CS224

Lab No: 06

Section No: 04

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EXPERIMENTS WITH DATA CACHE PARAMETERS

Data for Matrix Size 1 (N = 50)

a)

**Block Size (Words) 2 4 8 16** **32**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cache Size (Bytes)** |  | | | | |
|  | Miss Rate = 75% | Miss Rate = 85% | Miss Rate = 84% | Miss Rate = 84% | Miss Rate = 84% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 2294 | Misses = 2589 | Misses = 2571 | Misses = 2563 | Misses = 2560 |
|  | Miss Rate = 44% | Miss Rate = 62% | Miss Rate = 84% | Miss Rate = 84% | Miss Rate = 84% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1344 | Misses = 1892 | Misses = 2571 | Misses = 2563 | Misses = 2560 |
|  | Miss Rate = 44% | Miss Rate = 39% | Miss Rate = 53% | Miss Rate = 84% | Miss Rate = 84% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses = 1625 | Misses = 2562 | Misses = 2558 |
|  | Miss Rate = 44% | Miss Rate = 39% | Miss Rate = 36% | Miss Rate = 56% | Miss Rate = 84% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses =1113 | Misses = 1709 | Misses = 2558 |
|  | Miss Rate = 44% | Miss Rate = 39% | Miss Rate = 36% | Miss Rate = 35% | Miss Rate = 56% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses = 1113 | Misses = 1074 | Misses = 1723 |
|  |  |  |  |  |  |

Table 1.1: Direct Mapped Cache Row, Miss Rates for N = 50 Matrix Size

HIT RATE

**Block Size (Words) 2 4 8 16** **32**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cache Size (Bytes)** |  | | | | |
|  | Miss Rate = 96% | Miss Rate = 95% | Miss Rate = 95% | Miss Rate = 95% | Miss Rate =95% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 2294 | Misses = 2589 | Misses = 2571 | Misses = 2563 | Misses = 2560 |
|  | Miss Rate = 96% | Miss Rate = 95% | Miss Rate = 84% | Miss Rate = 84% | Miss Rate = 84% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1344 | Misses = 1892 | Misses = 2571 | Misses = 2563 | Misses = 2560 |
|  | Miss Rate = 83% | Miss Rate = 77% | Miss Rate = 95% | Miss Rate = 95% | Miss Rate = 95% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses = 1625 | Misses = 2562 | Misses = 2558 |
|  | Miss Rate = 44% | Miss Rate = 39% | Miss Rate = 76% | Miss Rate = 95% | Miss Rate = 95% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses =1113 | Misses = 1709 | Misses = 2558 |
|  | Miss Rate = 48% | Miss Rate = 39% | Miss Rate = 36% | Miss Rate = 35% | Miss Rate = 56% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 1343 | Misses = 1191 | Misses = 1113 | Misses = 1074 | Misses = 1723 |
|  |  |  |  |  |  |

Table 1.2: Direct Mapped Cache Column, Miss Rates for N = 50 Matrix Size



BLOCK SIZE (WORDS)

35

30

25

20

15

10

5

0

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%

4096

2048

1024

512

256

**MISS RATE VS BLOCK SIZE (N = 50)**

MISS RATE

Graph 1:Miss Rate vs Block Size for N = 50 Matrix Size (different colors represent different cache sizes)

b)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Good Miss rate Block Size (words) = 16**  **Cache Size (bytes) = 4096** | **Medium Miss rate Block Size (words) = 8**  **Cache Size (bytes) = 1024** | **Poor Miss rate Block Size (words) = 16**  **Cache Size (bytes) = 1024** |
| **Direct Mapped** | Miss Rate = 35% Number of Miss = 1074 | Miss Rate = 53% Number of Miss = 1625 | Miss Rate = 84% Number of Miss = 2562 |
| **Fully Associative (LRU)** | Miss Rate = 7% Number of Miss = 216 | Miss Rate = 84% Number of Miss = 2570 | Miss Rate = 84% Number of Miss = 2562 |
| **Fully Associative (Random)** | Miss Rate = 17% Number of Miss = 510 | Miss Rate = 62% Number of Miss = 1897 | Miss Rate = 80% Number of Miss = 2454 |

Table 1.3: Fully Associative Cache, Block Replacement Policies and Miss Rates for N =50 Matrix Size

c)

|  |  |  |  |
| --- | --- | --- | --- |
| **N-way Set Associative Set Sizes** | **Good Miss rate Block Size (words) = 16 Cache Size (bytes) = 4096** | **Medium Miss rate Block Size (words) = 8**  **Cache Size (bytes) = 1024** | **Poor Miss rate Block Size (words) = 16**  **Cache Size (bytes) = 1024** |
| **2** | Miss Rate = 19% Number of Miss = 585 | Miss Rate = 73% Number of Miss = 2218 | Miss Rate = 84% Number of Miss = 2562 |
| **4** | Miss Rate = 17% Number of Miss = 521 | Miss Rate = 84% Number of Miss = 2570 | Miss Rate = 84% Number of Miss = 2562 |
| **8** | Miss Rate = 7% Number of Miss = 216 | Miss Rate = 84% Number of Miss = 2570 | Miss Rate = 84% Number of Miss = 2562 |
| **16** | Miss Rate = 7% Number of Miss = 216 | Miss Rate = 84% Number of Miss = 2570 | Miss Rate = 84% Number of Miss = 2562 |

Table 1.4: N-way Set Associative Cache, Set Sizes and Miss Rates for N = 50 Matrix Size

Report for Matrix Size 2

1. (N= 100)

**Block Size (Words) 2 4 8 16** **32**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cache Size (Bytes)** |  | | | | |
|  | Miss Rate = 44% | Miss Rate = 22% | Miss Rate = 11% | Miss Rate = 6% | Miss Rate = 3% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 10169 | Misses = 10139 | Misses = 10121 | Misses = 10113 | Misses = 10110 |
|  | Miss Rate = 44% | Miss Rate = 22% | Miss Rate = 11% | Miss Rate = 6% | Miss Rate = 3% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 10169 | Misses = 10139 | Misses = 10121 | Misses = 10113 | Misses = 10110 |
|  | Miss Rate = 44% | Miss Rate = 22% | Miss Rate = 11% | Miss Rate = 6% | Miss Rate = 3% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 8818 | Misses = 8113 | Misses = 10120 | Misses = 10112 | Misses = 10108 |
|  | Miss Rate = 44% | Miss Rate = 22% | Miss Rate = 11% | Miss Rate = 6% | Miss Rate = 3% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 5118 | Misses = 2563 | Misses =8095 | Misses = 10112 | Misses = 10108 |
|  | Miss Rate = 44% | Miss Rate = 22% | Miss Rate = 11% | Miss Rate = 6% | Miss Rate = 3% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 5118 | Misses = 2563 | Misses = 7045 | Misses = 8573 | Misses = 10108 |
|  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 2.1: Direct Mapped Cache Row, Miss Rates for N = 100 Matrix Size

**Block Size (Words) 2 4 8 16** **32**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cache Size (Bytes)** |  | | | | |
|  | Miss Rate = 96% | Miss Rate = 96% | Miss Rate = 95% | Miss Rate = 95% | Miss Rate = 95% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 10169 | Misses = 10139 | Misses = 10121 | Misses = 10113 | Misses = 10110 |
|  | Miss Rate = 96% | Miss Rate = 77% | Miss Rate = 76% | Miss Rate = 81% | Miss Rate = 88% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 10169 | Misses = 10139 | Misses = 10121 | Misses = 10113 | Misses = 10110 |
|  | Miss Rate = 83% | Miss Rate = 77% | Miss Rate = 95% | Miss Rate = 95% | Miss Rate = 95% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 8818 | Misses = 8113 | Misses = 10120 | Misses = 10112 | Misses = 10108 |
|  | Miss Rate = 48% | Miss Rate = 24% | Miss Rate = 76% | Miss Rate = 95% | Miss Rate = 95% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 5118 | Misses = 2563 | Misses =8095 | Misses = 10112 | Misses = 10108 |
|  | Miss Rate = 48% | Miss Rate = 24% | Miss Rate = 66% | Miss Rate = 81% | Miss Rate = 95% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Misses = 5118 | Misses = 2563 | Misses = 7045 | Misses = 8573 | Misses = 10108 |
|  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Table 2.2: Direct Mapped Cache Column, Miss Rates for N = 100 Matrix Size



BLOCK SIZE (WORDS)

35

30

25

20

15

10

5

0

0%

20%

40%

60%

80%

100%

120%

4096

2048

1024

512

256

**MISS RATE VS BLOCK SIZE (N = 100)**

MISS RATE

Graph 2: Miss Rate vs Block Size for N = 100 Matrix Size (different colors represent different cache size

b)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Good Miss rate Block Size (words) = 4**  **Cache Size (bytes) = 2048** | **Medium Miss rate Block Size (words) = 2**  **Cache Size (bytes) = 2048** | **Poor Miss rate Block Size (words) = 8 Cache Size (bytes) = 512** |
| **Direct Mapped** | Miss Rate = 24% Number of Miss = 2563 | Miss Rate = 48% Number of Miss = 5118 | Miss Rate = 95% Number of Miss = 10121 |
| **Fully Associative (LRU)** | Miss Rate = 24% Number of Miss = 2563 | Miss Rate = 48% Number of Miss = 5118 | Miss Rate = 95% Number of Miss = 10120 |
| **Fully Associative (Random)** | Miss Rate = 42% Number of Miss = 4481 | Miss Rate = 58% Number of Miss = 6171 | Miss Rate = 95% Number of Miss = 10108 |

Table 2.3: Fully Associative Cache, Block Replacement Policies and Miss Rates for N = 100 Matrix Size

c)

|  |  |  |  |
| --- | --- | --- | --- |
| **N-way Set Associative Set Sizes** | **Good Miss rate Block Size (words) = 4**  **Cache Size (bytes) = 2048** | **Medium Miss rate Block Size (words) = 2**  **Cache Size (bytes) = 2048** | **Poor Miss rate Block Size (words) = 8 Cache Size (bytes) = 512** |
| **2** | Miss Rate = 24%  Number of Miss = 2563 | Miss Rate = 48%  Number of Miss = 5118 | Miss Rate = 95%  Number of Miss = 10121 |
| **4** | Miss Rate = 24%  Number of Miss = 2563 | Miss Rate = 48%  Number of Miss = 5118 | Miss Rate = 95%  Number of Miss = 10121 |
| **8** | Miss Rate = 24%  Number of Miss = 2563 | Miss Rate = 48%  Number of Miss = 5118 | Miss Rate = 95%  Number of Miss = 10120 |
| **16** | Miss Rate = 24%  Number of Miss = 2563 | Miss Rate = 48%  Number of Miss = 5118 | Miss Rate = 95%  Number of Miss = 10120 |

Table 2.4: N-way Set Associative Cache, Set Sizes and Miss Rates for N = 100 Matrix Size