pThe University of Alabama in Huntsville
ECE Department
CPE 431 01, CPE 531 01/01R
Instructions – Language of the Computer
Fall 2022

Due September 7, 2022

You must show your work to get full credit. The number In parentheses is the point value of the problem. The numbers in <> indicate the sections of the book that discuss this topic.

1.0(15), 2.0(5) 3.0(10), 4.0(5), 5.0 (10), 6.0(5), 7.0(15), 8.0.1(5), 8.0.2(5), 9.0(5), 10.0(5)

1.0 For the following C statement, what is the corresponding MIPS assembly code? Assume that the variables **`f`**, **`g`**, **`h`**, **`i`**, and **`j`** are assigned to registers **`$s0`**, **`$s1`**, **`$s2`**, **`$s3`**, and **`$s4`**, respectively. Assume that the base address of the arrays (**`A`** and **`B`**) are in registers **`$s6`** and **`$s7`**, respectively. Also, assume that **`A`** and **`B`** are arrays of words.

```
B[f] = B[i-j] + A[g]
```

2.0 Translate 0xF806_4020 from signed 2s complement representation to decimal.

3.0 **<2.2, 2.3>** For the MIPS assembly instructions below, what is the corresponding C statement? Assume that the variables **`f`**, **`g`**, **`h`**, **`i`**, and **`j`** are assigned to registers **`$s0`**, **`$s1`**, **`$s2`**, **`$s3`**, and **`$s4`**, respectively. Assume that the base address of the arrays **`A`** and **`B`** are in registers **`$s6`** c **`$s7`**, respectively.

```
sll   $t0, $s0, 2
add   $t0, $s6, $t0
sll   $t1, $s1, 2
add   $t1, $s7, $t1
lw    $t2, 0($t0)
addi  $t0, $t0, 4
lw    $t0, 0($t0)
add   $t0, $t0, $t2
sw    $t0, 0($t1)
```

4.0 **<2.2, 2.3>** Translate the following MIPS code to C. Assume that the variables **`f`**, **`g`**, **`h`**, **`i`**, and **`j`** are assigned to registers **`$s0`**, **`$s1`**, **`$s2`**, **`$s3`**, and **`$s4`**, respectively. Assume that the base address of the arrays **`A`** and **`B`** are in registers **`$s6`** and **`$s7`**, respectively and that **`A`** and **`B`** are arrays of words.

```
addi  $t0, $s6, 4
lw    $t0, 0($t0)
add   $t0, $t0, $t0
sw    $t0, 0($s6)
```

5.0 **<2.4>** Assume that **`$s0`** holds the value -1450_{ten}.

5.0.1 **<2.4>** For the instruction **`add $t0, $s0, $s1`**, what is the range(s) of values for $s1 that would result in overflow?

5.0.2 **<2.4>** For the instruction **`sub $t0, $s0, $s1`**, what is the range(s) of values for $s1 that would result in overflow?

6.0 **<2.2, 2.5>** Provide the type and assembly language instruction for the following binary value:
`0000 0010 0001 0000 1000 0000 0010 0000`$_{two}$

7.0 **<2.6>** Assume the following register contents: **`$t0 = 0x1357_9BDE, $t1 = 0x8697_51CA`**

7.0.1 **<2.6>** For the register values given, what is the value of **`$t2`** for the following sequence of instructions?

```
sll   $t2, $t0, 4
or    $t2, $t2, $t1
```

7.0.2 **<2.6>** For the register values given, what is the value of **`$t2`** for the following sequence of instructions?

```
sll   $t2, $t0, 4
andi  $t2, $t2, -1
```

7.0.3 **<2.6>** For the register values given, what is the value of **`$t2`** for the following sequence of instructions?

```
srl   $t2, $t0, 3
andi  $t2, $t2, 0xFFEF
```

8.0 **<2.7>** Consider the following MIPS loop:

```
LOOP:  slt   $t2, $0, $t1
       beq   $t2, $0, DONE
       subi  $t1, $t1, 1
       addi  $s2, $s2, 2
       j     LOOP
DONE:
```

8.0.1 **<2.7>** Assume that the register **`$t1`** is initialized to the value 25. What is the value in register **`$s2`** assuming **`$s2`** is initially 1000?

8.0.2 **<2.7>** For the loop written in MIPS assembly above, assume that the register **`$t1`** is initialized to the value N. How many MIPS instructions are executed?

9.0 **<2.6, 2.10>** If the current value of the PC is 0x57F0_3280, can you use a single jump instruction to get to the PC address 0x5700_3291? If so, give the address value for the jump instruction.

10.0 **<2.6, 2.10>** If the current value of the PC is 0x1FFF F000, can you use a single branch instruction to get to the PC address 0xFFFE_52AC? If so, give the offset value for the branch instruction.