

Homework 7 - MIPS Instruction Set Architecture

- Template file for submitting the solutions:
https://grader.eecs.jacobs-university.de/courses/320241/2019.2/lectures/template_hw.tex
- The TAs are grading solutions to the problems according to the following criteria:
https://grader.eecs.jacobs-university.de/courses/320241/2019.2/Grading-Criteria_CAPL.pdf

Problem 7.1 *One function*

(2 points)

Translate the following C-code into MIPS assembler code:

```
int my_function(int x, int y) {  
    if (x > 10)  
        return x - y;  
    else  
        return x + y;  
}
```

Comment your code.

Problem 7.2 *Two functions*

(3 points)

Translate the following C-code into MIPS assembler code:

```
int is_more_than_fifty(int a, int b) {  
    if (prod(a, b) > 50)  
        return 1;  
    else  
        return 0;  
}  
  
int prod(int a, int b) {  
    return a * b;  
}
```

Comment your code.

Problem 7.3 *MIPS to C*

(2 points)

Translate the following MIPS assembler code to C-code. You can assume that `$s6` contains the base address of an array `A`, `$s3` contains the value 0, and `$s5` contains the value `-1`.

```
Loop: sll $t1, $s3, 2  
      add $t1, $t1, $s6  
      lw $t0, 0($t1)  
      beq $t0, $s5, Exit  
      addi $s3, $s3, 1  
      j Loop  
Exit:
```

Problem 7.4 *MIPS to machine code*

(3 points)

Assume that the loop from **Problem 7.3** is placed at location 60000 in memory. What is the machine code for the loop given above? Write down the machine code in two columns, the first as decimal values, the second as a binary representation. Keep in mind that MIPS instructions have byte addresses, so addresses of sequential words differ by 4. `beq` will jump relative to the following instruction. `j` uses the absolute address, but make sure it jumps to a word address not a byte address.

Write down your calculations and/or explanations.

Problem 7.5 *Bit pattern*

(2 points)

In a von Neumann architecture, groups of bits have no intrinsic meanings by themselves. The following table shows bit patterns expressed in hexadecimal notation. Answer the questions below for each bit pattern.

(i)	0x0C000000
(ii)	0xC4630000

What decimal number does the bit pattern represent:

- (a) if it is a two's complement number?
- (b) if it is an unsigned integer?
- (c) if this bit pattern is placed into the Instruction Register, what MIPS instruction would it be?

Write down your calculations and/or explanations.

How to submit your solutions

You can submit your solutions via *Grader* at <https://grader.eecs.jacobs-university.de> as a generated PDF file from the given template TEX file.

If there are problems with *Grader* (but only then), you can submit the file by sending mail to k.lipskoch@jacobs-university.de **with a subject line that starts with CO20-320241.**

Please note, that after the deadline it will not be possible to submit solutions. It is useless to send solutions by mail, because they will not be graded.

This homework is due by Monday, November 4th, 23:00.