

Question 1: Course Terms Provide a short definition for each term.

1.1. Computer

1.2. Digital Logic

1.3. Hardware

1.4. Computer Organization

1.5. Computer Architecture

1.6. High-Level Programming Language

1.7. Assembly Language

1.8. Machine Code

Question 2: Investigating RISC-V Suppose the registers have the initial states:

$$a0 = 7 \quad t0 = 3 \quad t1 = 5$$

```
addi t0, t0, 2
sub  t1, a0, t0
add  a0, t0, t1
addi t1, t1, -1
```

2.1. What role do you think `a0`, `t0`, and `t1` play in this code listing?

2.2. Trace the instructions by filling in the register values.

	a0	t0	t1
Initial	7	3	5
After instruction 1			
After instruction 2			
After instruction 3			
After instruction 4			

2.3. Based on your trace, what do you think `add`, `addi`, and `sub` mean? What pattern do you notice in the order of their operands?

2.4. Now consider:

```
loop:
    sub  a0, a0, t0
    bne  a0, zero, loop
```

Assume initially that `a0` = 4 and `t0` = 1. What do you think this code does? What do you think `bne`, `zero`, and `loop:` mean?

Question 3: Binary Addition and Overflow What is the 4-bit result of the following unsigned operations? Did overflow occur (yes/no)?

3.1. $1010_2 + 0101_2$

3.2. $1010_2 + 0111_2$

3.3. $1001_2 + 0111_2$

3.4. $0110_2 + 0110_2$

Question 4: Two's Complement 4.1. Represent -15 in two's complement with 7 bits

4.2. What is the minimum number of bits needed to represent 20 in two's complement?

4.3. Convert the following two's complement number to decimal: `0b1111_1110` complement?

4.4. Convert the following two's complement number to decimal: `0b0011_1000`