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)** |  | | | | |
|  | Hit Rate = 87% | Hit Rate = 80% | Hit Rate = 84% | Hit Rate = 98% | Hit Rate = 99% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 2294 | Hit = 2589 | Hit = 2571 | Hit = 2563 | Hit = 2560 |
|  | Hit Rate = 87% | Hit Rate = 93% | Hit Rate = 84% | Hit Rate = 84% | Hit Rate = 84% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 1344 | Hit = 1892 | Hit = 2571 | Hit = 2563 | Hit = 2560 |
|  | Hit Rate = 44% | Hit Rate = 39% | Hit Rate = 53% | Hit Rate = 84% | Hit Rate = 84% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 1343 | Hit = 1191 | Hit = 1625 | Hit = 2562 | Hit = 2558 |
|  | Hit Rate = 44% | Hit Rate = 39% | Hit Rate = 36% | Hit Rate = 56% | Hit Rate = 84% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 1343 | Hit = 1191 | Hit =1113 | Hit = 1709 | Hit = 2558 |
|  | Hit Rate = 44% | Hit Rate = 39% | Hit Rate = 36% | Hit Rate = 35% | Hit Rate = 56% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 1343 | Hit = 1191 | Hit = 1113 | Hit = 1074 | Hit = 1723 |
|  |  |  |  |  |  |

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

MISS RATE



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

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

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

b)

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

Table 1.2: Fully Associative Cache, Block Replacement Policies and Hit Rates for N =50 Matrix Size

c)

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

Table 1.3: N-way Set Associative Cache, Set Sizes and Hit 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)** |  | | | | |
|  | Hit Rate = 87% | Hit Rate = 93% | Hit Rate = 96% | Hit Rate = 98% | Hit Rate = 99% |
| **256 (0.25KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 10169 | Hit = 10139 | Hit = 10121 | Hit = 10113 | Hit = 10110 |
|  | Hit Rate = 92% | Hit Rate = 93% | Hit Rate = 96% | Hit Rate = 98% | Hit Rate = 99% |
| **512 (0.5KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 10169 | Hit = 10139 | Hit = 10121 | Hit = 10113 | Hit = 10110 |
|  | Hit Rate = 83% | Hit Rate = 77% | Hit Rate = 95% | Hit Rate = 95% | Hit Rate = 95% |
| **1024 (1KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 8818 | Hit = 8113 | Hit = 10120 | Hit = 10112 | Hit = 10108 |
|  | Hit Rate = 48% | Hit Rate = 24% | Hit Rate = 76% | Hit Rate = 95% | Hit Rate = 95% |
| **2048(2KB)** | Number of | Number of | Number of | Number of | Number of |
|  | Hit = 5118 | Hit = 2563 | Hit =8095 | Hit = 10112 | Hit = 10108 |
|  | Hit Rate = 48% | Hit Rate = 24% | Hit Rate = 66% | Hit Rate = 81% | Hit Rate = 95% |
| **4096 (4KB)** | Number of | Number of | Number of | Number of | Number of |
|  |  |  |  |  |  |
|  | Hit = 5118 | Hit = 2563 | Hit = 7045 | Hit = 8573 | Hit = 10108 |
|  |  |  |  |  |  |

Table 2.1: Direct Mapped Cache, 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

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

MISS RATE

Graph 2: Hit Rate vs Block Size for N = 100 Matrix Size (different colors represent different cache sizes)

b)

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

Table 2.2: Fully Associative Cache, Block Replacement Policies and Miss Rates for N = 100 Matrix Size

c)

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

Table 2.3: N-way Set Associative Cache, Set Sizes and Miss Rates for N = 100 Matrix Size