CS 224
Laboratory Assignment 6
Section 02

Yunus Günay
22203758

12 Dec 2024

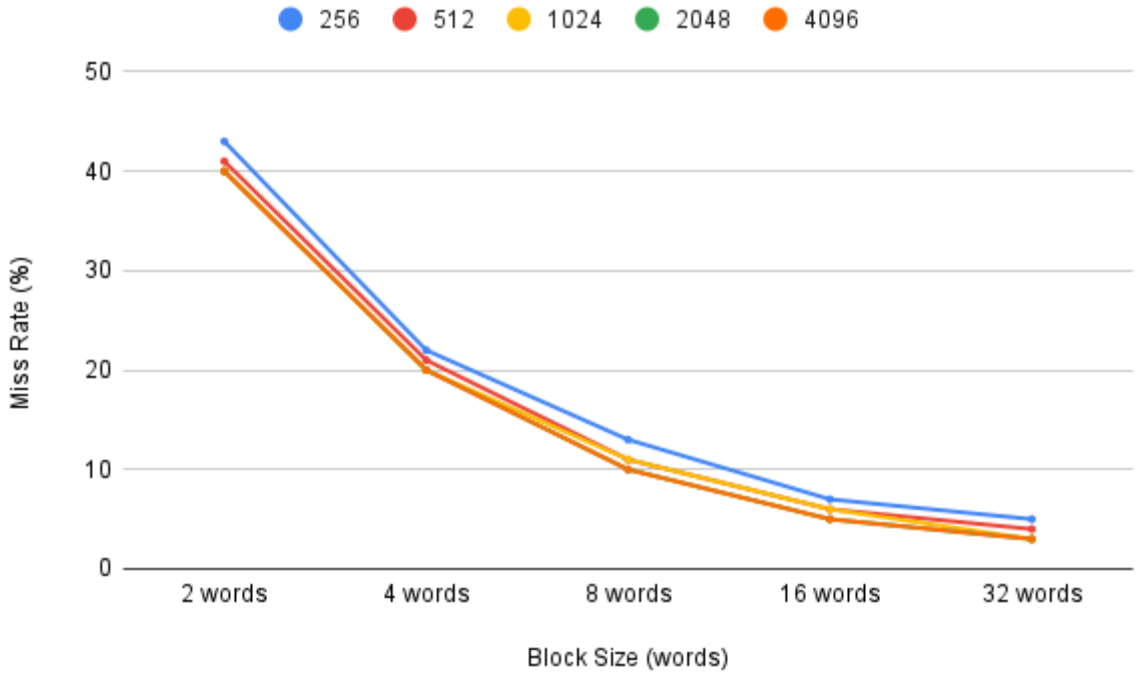
EXPERIMENTS WITH DATA CACHE PARAMETERS

Report 1 Matrix Size: (N = 50)

1.a-) Direct Mapped Caches

Block Size (words) \ Cache Size (bytes)	2	4	8	16	32
256	Hit Rate: 57% Miss Rate: 43% # of Misses: 1394	Hit Rate: 78% Miss Rate: 22% # of Misses: 722	Hit Rate: 87% Miss Rate: 13% # of Misses: 419	Hit Rate: 93% Miss Rate: 7% # of Misses: 223	Hit Rate: 95% Miss Rate: 5% # of Misses: 156
512	Hit Rate: 59% Miss Rate: 41% # of Misses: 1337	Hit Rate: 79% Miss Rate: 21% # of Misses: 682	Hit Rate: 89% Miss Rate: 11% # of Misses: 371	Hit Rate: 94% Miss Rate: 6% # of Misses: 192	Hit Rate: 96% Miss Rate: 4% # of Misses: 124
1024	Hit Rate: 60% Miss Rate: 40% # of Misses: 1307	Hit Rate: 80% Miss Rate: 20% # of Misses: 660	Hit Rate: 89% Miss Rate: 11% # of Misses: 347	Hit Rate: 94% Miss Rate: 6% # of Misses: 178	Hit Rate: 97% Miss Rate: 3% # of Misses: 104
2048	Hit Rate: 60% Miss Rate: 40% # of Misses: 1292	Hit Rate: 80% Miss Rate: 20% # of Misses: 650	Hit Rate: 90% Miss Rate: 10% # of Misses: 335	Hit Rate: 95% Miss Rate: 5% # of Misses: 171	Hit Rate: 97% Miss Rate: 3% # of Misses: 93
4096	Hit Rate: 60% Miss Rate: 40% # of Misses: 1286	Hit Rate: 80% Miss Rate: 20% # of Misses: 646	Hit Rate: 90% Miss Rate: 10% # of Misses: 331	Hit Rate: 95% Miss Rate: 5% # of Misses: 169	Hit Rate: 97% Miss Rate: 3% # of Misses: 89

(Table 1.1: Column-Major Summation with Direct Mapped Cache)

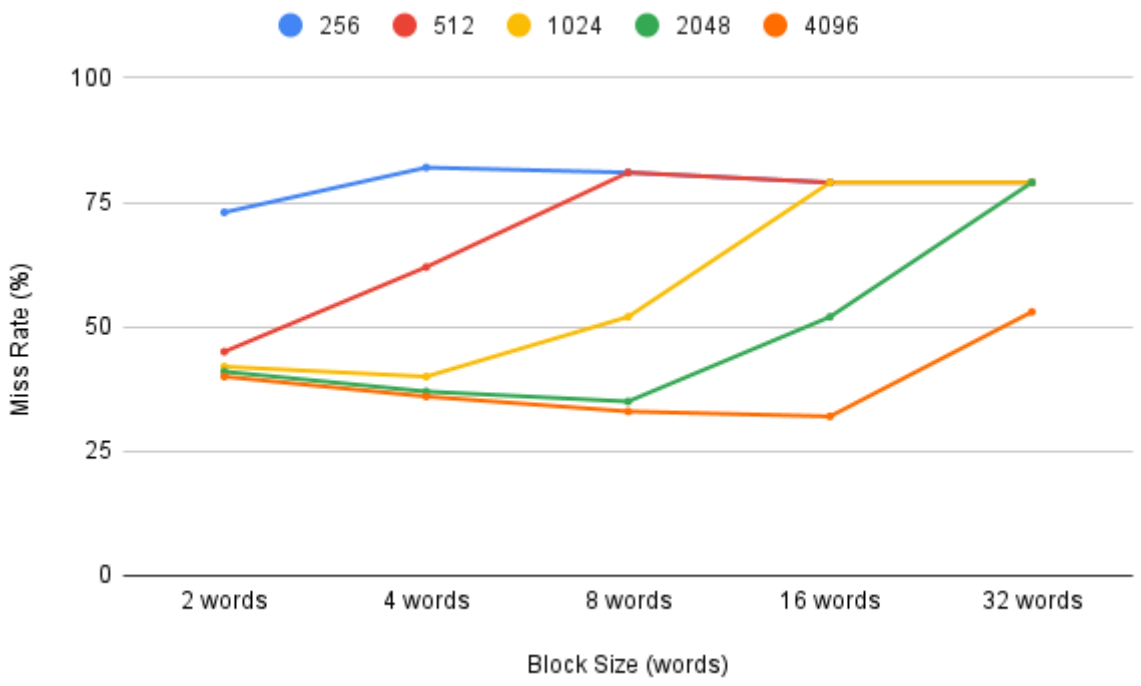


(Graph 1.1: Miss Rate versus Block Size of the Column-Major Summation)

Block Size (words) \ Cache Size (bytes)	2	4	8	16	32
256	Hit Rate: 27% Miss Rate: 73% # of Misses: 2357	Hit Rate: 18% Miss Rate: 82% # of Misses: 2663	Hit Rate: 19% Miss Rate: 81% # of Misses: 2607	Hit Rate: 21% Miss Rate: 79% # of Misses: 2555	Hit Rate: 21% Miss Rate: 79% # of Misses: 2554
512	Hit Rate: 55% Miss Rate: 45% # of Misses: 1455	Hit Rate: 38% Miss Rate: 62% # of Misses: 1993	Hit Rate: 19% Miss Rate: 81% # of Misses: 2607	Hit Rate: 21% Miss Rate: 79% # of Misses: 2555	Hit Rate: 21% Miss Rate: 79% # of Misses: 2553
1024	Hit Rate: 58% Miss Rate: 42% # of Misses: 1367	Hit Rate: 60% Miss Rate: 40% # of Misses: 1279	Hit Rate: 48% Miss Rate: 52% # of Misses: 1690	Hit Rate: 21% Miss Rate: 79% # of Misses: 2555	Hit Rate: 21% Miss Rate: 79% # of Misses: 2553

2048	Hit Rate: 59% Miss Rate: 41% # of Misses: 1322	Hit Rate: 63% Miss Rate: 37% # of Misses: 1194	Hit Rate: 65% Miss Rate: 35% # of Misses: 1134	Hit Rate: 48% Miss Rate: 52% # of Misses: 1695	Hit Rate: 21% Miss Rate: 79% # of Misses: 2553
4096	Hit Rate: 60% Miss Rate: 40% # of Misses: 1304	Hit Rate: 64% Miss Rate: 36% # of Misses: 1152	Hit Rate: 67% Miss Rate: 33% # of Misses: 1074	Hit Rate: 68% Miss Rate: 32% # of Misses: 1028	Hit Rate: 47% Miss Rate: 53% # of Misses: 1703

(Table 1.2: Row-Major Summation with Direct Mapped Cache)



(Graph 1.2: Miss Rate versus Block Size of the Row-Major Summation)

1.b-) Fully Associative Caches

	Good Hit Rate Block Size: 16 Cache Size: 4096	Medium Hit Rate Block Size: 8 Cache Size: 1024	Poor Hit Rate Block Size: 16 Cache Size: 256
Direct Mapped	Miss Rate: 32% # of Misses: 1028	Miss Rate: 52% # of Misses: 1690	Miss Rate: 79% # of Misses: 2555
Fully Associative (LRU)	Miss Rate: 6% # of Misses: 206	Miss Rate: 81% # of Misses: 2607	Miss Rate: 79% # of Misses: 2555
Fully Associative (Random)	Miss Rate: 14% # of Misses: 468	Miss Rate: 60% # of Misses: 1942	Miss Rate: 79% # of Misses: 2555

(Table 1.3: Miss Rate Performance for Fully Associative Caches)

1.c-) N-Way Set Associative Caches

Set Sizes	Good Hit Rate Block Size: 16 Cache Size: 4096	Medium Hit Rate Block Size: 8 Cache Size: 1024	Poor Hit Rate Block Size: 16 Cache Size: 256
1 (Direct Mapped)	Miss Rate: 32% # of Misses: 1028	Miss Rate: 52% # of Misses: 1690	Miss Rate: 79% # of Misses: 2555
2	Miss Rate: 19% # of Misses: 599	Miss Rate: 70% # of Misses: 2262	Miss Rate: 79% # of Misses: 2555
4	Miss Rate: 16% # of Misses: 508	Miss Rate: 81% # of Misses: 2607	Miss Rate: 79% # of Misses: 2555
8	Miss Rate: 6% # of Misses: 206	Miss Rate: 81% # of Misses: 2607	Miss Rate: 79% # of Misses: 2555

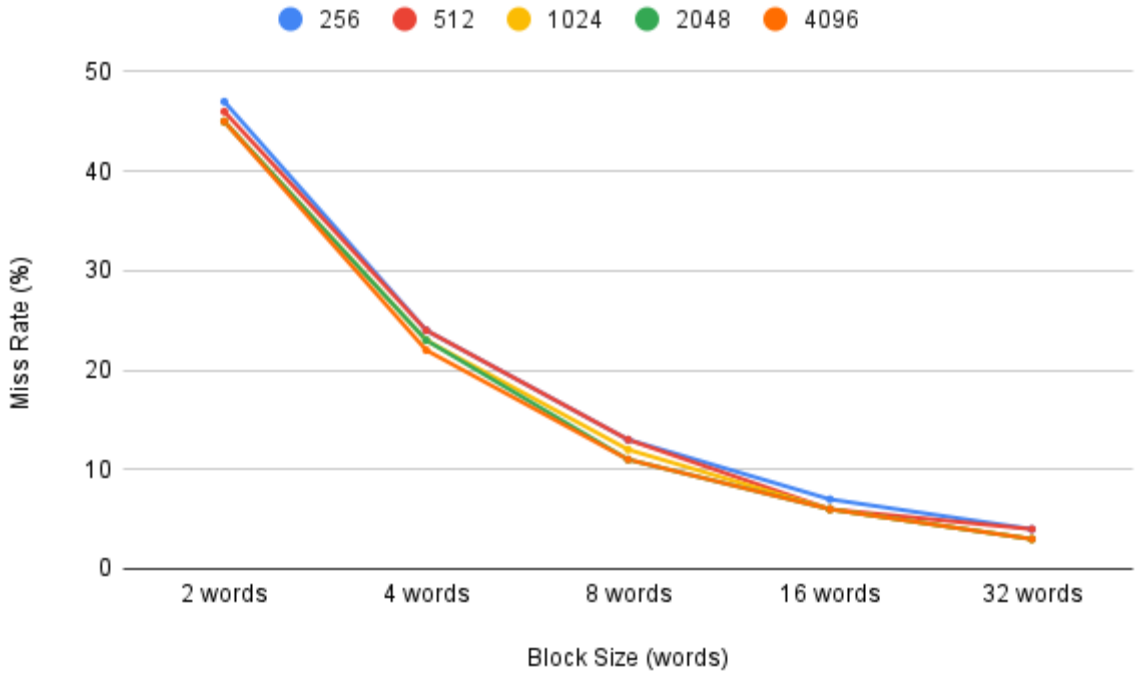
(Table 1.4: Miss Rate Performance for N-Way Set Associative Caches)

Report 2 Matrix Size: (N = 100)

2.a-) Direct Mapped Caches

Block Size (words) \ Cache Size (bytes)	2	4	8	16	32
256	Hit Rate: 53% Miss Rate: 47% # of Misses: 5324	Hit Rate: 76% Miss Rate: 24% # of Misses: 2713	Hit Rate: 87% Miss Rate: 13% # of Misses: 1469	Hit Rate: 93% Miss Rate: 7% # of Misses: 748	Hit Rate: 96% Miss Rate: 4% # of Misses: 461
512	Hit Rate: 54% Miss Rate: 46% # of Misses: 5258	Hit Rate: 76% Miss Rate: 24% # of Misses: 2669	Hit Rate: 87% Miss Rate: 13% # of Misses: 1425	Hit Rate: 94% Miss Rate: 6% # of Misses: 726	Hit Rate: 96% Miss Rate: 4% # of Misses: 438
1024	Hit Rate: 55% Miss Rate: 45% # of Misses: 5141	Hit Rate: 77% Miss Rate: 23% # of Misses: 2591	Hit Rate: 88% Miss Rate: 12% # of Misses: 1341	Hit Rate: 94% Miss Rate: 6% # of Misses: 677	Hit Rate: 97% Miss Rate: 3% # of Misses: 375
2048	Hit Rate: 55% Miss Rate: 45% # of Misses: 5084	Hit Rate: 77% Miss Rate: 23% # of Misses: 2553	Hit Rate: 89% Miss Rate: 11% # of Misses: 1299	Hit Rate: 94% Miss Rate: 6% # of Misses: 654	Hit Rate: 97% Miss Rate: 3% # of Misses: 344
4096	Hit Rate: 55% Miss Rate: 45% # of Misses: 5116	Hit Rate: 78% Miss Rate: 22% # of Misses: 2533	Hit Rate: 89% Miss Rate: 11% # of Misses: 1279	Hit Rate: 94% Miss Rate: 6% # of Misses: 644	Hit Rate: 97% Miss Rate: 3% # of Misses: 330

(Table 1.1: Column-Major Summation with Direct Mapped Cache)

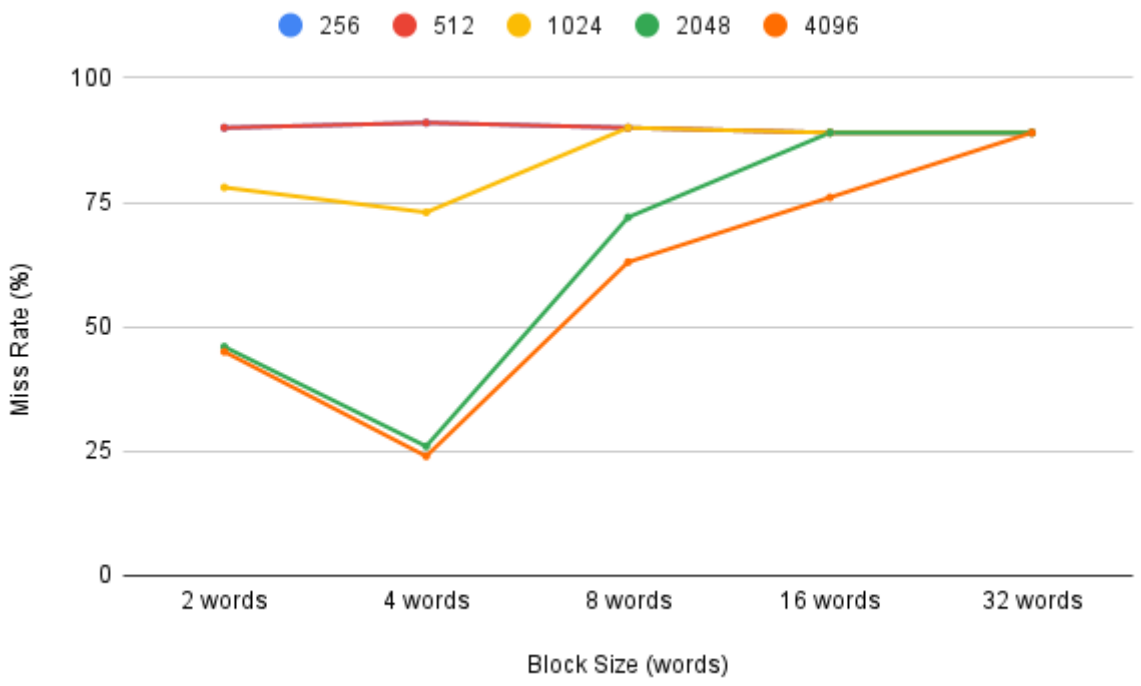


(Graph 2.1: Miss Rate versus Block Size of the Column-Major Summation)

Block Size (words) \ Cache Size (bytes)	2	4	8	16	32
256	Hit Rate: 10% Miss Rate: 90% # of Misses: 10175	Hit Rate: 9% Miss Rate: 91% # of Misses: 10313	Hit Rate: 10% Miss Rate: 90% # of Misses: 10207	Hit Rate: 11% Miss Rate: 89% # of Misses: 10105	Hit Rate: 11% Miss Rate: 89% # of Misses: 10104
512	Hit Rate: 10% Miss Rate: 90% # of Misses: 10175	Hit Rate: 9% Miss Rate: 91% # of Misses: 10313	Hit Rate: 10% Miss Rate: 90% # of Misses: 10207	Hit Rate: 11% Miss Rate: 89% # of Misses: 10105	Hit Rate: 11% Miss Rate: 89% # of Misses: 10103
1024	Hit Rate: 22% Miss Rate: 78% # of Misses: 8808	Hit Rate: 27% Miss Rate: 73% # of Misses: 8312	Hit Rate: 10% Miss Rate: 90% # of Misses: 10207	Hit Rate: 11% Miss Rate: 89% # of Misses: 10105	Hit Rate: 11% Miss Rate: 89% # of Misses: 10103

2048	Hit Rate: 54% Miss Rate: 46% # of Misses: 5206	Hit Rate: 74% Miss Rate: 26% # of Misses: 2934	Hit Rate: 28% Miss Rate: 72% # of Misses: 8167	Hit Rate: 11% Miss Rate: 89% # of Misses: 10105	Hit Rate: 11% Miss Rate: 89% # of Misses: 10103
4096	Hit Rate: 55% Miss Rate: 45% # of Misses: 5116	Hit Rate: 76% Miss Rate: 24% # of Misses: 2724	Hit Rate: 37% Miss Rate: 63% # of Misses: 7095	Hit Rate: 24% Miss Rate: 76% # of Misses: 8581	Hit Rate: 11% Miss Rate: 89% # of Misses: 10103

(Table 2.2: Row-Major Summation with Direct Mapped Cache)



(Graph 2.2: Miss Rate versus Block Size of the Row-Major Summation)

2.b-) Fully Associative Caches

	Good Hit Rate Block Size: 4 Cache Size: 4096	Medium Hit Rate Block Size: 8 Cache Size: 4096	Poor Hit Rate Block Size: 16 Cache Size: 256
Direct Mapped	Miss Rate: 24% # of Misses: 2724	Miss Rate: 63% # of Misses: 7095	Miss Rate: 89% # of Misses: 10105
Fully Associative (LRU)	Miss Rate: 22% # of Misses: 2516	Miss Rate: 12% # of Misses: 1309	Miss Rate: 89% # of Misses: 10105
Fully Associative (Random)	Miss Rate: 28% # of Misses: 3158	Miss Rate: 37% # of Misses: 3049	Miss Rate: 89% # of Misses: 10105

(Table 2.3: Miss Rate Performance for Fully Associative Caches)

2.c-) N-Way Set Associative Caches

Set Sizes	Good Hit Rate Block Size: 4 Cache Size: 4096	Medium Hit Rate Block Size: 8 Cache Size: 4096	Poor Hit Rate Block Size: 16 Cache Size: 256
1 (Direct Mapped)	Miss Rate: 24% # of Misses: 2724	Miss Rate: 63% # of Misses: 7095	Miss Rate: 89% # of Misses: 10105
2	Miss Rate: 22% # of Misses: 2516	Miss Rate: 16% # of Misses: 1856	Miss Rate: 89% # of Misses: 10105
4	Miss Rate: 22% # of Misses: 2516	Miss Rate: 13% # of Misses: 1469	Miss Rate: 89% # of Misses: 10105
8	Miss Rate: 22% # of Misses: 2516	Miss Rate: 12% # of Misses: 1309	Miss Rate: 89% # of Misses: 10105

(Table 2.4: Miss Rate Performance for N-Way Set Associative Caches)