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**BILKENT UNIVERSITY**

**CS224: COMPUTER ORGANISATION**

**LAB6 PRELIMINARY REPORT**

**BERAT BİÇER**

**21503050**

**SECTION 5**

Without Data-Cache Simulator

|  |  |  |
| --- | --- | --- |
| N  Size | Fill time  O(1) | Sort time  O(n^2) |
| 50 | 0.015 | 0.031 |
| 100 | 0.002 | 0.140 |
| 200 | 0 | 0.468 |
| 400 | 0.001 | 1.94 |

Using Data-Cache Simulator

|  |  |  |
| --- | --- | --- |
| N  Size | Fill time  O(1) | Sort time  O(n^2) |
| 50 | 0.001 | 0.042 |
| 100 | 0.001 | 0.168 |
| 200 | 0.001 | 0.629 |
| 400 | 0.001 | 2.302 |

PART 2-A

Without Data-Cache Simulator

|  |  |  |
| --- | --- | --- |
| N  Size | Fill time  O(1) | Sort time  O(n^2) |
| 50 | 0 | 0.031 |
| 100 | 0.002 | 0.119 |
| 200 | 0 | 0.468 |
| 400 | 0.001 | 1.94 |

Using Data-Cache Simulator

|  |  |  |
| --- | --- | --- |
| N  Size | Fill time  O(1) | Sort time  O(n^2) |
| 50 | 0 | 0.047 |
| 100 | 0 | 0.159 |
| 200 | 0 | 0.637 |
| 400 | 0 | 2.287 |

PART 2-B

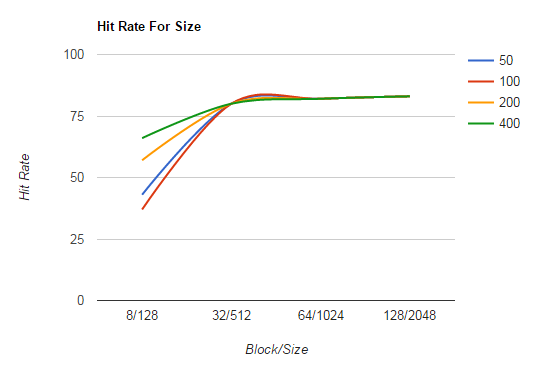
Direct Map Cache

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 8 | 128 | 0 | 0.5 | 43 |
| 100 | 8 | 128 | 0 | 2.121 | 37 |
| 200 | 8 | 128 | 0 | 7.353 | 57 |
| 400 | 8 | 128 | 0 | 30.21 | 66 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 32 | 512 | 0 | 0.577 | 80 |
| 100 | 32 | 512 | 0 | 2.028 | 80 |
| 200 | 32 | 512 | 0 | 8.231 | 80 |
| 400 | 32 | 512 | 0 | 30.184 | 80 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 64 | 1024 | 0 | 0.562 | 82 |
| 100 | 64 | 1024 | 0 | 2.187 | 82 |
| 200 | 64 | 1024 | 0 | 7.499 | 82 |
| 400 | 64 | 1024 | 0 | 30.644 | 82 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 128 | 2048 | 0 | 0.595 | 83 |
| 100 | 128 | 2048 | 0 | 2.137 | 83 |
| 200 | 128 | 2048 | 0 | 7.822 | 83 |
| 400 | 128 | 2048 | 0 | 31.909 | 83 |



Fully Associative Cache

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 8 | 128 | 0 | 0.562 | 83 |
| 100 | 8 | 128 | 0 | 2.215 | 83 |
| 200 | 8 | 128 | 0 | 8.943 | 83 |
| 400 | 8 | 128 | 0 | 31.814 | 83 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 32 | 512 | 0 | 0.608 | 83 |
| 100 | 32 | 512 | 0 | 1.95 | 83 |
| 200 | 32 | 512 | 0 | 8.148 | 83 |
| 400 | 32 | 512 | 0 | 32.651 | 83 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 64 | 1024 | 0 | 0.593 | 83 |
| 100 | 64 | 1024 | 0 | 2.607 | 83 |
| 200 | 64 | 1024 | 0 | 8.257 | 83 |
| 400 | 64 | 1024 | 0 | 32.466 | 83 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 128 | 2048 | 0 | 0.577 | 83 |
| 100 | 128 | 2048 | 0 | 2.358 | 83 |
| 200 | 128 | 2048 | 0 | 8.601 | 83 |
| 400 | 128 | 2048 | 0 | 31.68 | 83 |

N-Way Set-Associative Cache

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Set  Size | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 8 | 128 | 2 | 0 | 0.546 | 69 |
| 100 | 8 | 128 | 2 | 0 | 2.201 | 69 |
| 200 | 8 | 128 | 2 | 0 | 7.963 | 69 |
| 400 | 8 | 128 | 2 | 0 | 30.768 | 69 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Set  Size | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 32 | 512 | 4 | 0 | 0.579 | 81 |
| 100 | 32 | 512 | 4 | 0 | 2.012 | 81 |
| 200 | 32 | 512 | 4 | 0 | 8.435 | 81 |
| 400 | 32 | 512 | 4 | 0 | 30.675 | 81 |

Random

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Set  Size | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 32 | 1024 | 16 | 0 | 0.621 | 91 |
| 100 | 32 | 1024 | 16 | 0 | 2.028 | 91 |
| 200 | 32 | 1024 | 16 | 0 | 8.207 | 91 |
| 400 | 32 | 1024 | 16 | 0 | 31.746 | 91 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N  Size | Number of  Blocks | Cache Size(Bytes) | Set  Size | Fill time  O(1) | Sort time  O(n^2) | Hit Rate  (%) |
| 50 | 64 | 2048 | 32 | 0 | 0.562 | 91 |
| 100 | 64 | 2048 | 32 | 0 | 2.202 | 91 |
| 200 | 64 | 2048 | 32 | 0 | 8.467 | 91 |
| 400 | 64 | 2048 | 32 | 0 | 32.856 | 91 |

PART D

Loop Unrolling - Using Random Replacement Policy

N-Way Set Associative Cache

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N | Number  of  Blocks | Cache  Size  (Bytes) | Set  Size  (blocks) | Block  Size  (words) | Fill  time  O(1) | Sort  time  O(n^2) | Hit Rate  (%) |
| 50 | 16 | 1024 | 8 | 16 | 0.016 | 0.441 | 95 |
| 100 | 16 | 1024 | 8 | 16 | 0 | 1.642 | 95 |
| 200 | 16 | 1024 | 8 | 16 | 0 | 6.890 | 95 |
| 400 | 16 | 1024 | 8 | 16 | 0 | 27.19 | 95 |