CPE 325: Embedded Systems Laboratory
Laboratory Assignment #4

Assignment   [100 pts]

1. For this lab assignment, please implement an assembly program that counts the number of words and sentences in a string variable. A sentence always ends with either '.', '!' or '?'. The string can be hard-coded in the program as a *cstring* type.

    Please store the count values in variables (defined using .data in your code). You should display this value using memory browser.

    Hint: Please create an assembly project as mentioned in the tutorial for Lab4. You do not need to print the result in console window.
    Hint: You need to declare your variable in data segment (.data) of the code to make them readable and writable as shown in the example below:

    ```
              .data
    sent_count:        .int        0    ;
    w_count:           .int        0    ;                                [50 pts]
    ```

    Please include a flowchart for your implementation.

2. 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.   **[50 pts]**
    Hint: The mathematical expression can be formed with all single digit numbers only. The mathematical operators can be restricted to "+" and "-".

3. **(Bonus: up to 15pts)**: Write an assembly program where you would declare a string as shown below. You are required to update the contents of the strings to uppercase letters if they are lowercase letters. This means you need to change the value in their original location. For demonstration, you must present the updated values in memory browser.
    Hint: You need to declare your variable in data segment (.data) of the code to make them readable and writable as shown below.
    ```
              .data
    myString:    .cstring       "I enjoy learning msp430"    ;
    ```

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 Q2.
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. Give an example of indirect addressing with auto increment.
3.

Deliverables

1. Lab report which includes:
   a. Screenshots of the memory browser and registers
   b. Flowchart for question 1
2. Source files (.asm files) or as directed