COAL Lab-06

Load & Store Instruction Assembly Code

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Literature Review:

Load Instructions:

Load instructions are used to move data from memory to registers (before operation). Loads are encoded in the I-type format. The effective byte address is obtained by adding register rs1 to the sign-extended 12-bit offset. Loads copy a value from memory to register rd. The assembly representation for load instructions are:

lw (destination_register), (offset)(source_register)

or

lw (rd), offset(rs1)

The LW instruction loads a 32-bit value from memory into rd. LH loads a 16-bit value from memory, then sign-extends to 32-bits before storing in rd. LHU loads a 16-bit value from memory but then zero extends to 32-bits before storing in rd. LB and LBU are defined analogously for 8-bit values.

Store Instructions:

Store instructions are used to move data from registers to memory (after operation). Stores are encoded in the S-type format. The effective byte address is obtained by adding register rs1 to the sign-extended 12-bit offset. Stores copy the value in register rs2 to memory.. The assembly representation for store instructions are:

sw (source_register_2), (offset)(source_register_1)

or

sw (rs2), offset(rs1)

The SW instruction stores a 32-bit value from the low bits of register rs2 to memory. SH stores a 16-bit value from the low bits of register rs2 to memory. SB stores a 8-bit value from the low bits of register rs2 to memory.

Lab Exercise 1:

Task:

Run the below assembly code on Venus Simulator

```
li s0, 0x12345678 # Data to be store

li s1, 0x00000020 # memory address

sb s0, 0x0(s1)

sh s0, 0x4(s1)

sw s0, 0x8(s1)
```

sb s0, 0x0(s1)

0000000	01000	01001	000	00000	0100011

Machine Code: 0000 0000 1000 0100 1000 0000 0010 0011

Hexadecimal Code: 00848023

sh s0, 0x4(s1)

0000000	01000	01001	001	00100	0100011

Machine Code: 0000 0000 1000 0100 1001 0010 0010 0011

Hexadecimal Code: 00849223

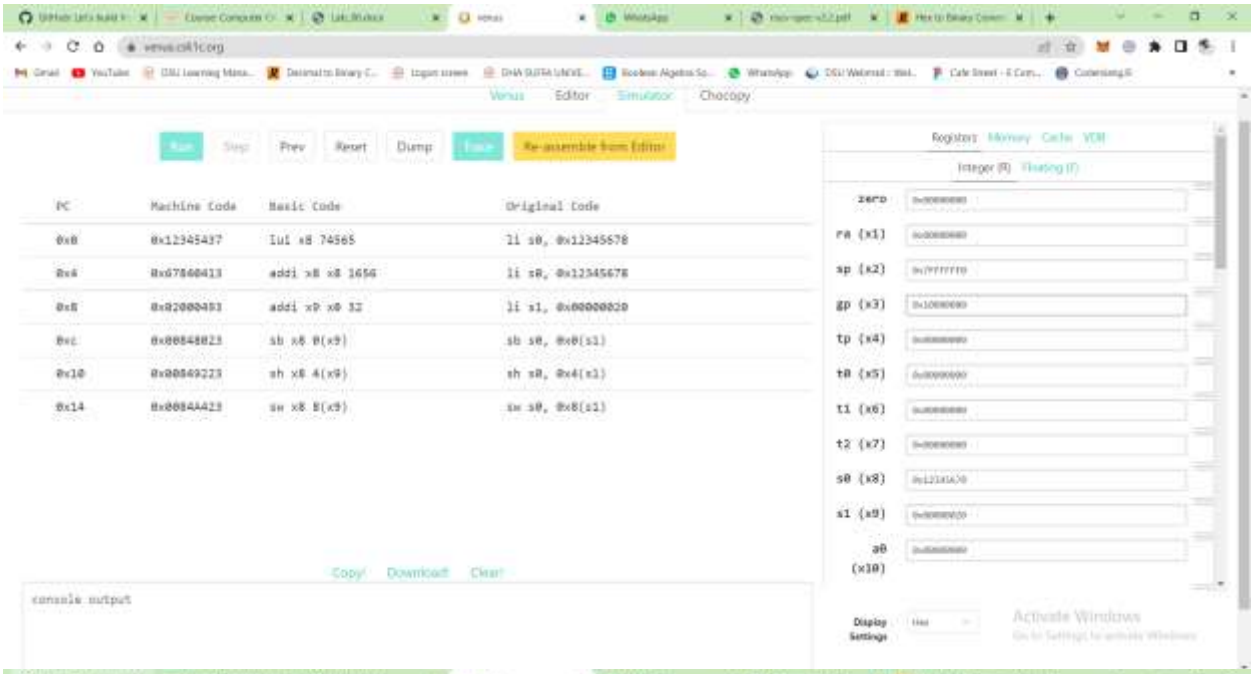
sw s0, 0x8(s1)

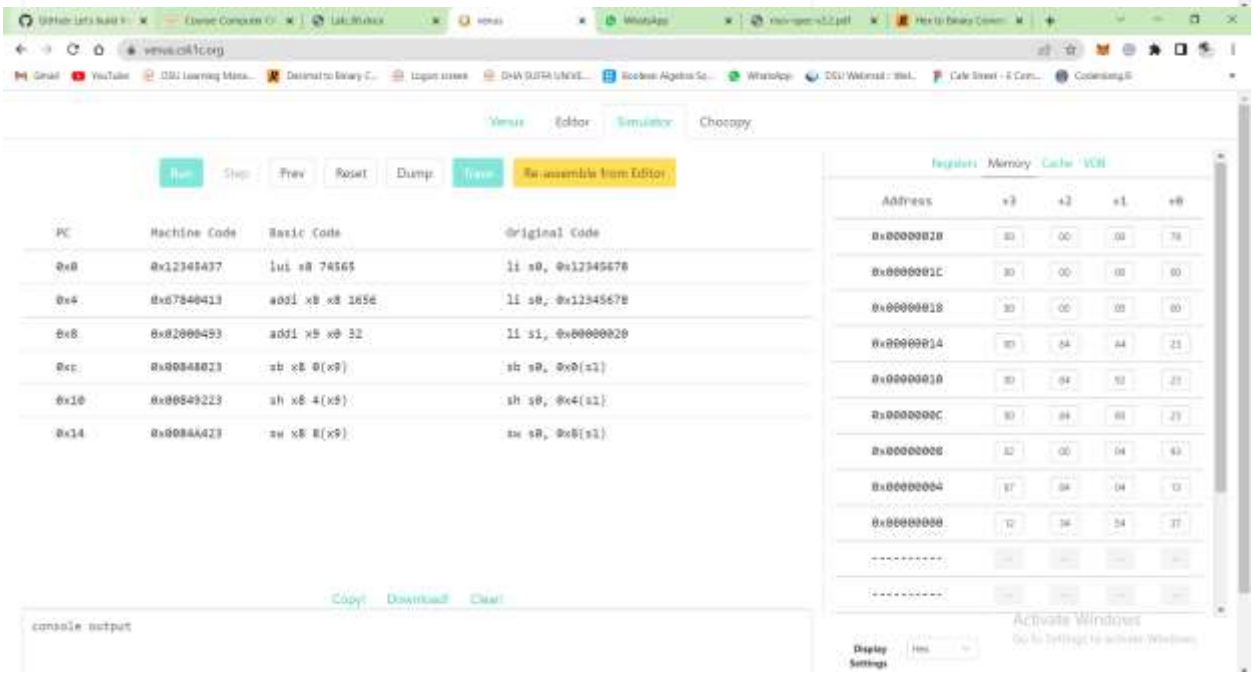
0000000	01000	01001	010	01000	0100011

Machine Code: 0000 0000 1000 0100 1010 0100 0010 0011

Hexadecimal Code: 0084A423

Venus Simulation:





Lab Exercise 2:

Task:

Run the below assembly code on Venus Simulator

lb t0, 0x0(x0)

lbu t1, 0x4(x0)

lh t2, 0x8(x0)

lhu s0, 0xC(x0)

lw s1, 0x10(x0)

lb t0, 0x0(x0)

000000000000	00000	000	00101	0000011

Machine Code: 0000 0000 0000 0000 0000 0010 1000 0011

Hexadecimal Code: 00000283

lbu t1, 0x4(x0)

000000000100	00000	100	00110	0000011

Machine Code: 0000 0000 0100 0000 0100 0011 0000 0011

Hexadecimal Code: 00404303

lh t2, 0x8(x0)

000000001000	00000	001	00111	0000011

Machine Code: 0000 0000 1000 0000 0001 0011 1000 0011

Hexadecimal Code: 00801383

lhu s0, 0xC(x0)

000000001100	00000	101	01000	0000011

Machine Code: 0000 0000 1100 0000 0101 0100 0000 0011

Hexadecimal Code: 00C05403

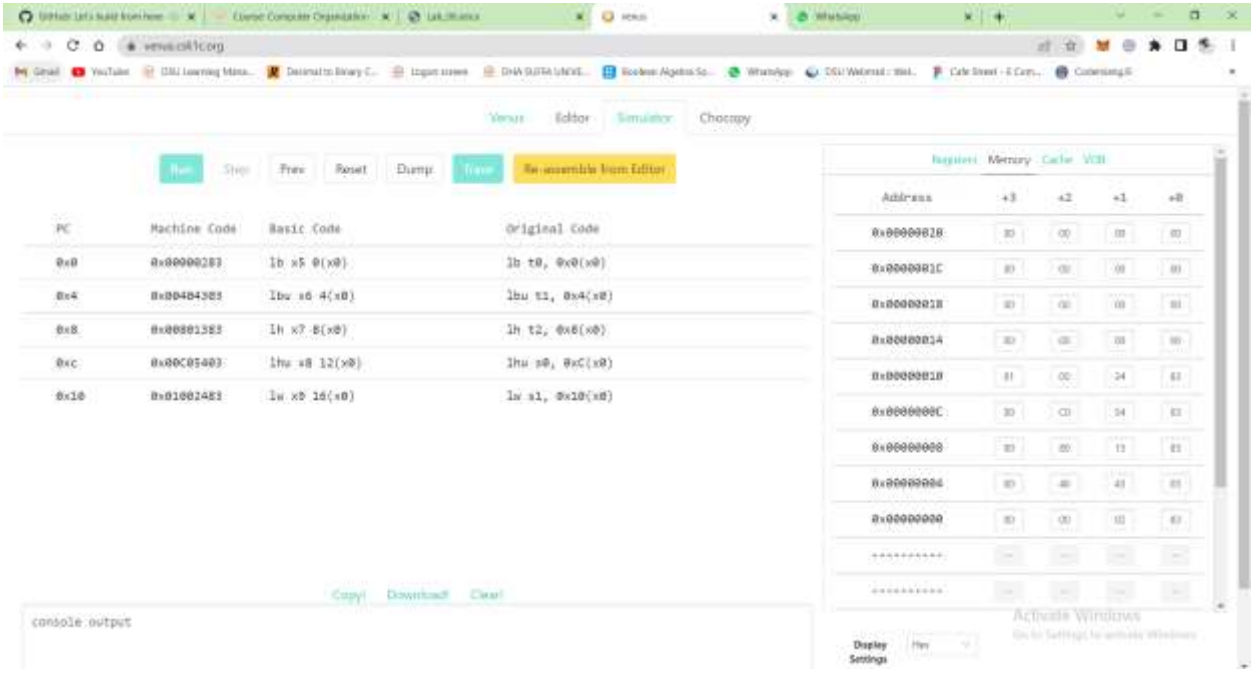
lw s1, 0x10(x0)

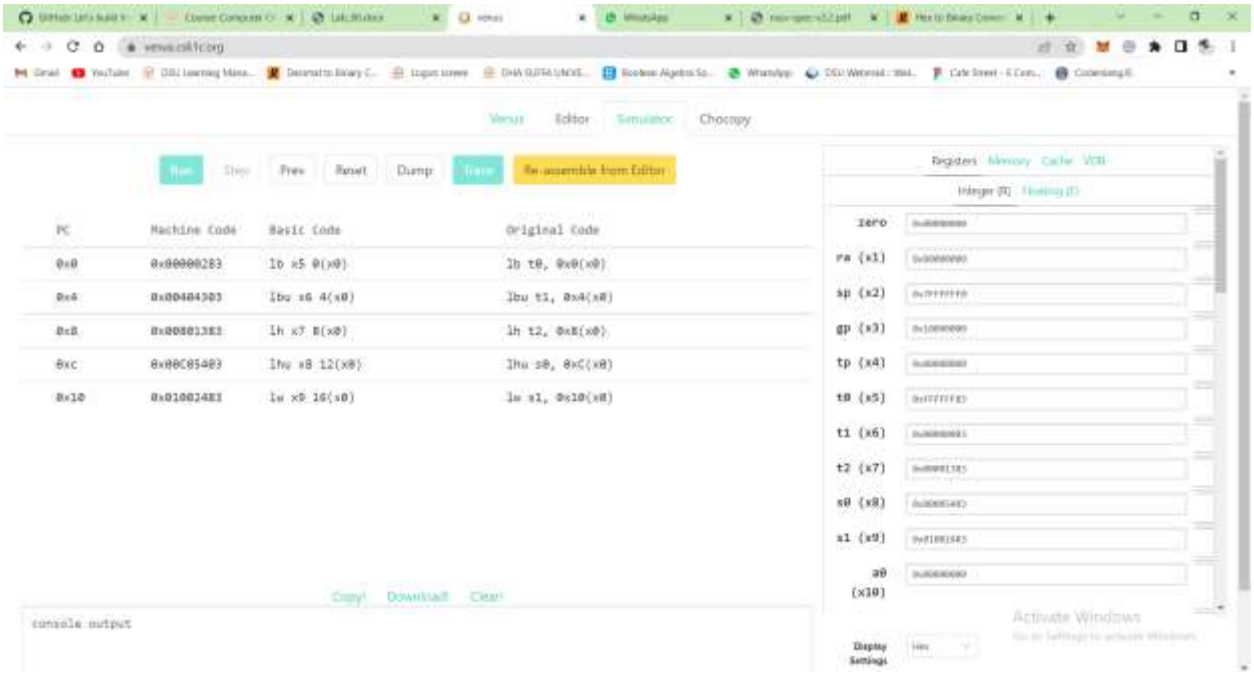
000000010000	00000	010	01009	0000011

Machine Code: 0000 0001 0000 0000 0010 0100 1000 0011

Hexadecimal Code: 01002483

Venus Simulation




Venus
Editor
Simulator
Chocopy
Run
Step
Prev
Reset
Dump
Save
Re-assemble from Editor
PC
Machine Code
Basic Code
Original Code
0x0
0x00000283
lb x5 0(x0)
lb t0, 0x0(x0)
0x4
0x00404303
lbu x6 4(x0)
lbu t1, 0x4(x0)
0x8
0x00813E83
lh x7 8(x0)
lh t2, 0x8(x0)
0xc
0x00C05403
lhu x8 12(x0)
lhu s0, 0xC(x0)
0x10
0x01002483
lw x9 16(x0)
lw s1, 0x10(x0)
Copy!
Download!
Clear!
console output
Registers
Memory
Cache
VCR
Integer (R)
Floating (F)
zero
ra (x1)
sp (x2)
gp (x3)
tp (x4)
t0 (x5)
t1 (x6)
t2 (x7)
s0 (x8)
s1 (x9)
a0 (x10)
Display Settings
Activate Windows

InLab Tasks:

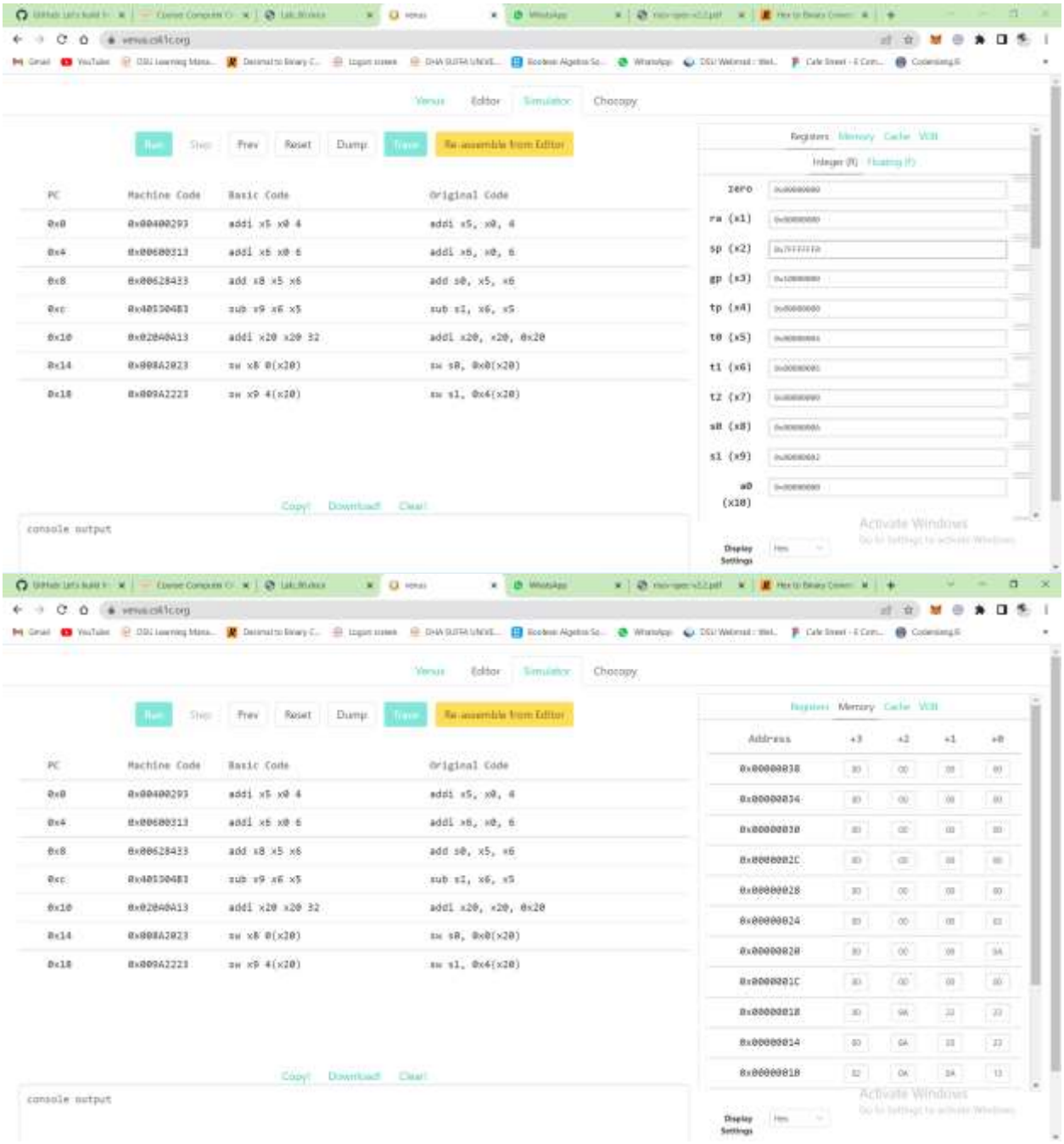
Task 1:

Write down a simple assembly program to add, and subtract two integer numbers and store their result into different memory locations. Stimulate the code on Venus.

RISC-V Assembly Code:

```
addi x5, x0, 4 # storing 4 in register x5

addi x6, x0, 6 # storing 6 in register x6

add s0, x5, x6 # addition

sub s1, x6, x5 # subtraction


addi x20, x20, 0x20 # setting memory's base address


sw s0, 0x0(x20) # storing s0's added value in memory

sw s1, 0x4(x20) # storing s1's subtracted value in memory
```

Venus Simulation:



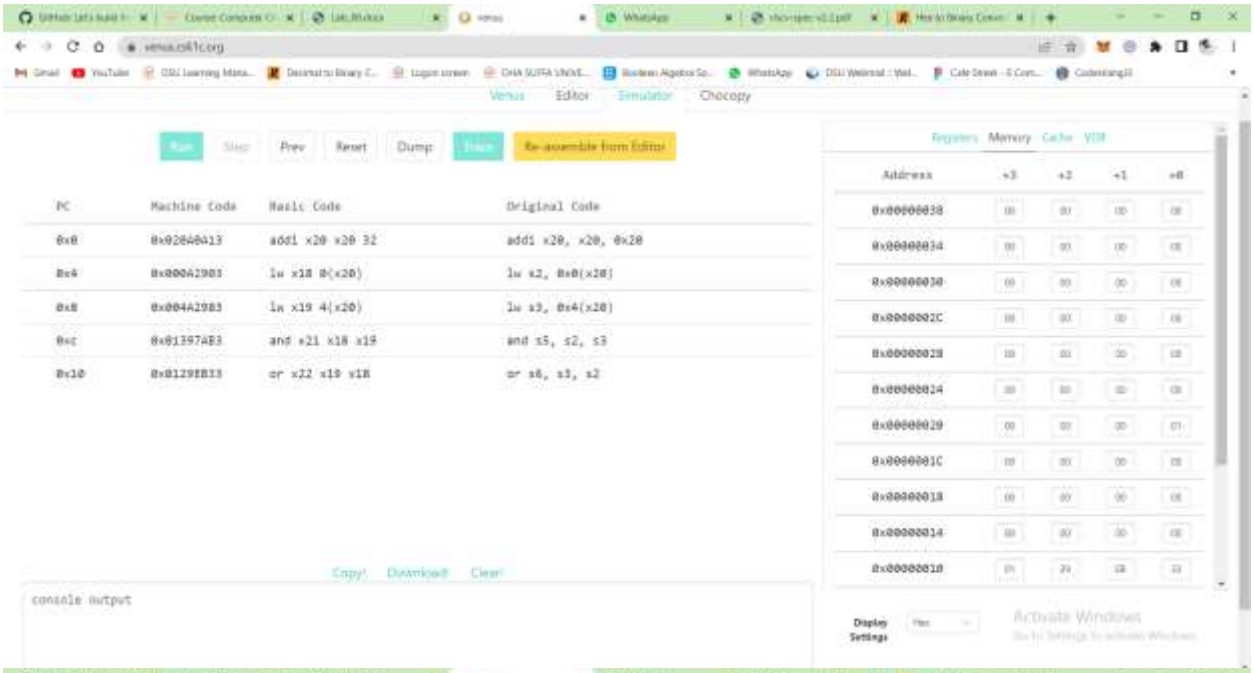
Task 2:

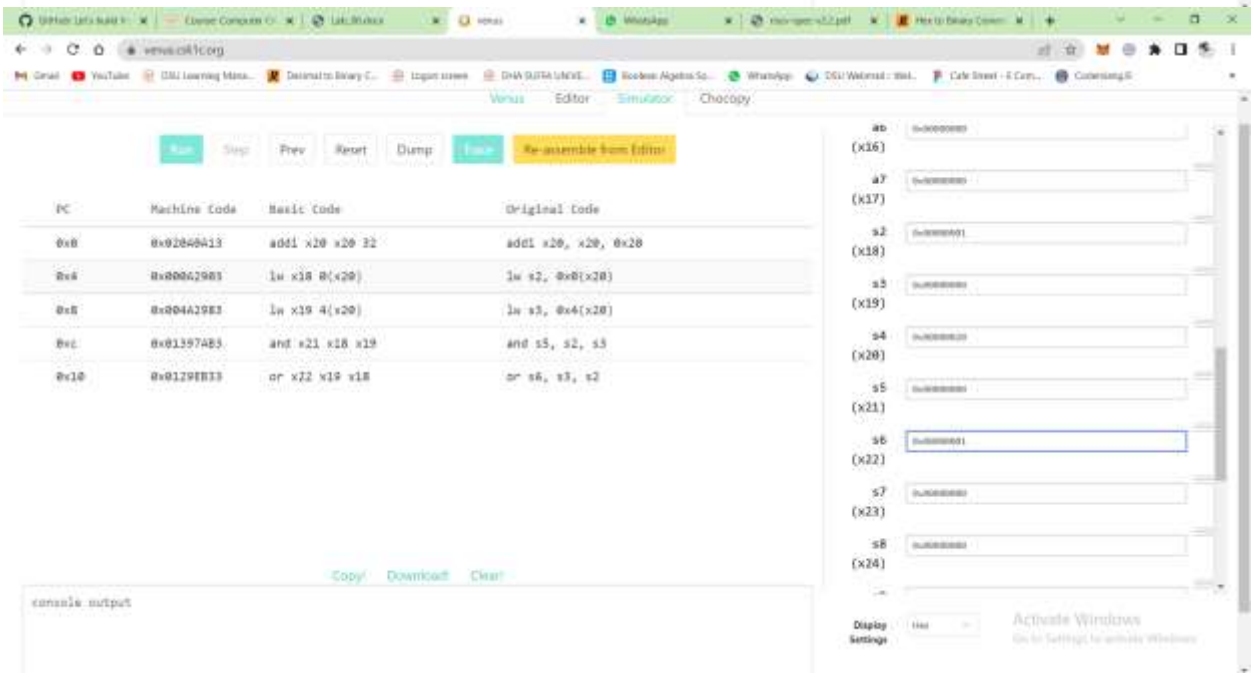
Write down a simple assembly program to load the contents from memory into registers and perform the logical operations on them. Stimulate the code on Venus.

RISC-V Assembly Code:

```
addi x20, x20, 0x20 # setting memory's base address


lw s2, 0x0(x20) # loading data from memory into register

lw s3, 0x4(x20) # loading data from memory into register


and s5, s2, s3 # ANDing data loaded from memory

or s6, s3, s2 # Oring data loaded from memory
```

Venus Simulation:





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