CSE 4095 – Special Topics in Computer Engineering III:
Introduction to Embedded Systems

Project # 1
(Due: 07.04.2023 23:59)

For the following problems, write ARM assembly language programs. In the Keil MDK-ARM IDE, create a project for each, enter and build the program, and then execute and debug it in the Keil MDK-ARM debugger. You may run the programs in the simulation mode. You should write a minimum 2-pages long project report that describes how you implemented the project. In addition to explanations, for each program provide (1) a printout of the source program, and (2) one "screen capture" of the debugger memory window, showing the program results at the conclusion of the program. (The results written by the program.) *Please circle the results in the memory window or trace window.*

Q1. In this question, you will implement an assembly program that reads two hexadecimal strings and calculates their subtraction. First, you should initialize two null-terminated strings for two positive hexadecimal numbers and declare a word to store the result of $a - b$. In the CODE region, you should read the hexadecimal strings, convert them into 32-bit numbers, and calculate and store the result of $a - b$ in the memory.

Q2. In this question, you will implement an assembly program that reads two strings, convert all uppercase letters to lowercase ones in the first string, and convert all lowercase letters to uppercase ones in the second string. First, you should initialize two null-terminated strings and allocate two blocks of zeroed memory in the DATA area. In the CODE area, read the strings char-by-char, make the necessary conversion, and write them back to the allocated memory blocks.

Q3. In this question, you will implement an assembly program that transposes a given 2D matrix. First, you can initialize a 4-by-3 matrix with some initial values and a block of zeroed memory to store transposed version. In the CODE area, read the input matrix, calculate the transpose, and write them back to the allocated memory blocks. Your implementation should have two nested loops.

Important Notes:

- You can work in groups of 2-3 people.
- It should be noted that only selected question(s) will be graded.
- We use tools that automatically detect plagiarism among the submissions!
- In case of any form of copying and cheating on solutions, you will get **FF** grade from the course! You should submit your own work. In case of any forms of cheating or copying, both giver and receiver are equally culpable and suffer equal penalties.

- Please zip and submit your files using filename StudentNumbersProject1.zip (ex: 150713852_150713098_150101122_Project1.zip) to Canvas system (under Assignments tab).
- No late submission will be accepted.