Homework 6 - 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 6.1 *Instruction format*   (1 point)
In the register instruction format (used e.g., for `add`), the fields `rs`, `rt`, and `rd` occupy 5 bits each. Why are they 5 bits wide, and not 4 or 6 or some other value?

Problem 6.2 *MIPS decimal to MIPS instruction*   (1 point)
Write down the MIPS assembler instructions corresponding to the following representations:

(a) `op = 0, rs = 8, rt = 9, rd = 10, shamt = 0, funct = 34`

(b) `op = 0x23, rs = 17, rt = 18, const = 0x4`

Problem 6.3 *MIPS decimal to MIPS binary*   (1 point)
Determine the binary representation of the following MIPS instructions:

(a) `op = 0, rs = 8, rt = 9, rd = 10, shamt = 0, funct = 34`

(b) `op = 0x23, rs = 17, rt = 18, const = 0x4`

Problem 6.4 *MIPS instructions*   (1 point)
Assume that register `$t0` contains the value `0010 0100 1001 0010 0100 1001 0010 0100` and `$t1` contains the value `0011 1111 1111 1000 0000 0000 0000 0000`. What is the value of `$t2` after executing the following MIPS instructions?

```
      slt $t2, $t0, $t1
      beq $t2, $0, ELSE
      j DONE
ELSE: addi $t2, $0, 2
DONE:
```

Problem 6.5 *MIPS addition*   (1 point)
Assume that the base address of an array `A` of words is stored in the register `$s0`. Write down the MIPS assembler commands to add the content of `$s1` to `A[6]`.

Problem 6.6 *MIPS load*   (1 point)
In MIPS assembler, load the 32-bit constant `0000 0000 0010 0011 0000 0000 0010 0011` into `$s4`.

Problem 6.7 *MIPS loop*   (2 points)
Translate the following C-code into MIPS assembler code. Assume that `a` is associated with register `$s0` and `i` is associated with register `$t0`.

```
for (i = 0; i < 8; i++) {
  a = a + 4;
}
```

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, October 21$^{\text{st}}$, 23:00.