Assignment #3

Tianhao Liu

[liux3271@umn.edu](mailto:liux3271@umn.edu)

Section 014 (02:30 PM on Thursday)

Problem #1)

a)

|  |  |
| --- | --- |
| Fetch | icode:ifun <- M1[PC]  valP <- PC+1 |
| Decode | valA <- R[%rbp]  valB <- R[%rbp] |
| Execute | valE <- valB+8 |
| Memory | valM <- M8[valA] |
| Write back | R[%rsp] <- valE  R[%rbp] <- valM |
| New PC | PC <- valP |

b)

|  |  |
| --- | --- |
| Fetch | icode:ifun <- M1[PC]  rA:rB <- M1[PC+1]  valC <- M8[PC+2]  valP <- PC+10 |
| Decode | valB <- R[rB] |
| Execute | valE <- valB+valC  set CC |
| Memory |  |
| Write back | R[rB] <- valE |
| New PC | PC <- valP |

c)

|  |  |
| --- | --- |
| Fetch | icode:ifun <- M1[PC]  rA:rB <- M1[PC+1]  valC <- M8[PC+2] |
| Decode | valB <- R[rA] |
| Execute | valE <- valB+valC |
| Memory | valM <- valE |
| Write back |  |
| New PC | PC <- valM |

Problem #2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instr. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Iteration 1 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.2 |  | F | D | D | D | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |
| Inst.3 |  |  | F | F | F | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |
| Inst.4 |  |  |  |  |  |  | F | D | D | D | D | E | M | W |  |  |  |  |  |  |
| Inst.5 |  |  |  |  |  |  |  | F | F | F | F | D | E | M | W |  |  |  |  |  |
| Inst.6 |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |
| Inst.7 |  |  |  |  |  |  |  |  |  |  |  |  | F | D | D | E | M | W |  |  |
| Inst.8 |  |  |  |  |  |  |  |  |  |  |  |  |  | F | F | D | E | M | W |  |
| Iteration 2 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E |
| Inst.2 | D | D | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  | F | D |
| Inst.3 | F | F | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  | F |
| Inst.4 |  |  |  | F | D | D | D | D | E | M | W |  |  |  |  |  |  |  |  |  |
| Inst.5 |  |  |  |  | F | F | F | F | D | E | M | W |  |  |  |  |  |  |  |  |
| Inst.6 |  |  |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |
| Inst.7 |  |  |  |  |  |  |  |  |  | F | D | D | E | M | W |  |  |  |  |  |
| Inst.8 |  |  |  |  |  |  |  |  |  |  | F | F | D | E | M | W |  |  |  |  |
| Iteration 3 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M | W |  |
| Inst.2 | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  | F | D | D | D | D |
| Inst.3 | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  | F | F | F | F |
| Inst.4 | F | D | D | D | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.5 |  | F | F | F | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |
| Inst.6 |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |
| Inst.7 |  |  |  |  |  |  | F | D | D | E | M | W |  |  |  |  |  |  |  |  |
| Inst.8 |  |  |  |  |  |  |  | F | F | D | E | M | W |  |  |  |  |  |  |  |

Problem #3)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instr. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Iteration 1 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.2 |  | F | D | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.3 |  |  | F | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.4 |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |
| Inst.5 |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |
| Inst.6 |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |
| Inst.7 |  |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |
| Inst.8 |  |  |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |
| Iteration 2 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 |  |  |  |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |
| Inst.2 |  |  |  |  |  |  |  |  |  |  | F | D | D | E | M | W |  |  |  |  |
| Inst.3 |  |  |  |  |  |  |  |  |  |  |  | F | F | D | E | M | W |  |  |  |
| Inst.4 |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M | W |  |  |
| Inst.5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M | W |  |
| Inst.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M | W |
| Inst.7 | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E | M |
| Inst.8 | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D | E |
| Iteration 3 | | | | | | | | | | | | | | | | | | | | |
| Inst.1 | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F | D |
| Inst.2 | D | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  | F |
| Inst.3 |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.4 |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.5 |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |  |
| Inst.6 |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |  |
| Inst.7 |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |  |
| Inst.8 |  |  |  |  |  |  | F | D | E | M | W |  |  |  |  |  |  |  |  |  |

Problem #4)

|  |  |  |  |
| --- | --- | --- | --- |
| Operation | Address | hit? | Read Value or unknown |
| Read | 0x830 | Yes | 0x77 |
| Read | 0x408 | No | unknown |
| Read | 0xFFD | Yes | 0x97 |
| Read | 0x40B | Yes | unknown |

Problem #5)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| dst array | | | | | src array | | | | |
|  | Col.0 | Col.1 | Col.2 | Col.3 |  | Col.0 | Col.1 | Col.2 | Col.3 |
| Row 0 | m | m | m | m | Row 0 | m | m | h | m |
| Row 1 | m | m | m | m | Row 1 | m | h | m | h |
| Row 2 | m | m | m | m | Row 2 | m | m | h | m |
| Row 3 | m | m | m | m | Row 3 | m | h | m | h |

Problem #6)

sumA: approximate 25%

sumB: approximate 100%

sumC: approximate 50%