**Midterm**

**CS311 – Spring 2021**

This is a **closed** book exam. **Show all working steps.** Partial credit is given for all questions, with half points being allocated for detailed working.

**Honor Code Statement:** I pledge that this written exam is solely my work, and that I have neither given, nor received help from anyone.

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**Question 1:**  20 Marks

*(10pt for working, 10pt for answer)*

Given the following number in base-10, calculate its equivalent base-16 (IEEE 754 format) number.

1. Convert To Binary -99.187510 -> 11000112
2. Do The Division

99/2 = 49 = 1

49/2 = 24 = 1

24/2 = 12 = 0

12/2 = 6 = 0

6/2 = 3 = 0

3/2 = 1 = 1

½ = 0 = 1

0.1875 = 0.0011

Repeat Steps from above but for the decimal part by multiplication.

0.1875 = 0.0011

0.1875 \* 2 = 0.375 = 0

0.375 \* 2 = 0.75 = 0

0.75 \* 2 = 1.5 = 1

0.5 \* 2 = 1 = 1

Final Result: 1100011.0011 x 26

133/2 = 66 = 1

66/2 = 33 = 0

33 / 2 = 16 = 1

16/2 = 8 =0

8/2 = 4 =0

4/2 = 2 = 0

2 / 2 = 1 = 0

1 / 2 = 0 = 1

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| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1100 | 0010 | 1100 | 0110 | 0110 | 0000 | 0000 | 0000

12 = C 2 12 = C 6 6 0 0 0

Answer: 0x0060c6c2

**Question 2:**  20 Marks

*(10pt for working, 10pt for answer)*

Given the following listing file, fill in the missing details. In column 3, for labels a, c and d, the values must be in decimal (base 10) format.

***Column 1 Column 2 Column 3***

1 00000000 24 a db 24

2 00000001 **008031C2** b dd -44.375

3 00000005 A4000000<rept> c times \_\_15\_\_\_ \_\_\_dd\_\_ \_\_\_164\_\_

4 00000041 3B00AB00E103 d dw \_\_\_59\_\_ \_\_171\_\_\_ \_\_\_993\_\_

5 00000047 FE21010000100010 e \_dq\_ 0x\_\_10001000000121fe\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Work shown on paper**

**Question 3:**  20 Marks

Given the following data segment, write code in main which adds all the numbers in **a**. If the final sum is **positive**, it should be saved in **EBX register**, and if it is **negative**, then it should be saved in **R8x register** where x is the 32-bit equivalent size suffix which you need to assign!.

segment .data

a dw -126, 47, 84

segment .text

global main

main:

xor rax, rax ; 0’s out all the used registers

xor rbx, rbx

xor rcx, rcx

movsx rax, word[a] ; moves the magnitudes of the addresses to the registers.

movsx rbx, word[a+2]

movsx rcx, word[a+4]

add rax, rbx ; adds these registers together.

add rax, rcx

mov [result], rax ; moves rax, to result

cmovg ebx, [result] ; conditionals based on positive / negative.

cmovl r8w, [result]

ret ; returns values.

**Question 4:**  40 Marks

Given the following specifications:

1. Two different data inputs are given, and
2. The following equation has to be coded:

= (26+132) + (-18-34) = 106

Where is the size of and .

1. The result has to be saved in a memory location through **dereferencing**.

**Write a code in assembly, which meets these requirements**. You will need to **dereference** and then store/update the values.

**Part A:**

You are required to do the following:

1. Allocate the variables and with the **minimum** data type allowed to store their values and as a quad size memory. (5 pts)
2. Code the given equation and save the result in, using only **2 registers**. (20 pts)

**Part B:**

Answer the following questions using the GDB debugger:

What GDB command is needed to **examine** the contents of in **Hex (base 16)** (5 pts)

**ANSWER** x/ memory address - I believe gives you the ability to examine the value in base16

1. What GDB command is needed to **print** the value of in base 10 after evaluating the equation and saving the result and what is that final result in **Base 10**  (10 pts)

GDB command: print/d d, decimal I believe

Final result in base : 10610

Compete the following code section:

**segment .data**

A dq - 132, 34

B dq 26, - 18

R dq 0

**segment .text**

**global main**

main:

xor rax, rax

mov rax, [B]

mov rbx, [A]

neg rbx

add rax, rbx

mov [R], rax

xor rax, rax

xor rbx, rbx

mov rax, [B+8]

mov rbx, [A+8]

neg rbx

add rax, rbx

add [R], rax

ret