CEG 3310/5310 – Computer Organization

Lab 2 – Simple Programs

Learning Objectives

- Understand writing simple programs in the LC3 simulator
- Learn the interface of the LC3 simulator and editor

Overview

You will be implementing simple loops, if statements, and mathematical operations in assembly.

The Programs

You will be writing 4 separate programs in assembly for the LC3:

1. Write a program that calculates the result of $z = x^y$
    a. The x and y variables should exist in memory after loading your program (use .FILL)
    b. Assume (6 >= x >= 0) and (6 >= y >= 0)
    c. Store the result of your exponential operation into the memory address x8000 and HALT your program
2. Write a program that implements a for loop that adds 5 to R3 every iteration
    a. Increment a register by 1 in every cycle of the loop to keep track of the loop iterations
    b. Store the maximum amount of iterations that the loop can have in a memory location
    c. Your for loop should start at 0 iterations (i.e. i = 0) and stop looping once the maximum is reached
    d. Store the result (R3) into the memory address x8001 and HALT your program
3. Write a program that implements an if-else statement
    a. An if-else statement will execute only one out of two blocks of code
    b. Your if-else statement should check if R0 = R1, then make R3 = 5, if R0 ≠ R1, then make R3 = -5
    c. The values used for R0 and R1 should exist in memory after loading your program (use .FILL)
    d. Store the result (R3) of your if-else statement into the memory address x8002 and HALT your program
4. Write a program that initializes a blank array and allows the user to input their own numbers (0 to 9) into the array
    a. Initialize a blank array of size n, where 5 <= n <= 20
    b. Create a loop that loops a total of n times, during each loop display a prompt asking the user to input a number
    c. Capture the user's input (using GETC) and subtract x0030 from the ASCII character the user entered
    d. Using the STR instruction, store the result into the first available memory location of the array
    e. For subsequent entries, store the user's input (with x0030 subtracted) in the next blank entry in the array
    f. Once the loop has finished, HALT your program
    g. You can assume the user will always enter a single digit number 0 to 9

Assignment

Complete the 4 previously mentioned programs in separate .txt files. There should be 4 .txt files uploaded for your submission titled: exponent.txt, for.txt, ifelse.txt, and array.txt. Each program must start at address x3000 (.ORIG x3000). Please use a zip file to contain all these .txt files titled: YOUR-LAST-NAME-Lab2.zip

Make sure you test your programs in the simulator before submitting. If you cannot solve one or more of the programs, please try the others. Partial submissions will be accepted and programs that are incomplete can still earn some points.

Hint: use the sample code in the slides to your advantage!

Grading

This lab is worth 5.00 points, distributed as follows:

Task	Points
Successfully implement an exponential function	1.25
Successfully implement a for loop	1.25
Successfully implement an if-else statement	1.25
Successfully implement the array program	1.25