

Computer Organization HW1

Problem 1 (20 points)

For the following C statement, write the corresponding RISC-V assembly code. Assume that the variables i , and j are assigned to registers $x28$ and $x29$, the base address of the arrays A and B are in registers $x10$ and $x11$. Assume that the elements of the arrays A and B are 4-byte words:

```
B[8] = A[i] - (A[j] - 5);
```

Problem 2 (25 points)

Please answer the following questions, you need to show the procedures.

a) (10 points)

For the following binary value, provide the instruction type and the corresponding assembly language instruction:

$00000000000100001000000010110011_2$

b) (15 points)

Provide the instruction type, assembly language instruction, and the hexadecimal representation of the instruction described by the following RISC-V fields:

$opcode = 0x3; funct3 = 0x0; rs1 = 27; rd = 3; imm = -5$

Problem 3 (25 points)

Consider the following RISC-V loop:

```
LOOP:  beq x6, x0, DONE
        addi x6, x6, -1
        addi x5, x5, 2
        jal x0, LOOP
DONE:
```

a) (10 points)

Assume that the register $x6$ is initialized to the value 10. What is the final value in register $x5$ assuming the $x5$ is initially zero?

b) (15 points)

For the loop above, write the equivalent C code. Assume that the registers $x5$ and $x6$ are integers A and i , respectively.

Problem 4 (30 points)

Translate function `f` into RISC-V assembly language. The C code is as follows:

Register Selection Guidelines:

- Assume that the arguments `a`, `b`, `c` and `d` are initially assigned to register `a0~a3`.
- Follow the RISC-V function calling convention when passing arguments and returning values.
- Be mindful to preserve values during function calls if needed and try to keep the implementation efficient by using only necessary registers.

```
int f(int a, int b, int c, int d) {  
    return g(g(a, b), c + d);  
}  
int g(int a, b) {  
    return a+b;  
}
```