

# CS270 Programming Assignment 3

## “LC3 Assembly Programming”

Program due Saturday, Oct 26, 2013 (via Check-in by 4:59pm)

### Goals

In this assignment, you will write three LC-3 assembly programs. The goals are:

- Learn how to write a non-trivial LC-3 program, and
- Expand your understanding of the LC-3 architecture and tools.

You will need to use the LC3 tool-chain to complete the assignment. Details can be found at <http://www.cs.colostate.edu/~fsieker/misc/cs270.html> as discussed in Recitation 7.

### The Assignment

You are given with the sample assembly code in file hello.asm to make you understand about one of the TRAP calls i.e. to print the output. Download the file from <http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/hello.asm> and run it using the script(text file) available at <http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/hello.txt>. As you run the code you can see, program prints “HELLO WORLD” .

There are three parts for this programming assignment. You are required to submit separate file for each part.

#### **PART 1: Conditional print using the value of Register R4. (25 points)**

Please download the following files for part1 at

Model File: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part1.asm](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part1.asm)

Run Script: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part1.txt](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part1.txt)

Modify the above program to test the value of register R4. If the value of register R4 is non-zero, print “GOODBYE CS270”, otherwise print “HELLO CS270”. Save your source file as ‘PA3\_Part1.asm’.

#### **PART 2: Read character using the TRAP GETC instruction. (35 points)**

Please download the following files for the part2 at

Model File: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part2.asm](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part2.asm)

Run Script: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part2.txt](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part2.txt)

Modify the above program to read a character from user. If user enters an “A” the program should print the string “TRAP CS270”, otherwise print “HELLO CS270”. Save your source file as ‘PA3\_Part2.asm’.

#### **PART 3: Square (35 points)**

Please download the following files for the part2 at

Model File: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part3.asm](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part3.asm)

Run Script: [http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3\\_Part3.txt](http://www.cs.colostate.edu/~cs270/Fall13/Assignments/PA3/PA3_Part3.txt)

Modify the above program to compute the square of the given input and you are expected to handle both signed and unsigned numbers. Save your source file as ‘PA3\_Part3.asm’. The structure of the program must use the subroutine MULTIPLY that you will write in recitation. That subroutine multiplies two **positive** integers. Your program should first call a subroutine named SQUARE, whose job is to test the sign of the argument. If the argument is positive it should simply call MULTIPLY with both arguments the same, otherwise it should (arithmetic) negate the argument and then call MULTIPLY with the both arguments the same.

You can compile and run the code with the following commands. Please remember none of the above code gives correct results as they are incomplete.

**Compile Command:** \$ ~cs270/lc3tools/lc3as <filename>.asm

**Run Command:** `$ ~cs270/lc3tools/lc3sim -s <filename>.txt`

**Submission Instructions (5 points)**

Create a directory called PA3 to store the assembly files. Submit a tar.gz file generated from the following command (assuming you are running this command from inside PA3 directory):

**\$ cd ..; tar czvf PA3.tar.gz PA3**

Do not submit the assignment with lc3tools inside PA3. There should be only three files in your PA3, namely, PA3\_Part1.asm, PA3\_Part2.asm and PA3\_Part3.asm. All the prints must be exactly as stated above. They are all uppercase print with exactly 2 words.

**Grading Criteria**

Points will be awarded as follows:

- Part 1: 25 points
- Part 2: 35 points
- Part 3: 35 points
- Following submission instructions: 5 points
- Extra credit, Use as little memory as possible for your program (this includes code as well as data): 5 points.

**Late Policy**

This assignment will be accepted up to 24 hours past the due date with a 10% penalty. This assignment will not be accepted past this period. If you were unable to submit via Check-in for any reason, contact us via email and we may be able to help. DO NOT SUBMIT YOUR ASSIGNMENT VIA EMAIL.