Institute for Advancing Intelligence, TCG CREST
(TCG Centres for Research and Education in Science and Technology)

Introduction to Programming and Data Structures, 2023-24, Semester-II
Assignment 03

Maximum Marks: 150
Topic: Structures and strings

Submission Deadline: **2023-Sep-21**
Clarification Deadline: **2023-Sep-15**

Here are 3 problems. You are to write C programs for the following problems. In each solution, you should take/give input/output only from/to a file only.

AP0301: Create a C program that implements rational number operations using structures.

Define a structure to represent rational numbers. Each rational number should have two components: numerator and denominator.

Implement the following rational number operations as separate functions:

- Addition of two rational numbers
- Subtraction of two rational numbers
- Multiplication of two rational numbers
- Division of two rational numbers

Implement a function to display rational numbers in the standard format (numerator/denominator).

In the main function, demonstrate the use of these operations by performing the following tasks:

- Create two rational numbers by reading their numerator and denominator from the user.
- Perform addition, subtraction, multiplication, and division of the two rational numbers using the implemented functions.
- Display the results of each operation in the standard format.

Ensure that your program handles division by zero (i.e., denominator should not be zero) and reduce fractions to their simplest form (e.g., 2/4 should be displayed as 1/2).

Provide meaningful comments and proper code documentation for better understanding.

Sample Input: from a file with filename "`input_0301.txt`"
First line contains number of test cases followed by the test cases. Each test case is of the form $a\ b\ op\ c\ d$ where $op \in \{+, -, *, /\}$, a, b, c and d are *int*s.

AP0302: Create a C program that implements complex number operations using structures.

Define a structure to represent complex numbers. Each complex number should have two components: real and imaginary.

Implement the following complex number operations as separate functions:

- Addition of two complex numbers
- Subtraction of two complex numbers
- Multiplication of two complex numbers
- Division of two complex numbers

Implement a function to display complex numbers in the standard format (a + bi), where 'a' represents the real part, 'b' represents the imaginary part, and 'i' represents the imaginary unit.

In the main function, demonstrate the use of these operations by performing the following tasks:

- Create two complex numbers by reading their real and imaginary parts from the user.
- Perform addition, subtraction, multiplication, and division of the two complex numbers using the implemented functions.
- Display the results of each operation in the standard format.

Ensure that your program handles division by zero (i.e., denominator should not be zero).

Provide meaningful comments and proper code documentation for better understanding.

Sample Input: from a file with filename "`input_0302.txt`"
First line contains number of test cases followed by the test cases. each test case is of the form a b op c d where $op \in \{+, -, *, /\}$, a, b, c and d are $floats$.

AP0203: To be uploaded soon.

[50+50+100]

Note: For bad indentation of wrong filename, 10% marks will be automatically deducted.