EECS 388: Computer Systems and Assembly Language

Lab 2 Introduction to Assembly Language and Arithmetic Instructions

Objectives:

A) To become more familiar with the 68HC12 instruction set.
B) To learn more about developing assembly language programs.

Problem 1: Modifying Hello World

Download the “hello.asm” file from the website. This is the same “hello world” program that we used in lab 1. Make the following modifications to the code:
1. Modify it to load into memory location 4100
2. Modify it to output your name to the screen, instead of “hello world.”

Required: Execute the program for the GTA.

Problem 2: Arithmetic Instructions

The following program demonstrates arithmetic instructions. Note that here we're adding actual numeric values, rather than the contents of memory. That's why we use the notation #$20 for the numeric value 20 hex, etc. Use an editor, type the program into a file, and save it as prob1.asm.

```
;EECS 388
;Lab 2
;Program 1
;Description: This program demonstrates arithmetic operations.

        ORG $4000   ;Addition (20 + 8).
        LDAA #$20   ;Load the number 20 in accumulator A.
        ADDA #$8    ;Add the number 8 to the contents of A and store the result in A.

        STAA $4100  ;Store the result in memory location $4100.

        ;Multiplication (3 * 21)
        LDAA #$3    ;Load the number into accumulator A.
        LDAB #$21   ;Load the number into accumulator B.
        MUL         ;Multiply.

        ;Copy the result from accumulator D to memory locations starting at $4110.
        STD $4110

        SWI
```

Before loading the program, use the BF (block fill) command to fill memory locations 4000 to 413F with zeros. Display the memory starting at 4000, to make sure that it's filled with zeros.

Assemble the program, and load it onto the board. Now view the memory contents starting at 4000 to see the actual program instructions.

Before executing the program, display memory starting at location 4100. Now execute the program, and view the changes it made to memory starting at 4100.

Now complete the following. **Keep in mind that all numbers are hexadecimal.**

Part 1: Subtraction

Prob1.asm demonstrates how to add two 8-bit numbers using the ADDA instruction (p. 31 of the text). The SUBA instruction (p. 33) is used for subtraction, and works similarly to the ADDA instruction. Add code to prob1.asm to subtract 8 from 99, and store the result in memory location 4120.

Part 2: Division

Prob1.asm demonstrates how to multiply two 8-bit numbers using the MUL instruction (p. 34). The IDIV instruction (p. 35) is used for division, and works similarly to the MUL instruction. Add code to prob1.asm to divide 150 by 3, and store the result in memory location 4130. Make sure you combine the original code and the code from parts 1 and 2 into one program.

REQUIRED: Demonstrate your modified program to the GTA. Before demonstrating your results, use the BF (block fill) command to fill memory locations 4100 to 413F with zeros. Execute your program, and then show the GTA the results by displaying the memory starting at location 4100.

Report Format and Grading:

Following the report format in your syllabus, include the following in your report:

1. Your name, student number, lab project number and title, course number, lab section number, and date.

2. Description of the lab in your own words. What did you learn? If your code did not work in the lab, explain why. (45% of report grade)

3. The source code for your modified hello.asm program, and the source code for your modified prob1.asm program. Be sure to include comments in your source code. Clearly mark sections that you’ve added to each of these programs with the problem number. If

we can’t find your changes, you won’t get credit for them, so make sure they’re clearly marked! For example, for the subtraction section of problem two, put the following comments before and after the code you add:

```
;Problem 2, part 1 start:
        (your code here)
;Problem 2, part 1 end
```

(45% of report grade)

4. A short evaluation of the lab. What did you like about the lab? What could be improved? (10% of report grade)