

Fall 2021 CSE4117 Microprocessors Homework 1

Deadline: 14.11.2021 23:59

Demo schedule will be announced later.

You will send your files to cse4117@gmail.com as a zip file that contains all answers and its name will be the name of group members. Any of group members can send the file.

Question 1 Logisim Part (50 Points)

1. Realize Reptile-8 in Logisim.
2. Connect register 0 to 4x7-segment display unit.
3. Write a program which will have a variable named TERMS in its .data area. Your code should evaluate the sum (note that only square of odd numbers are added)

$$1^2 + 3^2 + 5^2 + 7^2 + \dots + \text{TERMS}^2$$

4. When this sum is calculated, it must be loaded into register 0 and become visible in 4x7 segment display. After that, your program must enter into an infinite loop.
5. You must complete and use the assembler given in the lecture notes to assemble your code.
6. Your system must work with 4 KHz clock of Logisim.

Question 1 Verilog Part (50 Points)

Realize the above system with Verilog and FPGA. In this case, you must connect 4x7 segment display to Register 0 physically via GPIO pins of DE0-nano card. Your system must work with 50 MHz system clock. But, for debugging purposes, you may find it more convenient to connect your clock to a pushbutton (**on FPGA**) when developing the system.

Bonus for Question 1

You may write your programs to display your result in hexadecimal. But if you display your result in decimal, you will get an additional 10 points. For this, you must write an additional piece of code (**Assembly code not in Verilog**) to convert your hexadecimal result into decimal (or binary coded decimal, BCD). You must do this in software and **NOT in hardware**. Some hints on how this can be done is described in the following link:

<https://my.eng.utah.edu/~nmcdonal/Tutorials/BCDTutorial/BCDConversion.html>

Disregard "BCD conversion in hardware" part.