

Name:

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COE 301/ICS 233, Term 161

Computer Architecture & Assembly Language

Quiz# 5

Date: Tuesday, Dec. 25, 2016

Q1. A benchmark program runs for 100 seconds. We want to improve the speedup of the benchmark by a factor of 3. We enhance the floating-point hardware to make floating point instructions run 5 times faster. How much of the initial execution time would floating-point instructions have to account for to show an overall speedup of 3 on this benchmark?

Q2. Consider the following fragment of MIPS code. Assume that a and b are arrays of words and the base address of a is in \$a0 and the base address of b is in \$a1. How many instructions are executed during the running of this code? If ALU instructions (addu and addiu) take 1 cycle to execute, load/store (lw and sw) take 5 cycles to execute, and the branch (bne) instruction takes 3 cycles to execute, how many cycles are needed to execute the following code (all iterations). What is the average CPI?

```

                                addu $t0, $zero, $zero    # i = 0
                                addu $t1, $a0, $zero    # $t1 = address of a[i]
                                addu $t2, $a1, $zero    # $t2 = address of b[i]
                                addiu $t3, $zero, 101   # $t3 = 101 (max i)
loop:                          lw $t4, 0($t2)         # $t4 = b[i]
                                addu $t5, $t4, $s0     # $t5 = b[i] + c
                                sw $t5, 0($t1)         # a[i] = b[i] + c
                                addiu $t0, $t0, 1     # i++
                                addiu $t1, $t1, 4     # address of next a[i]
                                addiu $t2, $t2, 4     # address of next b[i]
                                bne $t0, $t3, loop    # loop if (i != 101)
```