Name:

Date:

Period:

**CS 160**

**Introduction to Computer Science**

**Lab #1 Understanding Machine Language**

PURPOSE OF LAB

This lab uses the Machine Language Simulator that is part of the text Computer Science: An Overview, by J. Glenn Brookshear, Professor Emeritus at Marquette University. You are not expected to memorize the basic operations of this machine language. Rather, you will use this lab to enhance your understanding of the machine cycle and basic machine instructions.

TO COMPLETE LAB

Go to the following website <https://joeledstrom.github.io/brookshear-emu/> to enter your machine code.

BROOKSHEAR'S MACHINE LANGUAGE SUMMARY

The following table summarizes the machine language presented in Computer Science: An Overview. Each instruction is 16 bits, or two bytes, long and thus is represented by four hexadecimal digits.

Op – code Operand Description

1 RXY LOAD register R with the contents of the memory cell at address

XY.

2 RXY LOAD register R with the value XY.

3 RXY STORE the contents of register R at memory location XY.

4 0RS MOVE the contents of register R to register S.

5 RST ADD the integer contents of registers S and T and leave the result

in register R. Integers are stored using two's complement notation.

6 RST ADD the floating-point contents of registers S and T and leave the

result in register R.

7 RST OR the contents of registers S and T and place the result in register

R.

8 RST AND the contents of registers S and T and place the result in

register R.

9 RST EXCLUSIVE OR the contents of registers S and T and leave the

result in register R.

A R0X ROTATE the contents of register R one bit to the right X times.

B RXY JUMP to the instruction located at memory address XY if the

contents of register R equals that of register 0.

C 000 HALT

**Examples**

The machine instruction 1234 has op – code 1 and means:

LOAD register R1 with the contents of the memory cell at address 34

The machine instruction 20FF has op – code 2 and means:

LOAD register R0 with the value FF

The machine instruction 34B0 has op – code 3 and means:

STORE the contents of register R4 at memory location B0

The machine instruction 4602 has op – code 4 and means:

ADD the contents of registers R0 and R2 and place the sum in register R6

The machine instruction B6A4 has op – code B and means:

JUMP to the instruction in memory location A4 if the contents of register R6 equals that of register R0.

Lab 1

Using the model CPU demonstrated in class, write code using the simple machine language of Appendix C to solve the following problem: 27 – 17 + 9. Store the result in memory location EE. Remember that the model CPU uses hexadecimal values, so you will need to represent the decimal values in the problem in hex. You will then need to convert the number 17 from a positive to a negative number, in your code, and then add the three numbers together. Due Monday Feb. 5, 2018 @ 11:55 PM. Submit in Moodle.

Items to be turned in to get full credit:

1. Your code with translation for each step using Appendix C.
2. Screen capture of the Brookshear machine after program execution.