CSE 141
Spring 2012
HW #2
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2.38.1a

The instruction copies to EDI bytes ECX bytes from an array pointed to by ESI.

2.38.2a

```
loop:
        lb   $t0,0($a2)
        sb   $t0,0($a1)
        addi $a0,$a0,–1
        addi $a1,$a1,2
        addi $a2,$a2,2
        bnez $a0,loop
```

2.38.3a

x86: One cycle to read memory, one cycle to write memory, one cycle for each update. In total, x86 contains 5 cycles per instruction.

MIPS: One cycle to read memory, one cycle to write memory, one cycle for each instruction. In total, MIPS contains 6 cycles per instruction.

Speed-up: 6/5

2.39.1b

(4/5000)*500 + (40/5000)*300 + (3/5000)*100 = 2.86 seconds

2.39.2b

No. Computer performance will be reduced. The extra clock cycle will increase the CPU time and be slower when compared to the old execution time.

2.39.4b

(.50 * 2) + (.40 * 6) + (.10 * 3) = 3.7 = Average CPI

2.39.5b

1.35

1.4.4a

((1*650) + (5*100) + (5*600) + (2*50)) / 2GHz = 2125

2125 nanoseconds

1.4.4b

((1*750) + (5*250) + (5*500) + (2*500)) / 2GHz = 2750

2750 nanoseconds

1.4.5a

2125 nanoseconds = (1400 total instructions * CPI) / 2GHz

CPI = 3.036

1.4.5b

2750 nanoseconds = (2000 total instructions * CPI) / 2GHz

CPI = 2.75

1.4.6a

((1*650) + (5*100) + (5*300) + (2*50)) / 2GHz = 1375
Speed-up = 2125 / 1375 = 1.55

1.4.6b

((1*750) + (5*250) + (5*250) + (2*500)) / 2GHz = 2125
Speed-up = 2750 / 2125 = 1.29

1.12.4a

CPU time = # instructions * CPI/clock rate

10%
Because CPI and clock rate do not change, the CPU time increase is equal to the increase in the number of instructions.

1.13.4a

instructions
= Execution Time * (1-0.1) * 4 * 10^9/CPI
= 960 * .9 * 4 * 10^9/1.61
= 2146.58

1.16.1a

Initial total time = 12 + 45 + 6 + 36 + 3 = 102
Improved total time = 45 + 36 + (12 + 6 + 3)(0.85) = 98.85
Improvement = 3.09%

1.16.1b

Initial total time = 2 + 7 + 1 + 6 + 2 = 18
Improved total time = 7 + 6 + (2 + 1 + 2)(0.85) = 17.25
Improvement = 4.17%

1.16.2a

Initial total time = 12 + 45 + 6 + 36 + 3 = 102
Improved total time = 12 + (45*.90) + 6 + 36 + 3 = 97.5
Improvement = 4.41%

1.16.2b

Initial total time = 2 + 7 + 1 + 6 + 2 = 18
Improved total time = 2 + (7*.90) + 1 + 6 + 2 = 17.3
Improvement = 3.89%