## **General instructions for solving this assignment:**

* Do not use anyone else’s work as the plagiarism checker and/or exam marker will pick up similarities in the answers. No marks would be awarded if any match is found. Copying someone else’s work is considered CHEATING.
* If for any reason there is a match in your exam answer with someone else's exam answer, no marks would be awarded to all students with matching answers.
* No marks will be awarded if you copy any content, including material from lecture notes, textbook, revision/studies/labs/assignments, or external sources without being asked to do so. An academic misconduct investigation can also be started.
* If you copy/paste from another source, you must declare the source. If the source of any copy/paste answer is not declared, no marks will be awarded to that question.
* Even if you use a correct answer from somewhere else, you will not get any mark.
* Deadline for submission of this assignment is Friday, 21 Oct 2022. No submission allowed after the due date.

**How to provide your answers?**

* Your answers are to be provided within the designated locations.
* Do not change the layout or the structure of the question paper if you want your work to be marked.
* You can use any easily readable font face like Times Roman, Calibri, etc.
* Your answers need to be in black font on a white background.
* Many questions will ask you to submit code.
  + Create a folder named CC1123\_RollNo\_Name\_A1
  + For each question, create a subfolder named QuestionX inside CC1123\_RollNo\_Name\_A1, where X is the question number. Put all the code you create for that question in that folder.
  + Put the answer sheet (this document in which you wrote your answers) inside the folder CC1123\_RollNo\_Name\_A1
  + Compress the folder CC1123\_RollNo\_Name\_A1 using zip to create a file named CC1123\_RollNo\_Name\_A1.zip
  + Send the compressed file CC1123\_RollNo\_Name\_A1.zip to my email id: muhammad.abdullah@pujc.edu.pk
* An in-person (online or face-to-face) demonstration / explanation may be requested. I will contact you directly if such demonstration/explanation is needed.
* Results are not final until an in-person demonstration/explanation by you of your answers is completed (if requested).

Answer **all** questions and write your answers in the designated space. Do not write outside this space as no marks are given for anything outside this space.

For coding questions, test your answer by building and running your code using the GNU **C** compiler. Make sure it is **C** code and source code files have either .c or .h extensions.

If an exercise asks you to copy and paste code into the word document, then be careful when doing copy/paste as Word can change indentation, code layout and capitalization.

Global variables must not be used in any code.

**QUESTION 1 (25 Marks in total)**

We would like to write a C program that takes a string (which is an array of characters that ends with the character of ASCII code 0, i.e., ‘\0’) and finds how many times the sequence of characters “ab” appears in that string. The input string needs to be entered by the user and can be of any length from 1 to 255 characters maximum.

**a)** Provide the algorithm that performs the task above. Use modular programming.

Note that the function strlen (defined in string.h) returns the actual length of a null-terminated C string.

**[10 marks]**

*-------------------------****Provide Your Answer Here***  *------------------*

**b)** Write the C program that implements your algorithm of Question 1.a) above. You must use modular programming.

Create a folder named Question1 inside the folder CC1123\_RollNo\_Name\_A1. Put all the .c and .h files you create inside the folder Question1.

**[15 marks]**

**QUESTION 2 (25 Marks in total)**

Write an algorithm and then a C program that takes as input a string and checks whether the sentence reads the same backward and forward. Examples of such strings are

* *redivider*,
* *deified*,
* *civic*,
* *radar*,
* *level*,
* *rotor*

The program should be case insensitive. In other words, it should not make a difference between uppercase and lowercase letters, i.e., Civic is the same as civic and is the same as cIviC …

Finally, the program, should also convert the string into a string with proper capitalization, i.e., it should start with a capital letter and all the remaining characters should be lower case. It should the print the new string on screen.

For this question:

* + - You are allowed to use the function strcmp(), which takes as input to strings and returns:
      * 0 if the two strings are equal
      * A value that is different from 0 otherwise
    - You must implement your own function that converts characters to upper case or to lower case. Use this link to find the ASCII codes of the alphabet characters: <http://sticksandstones.kstrom.com/appen.html>

To submit the source code, create a folder named Question2 inside the folder CC1123\_RollNo\_Name\_A1. Put all the .c and .h files you created inside the folder Question2.

**[25 Marks]**

**Question 3 (25 marks in total)**

This question has two parts. You must use modular programming.

**a)** Write an algorithm that takes an array of N integers (N will be specified by the user at run time). It then finds how many numbers in the array are divisible by 3 and how many numbers are divisible by 7.

Note: an integer number is divisible by 3 (respectively 7) if the remaining of its division by 3 (respectively 7) is 0. You are allowed to use the modulus operator %.

**[5 Marks]**

*-------------------------****Provide Your Answer Here***  *------------------*

**b)** Write an algorithm that copies, from the input array above, the numbers that are divisible by 3 into a new array and those divisible by 7 into a different new array. Once copied, the algorithm should compute the average of each of these two new arrays and print the averages on the screen with suitable message to let the user know which average is being printed

What assumptions would you make about the sizes of the two new arrays? Explain why you made these assumptions.

**[5 Marks]**

*-------------------------* ***Provide Your Answer Here***  *------------------*

**c)** Using the C language, implement your algorithms for Questions 3a and 3b above. Build, run and test your program.

To submit the source code, create a folder named Question3 inside the folder CC1123\_RollNo\_Name\_A1. Put all the .c and .h files you create inside the folder Question3.

**[15 marks]**

**\*\*\*\*\*END OF ASSIGNMENT 1\*\*\*\*\***