



ECE3700J Introduction to Computer Organization

Homework 2

Assigned: September 28, 2023

Due: 2:00pm on October 10, 2023

Submit a PDF file on Canvas

1. (10 points) Consider a proposed new instruction named `rpt`. This instruction combines a loop's condition check and counter decrement into a single instruction. For example,

```
rpt x29, loop
```

would do the following:

```
if (x29 > 0) {  
    x29=x29-1;  
    goto loop;  
}
```

- 1) (5 points) If this instruction were to be added to the RISC-V instruction set, what is the most appropriate instruction format?
 - 2) (5 points) What is the shortest sequence of RISC-V instructions that performs the same operation?
2. (7 points) Given a 32-bit RISC-V machine instruction:
- ```
1111 1111 1110 1010 0101 1010 1110 0011
```
- 1) (6 points) What is the corresponding assembly instruction? What's its operation(s)?
  - 2) (1 point) What type of instruction is it?
3. (6 points) Given RISC-V assembly instruction:
- ```
jalr x11, -8(x1)
```
- 1) (5 points) What is the corresponding binary representation?
 - 2) (1 point) What type of instruction is it?
4. (12 points) If the RISC-V processor is modified to have 128 registers rather than 32 registers:



- 1) (4 points) show the bit fields of an R-type format instruction assuming opcode and funct fields are not changed.
 - 2) (4 points) What would happen to the I-type instruction if we want to keep the total number of bits for an instruction unchanged?
 - 3) (4 points) What is the impact on the range of addresses for a `beq` instruction? Assume all instructions remain 32 bits long and the size of opcode and funct fields don't change.
5. (15 points) Convert the following assembly code fragment into machine code, assuming the memory location of the first instruction (LOOP) is 0x1000F400

```
LOOP:    blt x0, x5, ELSE
          jal x0, DONE
ELSE:    addi x5, x5, -1
          sb x25, 0(x5)
          jal x0, LOOP
DONE:    ...
```