Landon Leigh Homework 5

5.1.1) There can be 4 32-bit integers in a 16-byte cache line because 16\*8 = 128 -> 128/32 = 4

5.1.2) Variables I and J and B[I][O] are used consistently so they exhibit temporal locality.

5.1.3) A[J][I] and A[I][J] change with J so it exhibits spatial locality.

5.2.1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference | Binary Word Address | Tag | Index | Hit or Miss |
| 0x03 | 00000011 | 0 | 3 | Miss |
| 0xb4 | 10110100 | B | 3 | Miss |
| 0x2b | 00101011 | 2 | B | Miss |
| 0x02 | 00000010 | 0 | 2 | Miss |
| 0xbf | 10111111 | B | F | Miss |
| 0x58 | 01011000 | 5 | 8 | Miss |
| 0xbe | 10111110 | B | E | Miss |
| 0x0e | 00001110 | 0 | E | Miss |
| 0xb5 | 10110101 | B | 5 | Miss |
| 0x2c | 00101100 | 2 | C | Miss |
| 0xba | 10111010 | B | A | Miss |
| 0xfd | 11111101 | F | D | Miss |

5.2.2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Binary Word Address | Tag | Index | Offset | Hit or Miss |
| 0x03 | 00000011 | 0 | 1 | 1 | Miss |
| 0xb4 | 10110100 | B | 2 | 0 | Miss |
| 0x2b | 00101011 | 2 | 5 | 1 | Miss |
| 0x02 | 00000010 | 0 | 1 | 0 | Hit |
| 0xbf | 10111111 | B | 7 | 1 | Miss |
| 0x58 | 01011000 | 5 | 8 | 0 | Miss |
| 0xbe | 10111110 | B | E | 0 | Hit |
| 0x0e | 00001110 | 0 | E | 0 | Miss |
| 0xb5 | 10110101 | B | 5 | 1 | Hit |
| 0x2c | 00101100 | 2 | C | 0 | Miss |
| 0xba | 10111010 | B | 5 | 0 | Miss |
| 0xfd | 11111101 | F | 6 | 1 | Miss |

5.3.1) The block size in words is 32 because 2^5 = 32

5.3.2) Cache has 32 entries because 2^5 = 32 with 5 blocks

5.3.3) 704 bits because 32\*22 = 704

5.6.1) P1 = 1/0.66 = 1.515 GHz

P2 = 1/0.9 = 1.11 GHz

5.6.2) P1 = 0.66 + (0.08 \* 70) = 6.26 ns

P2 = 0.9 + (0.06 \* 70) = 5.1 ns

5.6.3) P1 = 1 + ((0.08 \* 70) / 0.66) \* 0.36 = 4.054 CPI

P2 = 1 + ((0.06 \* 70) / 0.9) \* 0.36 = 2.68 CPI

P2 is faster because it has less CPI

5.12.1) PTE’s for a single level page table = 2^43/2^12 = 2^31 PTE’s

2^33 bytes needed to store the page table because 2^31\*2^2 = 2^33