

EECS 388: Computer Systems and Assembly Language

Lab 4

Assembly Language: Shifting, Logic & Bit Operations, and Addressing Mode

Objectives:

- A) To understand the use of shifting and logic & bit operations.
- B) To become familiar with index addressing mode.

Program Template:

For this lab, use the following program template for your program.

```
;Your Name
;EECS 388
;Lab Section X
;Lab 4

;Start of program code in memory.
    ORG $4000

;Problem 1:
    --- Problem 1 code here

;Problem 2:
    --- Problem 2 code here

;Problem 3:
    --- Problem 3 code here

;Software interrupt
    SWI
```

Note: All three problems should be combined into one program. You will therefore demonstrate all three problems to the GTA with one program execution.

Problem 1:

There are two 8-bit numbers in locations starting at address 4100 (use the monitor to set these numbers). Write program code to multiply each number by 8 using the correct shift instruction. Store the resulting numbers in locations starting at 4110.

Note: Be careful with overflow when the number is big. You need to keep the overflowed bits in order to obtain the correct result for a number multiplying 8. For example, \$30 (decimal 48) multiply by 8 is \$0180 (decimal 384), not \$80.

Problem 2:

There are two 8-bit numbers stored in consecutive locations starting at address 4120. Write program code to determine if the number is even or odd. **Use Logical Operation and BCLR methods.** Store results from the logical operation into memory locations starting at 4130, and stores results after BCLR at 4140. Please explain to the GTA why you think the result indicates that the number is either even or odd (also include explanation in report).

Note: Think about what is the difference between an even and an odd number. Then, use a logical operation with a certain number or BCLR with a certain bit mask to determine if it is even or odd (**please use both methods for this problem**).

Problem 3:

There are four 8-bit numbers stored in consecutive locations in table TAB1, starting at address 4150. Write program code to copy the numbers into locations in table TAB2, starting at 4160. **Use index addressing mode for this problem (e.g. LDAB 1,X+). Use EQU directives for TAB1 and TAB2.**

REQUIRED: Demonstrate your program to the GTA using the following procedure:

1. Use block fill to load memory locations 4100 – 416F with zeros.
2. Load your program onto the board using hyperterminal.
3. The GTA will then give you the numbers for all three problems, which you will then enter into memory using the monitor.
4. Execute the program, and display memory locations starting at 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 program, containing all three problems. Be sure to include comments in your source code. (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)