ASM Lab 3

Lab Section Meeting Day	Lab Start Date	Lab Due Date
Tuesday	9/12	9/19
Friday	9/15	9/22

You will submit your labs electronically via email until your TA has Brightspace access, here is the email address: mcdonala12@newpaltz.edu You will be notified when we switch to Brightspace.

Whenever you submit machine language programs, please provide the `.lst` file generated when using `lcc`. Also turn in a screenshot of your command prompt showing the output

1) Go to Brightspace and download the software for the course. Follow the instructions given on Brightspace. Run the program `ex0301.a` as instructed in those instructions. Show your lab TA that you have this working properly to receive credit for this portion of the lab.

2) In class, we wrote and explored the following program (I am providing the hex version):

```
2005
2205
1401
f402
f001
f000
0002
0003
```

Trace the *fetch, increment, decode, execute* loop that occurs for each line of code. You should be writing down what happens to each register (what is in the `pc` register; what is in the `ir` register; what is in `r0, r1`, and `r2`), as well as describing what happens (for example, note if something is printed) for each machine instruction.

3) What is the difference between a pc-relative address and an effective address?

4) We looked at one type of add instruction in class (the one introduced on page 28), it had two source registers. Look in chapter 2 on page 32 and read about the second type of `add` instruction. Rewrite a program that adds 2 and 3 with this `add` instruction. Do not store any numbers as data below halt. *Hint, the initial numbers sitting in all 8 registers is 0* Run this on your computer, and hand in what is requested at the top of this page.

5) Look on page 34 at the move immediate instruction. Explain it in your own words. Rewrite a program that adds 2 and 3 by using the `mvi` instruction to place those values in registers, and then add them together using the first `add` instruction. Run this on your computer, and hand in what is requested at the top of this page.

6) Recall that to subtract N from M (M – N), the computer will add M, ~N(the number N with it's bits flipped), and 1. Look at the `not` instruction on page 35 to see how to convert N to ~N, and use machine language to preform the operation of 5 – 3. Run this on your computer, and hand in what is requested at the top of this page.

7) Can you add -3 to 5 by using the second `add` instruction and placing -3 in the `imm5` field? Why or why not.

8) Write a machine language program in binary that adds 1, 200, 700, and -3. Run this on your computer, and hand in what is requested at the top of this page.

9) Read about the load effective address instruction on page 36. What is the difference between `ld` and `lea`?

10) Read the section about Strings on page 37. Practice using the `sout` instruction by printing your favorite word. Use `ex0204` as guidance. Run this on your computer, and hand in what is requested at the top of this page.