CSE/EEE230 Spring 2020 Assignment 5
Due March 23

This assignment consists of two questions. The first question has multiple parts. Create a single file with your answers to the questions and submit your work using the link on Canvas. Your answer must be in one of the following formats: .txt, .pdf, .doc

1. Use the following program for this question.

```
.data
        .word 7, 3
num:    .word 9

.globl main
.text
main:
        lui $t0, 0x1001
top:
        lw $t1, -4($t0)
        beq $s0, $s2, end
        jal func
        add $s0, $s1, $t0
        andi $s0, $0, 0xFFFF
        j top
        bne $s0, $0, top
end:
func:
        sll $v0, $t1, 4
        jr $ra
```

a. There are 5 labels in this code. If the .data section starts at 0x10010000 and the .text starts at 0x00400100, what is the value of each label? Include all 5 labels from the program. Note that the starting address of the .text is NOT the default location. 5 points

Num = 0x10010004
Main= 0x0x00400100
Top= 0x00400120
End= 0x00400220
Func=0x00400220

b. There are 10 unique instructions. What is the addressing mode for each instruction? 5 points

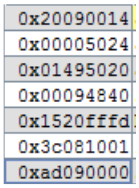
lui $t0, 0x1001 = Immediate Addressing
lw $t1, -4($t0) = Base addressing
beq $s0, $s2, end = PC-relative addressing
jal func = Pseudo-direct
add $s0, $s1, $t0 = Register addressing

andi $s0, $0, 0xFFFF = Immediate Addressing
j top = Pseudo-direct
bne $s0, $0, top = PC-relative addressing
sll $v0, $t1, 4 = Base addressing
jr $ra = Pseudo-direct

c. "Assemble" the program by converting it to the machine code (hex). 8 points

lui $t0, 0x1001 = 0x3c081001
lw $t1, -4($t0) = 0x8d09fffc
beq $s0, $s2, end = 0x12120004
jal func = 0x0c400004
add $s0, $s1, $t0 = 0x02288020
andi $s0, $0, 0xFFFF = 0x3010ffff
j top = 0x081000120
bne $s0, $0, top = 0x1600fffb
sll $v0, $t1, 4 = 0x00091100
jr $ra = 0x03e00008

2. The following is part of a MIPS program in machine code. Decode this code and convert it to the equivalent assembly language program. Your solution will have one label. Be sure to put it at the correct location. 7 points



Addi $t1,$zero,14

Add $t2,$zero,$zero

Add $t2,$t2,$t1

Sll $t1,$t1,4

Bne $t1,$0, (name of a label)

Lui $t0, 0x1001

Sw $t1,0($t0)