

CS224 Computer Organization

Preliminary Report

Lab 06

Section 2

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Part 1.1

| No. | Cache Size KB | N way cache | Word Size in bits | Block size (no. of words) | No. of Sets | Tag Size in bits | Index Size (Set No.) in bits | Word Block Offset Size in bits ¹ | Byte Offset Size in bits ² | Block Replacement Policy Needed (Yes/No) |
|-----|---------------|-------------|-------------------|---------------------------|-------------|------------------|------------------------------|---|---------------------------------------|--|
| 1 | 128 | 1 | 32 | 4 | 2^{13} | 15 | 13 | 2 | 2 | No |
| 2 | 128 | 2 | 32 | 4 | 2^{12} | 16 | 12 | 2 | 2 | Yes |
| 3 | 128 | 4 | 32 | 8 | 2^{10} | 17 | 10 | 3 | 2 | Yes |
| 4 | 128 | Full | 32 | 8 | 2^0 | 27 | 0 | 3 | 2 | Yes |
| 9 | 256 | 1 | 16 | 4 | 2^{15} | 19 | 15 | 2 | 1 | No |
| 10 | 256 | 2 | 16 | 4 | 2^{14} | 15 | 14 | 2 | 1 | Yes |
| 11 | 256 | 4 | 16 | 16 | 2^{11} | 16 | 11 | 4 | 1 | Yes |
| 12 | 256 | Full | 16 | 16 | 2^0 | 27 | 0 | 4 | 1 | Yes |

Part 1.2

| Memory Address Accessed (hex) | Set No. | Hit (yes/no) |
|-------------------------------|---------|--------------|
| 00 00 00 24 | 00 | no |
| 00 00 00 42 | 00 | no |
| 00 00 00 68 | 01 | no |
| 00 00 00 04 | 00 | no |
| 00 00 00 0C | 01 | no |
| 00 00 00 4C | 01 | no |

Part 1.3

| Memory Address Accessed (hex) | Set No. | Hit (yes/no) |
|-------------------------------|---------|--------------|
| 00 00 00 2C | 01 | no |
| 00 00 00 48 | 01 | no |
| 00 00 00 44 | 00 | no |
| 00 00 00 0C | 01 | no |
| 00 00 00 04 | 00 | no |
| 00 00 00 0C | 01 | yes |

Part 1.4

L1

Hit rate: 80%, Miss rate: 20%

Access time: 1 cycle

L2

Effective hit rate: (L1 Effective Miss Rate) * (L2 Hit Rate) = 20% * 95% = 19%

Effective miss rate: (L1 Effective Miss Rate) * (L2 Miss Rate) = 20% * 5% = 1%

Access time: 2 cycles

Effective Access time: L1 access time + 2 = 3 cycles

L3

Effective hit rate: (L2 Effective Miss Rate) = %1

Effective miss rate: 0

Access time: 20 cycles

Effective Access time: L2 effective access time + 20 = 23 cycles

$AMAT = (20 * 1 + 19 * 3 + 1 * 23) / 100 = 1.6 \text{ cycles}$

$Runtime = \#instructions * \#AMAT / \text{Clock Rate (Hz)} = (1.6 * 10^{12}) / (4 * 10^9) = 400 \text{ secs}$