COMP ENG 2SH4

DURATION OF EXAMINATION: 2.5 Hours Instructor: MOHAMED HASSAN
MCMASTER UNIVERSITY Deferred Final Exam Feb 2022

SPECIAL INSTRUCTIONS:

- First things first: Update the README file with your information.
- **Closed-Book Exam:** No reference material of any kind is allowed. Only McMaster standard calculator (Casio FX-991 MS or MS Plus) is allowed.
- Exam is four questions.
- Answer questions in their corresponding source files as instructed in each question.
- Make sure to commit/push at least after each part of the exam and/or every 10 minutes to avoid any problems.
- Students approved by SAS for extra-time, please follow the guidelines given to you in the SAS letter.

1. (20 Marks) **Question1.**
   This question with its parts should be answered in file: Q1.c.
   In this question we are interested in calculating $1^2 + 2^2 + ... + n^2$, where
   Pre-condition: n is 1 or greater
   Post-condition: this functions returns the value of $1^2 + 2^2 + ... + n^2$
   Examples: sum(1) is 1, sum(2) is 5, sum(3) is 14, ...

   (a) [7 Marks] Complete the function sum_while in Q1.c using a single while-loop.

   (b) [7 Marks] complete the function sum_for implementation in Q1.c using a single for-loop.

   (c) [6 Marks] complete the function sum_do_while implementation in Q1.c using a single do-while-loop.

   Note that you are given an incomplete function signature; you need to complete the signature as well as the function body to deploy the intended functionality as explained above.

2. (30 Marks) **Question2.**

This question with its parts should be answered in file: Q2.cpp.

Write a function that takes two arrays as input a and b as well as their sizes: size_a and size_b, respectively. Then for each element in a: it counts the number of occurrences in b and place this in a third array c.

You are given an incomplete prototype below Assume that array a does not contain repetitions.

```
void occurrences()
```

Example: If array a contains [8,23,41,100,-9], and array b contains [100, -9,41,87,41,-9,-9], then the function should update c to be: [0,0,2,1,3]

(a) [25 marks] Complete the function void occurrences() in Q2.cpp and correct the signature as well to perform this task.

(b) [5 marks] Complete the main() function in Q2.cpp to test the occurrences function.

3. (30 Marks) **Question 3.**
This question with its parts should be answered in files: Q3.cpp, Quad.h, Quad.cpp, Rectangle.h, and Rectangle.cpp.

(Q3-a)[10 Mark] Write a program that has an abstract base class named Quad. This class should have four member data variables (floats) representing side lengths and a pure virtual function Area. It should also have a method for setting the data variables.

(Q3-b)[10 Mark] Derive a class Rectangle from Quad and override the Area method so that it returns the area of the Rectangle.

(Q3-c)[10 Marks] Write a main function that creates a Rectangle and sets the side lengths. Also write a top-level function (i.e. not a member of any class) that will take a parameter of type Quad and return the value of the appropriate Area function.

4. (20 Marks) **Question 4.**
This question with its parts should be answered in files: Triple.h, Triple.cpp.

Declare a class named Triple with three private data members (floats) x, y, and z. Provide public functions for setting and getting values of all the private data members. Define a constructor that initializes the values to user-specified values or, by default, sets the values all equal to 0.

Also write the following member functions:
—addXYZ so that corresponding elements are added together
—display so that it displays the Triple in the form "The triple is (x, y, z)."
—assign that copies x to z, y to x, and z to y.
—incrXYZ so that x, y and z are increased by one each.

THE END