Lab 02 CSC 120

Use the emulator to find the answers to your work. The goal of this lab is to understand how to use the emulator and run instructions on it. You should be able to make sense of the values returned by the emulator.

**Emulator link below**

<https://joeledstrom.github.io/brookshear-emu/#AA01>

**Appendix C link below**

<https://blackboard.waketech.edu/bbcswebdav/pid-18088193-dt-content-rid-148874207_1/xid-148874207_1>

(+10) The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. **See the first page of this lab** Answer the questions below (there are two) assuming that the machine is started with its program counter containing 00.

**NOTE: Recall the language requires two bytes per instruction**

Address Content Interpretation

00 21 Execute the instruction 210B

01 0B

02 14 Execute the instruction 1404

03 04

04 C0 Execute the instruction C0000

05 00

What bit pattern will be in register 4 when the machine halts?

A A5 B. C0 C. 27 D. C7

What bit pattern will be in the program counter when the machine halts?

A 05 B. 06 C. 07 D. 04

(+5) The following table shows a portion of machine’s memory written in the language described in the language description table. Answer the questions below assuming that the machine is started with its **program counter containing 00.**

address content Interpretation

00 25 Execute instruction 2503

01 03

02 A5 Execute instruction A502

03 02

04 35 Execute instruction 3503

05 03

06 24 Execute instruction 2400

07 00

08 34 Execute instruction 3404

09 04

0A B0 Execute instruction B003

0B 03

0C C0 Execute instruction C000

0D 00

What bit pattern will be in memory location 03 when the machine halts?

A C0 B. 05 C. 00 D. A0

(+5) The following table shows a portion of a machine's memory containing a program written in the language described in the language description table**. See the first page of this lab** Answer the questions below assuming that the machine is started with its **program counter containing 00. *Use the emulator***

address content Instruction to execute

00 10 1002

01 02

02 24 2404

03 04

04 B4 B40A

05 0A

06 C0 C000

07 00

08 C0 C000

09 00

0A C0 C000

0B 00

0C C0 C000

0D 00

What bit pattern will be in register 4 when the machine halts?

A. 2A B. 24 C. C4 D. 04

(+10) The following table shows a portion of a machine's memory containing a program written in the language described in the language description table (adopted from Chapter review problem #15 ) ***Use the emulator***

Address Content Interpretation

* 1C Execute instruction 1C03
* 03
* 2B Execute 2B03
* 03
* 5A Execute 5ABC
* BC
* 3A Execute 3A00
* 00
* C0 Execute C000 (Halt)
* 00
* What bit pattern will be in register A when the machine halts?

A. 30 B. 03 C. C4 D. 06

* What bit pattern will be in memory address (cell) 00 when the machine halts?

A. 30 B. 03 C. C4 D. 06

(+10) Write a short program in the Vole architecture to perform the requested operation. Assume your program is placed in memory starting at address 00 (== 0x00) Remember to add C000 (== halt) to your program

Interchange the values stored at memory locations D8 and B3

As an example, to copy the value stored in memory address D8 to memory address B3 the following program would work:

Address Content Interpretation

* 10 Execute 10D8
* D8
* 11 Execute 11B3
* B3
* 30 Execute 30B3
* B3
* 31 Execute 31D8
* D8
* C0 Execute instruction C000 (== halt)
* 00

The above example can be interpreted as follows:

* Load the contents of address D8 into register 04
* Store the contents of register 04 (==\*(D8) ) into memory address B3
* Halt

(+25) Encode each of the following commands in terms of the machine language described in the language description table. **Use the following set of instructions**

~~17A5~~ ~~5465~~ ~~7465~~ B2B2

6456 ~~27A5~~ ~~8465~~ 34AA A750

27A5 LOAD register 7 with the value

17A5 LOAD register 7 with the contents of the memory cell at address A5.

5465 ADD the contents of registers 5 and 6 as though they are values in 2’scomplement notation and leave the result in register 4.

7465 OR the contents of registers 5 and 6, leaving the result in register 4.

8465 AND the contents of registers 5 and 6, leaving the result in register 4.

**(+10)** Why do modern CPU's have cache memory and a main memory? What is the function of the hard drive? Discuss how CPU speeds and main memory sizes have evolved from 1960's to 2021.

Note: I am looking for your understanding and hence you may have to read some articles online. Be sure to include the links to the articles that you have read. \*

Reasons why modern CPU's have cache memory and a main memory is that since the process of getting data from the main memory to the processor takes long time, which is known as slow process, cache memory invented which is “integrated directly into the CPU chip or placed on a separate chip that has a separate bus interconnect with the CPU.

cache memory makes the retrieve of the data easier”. It makes the process of the data faster. In addition, it known as a temporary memory. The function of the hard drive is that it saves documents, files for operating system, and applications. “Complex and reliable CPUs were built onto one or several printed circuit boards containing discrete (individual) components.” In 1964 IBM utilized the concept of a microprogram which brought computing power to more people with more convenient physical size and broadening the computer vendor field. Also, it still sees widespread usage in modern CPUs. Basically, the memory at the 1960s was larger than today main memory and the CPU was larger and slower before.

**https://searchstorage.techtarget.com/definition/cache-memoryczzdf**

**https://www.techwalla.com/articles/what-are-the-functions-of-a-hard-drive**

[**https://courses.lumenlearning.com/zeliite115/chapter/reading-the-central-processing-unit/**](https://courses.lumenlearning.com/zeliite115/chapter/reading-the-central-processing-unit/)

**https://computer.fandom.com/wiki/History\_of\_computing\_hardware\_(1960s%E2%80%93present)**

**(+15)** Explain briefly the concept of opcode/operand and the types of load instructions for the Vole architecture. What is the general format of the instruction? Give examples.

the concept of opcode is mean what kind of instruction to do or execute which is the first 4 bits in the code, while operand means where to apply these instructions which is the last 12 bits in the code.

* The types are:
* Control: direct the execution of the program such as JUMP, BRANCH
* Data Transfer: copy data from a location to another such as LOAD, STORE.
* Arithmetic/Logic: operations on bit patterns such as AND, OR, SHIFT, ROTATE

The general format is.

1011 1100 1111 0111 Bit pattern 16 bits

0XB 0XC 0XF 0X7 Hexadecimal pattern 4 digits

The first 4 bits are opcode, the last 12 bits are operand.

For example: 10D3 It means the continent of the memory cell located at address D3 to be placed in register 0x0, 21B4 it means the value of B4 placed in register 0x1.

**Python code required for the next 2 problems**

(+10) Write a python program to accept a number from a user. The program should print "even number" as an output if the number is even and print "odd number" as an output if the number is odd. If the number is negative, it should print "negative number".0 is considered even.

**Hint : Use the modulus operator "%". Read online on what it does and how to use it. Part of the exercise is to learn to find information online. Do not copy code directly without understanding it.**

(+10) Write a python program to print the first 20 even numbers. For example

**NOTE: Please name this file as yourlastNameLab02P2.py. As an example if your last name was Euclid then you should submit EuclidLab02P2.py**