set size	2	4	8	16
Miss rate	%78	%78	%78	%78
# of misses	5013	5013	5013	5013

Results for poor rate:

Set size	2	4	8	16
Miss rate	%99	%99	%99	%99
# of misses	10004	10004	10004	10004

N-way architecture didn't make a change in medium and poor rate. However, it made good rate worse. It is mostly affected when way number increased 2 to 4.

Results for 200x200 matrix:

Results for good rate:

Set size	2
Miss rate	%78
# of misses	31265

Results for medium rate:

Set size	2	4	8	16
Miss rate	%89	%100	%100	%100
# of misses	35875	40003	40003	40003

Results for poor rate:

Set size	2	4	8	16
Miss rate	%100	%100	%100	%100
# of misses	40004	40004	40004	40004

N-way architecture didn’t make a change in good and poor rate. However, it made medium rate worse. It is mostly affected when way number increased 2 to 4.