CARLOS III MADRID UNIVERSITY
COMPUTER SCIENCE DEPARTMENT
COMPUTER SCIENCE AND ENGINEERING DEGREE. COMPUTER STRUCTURE
October 6th,2022. Group 89 Exam

To do this quiz you have **25 minutes.** It is **not possible to use books, notes or calculators** of any type.

Student:_____.
Group: _____ .

Exercise 1. There is a 32-bit RISCV processor with a register file of 32 registers, 1 Gibibyte of main memory which addresses the main memory at byte level. Answer correctly and briefly to the following questions (2 points):

a) What is the Instruction Register (IR)?

The register which holds the instruction currently being executed or decoded

b) How many bits are needed to represent 200 operations?

8 bits

c) How many Mebibytes are in 1 Gibibyte?

1024 or 2^10

d) What stands for MIPS expressing computational power?

Millions of Instructions Per Second.

Exercise 2. Indicate the representation of the following numbers, reasoning your answer: (2 points):

a) -36 in two's complement with 8 bits

-36 = C(0010 0100)+1= 1101 1011+1 = 1101 1100

b) -128 in sign-magnitude with 8 bits

Not possible = $[-2^{8-1}+1, 2^{8-1}-1] = [-127, 127]$

Exercise 3. Indicate the representation of the following numbers:

a) Represent the number 5.5 in the standard IEEE754 simple precision, simple precision floating point (2 points)

$5.5 = 101.1 = 1.011 \times 2^2$
s = 0
e = 2 + 127 = 129 = 10000001
m = 1.011

The single-precision representation is: 0 10000001 01100000000000000000000

0x40b00000

Exercise 4. Given the following RISC-V assembler fragment

```
la t0, array  # rd = address address->32 bits
sw t1, 0(t0)  # Memory[n+rs1] = sw store word
```

a) What is the content of registers t0 and memory using **little-endian** data format?

Main Memory

	0x0F000000		
	0x0F000001		
	0x0F000002		
	0x0F000003		
array:	0x0F000004		11110000
	0x0F000005		00000000
	0x0F000006		11111111
	0x0F000007		00001111
	0x0F000008		
		…	

Registers

t1

00001111	11111111	00000000	11110000
31 24	23 16	15 8	7 0

t0

11110000	00000000	00000000	00001000
31 24	23 16	15 8	7 0

b) It is the data of the array memory aligned? Justify your answer

Yes, it is aligned because 0x0F000004 is multiple of 4