**CoE 142 Computer Organization**

**Sample Midterm 2**

**March 17, 2016**

**Instructor: Jun Yang**

**Student Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**ID:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. (2 pts each) Multiple choices. Circle the **only** correct answer from the following questions.
	1. A memory has 512M bytes and is byte addressable. How many bits of address are needed to address it? (b)

 (a) 30 bits (b) 29 bits (c) 28 bits (d) 27 bits (e) 26 bits

* 1. The same memory is now word addressable and each word is 4 bytes. How many bits of address are needed? (d)

 (a) 30 bits (b) 29 bits (c) 28 bits (d) 27 bits (e) 26 bits

* 1. Suppose an array is declared as char arry[8], the address of arry[0] is in $t0, what is the correct instruction to access arry[2]? (a)

lw $t1, 2($t0) (b) lw $s2, 3($t0) (c) lw $s2, 8($t0) (d) lw $t1, 12($t0)

* 1. Which MIPS instructions should be used upon function call and return respectively? (c)
		1. j and jr b) j and jal c) jal and jr d) jal and j
	2. What does the following MIPS assembly code do? (d)

slt $r1, $r2, $r3

beq $r1, $r0, Label; assuming r0 contains 0

* + 1. Branch to instruction marked “Label” if r2<r3
		2. Branch to instruction marked “Label” if r2>r3
		3. Branch to instruction marked “Label” if r2≤r3
		4. Branch to instruction marked “Label” if r2≥r3
1. (3 pts each) Multiple choices. Circle **all** correct answers (≥ 1) from the following questions. Selecting wrong choices results in 0pt. Selecting partial but not all correct choices results in 1pt.
	1. In the following instructions, what are the data transfer instructions between CPU and memory? (d, e)
2. add $s1, $s2, $s3
3. sub $s1, $s2, $s3
4. li $s1, 10
5. lw $s1, 32($t0)
6. sw $s1, 32($t0)
	1. To call a function in MIPS, the programmer is responsible for: (a,b,c)
		* 1. Saving registers in the caller function if necessary
			2. Saving register in the callee function if necessary
			3. Saving the return address
			4. Using “j Function” instruction to call “Function”
	2. Suppose MIPS increments stack pointer when growing the stack, which ones of the following pushes $t1 onto the stack? (c,d)
		1. sub $sp, $sp, 4 b) sw $t1, -4($sp) c) addi $sp, $sp, 4 d) sw $t1, 4($sp)

sw $t1, 0($sp) sub $sp, $sp, 4 sw $t1, 0($sp) addi $sp, $sp, 4

1. (2 pts each) MIPS assembly programming.
	1. For the following C code, fill in the missing instructions in its MIPS assembly code. You may refer to the brief instruction sheet on the next page.

 int count = 0;

 for (int i = 0 ; i < 32 ; i ++) {

 int bit = input & 1;

 if (bit != 0) {

 count ++;

 }

 input = input >> 1;

 }

 main:

 li $a0, 0x1234 ## input = 0x1234

 li $t0, 0 ## int count = 0;

 li $t1, 0 ## for (int i = 0

 li $t3, 32 ## t3 holds constant 32

 main\_loop:

 1. \_\_\_bge $t1, $t3, main\_exit\_\_\_\_\_

 andi $t2, $a0, 1 ## bit = input & 1

 2. \_\_\_beg $t2, $0, main\_skip\_\_\_\_

 addi $t0, $t0, 1 ## count ++

 main\_skip:

 srl $a0, $a0, 1 ## input = input >> 1

 add $t1, $t1, 1 ## i ++

 3. \_\_\_\_\_j main\_loop\_\_\_\_\_\_\_\_

 main\_exit:

 jr $ra