Bilkent University
Department of Computer Engineering

CS 224 – Computer Organization

Lab Report

Lab 06

Section 03

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CS224

Section No: 3

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Part 2. Experiments with Data Cache Parameters

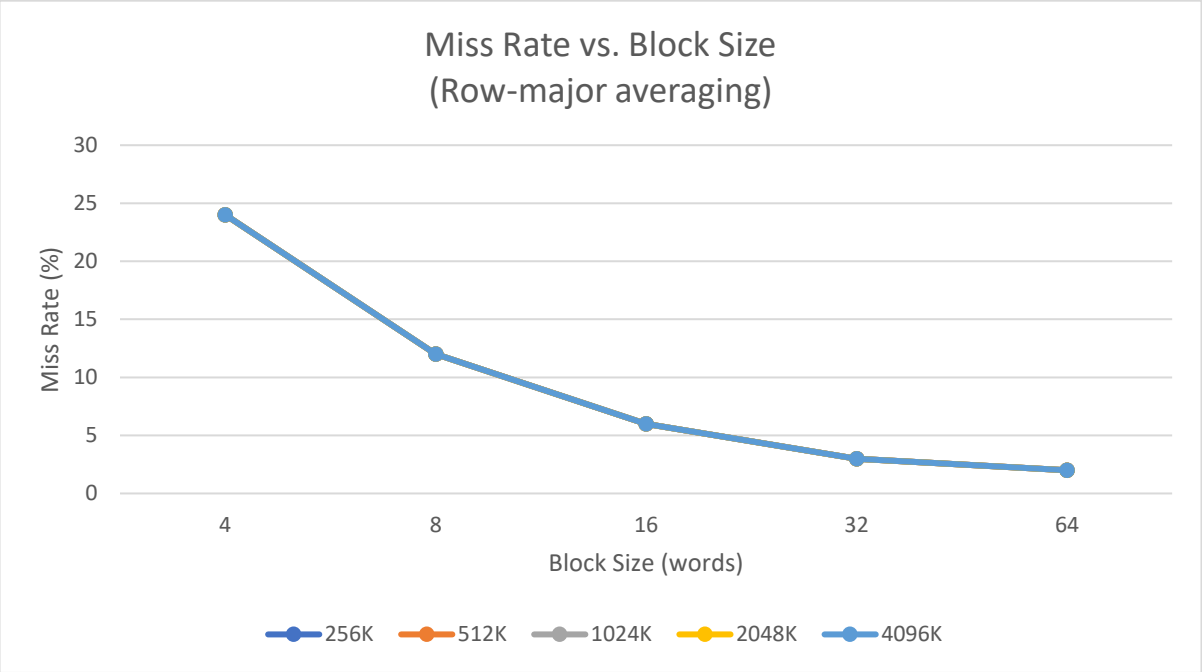
1) Matrix size = 50 x 50

a)

Row-major averaging

Block size (word) / Cache size (byte)	4	8	16	32	64
256	Miss rate = %24 Miss count = 638	Miss rate = %12 Miss count = 321	Miss rate = %6 Miss count = 162	Miss rate = %3 Miss count = 84	Miss rate = %2 Miss count = 44
512	Miss rate = %24 Miss count = 638	Miss rate = %12 Miss count = 321	Miss rate = %6 Miss count = 162	Miss rate = %3 Miss count = 83	Miss rate = %2 Miss count = 43
1024	Miss rate = %24 Miss count = 638	Miss rate = %12 Miss count = 321	Miss rate = %6 Miss count = 162	Miss rate = %3 Miss count = 83	Miss rate = %2 Miss count = 43
2048	Miss rate = %24 Miss count = 638	Miss rate = %12 Miss count = 321	Miss rate = %6 Miss count = 162	Miss rate = %3 Miss count = 83	Miss rate = %2 Miss count = 43
4096	Miss rate = %24 Miss count = 638	Miss rate = %12 Miss count = 321	Miss rate = %6 Miss count = 162	Miss rate = %3 Miss count = 83	Miss rate = %2 Miss count = 43

Table 1.1: Row-major averaging, 50x50 matrix, direct mapped cache

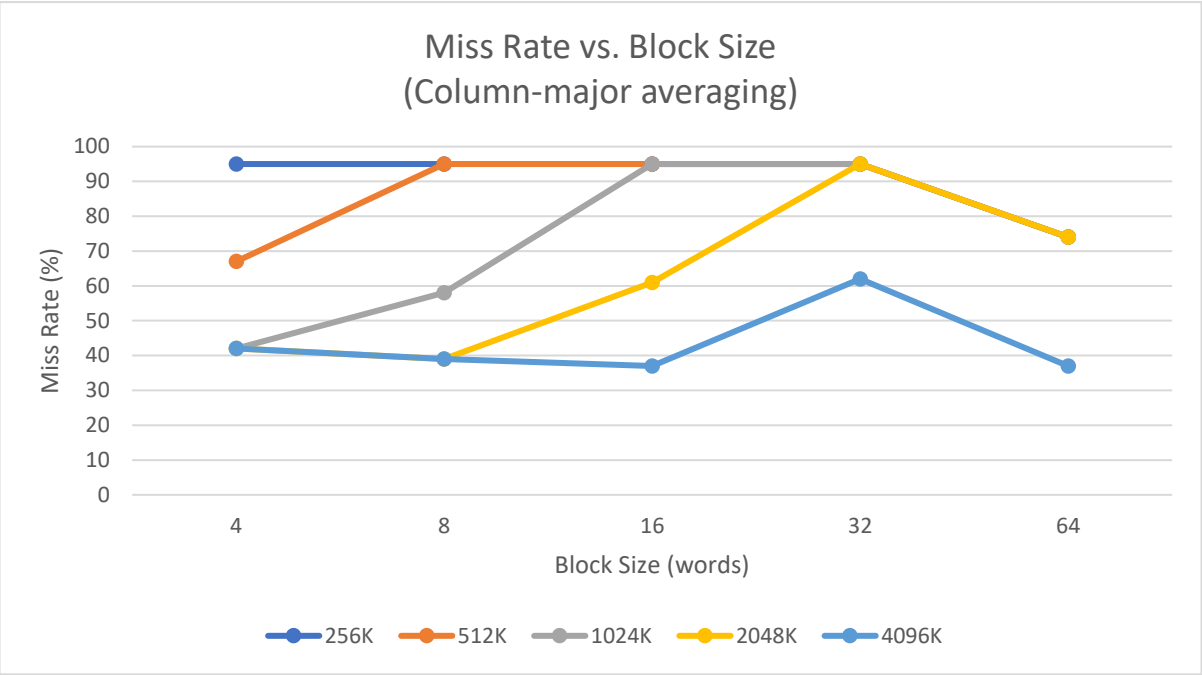


Graph 1.1 Row-major averaging, 50x50 matrix, direct mapped cache

Column-major averaging

Block size (word) / Cache size (byte)	4	8	16	32	64
256	Miss rate = %95 Miss count = 2515	Miss rate = %95 Miss count = 2510	Miss rate = %95 Miss count = 2506	Miss rate = %95 Miss count = 2506	Miss rate = %74 Miss count = 1960
512	Miss rate = %67 Miss count = 1781	Miss rate = %95 Miss count = 2510	Miss rate = %95 Miss count = 2506	Miss rate = %95 Miss count = 2505	Miss rate = %74 Miss count = 1958
1024	Miss rate = %42 Miss count = 1107	Miss rate = %58 Miss count = 1534	Miss rate = %95 Miss count = 2506	Miss rate = %95 Miss count = 2505	Miss rate = %74 Miss count = 1958
2048	Miss rate = %42 Miss count = 1107	Miss rate = %39 Miss count = 1022	Miss rate = %61 Miss count = 1619	Miss rate = %95 Miss count = 2505	Miss rate = %74 Miss count = 1958
4096	Miss rate = %42 Miss count = 1107	Miss rate = %39 Miss count = 1022	Miss rate = %37 Miss count = 978	Miss rate = %62 Miss count = 1638	Miss rate = %74 Miss count = 1958

Table 1.2: Column-major averaging, 50x50 matrix, direct mapped cache

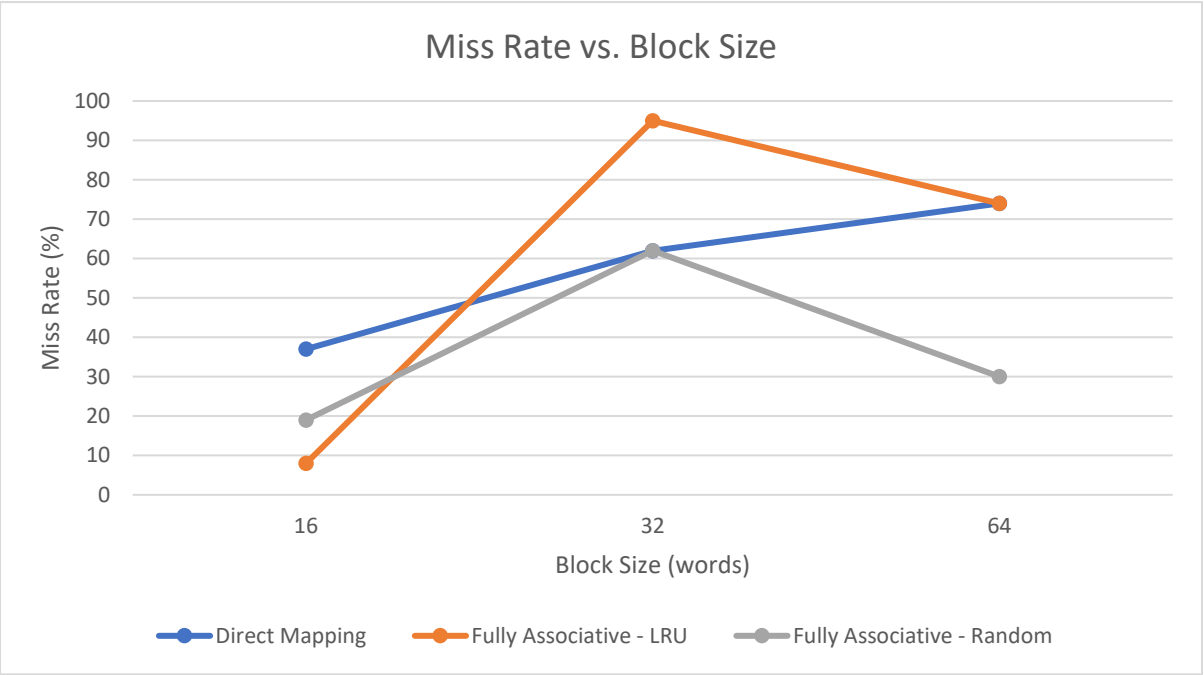


Graph 1.2 Column-major averaging, 50x50 matrix, direct mapped cache

b)

Cache type Cache size (bytes) / Block size (words)	Direct Mapping	Fully Associative - LRU	Fully Associative - Random
4096 / 16 (good)	Miss rate = %37 Miss count = 978	Miss rate = %8 Miss count = 206	Miss rate = %19 Miss count = 492
4096 / 32 (medium)	Miss rate = %62 Miss count = 1638	Miss rate = %95 Miss count = 2505	Miss rate = %62 Miss count = 1637
4096 / 64 (poor)	Miss rate = %74 Miss count = 1958	Miss rate = %74 Miss count = 1958	Miss rate = %65 Miss count = 1732

Table 1.3



Graph 1.3

c)

Cache size (bytes) / Block size (words) N – Way set size (blocks)	**4096 / 32 (medium)**	**4096 / 16 (good)**	**4096 / 64 (poor)**
2	Hit rate = %36 Miss rate = %64 Miss count = 1687	Hit rate = %80 Miss rate = %20 Miss count = 530	Hit rate = %31 Miss rate = %69 Miss count = 1825
4	Hit rate = %36 Miss rate = %64 Miss count = 1685	Hit rate = %81 Miss rate = %19 Miss count = 495	Hit rate = %33 Miss rate = %67 Miss count = 1762
8	Hit rate = %39 Miss rate = %64 Miss count = 1624	Hit rate = %84 Miss rate = %16 Miss count = 433	Hit rate = %33 Miss rate = %67 Miss count = 1766
16	Hit rate = %37 Miss rate = %63 Miss count = 1669	Hit rate = %83 Miss rate = %17 Miss count = 456	Hit rate = %34 Miss rate = %66 Miss count = 1744

Table 1.4

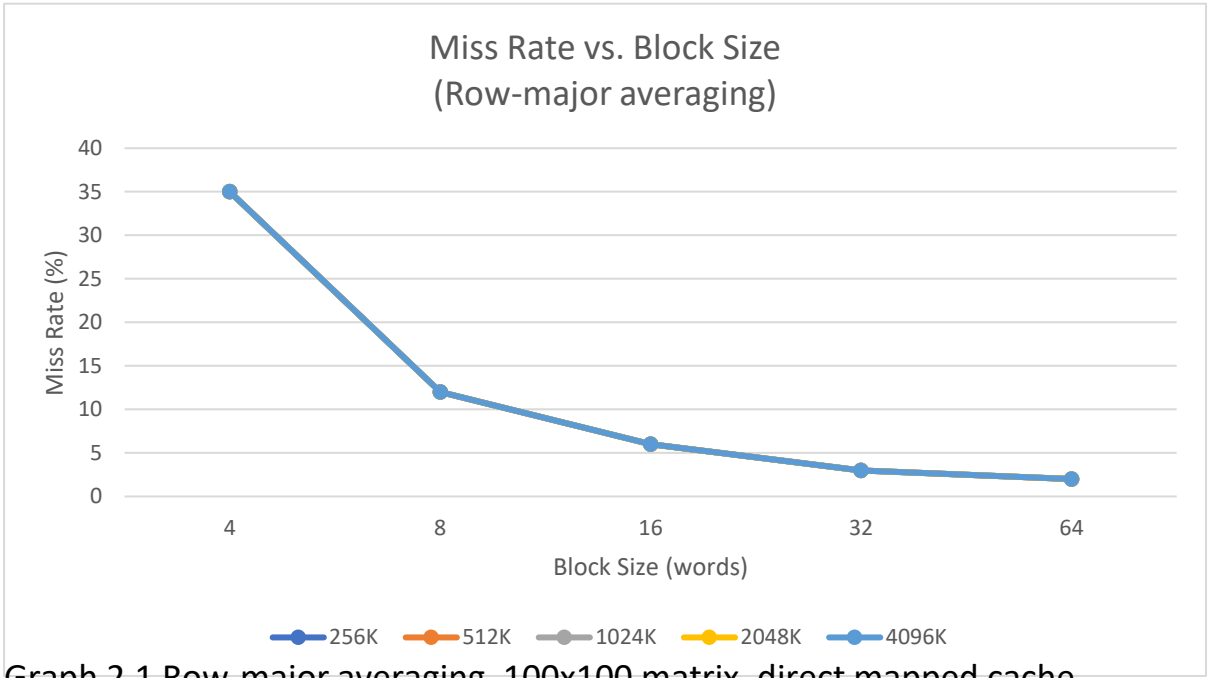
2) Matrix size = 100 x 100

a)

Row-major averaging

Block size (word) / Cache size (byte)	4	8	16	32	64
256	Miss rate = %35 Miss count = 2513	Miss rate = %12 Miss count = 1258	Miss rate = %6 Miss count = 630	Miss rate = %3 Miss count = 318	Miss rate = %2 Miss count = 161
512	Miss rate = %35 Miss count = 2513	Miss rate = %12 Miss count = 1258	Miss rate = %6 Miss count = 630	Miss rate = %3 Miss count = 317	Miss rate = %2 Miss count = 160
1024	Miss rate = %35 Miss count = 2513	Miss rate = %12 Miss count = 1258	Miss rate = %6 Miss count = 630	Miss rate = %3 Miss count = 317	Miss rate = %2 Miss count = 160
2048	Miss rate = %35 Miss count = 2513	Miss rate = %12 Miss count = 1258	Miss rate = %6 Miss count = 630	Miss rate = %3 Miss count = 317	Miss rate = %2 Miss count = 160
4096	Miss rate = %35 Miss count = 2513	Miss rate = %12 Miss count = 1258	Miss rate = %6 Miss count = 630	Miss rate = %3 Miss count = 317	Miss rate = %2 Miss count = 160

Table 2.1: Row-major averaging, 100x100 matrix, direct mapped cache

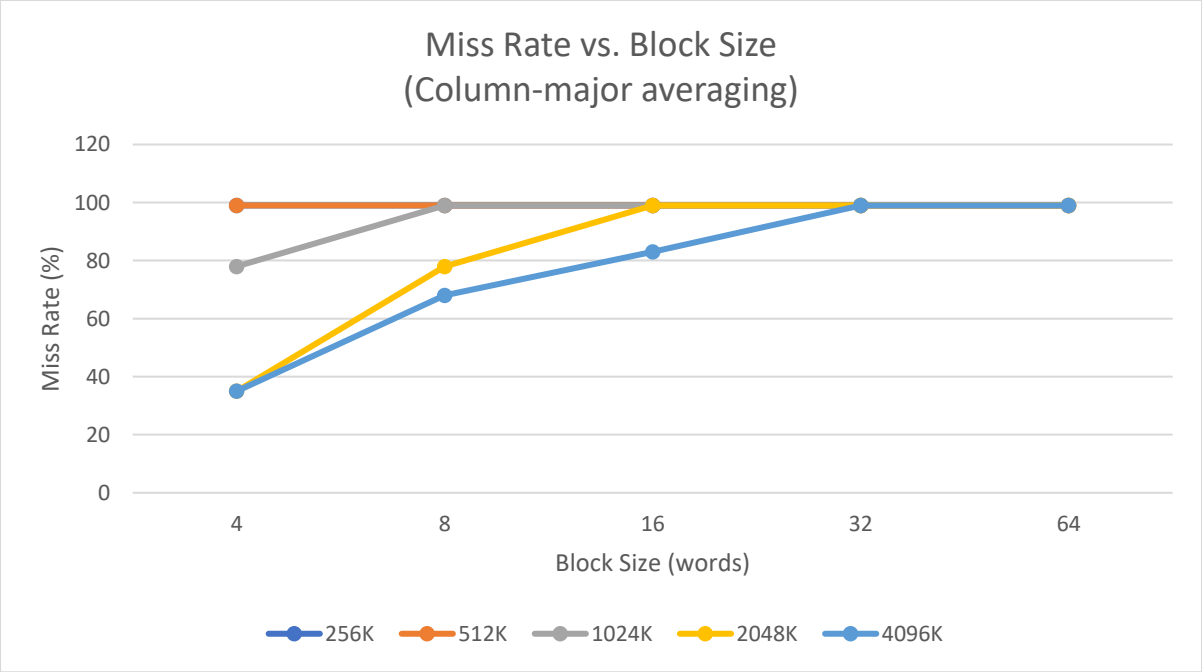


Graph 2.1 Row-major averaging, 100x100 matrix, direct mapped cache

Column-major averaging

Block size (word) / Cache size (byte)	4	8	16	32	64
256	Miss rate = %99 Miss count = 10015	Miss rate = %99 Miss count = 10010	Miss rate = %99 Miss count = 10006	Miss rate = %99 Miss count = 10006	Miss rate = %99 Miss count = 10006
512	Miss rate = %99 Miss count = 10015	Miss rate = %99 Miss count = 10010	Miss rate = %99 Miss count = 10006	Miss rate = %99 Miss count = 10005	Miss rate = %99 Miss count = 10004
1024	Miss rate = %78 Miss count = 7915	Miss rate = %99 Miss count = 10010	Miss rate = %99 Miss count = 10006	Miss rate = %99 Miss count = 10005	Miss rate = %99 Miss count = 10004
2048	Miss rate = %35 Miss count = 2515	Miss rate = %78 Miss count = 7910	Miss rate = %99 Miss count = 10006	Miss rate = %99 Miss count = 10005	Miss rate = %99 Miss count = 10004
4096	Miss rate = %35 Miss count = 2515	Miss rate = %68 Miss count = 6938	Miss rate = %83 Miss count = 8470	Miss rate = %99 Miss count = 10005	Miss rate = %99 Miss count = 10004

Table 2.2: Column-major averaging, 100x100 matrix, direct mapped cache

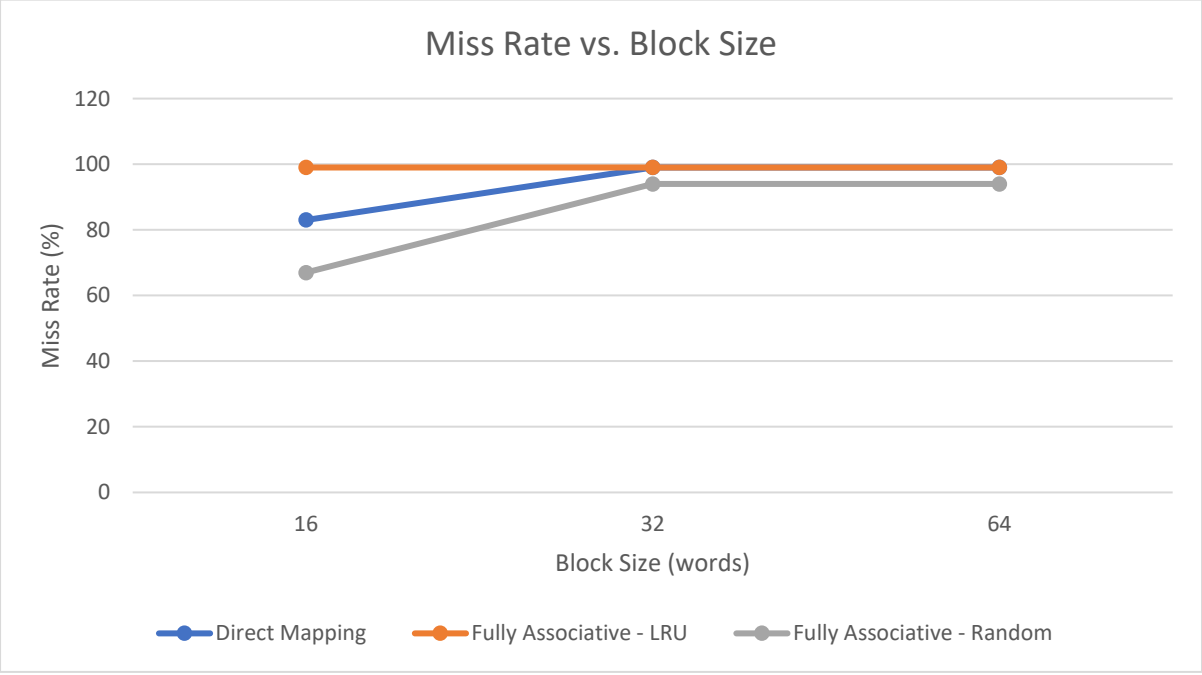


Graph 2.2 Column-major averaging, 100x100 matrix, direct mapped cache

b)

Cache type / Cache size (bytes) / Block size (words)	Direct Mapping	Fully Associative - LRU	Fully Associative - Random
4096 / 16 (good)	Miss rate = %83 Miss count = 8470	Miss rate = %99 Miss count = 10006	Miss rate = %67 Miss count = 6770
4096 / 64 (medium)	Miss rate = %99 Miss count = 10004	Miss rate = %99 Miss count = 10004	Miss rate = %98 Miss count = 9987
4096 / 32 (poor)	Miss rate = %99 Miss count = 10005	Miss rate = %99 Miss count = 10005	Miss rate = %94 Miss count = 9532

Table 2.3



Graph 2.3

c)

Cache size (bytes) / Block size (words) N – Way set size (blocks)	**4096 / 64 (medium)**	**4096 / 16 (good)**	**4096 / 32 (poor)**
2	Hit rate = %1 Miss rate = %99 Miss count = 9999	Hit rate = %34 Miss rate = %66 Miss count = 6672	Hit rate = %5 Miss rate = %95 Miss count = 9690
4	Hit rate = %1 Miss rate = %99 Miss count = 9998	Hit rate = %33 Miss rate = %67 Miss count = 6776	Hit rate = %5 Miss rate = %95 Miss count = 9617
8	Hit rate = %2 Miss rate = %98 Miss count = 9984	Hit rate = %33 Miss rate = %67 Miss count = 6830	Hit rate = %6 Miss rate = %94 Miss count = 9588
16	Hit rate = %2 Miss rate = %98 Miss count = 9984	Hit rate = %34 Miss rate = %66 Miss count = 6735	Hit rate = %6 Miss rate = %94 Miss count = 9546