CPE 325: Embedded Systems Laboratory
Laboratory Assignment #4

Assignment [100 pts]

Q.1 [50 pts] Write an assembly program that will create a new string by deleting the special characters from the original input string **(EXCEPT SPACE CHARACTERS)**. Assume that the string does not include more than one line. Count the number of deleted special characters, and put this in the port P3OUT register. Count the number of spaces and put this in the port P4OUT register. Assuming the input string is "Welcome To MSP/430 Ass*embly Language:)!", then the correct results for testing purposes are shown below:

Old string: "Welcome To MSP/430 Ass*embly Language:)!",
New string: "Welcome To MSP430 Assembly Language"
Total Number of Deleted Special Characters (P3OUT): 5
Total Number of Counted Space Characters (P4OUT): 4

Q.2 [50 pts] Write an assembly program that will update an input string. Each Uppercase letter in the input string should be replaced by the corresponding Lowercase letter. Each Lowercase letter in the input string should be replaced by the corresponding Uppercase letter. Assume that a string does not include more than one line. Count the number of changes from Uppercase to Lowercase and put it in P4OUT. Count the number of changes from Lowercase to Uppercase and put it in P3OUT. Assume the input string is "welcome To MsP430 ASSEMBLY LaNgUaGe!" then the correct results for testing purpose are shown below:

Updated string: "WELCOME tO mSp430 assembly lAnGuAgE!"
Total Number of Changes from Lower to Upper (P3OUT): 13 (D in Hex)
Total Number of Changes from Upper to Lower (P4OUT): 15 (F in Hex)

Q.3 (**Bonus: up to 10pts**) Write an assembly program where you would define a variable which is a string. This character array should indicate a mathematical expression. For example: your mathematical
expression can be as following (which can be evaluated to an integer).

"4+3-5"

You are required to evaluate the string and send the value to **P2OUT**. You should demonstrate the value using register window.
Hint: *The mathematical expression can be formed with all single digit numbers only. The mathematical operators can be restricted to "+" and "-".*

Questions To Be Addressed:

Please make sure that you have addressed following questions in your demonstration:

1. Describe briefly how you solve Q1.
2. In your memory browser window, show where the values are stored for Q1.
3. In the registers window, show the value of P2OUT at the end of Q3 (for bonus only).
4. What is register indirect addressing with auto increment? Do you use it anywhere in your code? How and Where?

Topics For Theory:

1. Assembler Directives
2. Different Addressing Modes
    a. Format and description of the following modes
        i. register
        ii. indexed
        iii. symbolic
        iv. absolute
        v. indirect
        vi. immediate
    b. Also, give an example of indirect addressing with auto increment.

Deliverables

1. Lab report which includes:
    a. Screenshots of the memory browser and registers
    b. **Flowchart for question 1 and 2**.
    c. Source code in appendix.