Name: KEY **Id#**

ICS 233, Term 072

Computer Architecture & Assembly Language

Quiz# 3

Date: Saturday, March 15, 2008

Q.1. Fill the blanks in the following questions:

1. The MIPS processor is a **Reduced Instruction Set (RISC)** computer.
2. The MIPS processor has **32** general purpose registers.
3. The MIPS instructions are **32** bit wide, and there are **3** instructions formats called: **Register (R-Format)**, **Immediate (I-Format)**, **Jump (J-Format)**.
4. The difference between **add** and **addu** instructions is that **overflow causes an arithmetic exception for add instruction but not for addu instruction**.
5. The difference between **sll** and **sllv** instructions is **the shift amount is constant for sll instruction but variable and stored in a register for sllv.**

Q.2. Write the **minimum** required MIPS instructions to implement each of the following pseudo instructions:

1. **li $s1, 0x12345678**

   lui $s1, 0x1234

   ori $s1, $s1, 0x5678

2. **move $s1, $s2**

   or $s1, $zero, $s2

3. **bgt $s1, $s2, Next**

   slt $at, $s2, $s1

   bne $at, $zero, Next

4. **bge $s1, $s2, Next**

   slt $at, $s1, $s2

   beq $at, $zero, Next

5. **rol $s1, $s1, 4**

   Note that this instruction should rotate the content of register $s1 by 4 bits to the left. For example, if $s1=0x12345678, after executing the instruction the content of $s1 becomes $s1=0x23456781.

```
srl $at, $s1, 28
sll $s1, $s1, 4
or $s1, $s1, $at
```

Q.3. Write the minimum required MIPS instructions to implement each of the following. Pseudo instruction can be used.

1. **Multiply** the content of register **$s1 by 30** without using multiplication instructions.

```
sll $t1, $s1, 5          # $t1=32*$s1
sll $s1, $s1, 1          # $s1=2*$s1
subu $s1, $t1, $s1       # $s1=2*$s1
```

2. **if (($s1 > 0) && (($s2 < 100) || ($s2 > $s3))) {$s4++;}**

```
    ble $s1, $zero, EndIf
    li $t1, 100
    blt $s2, $t1, Skip
    ble $s2, $s3, Endif
Skip:   addiu $s4, $s4, 1
EndIf:
```