CS270 Programming Assignment 3

“Assembly Required”

Program due Friday, March 8 via RamCT by 1 PM.

Documentation due Thursday March 7 beginning of the class in hard copy.

Goals

For this assignment you will write an LC3 program. The program will do the following (Note that some locations are identified using the associated labels).

- Add 4 numbers starting in location START, and place the result in location SUM.
- Perform bitwise AND of the contents of locations ZA and ZB, and place the result in location ZAANDB.
- Test if ZA > ZB, when taken as signed numbers. If ZA > ZB, place ASCII ‘Y’ in location ZAGRZB, otherwise place ‘N’ there.
- Multiply the numbers in ZA and ZB (assume they are positive) and place the result in location ZAXB.

You may use any programs you have seen so far in the class as a guide. You must use R2, R3 and R4 as specified.

Tools Needed

For this assignment you will need the LC3 tools to assemble and simulate the program.

The Assignment

The program must start with this code.

```
;File:      PA3.asm
;Description: --> fill this in (single line only)
;Author:    --> fill this in
;Date:        --> fill this in
; R2: pointer that holds an address        R3: accumulator for sum etc.
; R4: counter                              R5: -> fill if used
; ********************** BEGIN RESERVED SECTION **********************
; You may initialize values here (i.e., change the value of a .FILL
; statement), but you may *not* add or remove instructions or perform
; any edit which changes the address of a label in this section
                .ORIG x3000     ; DO NOT change any code before label ZAXB
                BR BEGIN_CODE    ; jump to beginning of code
START           .FILL 3
                .Fill 2
                .FILL 5
                .FILL -1
ZA              .FILL x1B
ZB              .FILL x21
ZAANDB          .BLKW 1
ZAGRZB          .BLKW 1
SUM     .BLKW 1
ZAXB            .BLKW 1;     end of specified locations
; ********************** END RESERVED SECTION **********************
;---------you may add more variables or code below this line --------
BEGIN_CODE                      ; your code begins here
```

Here are several assumptions you can make:

1. The contents of 4 locations beginning with START may be anything.
2. Assume ZA and ZB are both positive signed numbers.
3. The sum of the input data will be not overflow a 16-bit signed integer, and the product of ZA and ZB will fit in the 16-bits available .
4. The input data used to test your program will NOT match the example data.

Hints

Design your algorithm first. Use a flow chart (hand drawn or using drawing tools), then write the code.

Run the LC-3 assembler to build your assembly file into object (.obj)

Load the assembly program into the simulator. Test using different combination of values.

Submission Instructions

1. Submit the pa3.asm file will be submitted directly to RamCT.
2. Submit in hard copy the flowchart and a printout of the working code.

Reminders:

1. Adds comments appropriately.

Grading Criteria

To grade the assignment, we will examine and run program (20 points), and we will verify that your computation gets the right answers on the example data and our own test data (35 points). In addition points will be given for coding style and comments (15 points), following assignment directions (20 points), and 10 points for hardcopy documentation. The grading factors we consider for coding style include having clear and concise comments, consistent indentation, and the minimal amount of code to solve the problem.

Late Policy

There is a 25% penalty for late submission for each of the two parts. They cannot each be more than 24 hours late. Late hardcopy documentation must be submitted electronically by email to cs270@cs.colostate.edu.