**Wake Technical Community College**

**CSC120-0002 Computing Fundamentals I – Fall 2021**

**Instructor: Curtis Knowles**

**LAB 3 – Lesson 3: Data Manipulation**

**DUE DATE:**

This lab is due by Sunday 9/5 (11:59pm ET). Wake Tech does **NOT** allow any late submissions for this assignment.

**OBJECTIVES:**

In this lab assignment, students will review the following concepts in Python:

* Explore the Vole architecture using an online emulator.
* Write their first Python programs using:
  + the input and print function
  + the modulus and division operator
  + the while loop

**GRADING:**

This lab is worth 100 points. Submit all required files as attached files to the Lab 3 submission in Blackboard. Required Files:

* **Lab3\_<Last>\_<First>.docx** – answers to Section A: Emulator Exercises.
* **Lab3A\_<First>\_<Last>.py** – Section B: Programming Challenge Python program written for problem (a).
* **Lab3B\_<First>\_<Last>.py** – Section B: Programming Challenge Python program written for problem (b).

*(NOTE: in filenames, <Last> = student’s last name and <First> = student’s first name)*

**Section A - Emulator Exercises (70 points)**

**ASSIGNMENT:**

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 points) 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. 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 C000

### 05 00

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

### A A5 B. C0 C. 27 D. C7

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

### A 05 B. 06 C. 07 D. 04

**(10 points) The following table shows a portion of the 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

What value will be in the program counter when the machine halts?

1. C0 B. 01 C. 05 D. 00

**(15 points) 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**

0x00 1C Execute 1C03

0x01 03

0x02 2B Execute 2B03

0x03 03

0x04 5A Execute 5ABC

0x05 BC

0x06 3A Execute 3A00

0x07 00

0x08 C0 Execute C000 (Halt)

0x09 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

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

1. 30 B. 03 C. C4 D. 06

### (35 points) 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

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### Section B - Programming Challenge (30 points)

*(Watch the video “Starting to Program with Python” before attempting this challenge.)*

a. (15 points) Write a Python program to do the following:

Accept a number from the user as input. Have the program print “even number” as an output if the number is even, or print “odd number” if the number is odd. If the number is negative, it should also print "negative number" (consider 0 as an even number).

*Hint: Use the modulus operator "%". Read online what it does and how to use it. Part of this exercise is learning how to use Python resources online while you’re writing programs.*

b. (15 points) Write a Python program to do the following:

Using a while loop, print the first 20 even numbers (starting with 0).

*Hint: For the “first 20 even numbers” problem, also use the “%” operator but do so inside a properly formatted while loop.*