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 representations 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 01

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)

Machine Code:

0000 0000 1000 0100 1000 0000 0010 0011

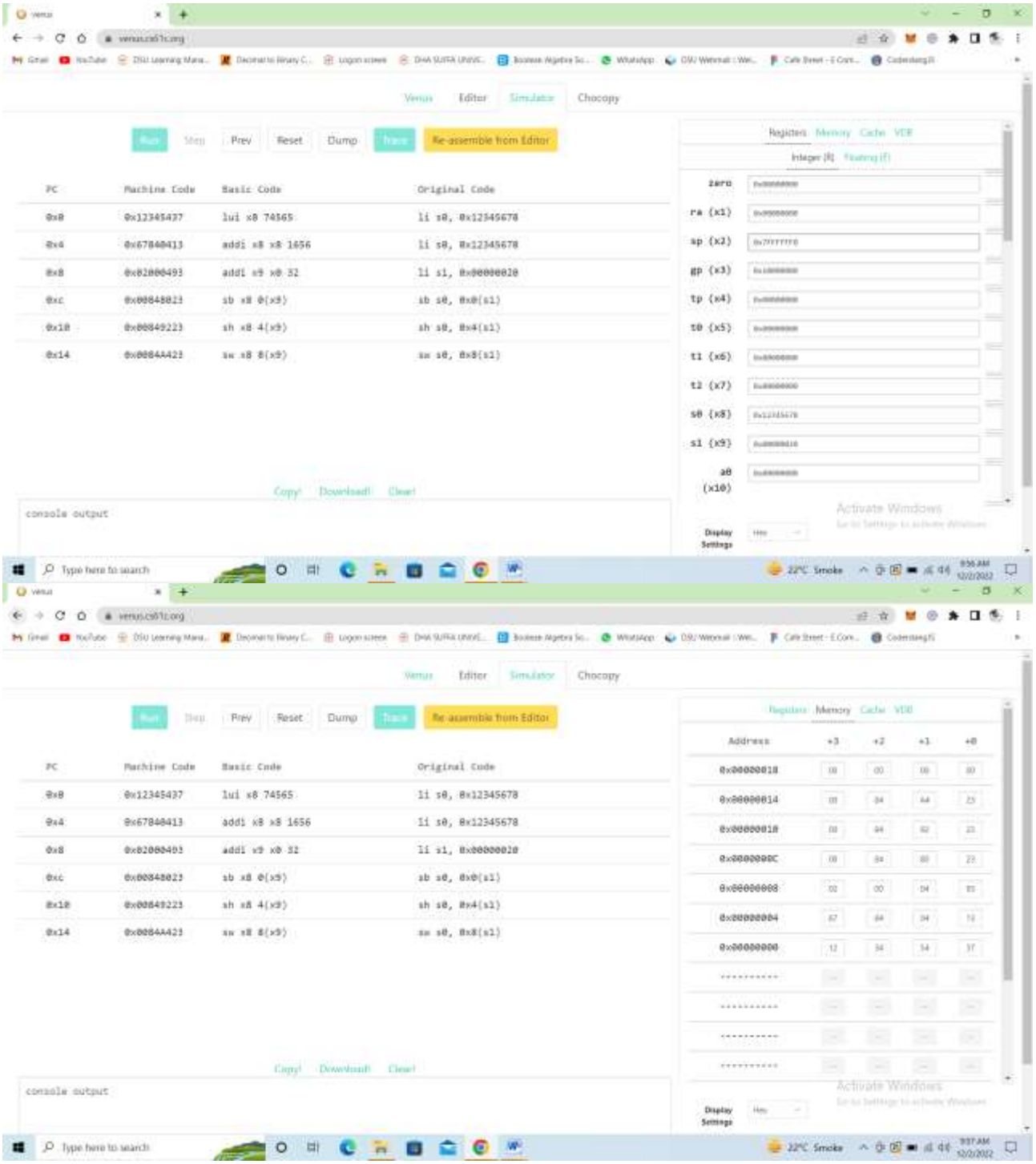
0000 0000 1000 0100 1001 0010 0010 0011

0000 0000 1000 0100 1010 0100 0010 0011

Hexa Code:

0x00848023
0x00849223
0x0084A423

Venus Simulation


Venus
Editor
Simulator
Chocopy
Run
Step
Prev
Reset
Dump
Trace
Re-assemble from Editor
PC
Machine Code
Basic Code
Original Code
0x0 0x12345437 lui x8 74565 li s0, 0x12345678
0x4 0x67840413 addi x8 x8 1656 li s0, 0x12345678
0x8 0x02000493 addi x9 x0 32 li s1, 0x00000020
0xc 0x00848023 sb x8 0(x9) sb s0, 0x0(s1)
0x10 0x00849223 sh x8 4(x9) sh s0, 0x4(s1)
0x14 0x0084A423 sw x8 8(x9) sw s0, 0x8(s1)
Registers
Memory
Cache
VCB
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)
Copy!
Download!
Clear!
console output
Display Settings
Activate Windows
Type here to search
22°C Smoke
9:56 AM
5/2/2022
Address
+3
+2
+1
+0
0x00000018
0x00000014
0x00000010
0x0000000C
0x00000008
0x00000004
0x00000000
9:57 AM

Lab Exercise 02

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)
```

Machine Code:

0000 0000 0000 0000 0000 0010 1000 0011

0000 0000 0100 0000 0100 0011 0000 0011

0000 0000 1000 0000 0001 0011 1000 0011

0000 0000 1100 0000 0101 0100 0000 0011

0000 0001 0000 0000 0010 0100 1000 0011

Hexa Code:

0x00000283

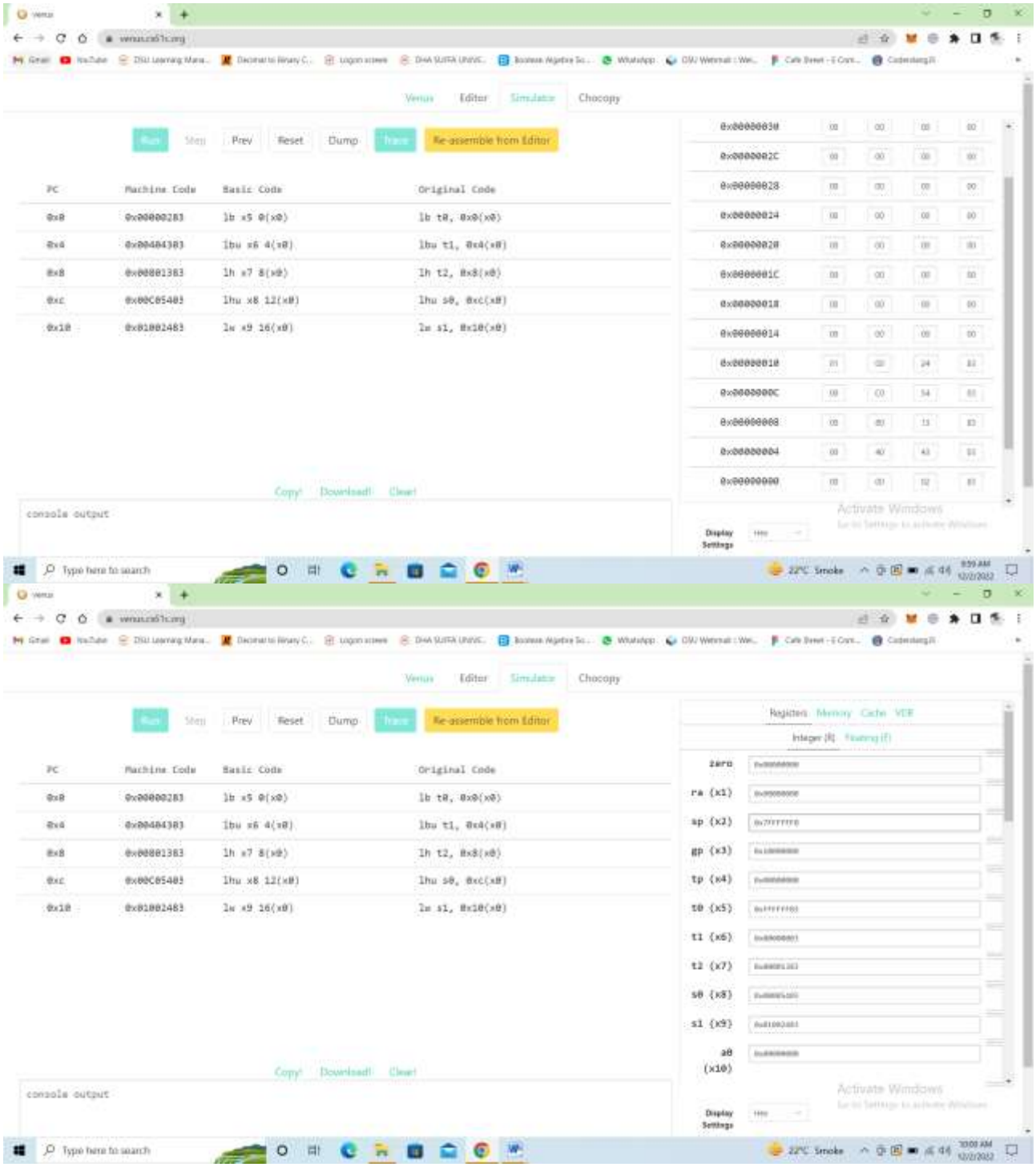
0x00404303

0x00801383

0x00C05403

0x01002483

Venus Simulation



In Lab Task

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

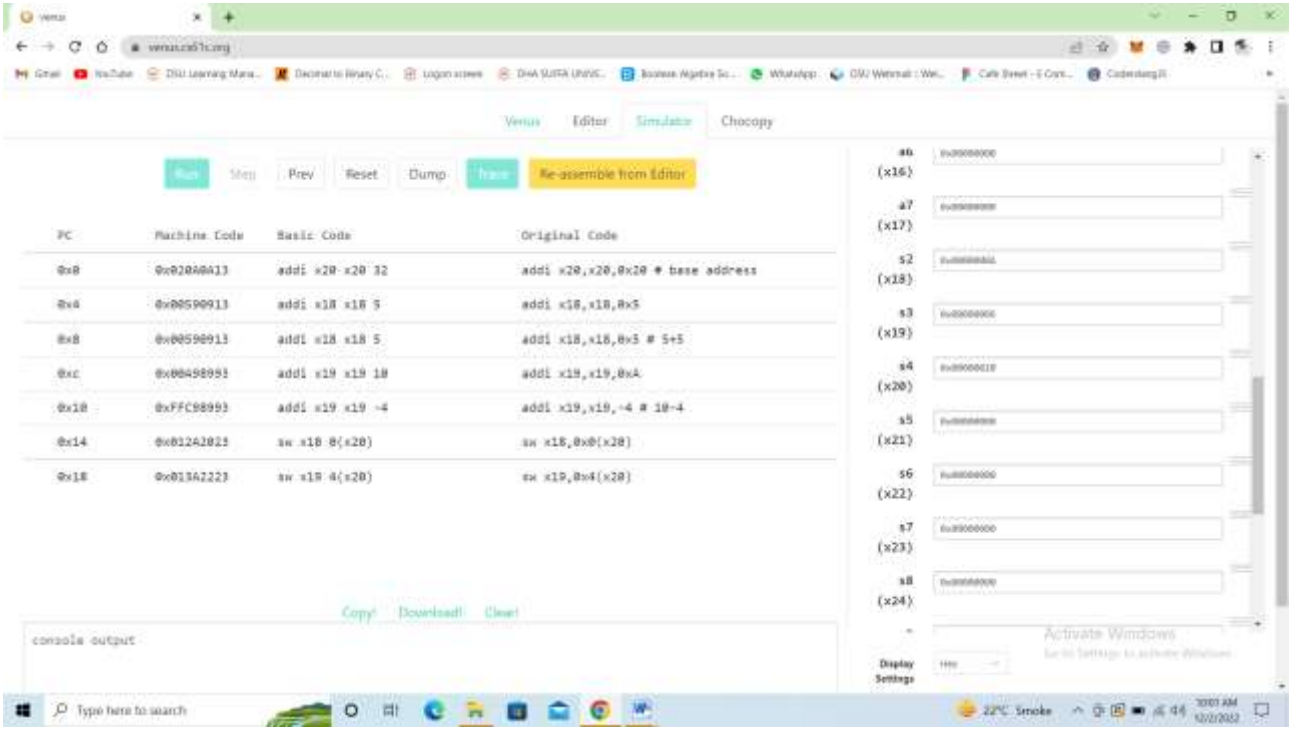
Assembly

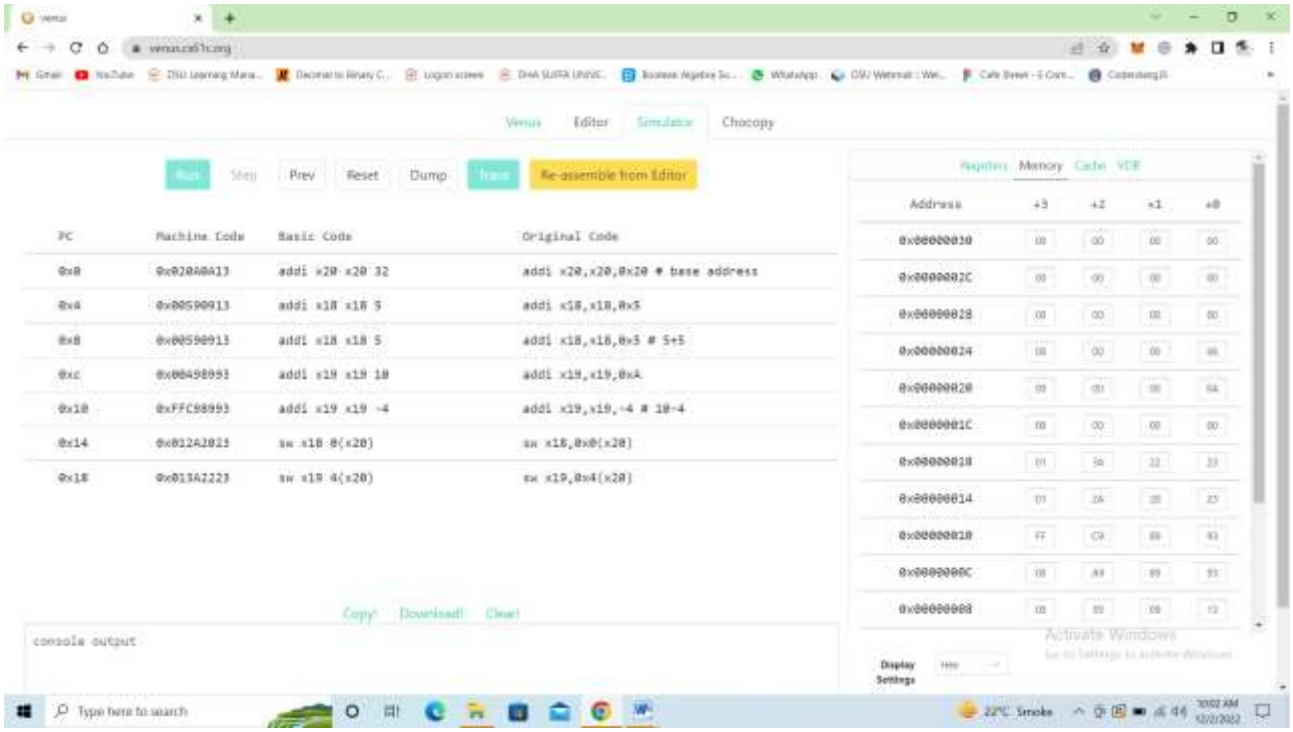
```
addi x20,x20,0x20 # base address
addi x18,x18,0x5
addi x18,x18,0x5 # 5+5

addi x19,x19,0xA
addi x19,x19,-4 # 10-4

sw x18,0x0(x20)
sw x19,0x4(x20)
```

Venus Simulation





Task 2

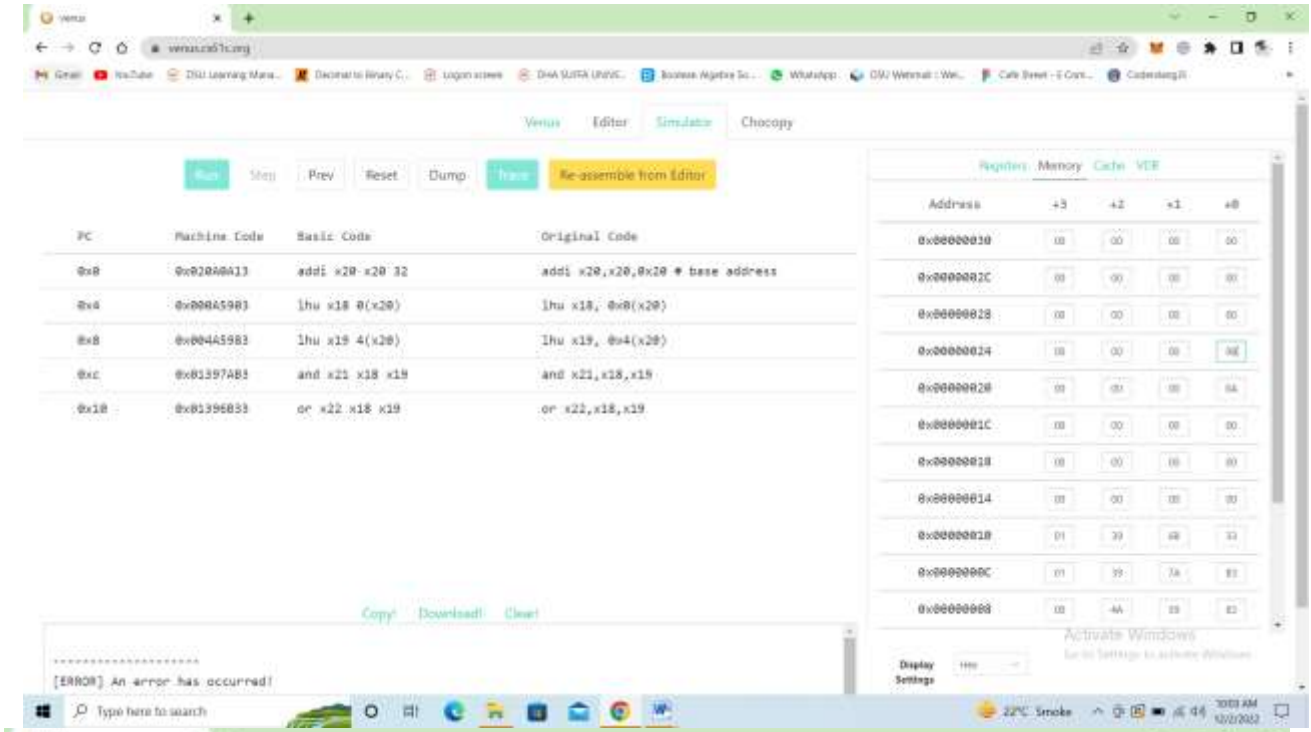
Write down a simple assembly program to load the contents from memory into registers and perform the logical operations on them. Stimulate the code on Venus.

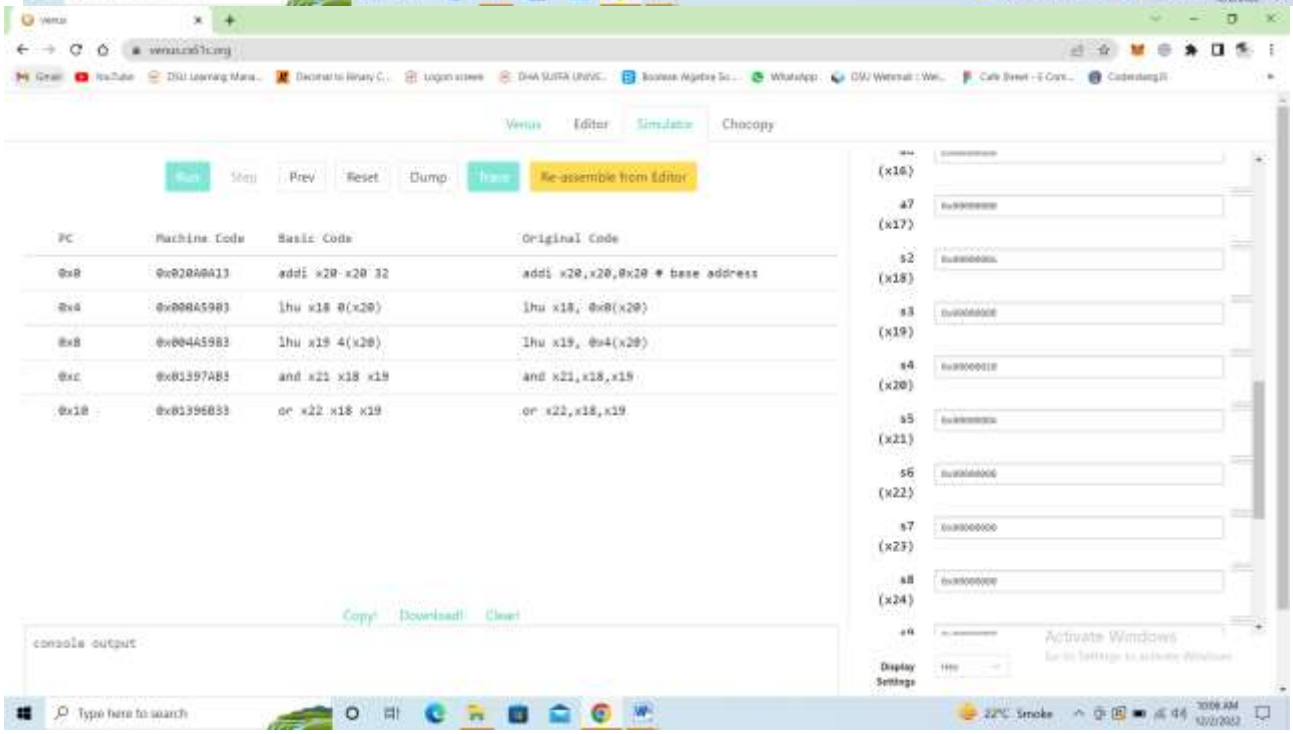
Assembly

```
addi x20,x20,0x20 # base address
lhu x18, 0x0(x20)
lhu x19, 0x4(x20)

and x21,x18,x19
or x22,x18,x19
```

Venus Simulation


Venus
Editor
Simulator
Chocopy
Run
Step
Prev
Reset
Dump
Trace
Re-assemble from Editor
Registers
Memory
Cache
VCR
Address
+3
+2
+1
+0
PC
Machine Code
Basic Code
Original Code
0x0
0x020A0A13
addi x20 x20 32
addi x20,x20,0x20 # base address
0x4
0x000A5983
lhu x19 0(x20)
lhu x19, 0x0(x20)
0x8
0x004A5983
lhu x19 4(x20)
lhu x19, 0x4(x20)
0xc
0x01397AB3
and x21 x18 x19
and x21,x18,x19
0x10
0x01396B33
or x22 x18 x19
or x22,x18,x19
Copy!
Download!
Clear!
[ERROR] An error occurred!
Display Settings
Activate Windows
Type here to search
22°C Smoke


Venus
Editor
Simulator
Chocopy
Run
Step
Prev
Reset
Dump
Trace
Re-assemble from Editor
PC
Machine Code
Basic Code
Original Code
0x0
0x020A0A13
addi x20 x20 32
addi x20,x20,0x20 # base address
0x4
0x000A5983
lhu x19 0(x20)
lhu x19, 0x0(x20)
0x8
0x004A5983
lhu x19 4(x20)
lhu x19, 0x4(x20)
0xc
0x01397AB3
and x21 x18 x19
and x21,x18,x19
0x10
0x01396B33
or x22 x18 x19
or x22,x18,x19
Copy!
Download!
Clear!
console output
Display Settings
Activate Windows
Type here to search
22°C Smoke