

CS224

Section No.: 01

Spring 2021

Lab No.: 06

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Part 2. [50 pts] Experiments with Data Cache Parameters

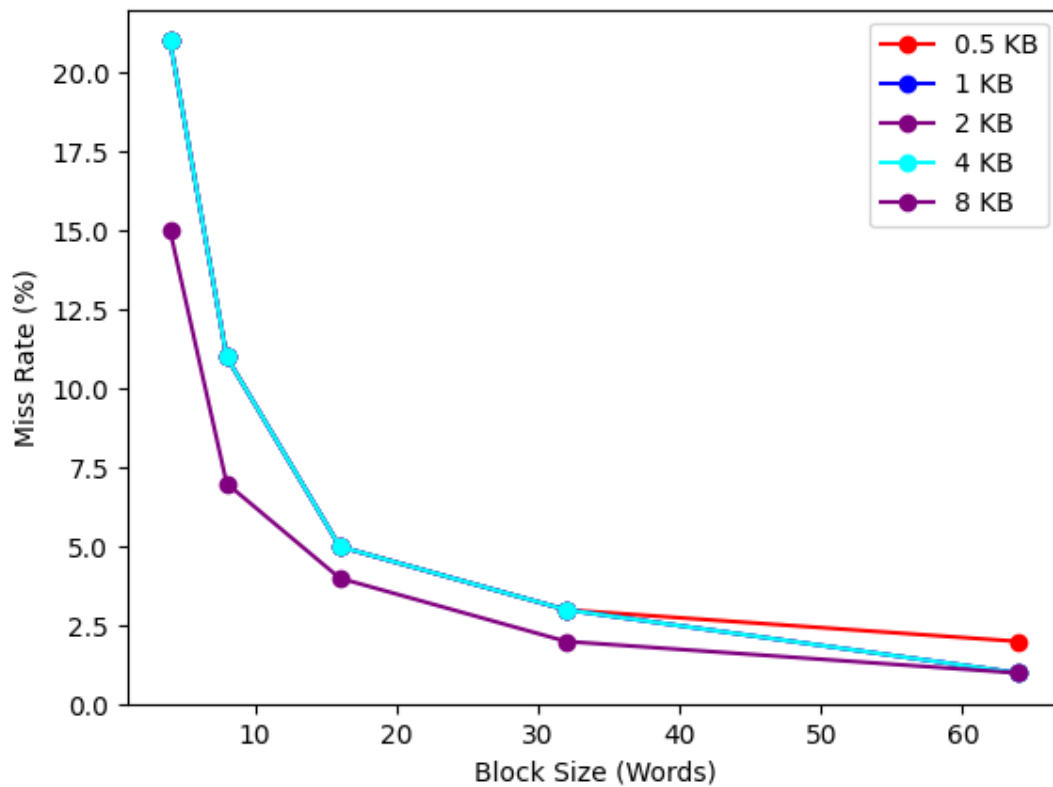
a) Direct Mapped Caches:

Size = 50

Cache Block Size (Words)	4	8	16	32	64
Cache Size (Bytes)					
512 (0.5 KB)	Miss %: 21% Number of misses: 1326	Miss %: 11% Number of misses: 671	Miss %: 5% Number of misses: 343	Miss %: 3% Number of misses: 179	Miss %: 2% Number of misses: 99
1024 (1 KB)	Miss %: 21% Number of misses: 1326	Miss %: 11% Number of misses: 669	Miss %: 5% Number of misses: 341	Miss %: 3% Number of misses: 175	Miss %: 1% Number of misses: 92
2048 (2 KB)	Miss %: 21% Number of misses: 1326	Miss %: 11% Number of misses: 669	Miss %: 5% Number of misses: 341	Miss %: 3% Number of misses: 175	Miss %: 1% Number of misses: 92
4096 (4 KB)	Miss %: 21% Number of misses: 1326	Miss %: 11% Number of misses: 669	Miss %: 5% Number of misses: 341	Miss %: 3% Number of misses: 175	Miss %: 1% Number of misses: 92
8192 (8 KB)	Miss %: 15% Number of misses: 929	Miss %: 7% Number of misses: 471	Miss %: 4% Number of misses: 243	Miss %: 2% Number of misses: 127	Miss %: 1% Number of misses: 69

(Table 1: Miss Rates for Row-Major Average)

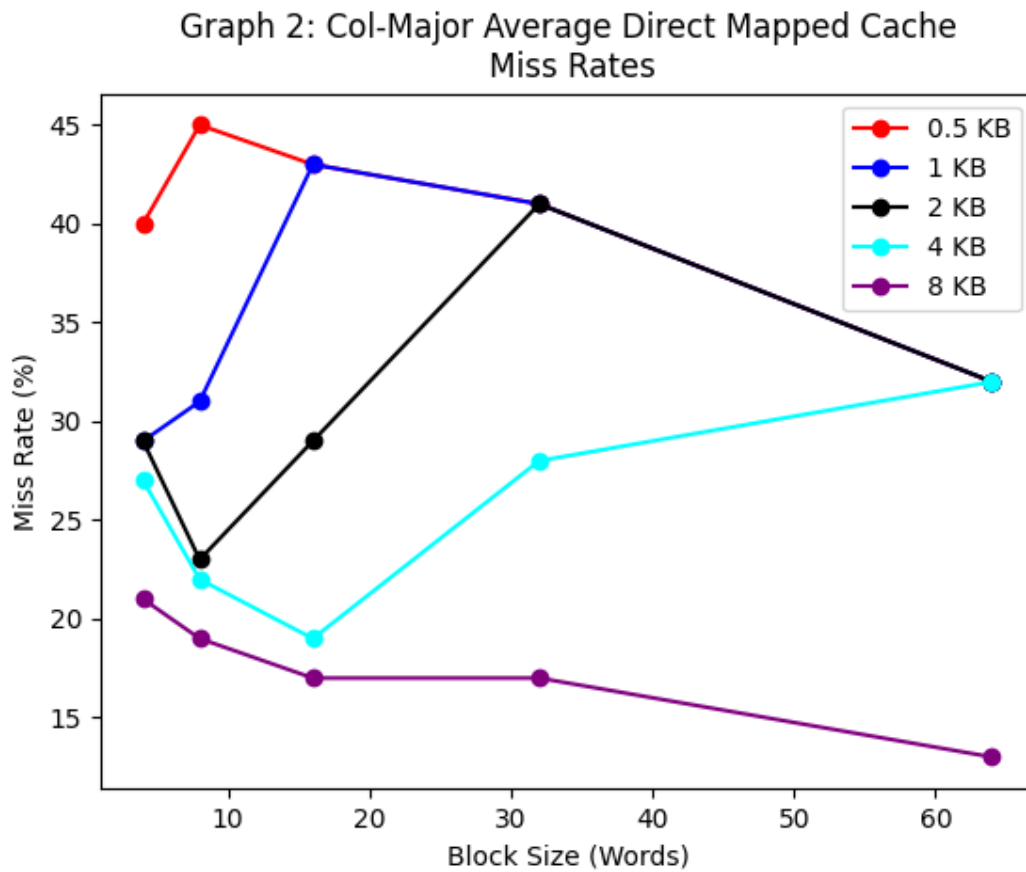
Graph 1: Row-Major Average Direct Mapped Cache Miss Rates



Cache Block Size (Words)	4	8	16	32	64
Cache Size (Bytes)					
512 (0.5 KB)	Miss %: 40% Number of misses: 2556	Miss %: 45% Number of misses: 2909	Miss %: 43% Number of misses: 2737	Miss %: 41% Number of misses: 2650	Miss %: 32% Number of misses: 2059
1024 (1 KB)	Miss %: 29% Number of misses: 1853	Miss %: 31% Number of misses: 1962	Miss %: 43% Number of misses: 2735	Miss %: 41% Number of misses: 2646	Miss %: 32% Number of misses: 2052
2048 (2 KB)	Miss %: 29% Number of misses: 1833	Miss %: 23% Number of misses: 1444	Miss %: 29% Number of misses: 1882	Miss %: 41% Number of misses: 2646	Miss %: 32% Number of misses: 2052
4096 (4 KB)	Miss %: 27% Number of misses: 1749	Miss %: 22% Number of misses: 1401	Miss %: 19% Number of misses: 1226	Miss %: 28% Number of misses: 1805	Miss %: 32% Number of misses: 2052

8192 (8 KB)	Miss %: 21% Number of misses: 1371	Miss %: 19% Number of misses: 1198	Miss %: 17% Number of misses: 1112	Miss %: 17% Number of misses: 1065	Miss %: 13% Number of misses: 853
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(Table 2: Miss Rates for Column-Major Average)

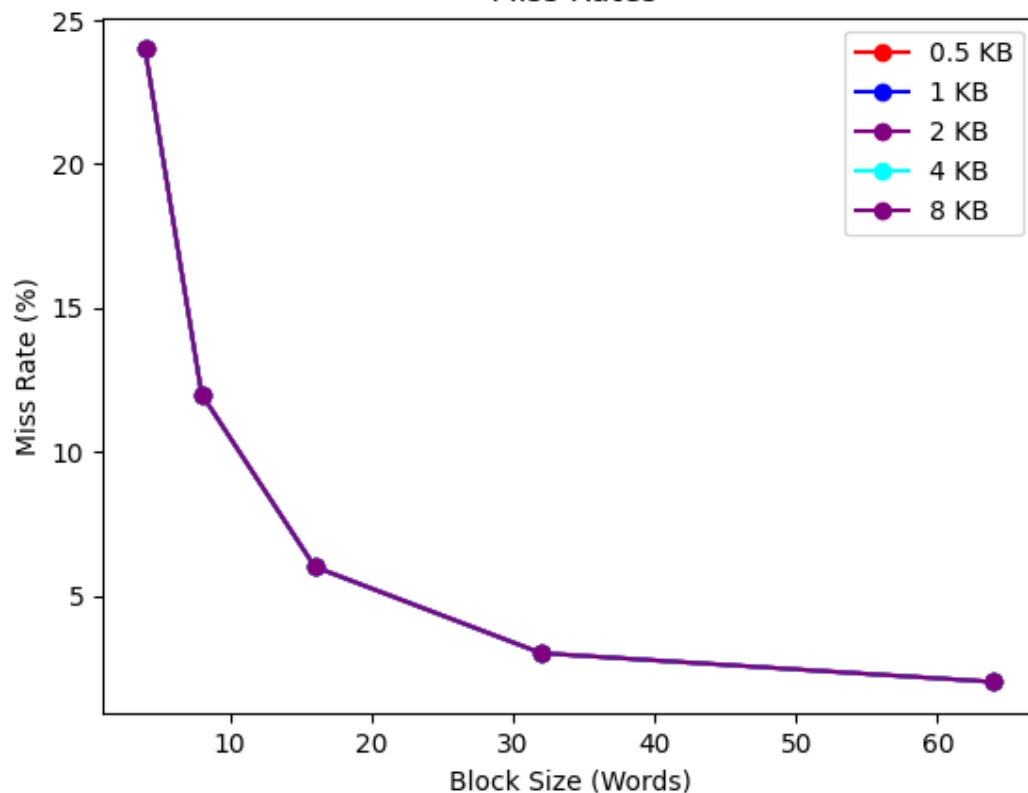


Size = 100

Cache Block Size (Words)	4	8	16	32	64
Cache Size (Bytes)					
512 (0.5 KB)	Miss %: 24% Number of misses: 5078	Miss %: 12% Number of misses: 2545	Miss %: 6% Number of misses: 1279	Miss %: 3% Number of misses: 647	Miss %: 2% Number of misses: 333
1024 (1 KB)	Miss %: 24% Number of misses: 5076	Miss %: 12% Number of misses: 2543	Miss %: 6% Number of misses: 1277	Miss %: 3% Number of misses: 643	Miss %: 2% Number of misses: 326
2048 (2 KB)	Miss %: 24% Number of misses: 5076	Miss %: 12% Number of misses: 2543	Miss %: 6% Number of misses: 1277	Miss %: 3% Number of misses: 643	Miss %: 2% Number of misses: 326
4096 (4 KB)	Miss %: 24% Number of misses: 5076	Miss %: 12% Number of misses: 2543	Miss %: 6% Number of misses: 1272	Miss %: 3% Number of misses: 643	Miss %: 2% Number of misses: 326
8192 (8 KB)	Miss %: 24% Number of misses: 5076	Miss %: 12% Number of misses: 2543	Miss %: 6% Number of misses: 1277	Miss %: 3% Number of misses: 643	Miss %: 2% Number of misses: 326

(Table 3: Miss Rates for Row-Major Average)

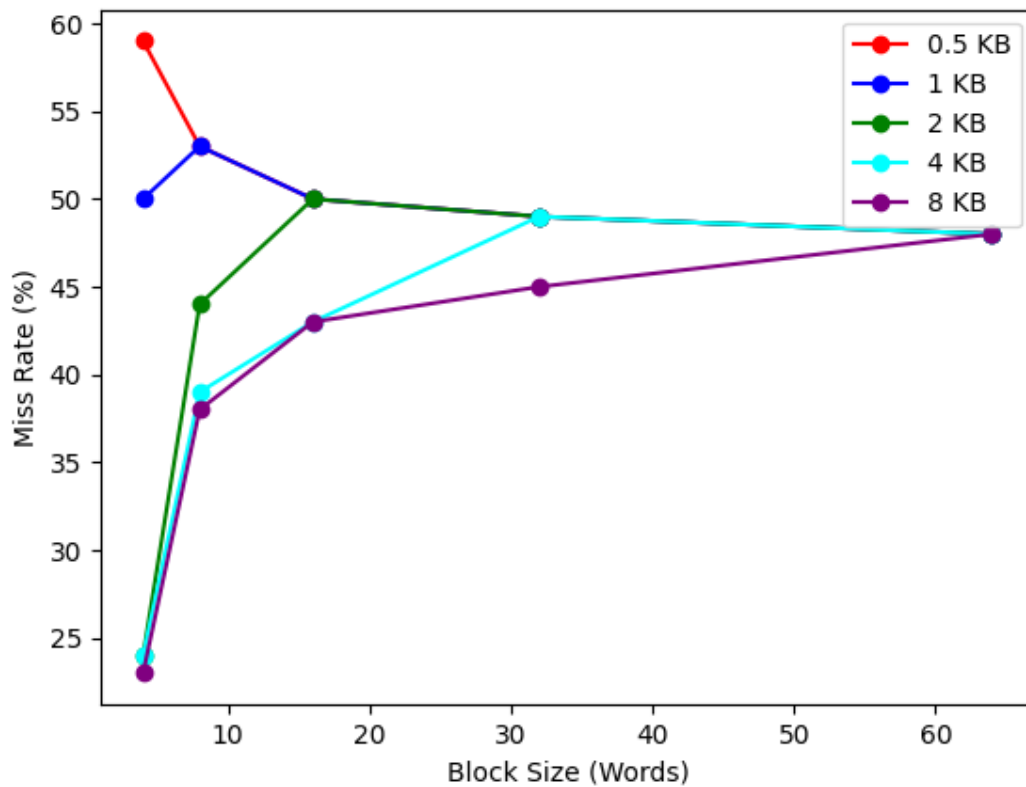
Graph 3: Row-Major Average Direct Mapped Cache Miss Rates



Cache Block Size (Words)	4	8	16	32	64
Cache Size (Bytes)					
512 (0.5 KB)	Miss %: 59% Number of misses: 12678	Miss %: 53% Number of misses: 11396	Miss %: 50% Number of misses: 10755	Miss %: 49% Number of misses: 10434	Miss %: 48% Number of misses: 10276
1024 (1 KB)	Miss %: 50% Number of misses: 10651	Miss %: 53% Number of misses: 11394	Miss %: 50% Number of misses: 10753	Miss %: 49% Number of misses: 10430	Miss %: 48% Number of misses: 10269
2048 (2 KB)	Miss %: 24% Number of misses: 5097	Miss %: 44% Number of misses: 9369	Miss %: 50% Number of misses: 10753	Miss %: 49% Number of misses: 10430	Miss %: 48% Number of misses: 10269
4096 (4 KB)	Miss %: 24% Number of misses: 5065	Miss %: 39% Number of misses: 8305	Miss %: 43% Number of misses: 9212	Miss %: 49% Number of misses: 10430	Miss %: 48% Number of misses: 10269
8192 (8 KB)	Miss %: 23% Number of misses: 4890	Miss %: 38% Number of misses: 8224	Miss %: 43% Number of misses: 9178	Miss %: 45% Number of misses: 9653	Miss %: 48% Number of misses: 10269

(Table 4: Miss Rates for Col-Major Average)

Graph 4: Col-Major Average Direct Mapped Cache Miss Rates



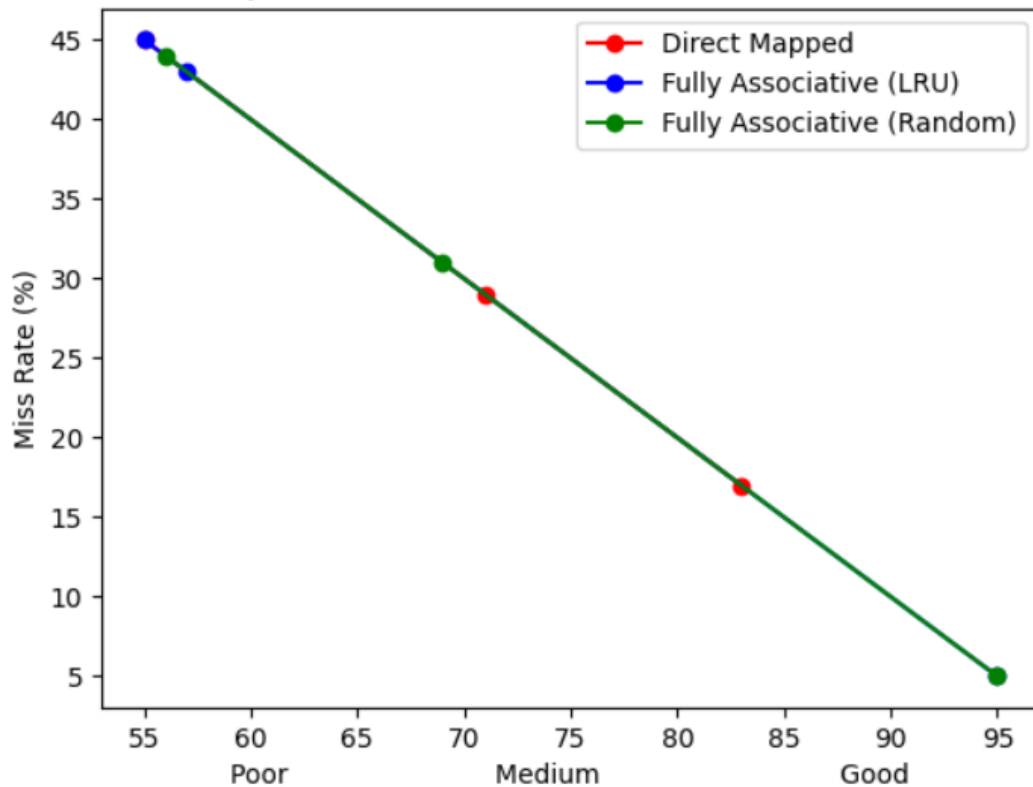
b) Fully Associative Caches:

Size = 50

	Good Hit Rate: 8KB Cache Size Block Size 16 Words	Medium Hit Rate: 2KB Cache Size Block Size 16 Words	Poor Hit Rate: 0.5KB Cache Size Block Size 8 Words
Direct Mapped	Miss Rate: 17% Hit Rate: 83% 1113 Misses	Miss Rate: 29% Hit Rate: 71% 1882 Misses	Miss Rate: 45% Hit Rate: 55% 2909 Misses
Fully Associative Cache (LRU)	Miss Rate: 5% Hit Rate: 95% 328 Misses	Miss Rate: 43% Hit Rate: 57% 2735 Misses	Miss Rate: 45% Hit Rate: 55% 2908 Misses
Fully Associative Cache (Random)	Miss Rate: 5% Hit Rate: 95% 315 Misses	Miss Rate: 31% Hit Rate: 69% 1937	Miss Rate: 44% Hit Rate: 56% 2810 Misses

(Table 5: Direct Mapped vs Fully Associative N = 50)

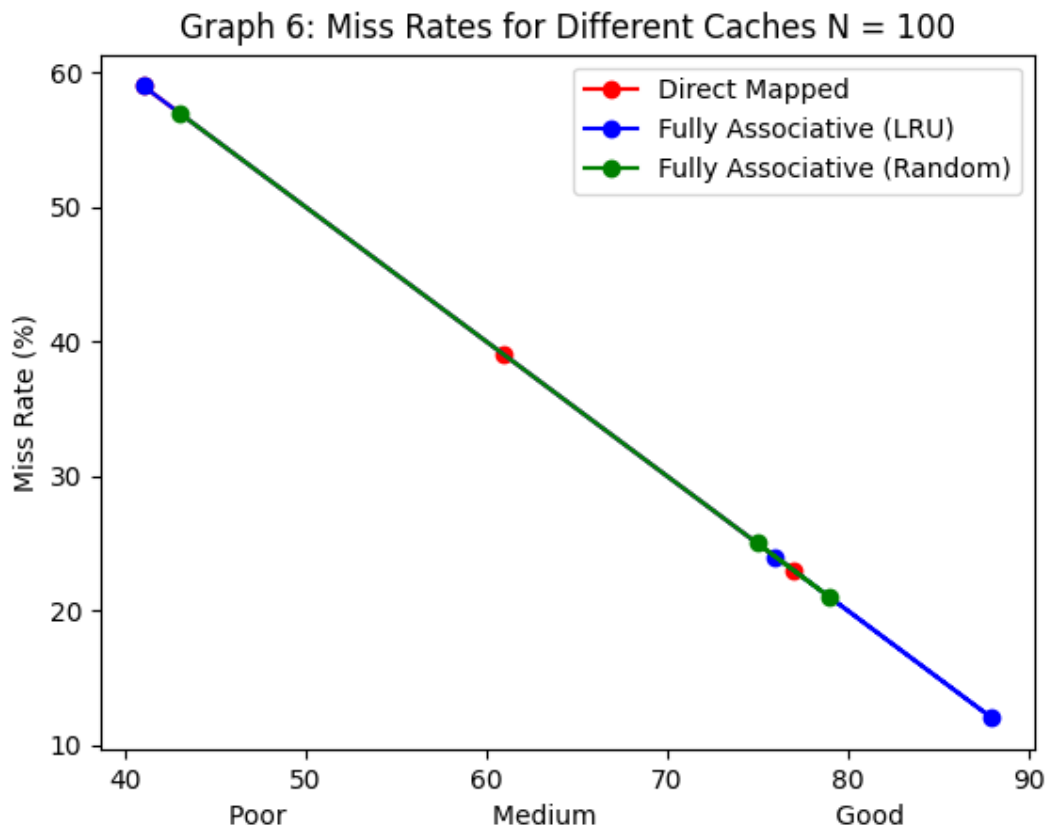
Graph 5: Miss Rates for Different Caches N = 50



Size = 100

	Good Hit Rate: 8KB Cache Size Block Size 4 Words	Medium Hit Rate: 4KB Cache Size Block Size 8 Words	Poor Hit Rate: 0.5KB Cache Size Block Size 4 Words
Direct Mapped	Miss Rate: 23% Hit Rate: 77% 4890 Misses	Miss Rate: 39% Hit Rate: 61% 8305 Misses	Miss Rate: 59% Hit Rate: 41% 12678 Misses
Fully Associative Cache (LRU)	Miss Rate: 24% Hit Rate: 76% 5061 Misses	Miss Rate: 12% Hit Rate: 88% 2606 Misses	Miss Rate: 59% Hit Rate: 41% 12676 Misses
Fully Associative Cache (Random)	Miss Rate: 25% Hit Rate: 75% 5283 Misses	Miss Rate: 21% Hit Rate: 79% 4437	Miss Rate: 57% Hit Rate: 43% 12310 Misses

(Table 6: Direct Mapped vs Fully Associative N = 100)



c) N-way Set Associative Caches:

Size = 50

	Good Hit Rate: 8KB Cache Size Block Size 16 Words	Medium Hit Rate: 2KB Cache Size Block Size 16 Words	Poor Hit Rate: 0.5KB Cache Size Block Size 8 Words
Set Size			
2	Miss %: 4% Number of misses: 276	Miss %: 35% Number of misses: 2261	Miss %: 45% Number of misses: 2909
4	Miss %: 5% Number of misses: 326	Miss %: 43% Number of misses: 2735	Miss %: 45% Number of misses: 2908
8	Miss %: 5% Number of misses: 331	Miss %: 43% Number of misses: 2735	Miss %: 45% Number of misses: 2907
16	Miss %: 5% Number of misses: 325	Miss %: 43% Number of misses: 2735	Miss %: 45% Number of misses: 2908

(Table 7: N Way Associative for N = 50)

Size = 100

	Good Hit Rate: 8KB Cache Size Block Size 4 Words	Medium Hit Rate: 4KB Cache Size Block Size 8 Words	Poor Hit Rate: 0.5KB Cache Size Block Size 4 Words
Set Size			
2	Miss %: 23% Number of misses: 5002	Miss %: 13% Number of misses: 2831	Miss %: 59% Number of misses: 12678
4	Miss %: 24% Number of misses: 5047	Miss %: 12% Number of misses: 2604	Miss %: 59% Number of misses: 12677
8	Miss %: 24% Number of misses: 5059	Miss %: 12% Number of misses: 2606	Miss %: 59% Number of misses: 12676
16	Miss %: 24% Number of misses: 5058	Miss %: 12% Number of misses: 2606	Miss %: 59% Number of misses: 12676

(Table 8: N Way Associative for N = 100)