CS2323: Computer Architecture, Autumn 2023
Homework-2: RISC-V Assembly
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1. Write equivalent machine code (in hexadecimal) for the given assembly instructions, by highlighting the various fields in the 32-bits of the instruction: [2 marks each]
   a. addi x15, x22, -45
   b. and x23, x8, x9
   c. blt x2, x11, 240
   d. sd x19, -54(x1)
   e. jal x3, -10116

2. For various pseudo instructions shown below, study their equivalent disassembled code using the RIPES simulator (when you type each of these in the simulator, the right pane shows the corresponding code using actual instructions). Briefly explain (1-2 sentences each) why such a translation occurs for each of them. [5 marks]
Note: The instruction li represents the pseudo instruction load immediate.

   a. li   x5, -1
   b. li   x5, 0xFFFFFFFF
   c. li   x5, 132
   d. li   x5, 2134
   e. li   x5, 0x2345abcd

3. Consider the code given below. Assume that the .data section starts at address 0x10000000. What is the value of register x3 at each step after the main label? A brief (1-line explanation) for each step should be provided. [8 marks]
The entire value of 16 hex digits should be written for all cases. (e.g., 0x000000007f7f7f7f). 0x7f7f7f7f is not acceptable.
Hint: First, identify which byte goes to which address of the memory and then solve.
Be careful with lb/lh/lw/ld and lbu/lhu/lwu

```
.data
.dword 0xa55aa5a593933939
.dword 0x39933939a55aa5a5
.text
   lui x1, 0x10000
main:
   lhu x3, 0(x1)
   lh x3, 0(x1)
   lh x3, 2(x1)
   ld x3, 0(x1)
   lw x3, 12(x1)
   lbu x3, 7(x1)
   lb x3, 7(x1)
   lb x3, 6(x1)
```

4. The .data section in our code maps to address 0x10000000. Is this a fixed address or is it configurable? How to change it? [2 marks]

Submission instructions:
   1. Create a pdf file mentioning the reasoning/observations for the questions asked above.
   2. The submission should be entirely your work
   3. The pdf file should be named YOUR_ROLLNUM.pdf (e.g., CSYYBTECHXXXXX.pdf)
   4. Submit the pdf file
   5. Deadline: 03-Oct-2023, 11.59 pm